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11,390	320
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12,299	709
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12,366	767

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1913.		**1913.**		**1913.**		**1913.**		**1913.**		**1913.**		**1913.**	
12,368	87	14,230	583	15,713	933	17,131	489	18,168	255	19,762	468	21,771	493
12,377	255	14,211	410	15,715	823	17,145	906	18,212	836	19,778	102	21,779	971
12,421	793	14,215	798	15,757	692	17,195	876	18,237	659	19,782	651	21,834	364
12,427	686	14,246	767	15,758	824	17,205	943	18,246	747	19,783	89	21,835	604
12,430	763	14,247	844	15,823	845	17,214	882	18,258	841	19,787	559	21,848	492
12,584	348	14,325	350	15,867	641	17,241	910	18,259	877	19,871	326	21,853	324
12,618	741	14,396	632	15,909	89	17,272	825	18,270	412	19,877	1009	21,862	668
12,626	750	14,405	840	15,915	276	17,279	73	18,279	480	19,921	842	21,925	978
12,640	82	14,420	737	15,919	835	17,288	148	18,303	73	19,955	783	21,928	736
12,666	802	14,424	790	15,922	816	17,304	100	18,333	241	19,970	686	21,930	547
12,668	216	14,426	359	15,923	836	17,307	569	18,350	1018	19,972	767	21,940	747
12,683	925	14,427	425	15,925	835	17,317	306	18,351	926	19,981	313	21,958	986
12,708	378	14,428	793	15,932	932	17,330	99	18,353	161	20,016	496	21,979	786
12,777	758	14,431	597	15,937	587	17,334	912	18,354	161	20,022	986	21,998	1064
12,790	197	14,432	821	15,943	836	17,387	498	18,355	854	20,036	241	22,012	408
12,800	366	14,479	274	15,957	841	17,400	883	18,371	1006	20,061	157	22,032	1080
12,815	758	14,481	799	15,965	411	17,411	871	18,382	564	20,077	955	22,050	372
12,816	605	14,493	613	15,970	853	17,420	804	18,406	912	20,093	1045	22,063	1144
12,817	638	14,498	910	15,982	488	17,432	853	18,413	411	20,103	133	22,065	957
12,818	71	14,502	187	16,005	73	17,449	939	18,417	685	20,106	652	22,094	1085
12,834	20	14,509	256	16,017	488	17,462	13	18,422	968	20,107	825	22,119	201
12,914	541	14,520	824	16,027	836	17,483	219	18,430	194	20,115	274	22,120	736
12,917	803	14,530	550	16,031	347	17,490	427	18,447	913	20,118	431	22,137	1063
12,927	788	14,541	632	16,033	838	17,508	865	18,542	953	20,122	969	22,151	1067
12,952	583	14,545	849	16,035	555	17,510	875	18,563	325	20,158	927	22,167	85
12,960	792	14,559	33	16,066	795	17,519	636	18,579	906	20,161	468	22,173	832
12,961	597	14,592	849	16,141	869	17,521	409	18,594	788	20,183	758	22,185	197
12,972	30	14,607	803	16,230	763	17,531	325	18,597	681	20,189	485	22,189	410
12,976	684	14,616	842	16,273	312	17,539	853	18,599	910	20,192	921	22,222	825
12,977	483	14,677	102	16,277	755	17,552	916	18,615	485	20,232	610	22,223	913
12,978	593	14,700	743	16,299	646	17,594	933	18,621	906	20,274	1110	22,234	1116
12,979	646	14,702	641	16,302	869	17,602	831	18,643	968	20,355	478	22,261	950
12,980	94	14,726	361	16,307	836	17,603	554	18,680	477	20,395	663	22,263	1095
12,981	797	14,753	842	16,318	586	17,611	474	18,681	244	20,401	931	22,277	1080
12,982	797	14,758	609	16,359	274	17,612	542	18,705	542	20,460	746	22,288	889
13,037	709	14,767	219	16,372	838	17,613	697	18,743	613	20,465	663	22,297	647
13,086	222	14,778	824	16,386	195	17,614	563	18,745	943	20,471	1063	22,302	932
13,104	636	14,784	215	16,396	422	17,616	883	18,769	489	20,476	1001	22,313	743
13,188	681	14,795	425	16,456	845	17,643	785	18,806	964	20,504	375	22,319	686
13,191	869	14,807	854	16,468	421	17,661	474	18,817	959	20,505	613	22,322	1036
13,214	252	14,860	19	16,480	603	17,676	714	18,818	24	20,593	353	22,331	1197
13,236	194	14,862	764	16,481	192	17,690	866	18,827	90	20,625	1148	22,346	1160
13,250	755	14,872	435	16,482	42	17,691	593	18,836	640	20,627	1069	22,358	322
13,261	782	14,884	211	16,554	355	17,692	866	18,837	803	20,652	849	22,386	1069
13,309	492	14,928	852	16,565	650	17,693	375	18,840	968	20,668	304	22,395	1226
13,321	569	14,937	658	16,577	930	17,722	911	18,841	968	20,700	468	22,400	64
13,360	196	14,938	561	16,578	875	17,723	330	18,856	650	20,712	659	22,411	950
13,382	757	14,939	801	16,599	825	17,773	1003	18,857	931	20,714	856	22,421	931
13,408	746	14,952	71	16,611	853	17,779	953	18,873	979	20,767	1004	22,455	255
13,414	697	14,972	659	16,636	423	17,780	306	18,890	326	20,787	274	22,462	215
13,415	697	15,020	750	16,653	1013	17,784	1018	18,920	952	20,795	95	22,476	319
13,422	430	15,048	806	16,681	937	17,790	926	18,925	702	20,816	565	22,514	105
13,426	842	15,049	806	16,684	650	17,799	890	18,932	953	20,897	1058	22,515	64
13,438	758	15,058	913	16,700	876	17,814	1045	18,937	968	20,919	698	22,528	416
13,441	740	15,064	846	16,712	72	17,815	1045	18,942	593	20,924	490	22,544	1100
13,465	780	15,070	607	16,715	767	17,828	714	18,944	926	20,942	497	22,595	1085
13,480	795	15,093	334	16,728	758	17,838	1044	18,984	954	20,954	267	22,618	1083
13,508	1041	15,159	920	16,738	641	17,839	1044	18,999	1066	20,964	823	22,638	703
13,544	646	15,163	784	16,751	949	17,854	910	19,005	1013	20,970	1153	22,644	655
13,607	906	15,165	422	16,768	828	17,857	149	19,021	835	20,971	1045	22,646	632
13,619	707	15,221	498	16,782	208	17,869	318	19,083	981	20,972	1045	22,647	564
13,657	653	15,256	858	16,800	938	17,871	960	19,084	483	21,012	793	22,657	926
13,689	747	15,263	13	16,821	597	17,873	965	19,099	746	21,015	350	22,692	868
13,696	803	15,293	482	16,827	19	17,874	755	19,102	933	21,027	544	22,694	70
13,724	412	15,297	854	16,828	889	17,877	853	19,109	1096	21,112	937	22,698	881
13,726	472	15,309	473	16,838	636	17,878	195	19,142	980	21,133	855	22,704	1100
13,737	411	15,304	793	16,844	153	17,880	431	19,159	1105	21,135	1041	22,709	1024
13,746	348	15,316	841	16,848	440	17,887	911	19,169	998	21,158	425	22,723	89
13,751	750	15,323	835	16,849	503	17,925	31	19,193	763	21,160	917	22,724	89
13,753	786	15,327	490	16,858	642	17,927	163	19,198	30	21,211	831	22,738	1196
13,760	430	15,367	542	16,871	926	17,941	483	19,228	474	21,213	853	22,744	361
13,777	689	15,379	849	16,892	871	17,944	909	19,277	320	21,273	542	22,745	359
13,813	636	15,439	191	16,893	906	17,953	838	19,302	968	21,276	408	22,746	482
13,825	43	15,459	782	16,898	555	17,955	318	19,338	740	21,289	964	22,761	1058
13,826	151	15,463	928	16,903	865	17,956	470	19,340	485	21,290	684	22,763	344
13,827	25	15,481	439	16,910	344	17,969	145	19,344	979	21,291	646	22,767	1080
13,840	933	15,482	766	16,911	344	17,971	916	19,346	979	21,295	660	22,775	853
13,855	801	15,524	853	16,936	890	17,979	222	19,363	685	21,331	1099	22,778	981
13,861	763	15,546	831	16,938	330	17,982	416	19,404	750	21,366	550	22,790	1117
13,881	913	15,551	889	16,978	614	17,998	921	19,409	849	21,374	1221	22,825	500
13,902	350	15,557	492	16,997	935	18,028	354	19,420	99	21,385	643	22,834	1161
13,924	781	15,568	81	16,999	485	18,030	912	19,427	688	21,427	241	22,836	194
13,928	803	15,595	959	17,003	889	18,055	906	19,435	415	21,462	312	22,854	767
13,929	190	15,605	503	17,011	471	18,061	93	19,463	219	21,478	492	22,873	490
13,947	419	15,612	833	17,016	422	18,072	871	19,481	865	21,481	408	22,874	795
13,974	662	15,624	126	17,018	503	18,073	756	19,488	545	21,542	987	22,875	490
13,987	699	15,625	65	17,028	978	18,095	440	19,514	649	21,547	842	22,911	784
14,008	222	15,629	258	17,030	743	18,096	195	19,522	689	21,553	190	22,924	353
14,096	271	15,668	418	17,031	418	18,102	23	19,596	565	21,579	1087	22,938	1116
14,120	503	15,677	542	17,035	421	18,105	20	19,597	540	21,581	1058	22,980	784
14,125	974	15,678	919	17,046	319	18,113	790	19,669	1013	21,650	1160	22,985	408
14,136	632	15,679	830	17,077	937	18,116	360	19,670	963	21,656	1111	22,989	632
14,182	486	15,703	979	17,121	1149	18,119	342	19,688	308	21,697	852	23,004	490
14,220	798	15,711	1057	17,123	807	18,161	836	19,697	345	21,725	757	23,023	256
14,226	255			17,128	890	18,166	910	19,745	708	21,731	469	23,026	795

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1913.		**1913.**		**1913.**		**1913.**		**1914.**		**1914.**		**1914.**	
23,054	1148	24,731	421	26,242	478	28,503	917	1039	549	4113	652	8126	1215
23,377	86	24,768	1192	26,255	736	28,524	256	1062	971	4242	825	8355	642
23,119	415	24,795	1215	26,269	241	28,571	600	1085	1111	4349	965	8577	743
23,128	757	24,813	659	26,303	1041	28,593	925	1103	884	4369	1080	8607	858
23,129	747	24,815	1226	26,357	801	28,604	793	1121	823	4452	636	8611	1014
23,174	1088	24,822	408	26,359	932	28,682	411	1145	348	4628	770	8690	743
23,196	858	24,823	750	26,411	408	28,736	985	1155	594	4657	907	8728	1227
23,274	473	24,839	669	26,418	469	28,737	483	1156	688	4668	559	8917	826
23,312	1101	24,847	361	26,535	666	28,763	251	1159	937	4673	1148	9085	915
23,339	1101	24,849	807	26,712	1160	29,026	547	1173	865	4757	635	9102	641
23,350	1149	24,850	796	26,727	1153	29,047	953	1223	828	4779	1161	9232	837
23,355	248	24,851	1006	26,732	643	29,048	256	1239	571	4805	933	9237	749
23,418	1083	24,912	1168	26,735	418	29,053	830	1247	942	4808	1144	9265	796
23,421	1164	24,920	1215	26,736	359	29,069	543	1252	1004	4826	505	9302	1082
23,488	1166	24,923	842	26,769	736	29,089	1043	1266	938	5001	660	9368	650
23,491	835	24,930	688	26,802	681	29,172	1099	1269	345	5011	829	9384	869
23,538	922	24,931	749	26,825	666	29,184	1170	1283	505	5018	1006	9472	825
23,548	98	24,932	221	26,826	666	29,224	247	1292	1197	5025	659	9486	943
23,555	243	24,938	859	26,908	588	29,259	555	1335	936	5104	854	9490	750
23,564	241	25,026	652	26,915	1214	29,281	1001	1355	583	5111	1218	9587	954
23,566	871	25,029	71	26,970	472	29,314	497	1443	743	5146	879	9636	1025
23,569	274	25,056	1169	27,010	638	29,329	949	1493	585	5197	1095	9955	907
23,605	1143	25,082	1152	27,014	737	29,381	542	1515	635	5230	598	9986	1058
23,638	606	25,134	1160	27,030	549	29,418	700	1550	865	5238	688	10,006	693
23,653	1167	25,144	1059	27,128	751	29,494	684	1667	569	5408	984	10,061	1014
23,719	699	25,185	652	27,130	907	29,512	1006	1692	740	5409	640	10,154	1085
23,732	70	25,239	1166	27,150	1014	29,517	410	1795	986	5432	1215	10,178	1116
23,736	906	25,265	1218	27,162	633	29,525	650	1805	866	5437	907	10,202	1217
23,740	643	25,289	881	27,201	823	29,542	1207	1837	767	5664	869	10,377	961
23,741	1095	25,291	1196	27,208	709	29,546	806	1869	806	5706	798	10,379	939
23,841	326	25,365	1102	27,222	598	29,624	911	2054	783	5730	910	10,415	1059
23,854	571	25,392	802	27,239	1193	29,651	798	2058	955	5798	750	10,491	964
23,918	422	25,393	793	27,260	563	29,714	783	2069	1001	5859	647	10,605	859
23,919	241	25,406	659	27,317	439	29,741	767	2085	866	5989	1053	10,616	871
23,932	639	25,410	613	27,365	871	29,813	832	2090	503	6036	740	10,681	1043
23,945	743	25,415	1096	27,406	425	29,827	749	2164	860	6155	920	10,774	1068
23,957	478	25,419	1226	27,499	1080	29,913	702	2167	933	6193	950	10,783	1192
23,959	1154	25,503	1221	27,536	488	29,928	1085	2213	746	6260	1221	10,980	794
24,043	1152	25,526	1207	27,642	908	29,988	374	2281	703	6288	907	11,094	907
24,081	835	25,547	1200	27,648	635	30,025	1085	2287	828	6349	870	11,581	1227
24,088	1045	25,567	854	27,663	653	30,047	440	2314	767	6354	1004	11,836	889
24,135	759	25,572	922	27,698	652	30,055	638	2394	1006	6357	693	11,839	999
24,137	1116	25,585	1081	27,744	837	30,068	668	2428	912	6593	825	12,061	855
24,141	594	25,588	906	27,775	1169	30,072	246	2578	910	6608	891	12,142	1217
24,223	593	25,590	1088	27,830	830	30,096	1045	2609	1002	6616	830	12,270	1014
24,234	128	25,682	867	27,867	603			2610	502	6711	1219	12,413	1169
24,236	642	25,691	860	27,888	685			2612	854	6731	869	12,505	1081
24,297	970	25,715	565	27,904	710	**1914.**		2787	889	6755	1227	12,582	1148
24,342	932	25,728	1111	27,966	1214			2813	658	6775	979	12,686	1152
24,347	555	25,730	1025	27,971	961	29	1148	2847	688	6793	938	12,766	931
24,355	600	25,749	884	27,977	565	41	865	2923	767	6876	640	12,768	931
24,376	958	25,802	1207	28,048	321	72	796	2952	692	6993	871	12,769	931
24,403	999	25,830	218	28,049	950	118	970	2998	933	6995	871	12,770	931
24,420	422	25,856	1217	28,071	483	201	915	3055	767	7027	964	13,011	979
24,426	1148	25,893	1080	28,097	1161	226	837	3074	976	7116	912	13,150	1152
24,461	412	25,923	583	28,167	876	228	740	3103	1192	7117	1004	13,160	1149
24,471	601	25,956	408	28,191	1089	304	825	3291	794	7317	747	14,119	928
24,482	440	25,967	644	28,245	637	327	1081	3312	742	7324	990	14,125	1153
24,550	1016	25,971	439	28,250	689	468	1154	3313	855	7338	782	14,582	1096
24,560	1059	25,995	999	28,261	602	484	907	3339	1014	7425	842	14,589	1196
24,569	928	26,026	600	28,262	702	528	557	3388	961	7456	608	14,689	1221
24,570	925	26,061	206	28,285	474	530	1217	3392	1111	7466	782	14,807	1169
24,587	469	26,073	916	28,294	1153	541	937	3531	842	7471	926	15,455	1161
24,601	632	26,079	694	28,334	865	552	1227	3546	644	7529	1053	15,643	1058
24,604	485	26,117	686	28,336	1170	591	936	3547	962	7636	950	15,980	954
24,622	1215	26,142	850	28,345	1095	746	633	3681	926	7792	686	16,840	1163
24,692	219	26,172	1045	28,389	636	754	644	3682	743	7839	1218	16,893	1046
24,721	917	26,199	325	28,390	256	764	758	3796	784	7899	478	17,190	912
24,722	73	26,218	359	28,398	350	922	704	3825	795	7978	1075	18,048	1218
24,726	610	26,233	750	28,410	927	944	417	4028	842	8015	830	24,284	1169

LIST OF JOURNALS ABSTRACTED, WITH ABBREVIATIONS USED, AND ADDRESSES OF PUBLISHERS AND PRICES.

Journal.	Abbreviation.	Address of Publisher, and Price.*
Agricultural Ledger	Agric. Ledger	Reporter on Economic Products to the Government of India, Calcutta.
Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation	Allgem. Z. Bierbrau. u. Malzfabr.	Michaelerstrasse 25, Vienna XVIII/$_1$. Krone 12 per annum.
American Journal of Pharmacy	Amer. J. Pharm.	145, North Tenth Street, Philadelphia, Pa., U.S.A. 30 cents.
American Journal of Science	Amer. J. Sci.	New Haven, Conn., U.S.A. $6.40 per annum.
Analyst	Analyst	Simpkin, Marshall, Hamilton, Kent, and Co., Ltd., 2, 4, 6, 8, Orange Street, London, S.W. 2s.
Annalen der Chemie	Annalen	C. F. Winter'sche Verlagshandlung, Leipzig, Germany. M. 24 per annum.
Annales de Chimie Analytique	Ann. Chim. Analyt.	M. Crinon, 45, Rue Turenne, Paris, 3e. 1 fr.
Annales des Falsifications	Ann. Falsific.	56, Rue Madame, Paris, 6e. 2 fr.
Annali di Chimica Applicata	Annali Chim. Appl.	Via Panisperna N, 89*b*, Rome. Lire 34 per annum.
Annali della R. Stazione Chimico Agraria Sperimentale di Roma	Ann. R. Staz. Chim. Agrar. Sperim. Roma	R. Stazione Chimico-Agraria Sperimentale di Roma, Rome.
Apotheker-Zeitung	Apoth.-Zeit.	Levetzowstrasse 16b, Berlin, N.W. 87. 25 Pf.
Archiv der Pharmazie	Arch. Pharm.	Selbstverlag des Deutschen Apotheker-Vereins, Berlin, Germany. M. 12 per annum.
Atti della Reale Accademia dei Lincei, Roma	Atti R. Accad. dei Lincei, Roma	Tipografia della R. Accademia dei Lincei, Rome. Lire 10 per annum.
Berichte der Deutschen Chemischen Gesellschaft	Ber.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W. 6, Germany. M. 32 per annum.
Berichte der Deutschen Pharmazeutischen Gesellschaft	Ber. deuts. Pharm. Ges.	Verlag von Gebr. Bornträger, Berlin, W. 35, Schöneberger Ufer 12A, Germany. M. 20 per annum.
Biedermann's Zentralblatt für Agricultur Chemie	Biedermann's Zentr.	O. Leiner, Königstrasse 26B, Leipzig, Germany. M. 22 per annum.
Bio-chemical Journal	Bio-chem. J.	Cambridge University Press, Fetter Lane, London, E.C. 7s.
Biochemische Zeitschrift	Biochem. Zeits.	Verlag von J. Springer, Berlin, W. 9, Linkstrasse 23/24. M. 14 per volume.
Board of Trade Journal	Bd. of Trade J.	Messrs. Wyman and Sons, Fetter Lane, London, E.C. 3d.
Brewers' Journal	Brewers' J.	F. W. Lyon, Eastcheap Buildings, Eastcheap, London, E.C. 2s.
British and Colonial Druggist	Brit. and Col. Drug.	104-200, Bishopsgate, London, E.C. 5s. per annum.
Bulletin de l'Association Chimique de Sucre et de Distillerie	Bull. Assoc. Chim. Sucr.	156, Boulevard Magenta, Paris, 10e, France. 2 fr.
Bulletin of the Bureau of Agricultural Intelligence and of Plant Diseases	Bull. Bureau Agric. Intell.	International Institute of Agriculture, Rome. 2 fr.
Bulletin of the Bureau of Standards (U.S.A.)	Bull. Bureau of Standards (U.S.A.)	Government Printing Office, Washington, D.C. 25 cents.
Bulletin de la Société Chimique de Belgique	Bull. Soc. Chim. Belg.	M. J. Wauters, Palais du Midi (Galerie du Travail, 7), Brussels.
Bulletin de la Société Chimique de France	Bull. Soc. Chim.	Masson et Cie., 120, Boulevard Saint-Germain (6e), Paris. 38 fr. per annum.
Bulletin de la Société Française de Photographie	Bull. Soc. Franç. Phot.	51, Rue de Clichy, Paris, 9e. 1 fr. 50.
Bulletin de la Société Industrielle du Nord de la France	Bull. Soc. Ind. Nord	Rue de l'Hôpital Militaire 116, Lille, France.
Bulletin de la Société Industrielle de Mulhouse	Bull. Soc. Ind. Mulhouse	Berger-Levrault et Cie., 5, Rue des Beaux-Arts, Paris. 60 fr. per annum.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale	Bull. Soc. d'Encour.	Secrétariat, Rue de Rennes 44, Paris, France. 36 fr. per annum.
Le Caoutchouc et le Gutta-Percha	Caoutchouc et Gutta-Percha	A. D. Cillard fils, 49, Rue des Vinaigriers, Paris, X. 26 fr. per annum.
Chamber of Commerce Journal	Ch. of Comm. J.	Oxford Court, Cannon Street, London, E.C. 1s.
Chemical News	Chem. News	E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C. 4d.
Chemical Trade Journal	Chem. Trade J.	Davis Bros., Danes Inn House, 265, Strand, London, W.C. 4d.
Chemical World	Chem. World	J. and A. Churchill, 7, Great Marlborough Street, London, W. 6d.
Chemiker-Zeitung	Chem.-Zeit.	Dr. v. Vietinghoff-Scheel, Cöthen, Anhalt, Germany. M. 28 per annum.
Chemische Industrie	Chem. Ind.	Weidmann'sche Buchhandlung, Zimmerstrasse 94, Berlin, S.W., Germany. M. 20 per annum.

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* The price for single copies is given where these are sold separately. In other cases, it is only possible to buy the Journals in question in complete volumes.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER AND PRICE.
Chemische Revue über die Fett- und Harz-Industrie	Chem. Rev. Fett-Ind.	Dr. L. Allen, Catherinenstrasse 25, Hamburg, Germany. M. 1.75.
Chemisches Zentralblatt	Chem. Zentr.	R. Friedländer und Sohn. Karlstrasse 11, Berlin, N.W. 6, Germany. M. 80 per annum.
Chemist and Druggist	Chem. and Drug.	42, Cannon Street, London, E.C. 6d.
Collegium	Collegium	K. Schorlemmer, Sebastian-Munster-Strasse 28, Worms am Rhein, Germany. 2s.
Collegium (London)	Collegium (London)	M. C. Lamb, 176, Tower Bridge Road, London, S.E. 2s.
Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences	Comptes rend.	Imprimerie Gauthier-Villars, Quai des Grands Augustins 55, Paris. 44 fr. per annum.
Comptes-Rendus des Travaux de Laboratoire de Carlsberg	Comptes-rend. Trav. Lab. Carlsberg	H. Hagerup, Copenhagen. 2 Kr. 50 Ore.
Deutsche Zuckerindustrie	Deuts. Zuckerind.	Verlag der Gesellschaft, Die Deuts. Zuckerindustrie, Berlin. M. 24 per annum.
Elektrochemische Zeitschrift	Elektrochem. Zeits.	F. Siemenroth, Hafenplatz 9, Berlin, S.W. 11. M. 1.50.
Engineering	Engineering	C. R. Johnson, 35 and 36, Bedford Street, Strand, London, W.C. 6d.
Engineering and Mining Journal	Eng. and Min. J.	505, Pearl Street, New York City. 15 cents.
Färber-Zeitung	Färber-Zeit.	Julius Springer, Linkstrasse 23/24, Berlin, W. Germany. M. 18.40 per annum.
Ferrum	Ferrum	W. Knapp, Mühlweg 19, Halle on Saale, Germany. M. 22 per annum.
Feuerungstechnik	Feuerungstechnik	O. Spamer, Täubchenweg 26, Leipzig-R., Germany. M. 4.80 per annum.
Foreign Office Annual Series (Cons. Reports)	F. O. Ann. Series	Wyman and Sons, Fetter Lane, London, E.C. 1½d. to 6d.
Gazzetta Chimica Italiana	Gazz. Chim. Ital.	La Direzione della "Gazzetta Chimica," Via Panisperna, 89, Rome. Lire 4.
Gerber	Gerber	VI/₂ Gumpendorferstrasse 89, Wien, Austria. Kr. 17.50 per annum.
Gummi-Zeitung	Gummi-Zeit.	Geschäftsstelle der "Gummi-Zeitung," Blücherstrasse 31, Berlin, S. 61, Germany. M. 16 per annum.
Imperial Institute Bulletin	Bull. Imp. Inst.	John Murray, Albemarle Street, London, W. 2s. 6d.
India-Rubber Journal	India-rubber J.	Maclaren and Sons, 37 and 38, Shoe Lane, London, E.C. 3d.
International Sugar Journal	Int. Sugar J.	2, St. Dunstan's Hill, London, E.C. 1s.
Internationale Zeitschrift für Metallographie	Internat. Z. Metallog.	Gebr. Bornträger, Schöneberger Ufer 12a, Berlin, W. 35. M. 40 per annum.
Journal of Agricultural Research	J. Agric. Res.	U.S. Department of Agriculture, Washington, D.C., U.S.A. 25 cents.
Journal of Agricultural Science	J. Agric. Sci.	University Press, Cambridge. 5s.
Journal of the American Chemical Society	J. Amer. Chem. Soc.	C. L. Parsons, Box 505, Washington, D.C., U.S.A. 60 cents.
Journal of the American Leather Chemists' Association	J. Amer. Leather Chem Assoc.	American Leather Chemists' Assoc., Easton, Pa., U.S.A. $6 per annum.
Journal of Biological Chemistry	J. Biol. Chem.	2419–21, York Road, Baltimore, Md., U.S.A. $3.25 per annum.
Journal of the Board of Agriculture	J. Board Agric.	Board of Agriculture and Fisheries, Whitehall Place, London, S.W. 4d.
Journal of the Canadian Mining Institute	J. Canad. Min. Inst.	3 and 4, Windsor Hotel, Montreal, Canada.
Journal of the Chemical Society of London, Transactions and Proceedings	Chem. Soc. Trans. *or* Chem. Soc. Proc.	Gurney and Jackson, 33, Paternoster Row, London, E.C. Trans. 5s.
Journal of the Chemical, Metallurgical, and Mining Society of South Africa	J. Chem. Met. Soc., S. Africa	F. Rowland, 9, South African School of Mines Building, Eloff Street, Johannesburg. 3s.
Journal de Chimie Physique	J. Chim. Phys.	Gauthier-Villars, 55, Quai des Grands Augustins, Paris. 25 fr. per annum; the price of a single copy varies according to the size.
Journal of the College of Agriculture, Tokyo Imperial University, Japan	J. Coll. Agric., Tokyo	Director of the College of Agriculture, Tokyo Imperial University, Japan. Price varies.
Journal of the College of Engineering, University of Tokyo	J. Coll. Eng., Univ. Tokyo	The University, Tokyo.
Journal of the College of Science, Imperial University of Tokyo	J. Coll. Science, Tokyo	Director of the College of Science. Tokyo Imperial University, Japan. Price varies.
Journal of the Franklin Institute	J. Franklin Inst.	The Actuary, The Franklin Institute, Philadelphia, Pa., U.S.A. 50 cents.
Journal für Gasbeleuchtung und Wasserversorgung	J. Gasbeleucht.	R. Oldenbourg, Glückstrasse 8, München, Germany. M. 20 per annum.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER AND PRICE.
Journal of Gas Lighting	J. Gas Lighting	W. King, 11, Bolt Court, Fleet Street, London, E.C. 6d.
Journal of Industrial and Engineering Chemistry	J. Ind. Eng. Chem.	C. L. Parsons, Box 505, Washington, D.C., U.S.A. 60 cents.
Journal of the Institute of Brewing	J. Inst. Brewing	Harrison and Sons, 45, Pall Mall, London, W. 4s.
Journal of the Institution of Mechanical Engineers	J. Inst. Mech. Eng.	Storey's Gate, Westminster, S.W.
Journal of the Institution of Petroleum Technologists	J. Inst. Petroleum Tech.	The Institution, 17, Gracechurch Street, London, E.C. 5s.
Journal of the Russian Physical-chemical Society	J. Russ. phys.-chem. Soc.	Laboratoire de Chimie, Université Impériale, St. Pétersbourg, Russia. R. 1.50.
Journal of Physical Chemistry	J. Phys. Chem.	W. D. Bancroft, Ithaca, N.Y., U.S.A. $4 per annum.
Journal de Pharmacie et de Chimie	J. Pharm. Chim.	O. Doin et fils, Place de l'Odéon, Paris, 8. 17 fr. per annum.
Journal für praktische Chemie	J. prakt. Chem.	J. A. Barth, Dörrienstr. 16, Leipzig, Germany. M. 26.50 per annum.
Journal of the Royal Society of Arts	J. Soc. Arts	G. Bell and Sons, York House, Portugal Street, London, W.C. 6d.
Journal of the Society of Dyers and Colourists	J. Soc. Dyers and Col.	Pear Assurance Buildings, Market Street, Bradford, Yorks. 2s.
Journal of the Washington Academy of Sciences	J. Wash. Acad. Sci.	2419, Greenmount Avenue, Baltimore, Md., U.S.A. 25 cents; 50 c. for July, Aug., and Sept. numbers.
Kolloid-Zeitschrift	Kolloid-Zeits.	T. Steinkopff, Bismarckplatz 16, I., Dresden-A, 14, Germany. M. 3—4.
L'Industria Chimica	L'Ind. Chimica	Associazione Chimica Industriale, Via Roma 28 (Galleria Nazionale Scala A), Turin, Italy. Lira 1.
Memoirs of the College of Science and Engineering, Kyoto Imperial University	Mem. Coll. Sci. and Eng. Kyoto Imp. Univ.	The University, Kyoto, Japan. Yen 0.65.
Mémoriale des Poudres et Salpêtres	Mém. Poudres et Salpêtres	Gauthier-Villars, 55, Quai des Grands Augustins, Paris. $2.
Metall und Erz	Metall u. Erz	W. Knapp, Mühlweg 19, Halle on Saale, Germany. M. 28 per annum.
Metallurgical and Chemical Engineering	Metall. and Chem. Eng.	McGraw Publishing Co., 239, West 39th Street, New York City, U.S.A. 10s. per annum.
Mining and Engineering World	Min. and Eng. World	Monadnock Building, Chicago, Ill., U.S.A. 10 cents.
Mittheilungen aus dem königlichen Materialprüfungsamt zu Gross-Lichterfelde West	Mitt. k. Materialprüf.	Julius Springer, Linkstrasse 23/24, Berlin, W. 9, Germany. M. 16 per annum.
Mittheilungen aus der Centralstelle für wissenschaftlich-technische Untersuchungen	Mitt. Centralst. Wiss.-techn. Unters.	Prof. Dr. W. Will, Neu-Babelsberg, bei Berlin, Germany.
Mittheilungen des k.k. Technischen Versuchsamtes	Mitt. k.k. Techn. Versuchsamtes	Verlag der k.k. Hof- und Staatsdruckerei, Wien. Austria.
Monatshefte für Chemie der kaiserlichen Akademie der Wissenschaften, Wien	Monatsh. Chem.	A. Hölder, Rothenthurmstrasse 25, Wien I, Austria. M. 16.50 per annum.
Moniteur Scientifique	Monit. Scient.	Dr. G. Quesneville, 12, rue de Buci, Faubourg St. Germain, Paris. 2 fr.
Oesterreichische Zeitschrift für Berg- und Hüttenwesen	Oesterr. Z. Berg- u. Hüttenw.	Kohlmarkt 20, Wien I, Austria. Kr. 28 per annum.
Oil, Paint, and Drug Reporter	Oil, Paint, and Drug Rep.	100, William Street, New York City, U.S.A. $6 per annum.
Paper Making	Paper Making	5, Ludgate Circus Buildings, E.C. 5s. per annum.
Papier-Fabrikant	Papierfabr.	Otto Elsner, Oranienstr. 140-142, Berlin, S. 42. 50 Pf.
Perfumery and Essential Oil Record	Perfumery and Essent. Oil Rec.	6, Serle Street, London, W.C. 1s.
Petroleum	Petroleum	Verlag für Fachtliteratur, Motzstrasse 8, Berlin, W. 30. M. 1.50.
Pharmaceutical Journal	Pharm. J.	150, Holborn, London, E.C. 6d.
Philippine Journal of Science	Philippine J. Sci.	Bureau of Science, Manila, Philippine Islands. 50 cents.
Philosophical Magazine and Journal of Science	Phil. Mag.	Taylor and Francis, Red Lion Court, Fleet Street, London, E.C. 2s. 6d.
Photographic Journal	Phot. J.	Harrison and Sons, 45, Pall Mall, London, S.W. 1s.
Proceedings of the American Society of Civil Engineers	Proc. Amer. Soc. Civ. Eng.	220, West 57th Street, New York City, U.S.A.
Proceedings of the Engineers' Society of Western Pennsylvania	Proc. Eng. Soc. W. Pa.	2511, Oliver Building, Pittsburg, Pa., U.S.A. 50 cents.
Proceedings of the Faraday Society	Proc. Faraday Soc.	The Secretary. 82, Victoria Street, London, S.W.
Proceedings of the Institution of Civil Engineers	Proc. Inst. Civ. Eng.	The Secretary. Great George Street, London, S.W.
Proceedings of the Institution of Mining and Metallurgy	Proc. Inst. Min. and Met.	1, Finsbury Circus, London, E.C. 21s. per annum.

Journal.	Abbreviation.	Address of Publisher and Price.
Proceedings of the Royal Society	Roy. Soc. Proc.	Harrison and Sons, 45, St. Martin's Lane, London, W.C. Price varies.
Recueil des Travaux Chimiques de Pays-Bas	Rec. Trav. Chim. Pays-Bas	A. W. Sijthoff, Leiden, Holland. 6 fl. per volume.
Revue Générale des Matières Colorantes	Rev. Gén. Mat. Col.	L. Lefevre, 4, rue de Stockholm, Gare St. Lazare, Paris, France. 3 fr.
Revue de Métallurgie	Rev. Mét.	H. Dunot and E. Pinat, 49, Quai des Grands Augustins, Paris. 4 fr. 50.
School of Mines Quarterly	Sch. Mines Quart.	T. H. Harrington, Columbia University, New York. 50 cents.
Science Reports of Tohoku Imperial University	Sci. Reports, Tohoku Imp. Univ.	The Maruzen-Kabushiki-Kaisha, Sendai, Japan. Price varies.
Scientific American	Scient. Amer.	361, Broadway, New York City, U.S.A. 10 c.
Scientific Proceedings of the Royal Dublin Society	Scient. Proc. Roy. Dublin Soc.	Leinster House, Dublin. Price varies.
Silikat-Zeitschrift	Silikat-Zeits.	Verlag von Müller und Schmidt, Coburn, Germany. M. 12 per annum.
Sitzungsberichte der Königlich, Preussischen Akademie der Wissenschaften	Sitzungsber. Kgl. Preuss. Akad. Wiss.	Verlag der Königlichen Akademie der Wissenschaften, Berlin. M. 12 per annum.
Sprechsaal	Sprechsaal	Verlag von Müller und Schmidt, Coburg, Germany. M. 14 per annum.
Stahl und Eisen	Stahl u. Eisen	A. Bagel, Breitestr. 27, Düsseldorf 74, Germany. M. 30 per annum.
Tonindustrie-Zeitung	Tonind.-Zeit.	Dreysestrasse 4, Berlin, N.W. 21, Germany. M. 20 per annum.
Transactions of the American Ceramic Society	Trans. Amer. Ceram. Soc.	The Secretary, Columbus, Ohio, U.S.A. $5.50 per annum.
Transactions of the American Electrochemical Society	Trans. Amer. Electrochem. Soc.	Lehigh University, South Bethlehem, Pa., U.S.A. $3 per vol.
Transactions of the American Foundrymen's Association	Trans. Amer. Foundrymen's Assoc.	R. Moldenke, Watchung, N.J., U.S.A.
Transactions of the American Institute of Metals	Trans. Amer. Inst. Metals	Buffalo, N.Y., U.S.A. $3 per annum.
Transactions of the American Institute of Chemical Engineers	Tr. Amer. Inst. Chem. Eng.	D. Van Nostrand Co., New York, and F. & N. Spon, Ltd., London.
Transactions of the Australian Institute of Mining Engineers	Tr. Austral. Inst. Min. Eng.	57-59, Swanston Street, Melbourne, Victoria, Australia.
Transactions of the English Ceramic Society	Trans. Engl. Ceram. Soc.	Victoria Institute, Tunstall, Staffordshire. 30s. per annum.
Transactions of the Institute of Metals	Trans. Inst. Metals	Institute of Metals, Caxton House, Westminster, London, S.W.
Transactions of the Iron and Steel Institute	Trans. Iron and Steel Inst.	28, Victoria Street, London, S.W.
Transactions of the North of England Institute of Mining and Metallurgy	Tr. N. Eng. Inst. Min. and Met.	Newcastle-on-Tyne.
Tropenpflanzer	Tropenpflanzer	Pariser Platz, 7, Berlin, N.W., Germany. M. 15 per annum.
United States Bureau of Mines, Bulletins and Technical Papers	U.S. Bureau of Mines, Bull. & Tech. Papers	Bureau of Mines, Washington, D.C., U.S.A. Price varies.
United States Department of Agriculture Bulletins	Bull. U.S. Dept. Agric.	Department of Agriculture, Washington, D.C., U.S.A. Price varies.
Wasser und Gas	Wasser u. Gas	G. Stalling, Oldenburg i. Gr., Germany.
West Indian Bulletin	West Ind. Bull.	Imperial Dept. of Agriculture, Barbados, W.I.
Wochenblatt für Papierfabrikation	Wochenbl. Papierfabr.	Güntter-Staib in Bieberach a. d. Riss, Würtemberg, Germany. 50 Pf.
Wochenschrift für Brauerei	Woch. f. Brau.	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany. M. 40 per annum.
Zeitschrift der analytischen Chemie	Z. anal. Chem.	C. W. Kreidel's Verlag, Wiesbaden. Germany. M. 2.
Zeitschrift für angewandte Chemie	Z. angew. Chem.	Verlag von Otto Spamer, Nürnberger Strasse 48, Leipzig, Germany. M. 36 per annum.
Zeitschrift der anorganischen Chemie	Z. anorg. Chem.	Verlag von L. Voss, Leipzig, Germany. M. 12 per volume.
Zeitschrift des Vereins der deutschen Zucker-Industrie	Z. Ver. deut. Zuckerind.	Vereins-Direktorium, Kleiststrasse 32, Berlin, W. 62, Germany. M. 45 per annum.
Zeitschrift für das gesammte Brauwesen	Z. ges. Brauw.	R. Oldenbourg, Glückstrasse 8, München, Germany. M. 20 per annum.
Zeitschrift für das gesammte Schiess- und Sprengstoffwesen	Z. ges. Schiess- u. Sprengstoffw.	J. F. Lehmann, Paul Heysestrasse 26, München, Germany. M. 1.
Zeitschrift für Elektrochemie und angewandte physikalische Chemie	Z. Elektrochem.	W. Knapp, Mühlweg 19, Halle a. S., Germany. $6.50 per annum.
Zeitschrift für Farben-Industrie	Z. Farben-Ind.	Verlag für Textil-Industrie, Kottbuser Ufer 39/40, Berlin, S.O. 26, Germany. M. 1.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER AND PRICE.
Zeitschrift für öffentliche Chemie	Z. öffentl. Chem. ..	M. & H. Schaper, Hannover, Germany. 50 Pf.
Zeitschrift für physikalische Chemie	Z. physik. Chem. ..	W. Engelmann, Mittelstrasse 2, Leipzig, Germany. M. 76 per annum.
Zeitschrift für physiologische Chemie.	Z. physiol. Chem. ..	Verlag von K. J. Trübner, Strassburg, Germany. M. 12 per volume.
Zeitschrift für Spiritusindustrie ..	Z. Spiritusind. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany. M. 30 per annum.
Zeitschrift für Untersuchung der Nahrungs- und Genussmittel	Z. Unters. Nahr. u. Genussm.	Julius Springer, Linkstrasse 23/24, Berlin, W. 9, Germany. M. 48 per annum.
Zeitschrift für Zuckerindustrie in Böhmen	Z. Zuckerind. Böhm...	Die Administration, Vodickova No. 704 (Palais Lucerna), Prag II, Bohemia. M. 17.20 per annum.

LIST OF ERRATA, 1914.

No. of Journal.	Page.	Column.	Line from Top.	Line from Bottom.	Errata.
No. 1—Jan. 15	32	1	..	14	*For* " Offerdahl-Larvik " *read* " Offerdahl."
No. 2—Jan. 31	73	2	..	16	*For* " 260,915 " *read* " 460,915."
,, ,,	93	2	25	..	*For* " Kempler " *read* " Kempter."
No. 3—Feb. 16	127	1	5	..	*For* " Cozzolins " *read* " Cozzolino."
,, ,,	136	2	..	9	*For* " 263,390 " *read* " 268,390."
No. 5—Mar. 16	254	1	..	22 & 23	These two lines should be transposed.
No. 6—Mar. 31	317	Table right-hand	8	..	*After* " 5 per cent." *insert semi-colon and after* " above " *a comma.*
,, ,,	323	1	27	..	*For* " lard " *read* " butter."
No. 10—May 30	557	2	..	9 to 12	*Delete these four lines and insert* " R. B. Earle, Assignor to Hood Rubber Co., Boston. U.S. Pat. 1,093,923, April 21, 1914."
No. 11—June 15	576	2	..	7	*For* " 1 in." *read* " 1 foot."
,, ,,	577	2	..	19	*For* " jelly " *read* " colloid."
,, ,,	578	1	12	..	*In analyses of pine oils table, col. 2, sp. gr. in last line should be* " 0·9383."
,, ,,	593	2	19	..	*For* " 1941 " *read* " 1914."
,, ,,	604	1	..	12	*For* " W. E. Heyl " *read* " G. E. Heyl."
,, ,,	608	2	12 & 13	..	*Should read* " Eng. Pats. 9170, Apr. 18, 1913, and 7456 of 1914, date of appl., Apr. 18, 1913."
No. 14—July 31	759	1	..	20 & 39	*For* " Anhydrat " *read* " Anhydat."
No. 15—Aug. 15	798	2	Title of Second Patent		*For* " Krapp " *read* " Krapf."
No. 17—Sept. 15	875	1	..	7	*For* " Van Fischenko " *read* " Von Tischenko."
No. 18—Sept. 30	917	1	4	..	*For* " Callebant " *read* " Callebaut."
,, ,,	933	2	8	..	*Insert patentee's name* " G. W. Sinclair."
No. 20—Oct. 31	1024	2	5	..	*For* " I. David " *read* " T. David."
No. 21—Nov. 16	1070	1	..	29	*For* " P. T. Muller " *read* " P. T. Müller."
No. 22—Nov. 30	1099	1	Title of First Patent		*Insert patentee's name,* " J. Haworth."
,, ,,	1110	1	..	23	*For* " capable " *read* " incapable."

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THE UTILISATION OF THE PHENOMENA OF PUTREFACTION, WITH SPECIAL REFERENCE TO THE TREATMENT AND DISPOSAL OF SEWAGE SLUDGE.

BY F. R. O'SHAUGHNESSY, A.R.C.SC., F.I.C.

The water carriage of solid refuse from domestic and industrial sources, whilst solving in a neat manner many of the problems of cleanliness, sanitation and commerce, has raised in the sewage itself a problem which is an exceedingly difficult one. It frequently happens that the difficulty of solving the sewage problem completely, grows at a greater rate than the volume of the sewage to be dealt with; for all along the line at each stage of clarification or purification of the sewage one is met by some difficulty, some hindrance, due to solid matter, which hampers the elimination of the soluble impurities in the liquor. So much is this the case that one may truly say that the sludge problem is the sewage problem, and certain of the difficulties, while easily coped with on a small scale, tend to get unmanageable on the large scale.

One of the most cogent difficulties too where masses of human ordure are accumulated is the prevention of aerial nuisance, and so important is this question in populous districts that the whole process is frequently modified and great expense incurred simply to achieve this end.

The fate of the sewage liquor and the conditions covering its treatment must greatly modify the process of sludge treatment, and I propose to show in a concrete case how such considerations have acted and are acting.

In 1908 the Royal Commission on Sewage Disposal in its Fifth Report dealt fairly fully with the sludge question at that time. Since then much work has been done both in this country and abroad towards the elucidation of this problem. The methods emerging and apparently finding increasing favour are towards the exhaustive digestion of the sludge by biological means. Incidentally some 20 to 30 per cent. or more of the solids of the sludge may be destroyed by the digestive process, but by far the most important result is the production of an odourless solid, which will dry in a reasonable time, all the operations being carried on without nuisance.

That such a digestive process may be conducted without nauseous smell is generally put down to the presence of iron in the sewage, but the fact is overlooked that the same result may be attained in a sewage with very little iron present; and on the other hand a sewage rich in iron may easily give rise to abominable odours during its treatment. In fact, whether iron is present or not, the greatest care must be exercised if nuisance is to be avoided, and if the digestive process is carried on under proper conditions the smell is generally least where the action is most vigorous. The advantage in the author's experience deriving from the presence of iron is that putrefactive change is held up in the sewage (as by any antiseptic trade waste). One has then a liquor relatively free from smell to manipulate, and although the iron undoubtedly causes difficulty in setting up active putrefaction later, still by proper manipulation this action can be promoted vigorously enough at the desired time, and then with a minimum of smell.

By sludge, the author indicates the solids deposited from sewage after the grit is removed. There are four ways in which sludge may be disposed of, viz. :—

(1) By burial in the ground.
(2) By discharge at sea.
(3) By burning.
(4) By tipping in hollows on waste ground.

True disposal consists in the destruction of the sludge *qua* sludge. Methods (1), (2) and (3) are absolute methods of disposal, whilst (4), although often having much to recommend it if the sludge has been properly prepared, cannot be carried on indefinitely, but has the advantage of cheapness.

The author proposes here to give a concise history of the evolution of the present process for treating the sludge at Birmingham. A natural process of elimination has operated whilst working towards the present system.

On March 10th, 1902, the author read a Paper before the London Section of this Society (this Journal, May 31st, 1902), in which some account was given of sludge treatment up to that time at Birmingham. The method up to 1900 consisted in chemical precipitation by lime (about

No. 1.—Table of Analyses.

Results expressed in parts per 100,000.

Year.	Oxygen absorbed. In 4 hours.		Estimated on dissolved and suspended matters.		Chlorine.	Nitrates and nitrites as nitrogen.	Dissolved solid matter.	Suspended matter.			
	Unsettled sample.	Settled sample.	Free and saline ammonia.	Albuminoid ammonia.				Total.	Volatile.	Non-volatile.	
					Crude Sewage.						
1910	23·61	14·55	3·78	1·32	14·7	—	—	40·7	24·9	15·8	
1911	24·88	15·20	3·65	1·43	16·8	—	—	43·2	26·8	16·4	
1912	20·77	12·81	4·01	1·41	14·2	—	—	40·6	23·8	16·8	
1913	24·16	15·72	3·74	1·39	15·7	—	—	38·0	24·3	13·7	11 months
					Preliminary sedimentation or Roughing Tanks Effluent.						
1910	23·33	13·85	3·98	1·34	15·3	—	—	31·1	16·1	15·0	
1911*	21·74	15·66	4·12	1·06	16·5	—	—	25·7	13·7	12·0	
1911†	17·79	14·02	3·88	0·88	17·2	—	—	7·7	4·0	3·7	
1912	14·87	10·21	3·73	0·85	13·5	—	—	12·7	7·2	5·5	
1913	15·07	11·90	3·53	0·72	14·2	—	—	8·7	4·6	4·1	11 months
					Secondary sedimentation or large Balancing Tank Effluent.						
1910	13·87	9·74	5·18	0·68	14·6	—	—	10·7	5·0	5·7	
1911*	16·53	11·50	5·65	0·91	16·0	—	—	17·9	9·8	8·1	
1911†	16·55	13·27	3·65	0·84	16·6	—	—	7·7	4·0	3·7	
1912	12·53	9·62	3·97	0·76	13·6	—	—	7·7	4·0	3·7	
1913	14·95	11·72	3·94	0·74	14·7	—	—	6·0	3·0	3·0	10 months

* 1st six months. † 2nd six months.

12 grains per gallon). The sludge was run on to the land in a crude state and allowed to dry, when it was dug in and a crop planted. The nuisance attaching to this method was intolerable, and in the early part of 1900, Mr. John D. Watson, the Engineer to the Drainage Board, introduced a method of trenching the sludge whereby the exposure to the air and therefore the nuisance was considerably reduced. Nevertheless the nuisance at times was very great, and another method was looked for. Lime treatment was given up and septic treatment introduced in 1901, and continued with various modifications, till the middle of 1911. At this time septic treatment of the whole sewage was adopted by general consent amongst many leading experts, and many varying statements were put forward as to the time the sewage should be submitted to the anaerobic digestion and as to the effects produced thereby. Witness for instance the conflicting evidence given by various experts before the Royal Commission on Sewage Disposal. The figure given for destruction of sludge by the septic tank at that time was :—

At Leeds	30 per cent.
At Manchester	25 per cent.
At Birmingham	10 per cent.

It soon became apparent that the septic tank as a means of sludge disposal had limitations, and with the steady growth of oxidising filters serious drawbacks appeared, viz. : (1) The very large "suspended solids" present in the septic tank effluent. (2) The nuisance produced by the septic tank effluent whilst being applied to the bacteria beds.

Unless a septic tank be of inordinate size in proportion to the flow the amount of suspended matter issuing from it in the tank effluent increases as the activity of the tank increases. The following figures are instructive in this regard :—

Sewage precipitated with 17 parts lime per 100,000 :—

	Suspended solids parts per 100,000.
Primary sedimentation tank	16·3
Secondary ditto	4·2

Sewage not limed but above tanks converted to septic tanks.

	Suspended solids parts per 100,000.
Primary sedimentation tank	30
Secondary ditto	26

The capacity of the primary tanks was later increased nearly 70 per cent., and that of the secondary tanks 44 per cent., and septic action was promoted freely in both sets of tanks. Notwithstanding the increased volume of the tanks, the effluents during the following years were as follows :—

Primary Sedimentation Tanks effluent.

	Suspended solids parts per 100,000.
During 1907	28·0
1908	29·9
1909	30·1
1910	31·1
First half 1911	25·7

Secondary Sedimentation Tanks effluent.

	Suspended solids parts per 100,000.
During 1907	24·2
1908	31·9
1909	19·1
1910	10·7
First half 1911	17·9

At this time the area of bacteria beds was being rapidly increased, and the disadvantage of the above septic tank effluent became more and more apparent. Further sedimentation in Dortmund tanks was given the tank liquor before passing it to the bacteria beds, but as this form of tank lends itself readily to septic action, the already foul liquor was rendered fouler and the sedimentation of the solids interfered with. Moreover two-thirds of the crude sludge arrested at Saltley outfall had to be treated by separate digestion in lagoons of huge size. The behaviour of the sludge in these lagoons furnished much extremely useful information, for it was seen that when once actively "working" crude sludge could be assimilated by them without any nuisance being produced. Their capacity, although great, was limited, and after 18 months they silted up (in 1909). The depth of the sludge in them after all the water had been drawn off the surface was about 10 feet. This sludge behaved like an emulsion and the water present was as follows :—

	Per cent. water.
At bottom 10 feet below surface	57·6
6 ditto	65·5
2 ditto	70·0
At the sufrace	75·0

It was found that on exposing the sludge from the above lagoon in layers about 12 inches thick on prepared plots of ground that after a time a hard dry sludge cake resulted.

For the reasons above mentioned and acting on the experience gained in these lagoons, experiments were started at Saltley in 1910 on the digestion of the crude sludge apart from the sewage liquor. The experiments continued till April, 1911, and indicated that vigorous putrefaction of the sludge apart from the sewage liquor could be expeditiously promoted, that no nuisance would be produced, whilst 15 to 20 per cent. of the sludge could be destroyed thereby. The resulting sludge was dried on prepared beds.

Curiously enough, following immediately on all this came the excessively hot summer of 1911, and the aerial nuisance produced by the exposure of the putrid tank effluent—about 25,000,000 gallons per day—during treatment, was so great and so extensive that it became absolutely necessary to change the process. The great sewer and Dortmund tanks were sterilised by bleaching powder, the putrid sludge from the primary sedimentation tanks was pumped away, and putrefaction of the sewage liquid was *prevented* as far as possible, whilst digestion of the sludge was started and *promoted* as much as possible. The nuisance abated immediately. This process has been steadily improved and extended since that time.

The primary sedimentation tanks (called Roughing Tanks by Mr. Charles Hawksley), five in number, have a combined holding capacity of 5,610,150 gallons. The sewage requires four or five hours to pass through them at ordinary times and deposits most of its suspended solids therein.

Analyses of Roughing Tanks effluent.

	Suspended solids.					Oxygen absorbed.	
	Total.	Volatile.	Free Amm.	Alb. Amm.	Cl.	Unsettled.	Settled.
1911*	25·7	13·7	4·12	1·06	16·5	21·74	15·66
1911†	7·7	4·0	3·88	·88	17·2	17·79	14·02
1912	12·7	7·2	3·73	·85	13·5	14·87	10·21
1913	8·7	4·6	3·53	·72	14·2	15·07	11·90

* 1st six months. † 2nd six months.

Each "roughing" tank runs for from two to three weeks, when it is stopped, the water overlying the sludge pumped back to the sewer outfall, and the sludge containing on the average 86·6 per cent. water is pumped to the secondary sedimentation tanks now used as digestion tanks. These digestion tanks are 20 in number arranged as follows :—

			galls.
16 small tanks each of	283,700 galls. capacity	Total	4,539,500
4 large ditto	680,920 ditto		2,723,680
		Digestion tanks capacity	7,263,180

The primary sedimentation tank effluent passes for further sedimentation through a large balancing tank holding about 6,000,000 gallons of sewage and used to regulate the flow of sewage led to the bacteria beds.

Balancing tank effluent.

	Suspended solids.					Oxygen absorbed.	
	Total.	Volatile.	Free Amm.	Alb. Amm.	Cl.	Unsettled.	Settled.
1911*	7·7	4·0	3·65	·84	16·6	16·55	13·27
1912	7·7	4·0	3·97	·76	13·6	12·53	9·62
1913	6·0	3·0	3·94	·74	14·7	14·95	11·72

* Last six months.

The sludge.—The sludge consists of the bulk of the solids in the sewage less the detritus, the larger solids arrested by a 6 in. screen, and the fine light matter passing over the tank weirs above. In considering its qualities an analysis of faecal matter is given here for comparison :—

Results of analysis of faecal matter.

Water	80 per cent.
Dry solids	20 per cent.

The dry faecal matter contains :—

Matter volatile at red heat	85·70 per cent.
Matter non-volatile ditto	14·30 per cent.
Total nitrogen	5·31 per cent.

Absorbs 16 per cent. of its weight of oxygen
(*a*) From acid $KMnO_4$ at 80° F. in 4 hours
(*b*) Dissolved oxygen from water in 2 days at 65° F.

By prolonged agitation with water about 70 per cent. of the solid faecal matter will be taken up by the water mostly (about 60 per cent.) in colloidal solution. When once taken up in this way the colloidal matter separates again only with extreme slowness from the water. In passing it may be remarked that this furnishes a strong objection to the use of fine-mesh screens for the sewage, as they break up the incoming faecal matter and cause it to be taken up by the liquid. For the same reason there is a similar objection to the pumping of crude sewage.

The average results of analysis of the crude sludge as produced under present conditions of manipulation are as follows :—

	Per cent.
Water	86·6
Dry solid matter	13·4

The dry solid matter contains :—

	Per cent.
Matter volatile at red heat	58·5
Matter non-volatile ditto	41·5
Total nitrogen	2·71
Matter extracted by ether	22·20
Fatty matter extracted by ether	20·00
Resinous ditto	2·20
The saponification equivalent of the fatty matter	267·3
Ditto ditto resinous matter	111·2
Average specific gravity of wet sludge (60° F.)	1·047
Ditto ditto dry solid matter	1·50

The crude sludge is a foul smelling, viscous mass, dirty grey to brown or black in colour and highly colloidal.

The sewage liquor which has carried the above sludge to the outfall receives large consignments of trade effluents inimical to bacterial life. For instance the following results show this :—

	Approx. dry weather flow.	Aerobic organisms per c.c.	Anaerobic organisms per c.c.
	galls.		
Saltley crude sewage	1,750,000	873,000	152,000
Rea crude sewage ..	11,000,000	370,000	150,000
Hockley crude sewage	7,000,000	121,000	1,000
Aston crude sewage..	5,250,000	453,000	81,500

The above figures, too, probably represent merely the organisms which have survived the action of the poisonous bodies present in the liquor which wrought the destruction of their fellows, for an average sewage will contain from 3,000,000 to 9,000,000 or more organisms per c.c.

In this respect the following results obtained from a sludge which had proved refractory and had lain in the digestion tanks for about three weeks smelling offensively prove very interesting :—

		Total Counts Organisms per c.c.
Gelatin-Peptone-Bouillon at 20° C.	Mean	24,000
Agar-Peptone-Bouillon at 37° C.	Mean	130,000,000
Coli group		7,000
Proteus group (including Enteritidis Sporogenes)		100,000
Denitrifiers		500
Fat splitting organisms		10,000
Cellulose		100,000

Note.—See also d and d_2, page 6.

Not till this sludge had undergone prolonged digestion and been admixed with more active sludge did it lose its nauseous smell, notwithstanding great care in its manipulation.

Samples of the crude sludge may be isolated and kept for months under favourable conditions for its putrefaction, and yet will undergo only trifling loss of weight.

Method of calculating the loss of weight of the digested sludge.—It may be as well at this point to indicate the method by which the loss in weight of the digested sludge is calculated.

Let x = the percentage of water in the original undigested sludge.
y = ditto volatile matter in this sludge dried at 105° C.—110° C.
x_1 = ditto water in the sludge after digestion.
y_1 = ditto volatile matter in the digested sludge dried at 105° C.—110° C.
L = ditto loss in weight due to digestion of the original dried sludge.

Then $$\frac{y-L}{100-L} \times 100 = y_1.$$

and $$100y - 100L = 100y - Ly_1$$

From this we get $$L = \frac{100\,(y-y_1)}{100-y_1}$$

also $$x_1 = \frac{x \times 100}{100 - \frac{L\,(100-x)}{100}}$$

For instance a sludge containing 85 per cent. water, and 60 per cent. volatile matter in the dry solids, undergoes digestion, and the dry digested residue is found to contain 40 per cent. organic matter. Then the loss

$$L = \frac{100\,(60-40)}{100-40} = \frac{100 \times 20}{60} = 33\tfrac{1}{3} \text{ per cent.}$$

and the water content

$$x = \frac{85 \times 100}{100 - \frac{33\frac{1}{3}\,(100-85)}{100}} = \frac{85 \times 100}{100-5}$$

$$\frac{85 \times 100}{95}$$

$$= 89{\cdot}5 \text{ per cent. water.}$$

The rate of disappearance of the organic matter in the sludge, of its nauseous odour, and colloidal character varies greatly, depending largely on the conditions to which the sludge is subjected. For instance sludge buried in large masses in water-logged ground has been observed by the author to remain almost unaltered for years. The following table gives the fate of sludge under different conditions :—

Description.	Vol. matter in dry sludge.	Remarks.
	per cent.	
(a) Faecal matter + water standing 7½ years	81·1	Sludge still brown and emitting H_2S.
(b_1) Crude sewage sampled 9th May, 1913	60·4	
(b_2) Analysed (b_1) six months later	56·3	Represents 9·4 per cent. destroyed. Sludge slimy and smelling of indol.
(c_1) Crude sludge sampled 24th May, 1913	59·6	
(c_2) Analysed (c_1) six months later	54·4	Represents 11·4 per cent. destroyed. Sample still grey, slimy and foul.
(d_1) Crude sludge which "worked" badly and putrefied slowly for 3 weeks, giving off foul odours. Sampled May 20th, 1913.	54·7	Bacteriological analysis given above.
(d_2) Analysed (d_1) again six months later	52·9	Sample dark but still foul.
(e_1) Sludge digesting slowly but steadily, May 29th, 1913	52·6	Partially digested.
(e_2) Analysed (e_1) again six weeks later	51·8	Partially digested.
(e_3) Analysed (e_1) after standing six months	41·7	Nearly 28 per cent. of sludge destroyed
(f_1) Sludge which had undergone digestion with double pumping in tanks, Saltley. Sampled September 27th, 1912.	42·2	Time in tanks six weeks. Nearly 28 per cent. destroyed.
(f_2) Analysed (f_1) 13 months later	39·3	Represents 31 per cent. destroyed.
(g) Sludge which had digested about five years in bottom of deep lagoon.	41·0	Sludge about quite "worked out."
(h) Sludge which had been put through the existing process at Saltley and had digested seven or eight weeks.	48·7	Perhaps 20 per cent. of original sludge destroyed. Sample black and had lost its nauseous odour. (Bacteriological Analysis below).

The first set of experiments on the digestion of sludge apart from the sewage liquor were started in October, 1910, and included the passing of varying amounts of water through the digestion tanks for the purpose of washing away the products of digestion as they are formed. With a flow through the tanks of about 2,000 galls. per hour (1/600th of their volume) the effluent was as follows :—

The effluent water was black, foul and opaque containing much sediment and colloidal matter :—

	Parts per 100,000.
Suspended solids—	
Total	26·0
Volatile at red heat	14·0
Solid colloids (precipitated by Fowler's process and weighed)—	
Total	41·0
Volatile at red heat	33·5
Free and saline ammonia	8·76
Albuminoid ammonia	0·78
Chlorine	12·4
Oxygen absorbed in 4 hours at 80° F.—	
Unsettled liquor	20·34
Settled liquor	15·20
Soluble colloids	12·01
Soluble non-colloids	3·19
Organic introgen—	
In settled sample	5·32
In soluble colloids	2·52

There are serious objections in practice to the passage of water through the sludge in this manner. Experiments were made on similar lines in June and July of this year (1913) and numerous observations made both in the laboratory and on the large scale as to the effect of washing sludge in this way. The balance of evidence indicated that the washing assisted the digestion to some extent, but the advantage in practice was small as compared with the disadvantage entailed in the treatment of the very foul effluents and the dilution of the sludge by the washwater.

Numerous estimations were made of the ammonia present in the putrefying sludge (the NH_3 being taken as an index). Great variation was observed, but although the ammonia was as high in some cases as 130 parts per 100,000 the sludge "worked" quite vigorously notwithstanding.

The crude sludge to be dealt with at the Saltley works averages 4,860 cube yards per week, and contains on the average 86·6 per cent. water with an average density of 1·047 at 60° F. This means 3,833 tons of wet sludge per week, or 514 tons of dry matter of 1·50 specific gravity.

The whole of this huge mass of filth was treated by the process of destructive digestion about to be described, during 1912 and 1913, with on the whole good results. The Secondary Sedimentary Tanks referred to earlier, with a capacity of about 40,000 cube yards, were used for this purpose. It had often been observed that when a mass of sludge began to putrefy the action was slow at first, then very vigorous, and after a time the action slowed off. If now the putrid mass be vigorously shaken or disturbed (as by shaking a sample in the laboratory or by pumping on the large scale) the sludge will begin to "work" with renewed vigour, and the process is thereby much expedited. This fact was taken advantage of in practice.

The sludge digestion operations.—As the crude sludge was pumped over from the sedimentation tanks to the digestion tanks, a portion of the well rotted sludge was drawn from an adjoining tank by another pump and forced into the delivery main along with the crude sludge. In this way the relatively sterile crude sludge was inoculated. The best mixture was found to be 1 of ripe sludge to 4 of crude sludge. After a couple of days the mass of sludge began to "work" vigorously, and after a fortnight the action began to slow down. A portion was then withdrawn and pumped over into a second set of tanks when further vigorous working ensued. It was always necessary to leave a modicum of rotting sludge in each of the tanks when sludge was withdrawn, and the larger the bulk of this residue in proportion to the incoming fresh sludge the better.

It is estimated that this second pumping of the sludge lessens the time of maturing by five or six weeks, being equivalent to an extra tank capacity of 30,000 cube yards or more. Economically therefore the double pumping pays.

The results obtained in 1912 were as follows :—

	Water in sludge.	Volatile matter in dry sludge.	Original sludge destroyed.
	per cent.	per cent.	per cent.
Sludge pumped from Primary Digestion Tanks	89·3	45·3	23
Sludge pumped from Secondary Digestion Tanks	87·8	42·4	27
The corresponding	figures for	1913 are	:—
Primary Digestion tanks	—	50·0	16
Secondary Digestion Tanks	85·0	46·9	21

Fat in digested sludge 14·00%. Total nitrogen 2·47%.

Note.—Much water was pumped back to the sewer from the rotting sludge.

The resulting sludge from the above process is pumped on to specially prepared drying plots. An area of close on 50 acres has been laid out for this purpose. The plots are levelled and are about ¾ of an acre in size, and an earthen bank 2 ft. high is erected round the plot. Drains consisting of 4 in. agricultural drain pipes are laid a few inches in the ground at 9 feet apart and covered with ashes

The whole floor of the bed is then covered with ashes to a depth of 3 to 6 in., and the bed is ready for use.

The plot is filled with sludge to a depth of 18 in., and the sludge is then allowed to dry. Something like 60 per cent. of the water escapes by the drains and is pumped back to the sewer. In moderate weather perhaps 30 per cent. disappears by evaporation, though this latter varies considerably. The time required for the drying process varies from three weeks to several months, depending on the condition of the sludge and on the weather. When dry the sludge is lifted into wagons and carried as a hard innocuous mass to the tip.

Attempts have been made to use the dried sludge as a fuel. The author has found it to burn fiercely when once started with a good draught, and a good clinker may be obtained. But as a means of steam raising the enormous ash (nearly 60 per cent. of the solids) tends to flux and adhere to the furnace bars, and this together with the moisture militates against its use for this purpose. Two estimations have been made of the calorific value as follows :—

	Calorific value of sludge dried at 212° F.	
Sample No. 1	4803 B.T.U.	H. Silvester, B.Sc.
" No. 2	4120 B.T.U.	W. B. Davidson, M.A., Ph.D.
Average	4507 B.T.U.	

One lb. of the dry material will evaporate about 5 lb. water theoretically, but when burnt in house refuse destructor on large scale it has been found that 1 lb. dry sludge as lifted from the Drying Beds will evaporate 1 lb. water.

Discussion of the merits of the above Digestion Process.—It is evident from the results given above that the destruction of organic matter in the sludge is at first very rapid. The rate of destruction also diminishes rapidly, and the limiting value seems to be reached when about 30 per cent. of the original sludge has disappeared. It is quite remarkable that Birmingham sludge which has undergone exhaustive digestion for very prolonged periods, even for several years, has still an organic content of about 40 per cent. This represents a destruction of about 30 per cent. of the original sludge. After a time then the change in the sludge becomes excessively slow. Here the limit can be reached in seven or eight weeks, but the resulting sludge is still colloidal in character and does not dry rapidly. The time required to produce a non-colloidal sludge is about three months, so that the last half of the time is occupied chiefly with a physical change in the sludge. When this change is complete the sludge separates from the sludge-liquor, which latter becomes translucent whilst the sludge loses its adhesive properties.

The bacteriological analysis of a sample of sludge which had undergone active digestion under the above process for seven to eight weeks gave the following results :—

	Total counts.	
	Aerobic.	Anærobic.
	per c.c.	per c.c.
G.P.B. at 20° C.	52,000,000	15,700,000
A.P.B. at 37° C.	5,000,000	3,000,000
Coli group	60,000	
Proteus group	100,000 at least	
Denitrifiers	100,000 at least	
Fat splitting organisms	100,000 at least	
Cellulose organisms	50,000	

Note.—About 20% of the original sludge had been destroyed.

The large Balancing Tank referred to in this Paper arrests a portion of the residual suspended solids and also a part of the solid matter in colloidal solution, held in the effluent from the Primary Sedimentation or Roughing Tanks. This matter so arrested slowly accumulates on the floor of this enormous basin, and the tank is cleaned out every two to three months. The sludge derived therefrom is a very uniform, finely divided, mobile, black mass, which is quite inoffensive, having a slight tar-like odour. On analysis the following results were obtained :

	Per cent.
Water	89·7
Solid matter (dried at 105° C.)	10·3

The dry solids contained :—

	Per cent
Matter volatile at red heat	55·4
Matter non-volatile ditto	44·6
Fatty matter, etc., extractable by ether	21·9

About 10,000 to 12,000 cube yards of the above sludge are produced per annum.

It was anticipated from the experience and considerations outlined earlier in the Paper, that this sludge would be biologically active. This was actually found to be the case, and the sludge was drawn upon to inoculate the crude sludge being fed to the Digestion Tanks. The digestive process received thereby a considerable impetus ; and the thick coat or scum which had accumulated on these tanks during months or even years of work was rapidly dissipated after inoculation in this way. Advantage is now taken of the qualities of this sludge, and it is incorporated with the crude sludge as a matter of routine when a charge is removed from the Balancing Tank.

The Cost of the Process. The figures for costs were taken over as lengthy a period as possible in order to get the aggregate and average cost in a reliable manner.

(1) Cost of Tankage, Digestion and Pumping to Drying Beds :—

	£	s.	d.
Wages	1,622	10	0
Coal	710	5	0
Stores and materials	90	9	0
Repairs, etc.	22	10	0
Water charges	75	5	0
Total	£2,420	19	0

Volume of sludge dealt with over this period 260,000 c. yds. Approximate cost per c. yd. of wet sludge, 2¼d.

(2) Cost of Drying Sludge, Lifting and carrying to Tip :—

	£	s.	d.
28,816 c. yds. of dry sludge	990	17	7
Cost per c. yd. of dry sludge			8·3
Ditto wet sludge			2·5

(3) Hence adding 1 and 2 together we get :—

Total cost per cube yd. of wet sludge, 86·6 % water 4·7 pence.
Total cost per ton of wet sludge, 86·6 % water .. 6·3 pence.

In comparing this cost with that of other processes, account must be taken of the percentage of water in the sludges treated. Especial care is paid to the method of manipulation of the Preliminary Sedimentation (Roughing) Tanks to ensure the reduction of the water in the crude sludge to a minimum. The result is a fresh sludge of exceptional density, containing on the average 86·6 per cent. water. Until recent years the figure for the water content of the fresh sludge was between 90 and 95 per cent., and if the present sludge were allowed to contain say 90 per cent. water, then the volume of the sludge to be dealt with would be increased by one-third. Under these conditions the aggregate cost would be appreciably increased, but the cost per cubic yard would appear rather less than the figure given above (see table below). Caution must be exercised, therefore, in making comparisons of this kind, and a fairer figure for comparison is the cost per million gallons treated or *per capita* of population.

	s.	d.
Cost of the above process per million gallons of sewage ..	9	6
Ditto *per capita* of population per annum		1¼

The dry weather sewage flow is close upon 30,000,000 gallons per day, and the population close upon 1,000,000 souls.

The figures for cost given by the Royal Commission on Sewage Disposal are as follows :—

	Per ton of wet sludge containing 90 % water. pence.
Sea disposal	4·1—6·9
Trenching in soil	4—7
Pressing (for large towns)	7·7—12·6
Pressing and burning	15
Sludge digestion at Birmingham, with drying and tipping	5d (approximate)

In connection with the very ingenious process of sludge digestion adopted in Essen, Germany, and which has been applied and perfected by Dr. K. Imhoff at various works in Essen, and other towns under the administration of the Emschergenossenschaft, the author wishes to remark that whereas the Imhoff Tank deals admirably with the sludge derived from normal flows up to three times the dry weather flow, it does not appear to lend itself to the treatment of sludge from storm water. In August last the author was very interested to see when on a visit to Dr. Imhoff at Essen that tanks were being constructed for the treatment of storm water sludge on similar lines to those worked out at Birmingham and described above.

This Paper is brought forward to furnish a record of work done in an attempt to solve this troublesome problem in a large inland town. Finality is far from reached yet in the disposal of the sludge, and much investigation is proceeding as to the possibilities of the sludge in various directions.

The author wishes to thank Mr. John D. Watson, M.Inst.C.E., Engineer to the Birmingham Drainage Board, for allowing this information to be brought forward, and Mr. Arthur Bryan, Chief Assistant Engineer, for much valuable help in preparing some of the statistics. Dr. Gilbert J. Fowler, of Manchester, has kindly helped by making some of the bacteriological examinations. The author also wishes to mention the work done by Mr. D. L. Black, Superintendent of Works, who has very ably carried out the operations connected with the tankage and digestion of the sludge, and has often helped with valuable practical suggestions.

Discussion.

Mr. G. F. Bartrip enquired if the dried sludge had any manurial value. He believed that similar dried sludge formed a component part of some fertilisers. Were the recent proposals for the liberation of the fatty acids of any real value?

Mr. H. Silvester said that when contact beds were first introduced it was stated that they were capable of dealing with the suspended matter in spite of the fact that much of this was inorganic, and this was soon found to be impossible. Destructive distillation of the pressed sludge was advocated before the Society some years ago, but the profit shown on that occasion could not be realised with ordinary sewage sludge.

The great value of the paper before them resulted from the large scale of the operations, and the length of time over which the observations had been made. The figures for suspended matter in the tank effluent were higher than what he had generally found in the effluent from the septic tank of a local sewage works. There was, however, an abnormal amount of trade waste in that sewage, and the comparative absence of colloidal matter possibly accounted for their more complete removal. He should be glad to know the author's explanation of the further digestion that resulted from pumping, and also if there was a considerable amount of fatty matter present in the finished sludge, and whether the quantity was worth attempting to recover.

As regards the utilisation of the sludge as a fuel, apart from its low calorific value, he should expect the very fusible clinker of which there was a considerable amount and which would prevent anything like complete combustion, to operate against it. Had the author any experience on this point?

Dr. W. B. Davidson said he was of opinion that the sludge, if it were dried—and did not contain more than from 5 per cent. to 10 per cent. of moisture—might be of some value in the manufacture of producer gas. It might be mixed with good coke because the nitrogen content was rather higher than ordinary coal. The question of ash was not a great objection with boilers of large capacity, as fuels with 30 per cent. of ash could be used. He would like to give the sludge a trial. If the cost of carriage were high, he doubted whether it would pay.

The Chairman (Mr. H. T. Pinnock) stated that he had tried the experiment of using dried sludge for making producer gas. It came from Bradford, and made an excellent ammonia recovery and rich gas, but difficulty was experienced owing to the large amount of ash, and the offensive smell resulting, when used in an open producer. He thought the sludge, however, might be used in a properly constructed producer.

Mr. Wm. Cliford said it was no small achievement to convert the whole of the sludge deposited at Saltley into a comparatively inodorous material and incidentally to reduce the bulk very considerably, even though the final dumping of the residue at a tip left something to be desired. The difficulties of dealing with large volumes of sludge in such a way as not to cause a nuisance raised the question of the advisability of draining the sewage of large inland populous areas to one outfall works. Destruction, whether by digestion or otherwise, was a last resort against nuisance and practically admitted failure to find a means for the utilisation of the sludge.

On the question of costs, one would like to know more fully what was included in the figures given, and how that amount was equivalent to 1½d. per capita. Did the amount include interest and sinking fund on all or any of the capital expenditure involved in the process of sludge disposal? Had any allowance been made for maintenance and repairs charges on tank and plant? Was any part of the establishment charges allocated to sludge disposal? The present process was the latest of a series which had their day and no doubt left a residue in the form of interest and sinking funds on scrapped plant and depreciated lands. Was anything taken of these charges? In short, where did the charges begin and where did they end?

Mr. O'Shaughnessy, replying, said that sewage sludge was a very slow acting manure and as against modern fertilisers was little favoured by farmers. The cost of transit even, deterred farmers from using it and the managers of small works were considered fortunate if they could get rid of their sewage sludge to farmers in their immediate neighbourhood. In certain exceptional instances it was possible to get a small fee of 6d. or 1s. per ton for the dried or pressed sludge. Innumerable attempts had been made to convert sewage sludge into a marketable manure, but notwithstanding repeated failures the problem was being actively investigated by various workers. The matter had received some attention from the Royal Commission on Sewage Disposal, and in their Fifth Report in 1905 they give the results of experiments and field trials by various experts on the manurial value of manures prepared with sewage sludge as a base. These results were not very encouraging.

Several investigators now claimed that they had evolved processes which were capable of yielding a handsome profit, and further experience of these would be awaited with interest.

With respect to the recovery of fatty acids from sludge, Dr. Grossmann, of Manchester, stated that he was doing this profitably at Oldham.

Mr. Silvester asked for the explanation of the increased activity resulting from the second pumping of the putrefying sludge. The bulk of the solid matter in the sludge fell after a time to the bottom of the tank, and the author's theory was that the products of putrefaction accumulated in the vicinity of the solids and tended to stop the action. Also digestion did not take place uniformly, and when the putrid sludge was pumped over into another tank, the whole mass was well mixed thereby and the organisms were again capable of acting vigorously.

It was true, as Mr. Silvester observed, that the fusibility of the clinker from the burning of sewage sludge, presented a serious difficulty in the way of the use of the sludge as a fuel. The fatty matter in the digested sludge was about 14 per cent. and the question of its use was under investigation.

The author was pleased to hear Dr. Davidson's optimistic opinion on the sludge as a source of producer gas, and Mr. Pinnock's results were in accord with that opinion.

The Birmingham Drainage Board Authorities would no doubt be pleased to let Dr. Davidson have some of the sludge for experimental purposes.

With respect to Mr. Clifford's observations he might say that whilst it was true that some of the valuable constituents of the sludge were destroyed by this process, the analysis of the final product showed that a little over one-third of the fatty matter and about one-fourth of the nitrogen were lost. The phosphoric acid would be very little altered. It was therefore far from the fact to say that the digested sludge resulting from the process was useless. In view of the possibilities of this sludge and the large amount of promising investigation going on just now he (the author) considered it a very desirable thing to accumulate the sludge on a tip. This process made such storage possible by eliminating the nauseous character of the sludge.

The merits of small versus large outfall works were chiefly engineering and financial ones, which usually told in favour of the large installation.

The means for utilising the sludge had yet to be worked out, and if the claims of the inventors of some recent processes were realised when tried on a large scale, then this means would be very shortly at hand. In the meantime the processes like the one described in this paper relieved the community of a serious nuisance.

The difficulty in connection with the manurial value of sludge was exemplified by the small proportion of the nitrogenous matter destroyed by the above process. This provided independent evidence of the extreme slowness with which the nitrogen became available for the nourishment of plant life.

As to the cost of the process, the costs given above were working costs, and included maintenance and repairs of working parts of machinery. From a mechanical point of view the process was simple and the wear and tear very small. The interest on capital and sinking fund charges were in this case very intricate, and so involved that it was almost impossible to assess them accurately. Their net contribution to the figure for cost was however probably small.

NOTE ON GRU-GRU OIL.

BY A. W. KNAPP, B.SC., F.I.C.

Gru-gru is the Trinidad name for *Acrocomia sclerocarpa.* I saw trees of the same species (*Acrocomia lasiospatha*) in Grenada, and they are said to grow in many parts of S. America. They will grow in the poorest of soils. The trunk has at intervals circles of sharp spines, so that it is almost impossible to climb. The tree belongs to the same tribe as the coconut palm—the leaflets are thinner and the trunk is generally swollen in the middle. The leaves are said to yield a very delicate fibre. The fruits are oblate spheroid in shape, about the size of a large plum, and dark green in colour. The skin is very tough, but if the fruits are allowed to fall to the ground this rots off leaving the nuts behind, the kernels remaining sweet. The shell of the nut is about ⅛-inch thick and hard, the kernel (⅝-inch across) has the appearance and flavour of coconut, but is tougher and more transparent.

Fruit: length 1½ inch, breadth 1¾ inch, weight 30 grammes.

	Per cent.
Pericarp	59·73
Shell	31·30
Kernel	8·97
	100·00

Dry ether extracts 2·44 per cent. from the pulp of the pericarp. The kernel contains:—

	Per cent.
Fat (petroleum ether extract)	49·13
Water	8·14
Albuminoids	13·70
Fibre and unestimated	29·03
	100·00

One tree I examined had on it 9 large bunches, each bunch containing about 400 fruits, that is, in all 3,600. The kernels were collected in March. The oil, which was obtained from the kernels by pressing them when hot, gave the following figures:—

	Oil.	Insoluble fatty acids.
Colour	Very pale yellow	White
Odour	Like coconut oil	Like coconut fatty acids
Taste	Ditto	Ditto
Sp. gr. (99° C. water at 15·5° C.)	0·861	0·838
Melting point	26·0° C.	24·0° C.
Titer		23·05° C.
Iodine value (Wijs)	19·4	20·3
Refraction at 40° C.	36·95	19·7
Saponification value	243·5	
Reichert-Meissl value	7·2	
Polenske value	13·9	
Shrewsbury and Knapp	163·0	
Neutralisation value	—	261·9
Mean molecular weight	—	214
Free fatty acids (as oleic)	0·62%	

From the above properties I conclude that this is the same oil as Mocaya oil of Paraguay and the oil from the maccasuba palm of Surinam (see De Nigri and Fabris, Chem. Rev., 1897, 82; and Sack "Inspectie van den Landbouw in West Indie," Bulletin 5, 1906).

It is evident both from the organoleptic and analytical tests that the oil is very similar to coconut and palm-kernel oils, so that it consists chiefly of laurin and myristin. It contains about 12 per cent. more olein than coconut oil, and hence should have about the same value as palm-kernel oil.

The soap produced from this oil is almost white and has excellent lathering properties, and the "stearine" from the oil would make a good edible fat.

It is not at present cultivated in the West Indies, and hence, although widely distributed is only thinly scattered, so that the gathering of sufficiently large quantities presents considerable difficulty. Further, the nuts are very hard. The shells when cracked are heavy enough to be separated from the kernels by immersion in brine. Last June, as an experiment, copra was prepared from gru-gru nuts in St. Vincent.

In conclusion I wish to thank Mr. S. B. Phillips for his assistance.

DISCUSSION.

Mr. **SILVESTER** asked if the author had any knowledge of gru-gru oil being used, for cocoanut oil, in the manufacture of margarine.

Mr. **KNAPP** replied that he was not aware that such a practice was followed, though there was no reason why it should not be pursued.

Newcastle Section.

Meeting held at Armstrong College on Wednesday, December 10th, 1913.

MR. T. W. LOVIBOND IN THE CHAIR.

THE SOLUBILITY OF MINERAL PHOSPHATES IN CITRIC ACID.

BY G. S. ROBERTSON, B.SC.

Quite recently artificial manure manufacturers have placed on the market large quantities of mineral rock phosphates as a suitable phosphatic manure. These mineral phosphates, in spite of the fact that they are very finely ground, are only slightly soluble in 2 per cent. citric acid.* They were therefore assumed to be of little use as an available manure compared with basic slag and bone meal, in which 80 to 95 per cent. of the phosphates are soluble in 2 per cent. citric acid.

With the object of testing mineral phosphates a series of experiments were laid down at Cockle Park, the results of which are given in the following tables :—

TABLE I.*

Upper Brick Field.

Plots 1/20th acre.	Three years' ley.	Average yield of hay for 3 years, per acre.
		cwt.
1.	10·85 cwt. of basic slag, 35·89 % phosphate of lime, 95% citric soluble	38¼
2.	9·1 cwt. basic slag, 42·7% phosphate of lime, 75% citric soluble	39¾
3.	9·75 cwt. basic slag, 39·97% phosphate of lime, 88·6 % citric soluble	39¾
5.	8·5 cwt. bone meal, 46·64% phosphate of lime, mostly citric soluble, and also contained 4·78% nitrogen	40¼
6.	6·6 cwt. Tunisian phosphate, 59·99% phosphate of lime, trace citric soluble .	37½
7.	No dressing	33¾
8.	10·5 cwt. Belgian rock phosphate (calcined) 37·16% phosphate of lime, trace citric soluble	40½

* See Guide to Cockle Park for 1913, page 39, also Guide for 1914.

TABLE II.*

Tower Hill Field.

Plots 1/20th acre.	Three years' ley.	Average yield of hay for 2 years per acre.
		cwt.
1.	9·5 cwt. basic slag, 41·3% phosphate of lime, 89% citric soluble	41¾
2.	19·7 cwt. basic slag, 19·82 % phosphate of lime, 66% citric soluble	44¾
3.	8·5 cwt. bone meal, 46·64% phosphate of lime, mostly citric soluble, also contained 4·78% nitrogen	38¾
4.	No dressing	38
5.	8·6 cwt. Tunisian rock phosphate (ground) 45·3% phosphate of lime, trace citric soluble............................	42½
6.	8·25 cwt. Belgian rock phosphate (ground) 47·2% phosphate of lime, trace citric soluble............................	42¾
7.	16·25 cwt. Belgian rock phosphate (calcined), 24% phosphate of lime, trace citric soluble	44½
8.	4·12 cwt. Belgian rock phosphate (ground) 47·2% phosphate of lime, and 6·5 cwt. superphosphate, 29·9% soluble phosphate of lime..................	45¾

* See Guide to Cockle Park for 1913, page 40. Also Guide for 1914

The cost of a unit of phosphate in rock phosphates is only about 9d., whilst in basic slag it is about 1s. 4d. It will therefore be readily understood that the use of rock phosphates might prove of considerable economical importance.

With the object of finding a satisfactory explanation of the successful results obtained by the use of rock phosphates, the following short investigation was carried out.

At the commencement of the investigation a Belgian rock phosphate and a calcined Belgian rock phosphate were submitted to two consecutive extractions with 2 per cent. citric acid. The Belgian phosphate showed three times as much phosphate soluble in the second extraction as in the first, while the calcined sample showed ten times as much soluble in the second as in the first extract.

These results led to five consecutive extractions being made of each of four rock phosphates. The results of these extractions are given in the following table :—

TABLE III.

Belgian Rock Phosphate.

Extraction.	P_2O_5	$Ca_3P_2O_8$	CaO
1st	1·58	3·45	13·84
2nd	4·81	10·49	10·80
3rd	4·81	10·49	9·02
4th	4·30	9·39	7·73
5th	3·20	6·98	—
Total for 5 extractions	18·70	40·80	41·39
Actual totals	21·24	46·36	49·28

Calcined Belgian Rock Phosphate.

Extraction.	P_2O_5	$Ca_3P_2O_8$	CaO
1st	·40	·86	47·63
2nd	3·76	8·21	8·01
3rd	3·72	8·12	5·82
4th	1·96	4·28	3·32
5th	0·70	1·53	1·13
Total for 5 extractions	10·54	23·00	65·91
Actual totals	11·16	24·34	67·50

Tunisian Phosphate.

Extraction.	P_2O_5	$Ca_3P_2O_8$	CaO
1st	3·86	8·44	17·23
2nd	7·72	16·88	12·54
3rd	5·78	12·62	9·42
4th	3·86	8·44	6·00
5th	1·48	3·25	2·24
Total for 5 extractions	22·70	49·63	47·43
Actual totals	22·61	49·46	46·50

Calcined Tunisian Phosphate.

Extraction.	P_2O_5	$Ca_3P_2O_8$	CaO
1st	1·22	2·65	19·96
2nd	4·90	10·68	9·05
3rd	4·26	9·28	6·48
4th	4·12	8·99	5·84
5th	3·15	6·90	4·42
Total for 5 extractions	17·65	38·50	45·75
Actual totals	24·29	53·01	55·79

In the case of the calcined Belgian phosphate it is probable that the large amount of free lime present did by neutralising the citric acid interfere with the solubility of the phosphates in the first extract. These results undoubtedly show that these rock phosphates are completely soluble in citric acid, if enough citric acid is used, and enough time is spent in the extraction. Further, if we take into consideration the fact that the process of solution in the soil rendering phosphates soluble is a continuous one, then the reasons why these so-called "citric insoluble phosphates" give just as good results as the high citric soluble slags is readily understood. It is worthy of note that the second and third extractions give the bulk of the phosphates soluble in citric acid, but the first extract contains more lime than any other extract. In other words, the citric acid test as commonly performed is a test for lime rather than a test for phosphates.

Conclusions.—This investigation demonstrates the worthlessness of the citric acid test as a means of judging the relative value to the plant of phosphatic manures. The original purpose of the citric acid test was to detect adulterations, against which purpose nothing is urged.

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* To perform this test 5 grms. of the phosphate are placed in a litre flask containing 500 c.c. of 2% citric acid solution. The flask is shaken end over end for 30 minutes in an apparatus making 30 revolutions per minute.

It is the subsequent interpretations which have been put on this test that the author considers unreliable.

Summary of Field Experiments on Three Years' Ley.

Manure.	Number of experiments.	Total number of years.	Average yield of hay per acre.
			cwt.
Slag (200 lb. P_2O_5 per acre) ..	5	13	40·3
Bone meal (200 lb. P_2O_5 per acre)	2	5	39·7
Mineral phosphates (200 lb. P_2O_5 per acre)	5	12	41·0
No manure................	2	5	35·2

The author wishes to express his sincere thanks to Mr. S. Hoare Collins for his invaluable advice and suggestions, and to Professor Gilchrist for permission to publish the figures in Tables I. and II.

ON THE DIFFERENCE BETWEEN THE CALCULATED AND DETERMINED CALORIFIC VALUES OF COAL GAS.

BY G. WEYMAN, M.SC.

In the course of the examination of the gas manufactured at the Elswick and Redhough Works of the Newcastle and Gateshead Gas Company, some interesting points were observed. It was noticed that the difference between the calculated and actually determined calorific values was about 28 B.T.U. per cub. ft. for the gas manufactured in the horizontal retort plants, and this difference —provided no great change was made in the method of working—was remarkably constant. When the vertical retort plant was started at Elswick, it was evident that no less than about 43 B.T.U. would have to be added to the calculated value to bring it up to the determined. When, some months later, a tar circulation was introduced to keep the cross-collecting mains free from thick tar, the difference between the two values considerably decreased. The tar for the circulation, which at first was taken back to the wells as soon as it entered the large main, was subsequently allowed to run with the gas right along to the condensers. A further decrease in the difference between the two calorific values was noticed. Suspicions as to stripping of the gas by the tar were aroused, and the following experiments were made to solve the point.

1. A twenty cubic-foot holder was filled with gas from the vertical plant, mixed, and allowed to attain a constant temperature. The calorific value was determined and an analysis made. The gas was then passed through a a sample of the tar at 16° C., which had been taken from the tar outlet beside the works' condensers and again examined. From the results shown in Table No. 1 it is evident that the calorific value of the gas had been depreciated by 11·7 B.T.U. by passing through the tar. The tar has stripped the gas of some hydrocarbons. The calculated calorific value (the constants used are taken from the table in Coste's *Calorific Power of Gases*), however, is practically the same. One would imagine then that the hydrocarbons removed by the tar are such as are not estimated in the analysis. In fact the olefines show a slight increase; while the carbon monoxide has suffered to the extent of nearly 1 per cent. The methane and hydrogen also show a change which is more than warranted by experimental error.

TABLE 1.—*Gas and tar separated at 72°. C.*

	Without tar.	Tar at 16° C.
Cal. val. gross detd.	559·3	547·6
Cal. val. calc. gross	542·5	543·1
CO_2	0·0	0·0
O_2	0·8	0·8
CnHm	2·1	2·2
CO	8·6	7·8
CH_4	29·9	29·5
H_2	53·2	54·7
N_2	5·4	5·0
	100·0	100·0

Note.—In all the analyses which were made in the Sodeau Apparatus the CnHm were absorbed in bromine water, the CH_4 and H_2 determined by explosion, and the N_2 by difference. All the calorific values are in gross B.T.U. pr. c. ft.

A fresh series of experiments was made in which the tar was heated to different temperatures. It should be noted that the gas and tar were separated in the works at 72° C. and in the results given in Table 2, the calorific value at 75° C. is slightly higher than the original sample of gas, while below this temperature it gradually decreases in value.

TABLE 2.—*Tar and gas separated at 72° C.*

	Without tar.	Tar at 60° C.	Tar at 64° C.	Tar at 70° C.	Tar at 75° C.
Cal. val. detd. gross....	555·6	542·0	544·5	553·1	558·8

An additional series of experiments gave confirmatory results which are shown in Table 3 :—

TABLE 3.—*Tar and gas separated at 72° C.*

	Without tar.	Tar at 85° C.	Tar at 87° C.	Tar at 92° C.	Tar at 86° C.	Tar at 75° C.	Tar at 60° C.
Cal. val. detd. gross	543·6	549·6	551·1	554·7	555·2	548·0	535·5
Cal. val. calc. gross	545·7			544·4			
CO_2	0·0			0·0			
O_2	0·4			0·3			
CuHm	2·4			2·4			
CO	9·1			8·8			
CH_4	29·4			29·2			
H_2	53·1			53·6			
N_2	5·6			5·7			
	100·0			100·0			

In this series the tar was gradually heated and then slowly cooled, the calorific value and samples for analysis being taken at intervals. The calculated value for the original gas is higher than the determined, but falls below as the temperature at which it passes through the tar is raised above 70° C. Considering these results as a whole it is quite clear that there are present in the gas some hydro-carbon vapours, which are not estimated in the analysis and therefore, while they contribute towards the determined calorific value, are not included in the calculated figure. These hydrocarbon vapours, unlike the hydro-carbons estimated by bromine are easily removed by tar, in fact a state of equilibrium exists between tar, gas and hydro-carbon vapour, which depends on the temperature at which they are in contact. The higher the temperature, the greater will be the amount of vapour in the gas, and if the gas is then removed, it will of course carry the vapour with it. Also it is evidently these vapours which make the difference between the calculated and determined values, rather than any difference in composition of the olefines determined by absorption in bromine water. The variation in the difference between the calculated and determined values shown in connection with the vertical plant is clearly due to the lower temperature of separation of tar and gas when the tar circulation was introduced, with consequent reduction in the amount of hydro-carbon vapour present. These considerations led me to find a way of estimating these hydro-carbon vapours, and I soon found that Bunsen had distinguished between the permanent unsaturated gases, ethylene, propylene, etc. (the olefines) and the vapours of volatile saturated hydro-carbons. Bunsen found that the vapours could be dissolved out in absolute alcohol, while the excess of alcoholic vapour could be afterwards removed by water. The estimation must be made before any treatment of the gas, since benzene and other vapours, are soluble in caustic soda, cuprous chloride and other reagents. It is necessary to have the oxygen expelled from alcohol and water by saturation with coal gas.

In order to find out exactly what difference the prior removal of the hydro-carbon vapours would make, I analysed a sample of gas with and without removing them. The result is given below :—

TABLE 4.

	Ordinary method.	Bunsen method.
Hydrocarbon vapours	—	2·0
CO_2	1·0	0·7
O_2	0·8	0·7
C_nH_m	3·3	2·4
CO	8·0	7·0
CH_4	34·8	31·9
H_2	47·2	48·6
N_2	5·9	6·7
Cal. val. gross detd.	618·6	618·6
Cal. val. gross calc.	597·6	624·2

Note.—Hydrocarbon vapour assumed to have cal. val. 3738 B.T.U. per c. ft. ; C_nH_m, 2301 B.T.U. per cub. ft.

The result is interesting as showing that the 2 per cent. of hydrocarbon vapours unless previously removed contributes to the amount of gas absorbed in the various reagents and is left in sufficient quantity to materially affect the determination of the methane and hydrogen. The olefines show a decrease of one per cent. which is partly to be attributed to the bromine removing some of the vapour, while the caustic soda used to remove the excess of bromine vapour adds to the effect; and also to some absorption of ethylene in the alcohol. The carbon-monoxide is affected to a similar extent. The vapour which has survived the absorbents in the first case is much richer in carbon than methane and this throws the calculation of the hydrogen out.

The apparent discrepancies shown in the analysis of gas passed through tar described above are evidently the result of varying amounts of the hydrocarbon vapours, so that instead of carbon monoxide being apparently dissolved by passing gas through tar it is merely due to abstraction of hydrocarbon vapour by the tar. A paper published in the Journal of the American Chemical Society for 1908 by Dennis and M'Carthy recommends the use of an ammoniacal solution of nickel cyanide for estimating benzene in coal gas. The solution, however, has to be used after the absorption by caustic soda, leaving the latter free to absorb any hydrocarbon vapours. The solution also does not absorb homologues of benzene.

It seems a great pity that modern authors seem to have overlooked the presence of these vapours. In fact in one book published in 1911 dealing with the subject, one finds benzene classed with the unsaturated hydrocarbons and assumed to be absorbed by bromine. Benzene, of course, is a saturated compound (the aromatic compounds corresponding to ethylene, and acetylene, are cinnamene and phenyl-acetylene) which is only very slightly attacked by bromine under specific conditions. Moreover, there is as Bunsen and others have pointed out, a great physical distinction between the hydrocarbon vapours and the permanent gases, ethylene, propylene, etc., and for that reason it is most desirable to estimate them separately. The gas-manager, for example, need not trouble about the olefines once they are formed, but the utmost care must be taken if the hydrocarbon vapours are not to be lost in the purification. On the other hand it is difficult to see how a correct gas analysis can be made unless these vapours are removed beforehand.

In order to complete the investigation, a similar series of experiments to those described above were made, except that the hydrocarbon vapours were separated by means of alcohol in the analysis. The results are given in Table 5 and need little explanation, though it might be remarked that the gas passed through tar at 60° C. has a greater calorific value than the original gas, which was not so in the former case till the tar reached a temperature of over 70° C. This is of course because the tar and gas were separated in the works at a lower temperature in the latter case.

TABLE 5.—*Tar and gas separated at 52° C.*

	Without tar.	Tar at 15° C.	Tar at 60° C.
Cal. val. gross detd.	532·3	523·3	542·2
Hydrocarbon vapours	1·3	0·5	1·6
CO_2	0·1	0·1	0·1
O_2	0·2	0·2	0·2
C_nH_m	2·4	2·4	2·4

Summary. It has been shown above that serious errors may be introduced into an analysis of coal gas if the hydrocarbon vapours are not first removed. Alcohol may be used for this purpose and distinction is then made between these vapours, and the olefine gases subsequently absorbed by bromine. A small amount of ethylene is absorbed by the alcohol. Unless an allowance is made for these vapours, of which the chief constituent is benzene, the calculated calorific value is likely to differ very considerably from the determined value. Although insufficient data is at present to hand regarding the calorific power of the vapours absorbed by alcohol, yet seeing that they consist largely of benzene the constant will approach that of benzene. It is also evident that the value taken for the olefines, 2301 B.T.U. per cub. ft. or sometimes higher) and which has been used to cover the calorific value of the hydrocarbon vapours, which have not usually been estimated, will be too high. In this connection the work of Lebeau and Damiens, who found in the Paris gas about 2 per cent. of ethylene and only about one-half per cent. of propylene, is of interest as indicating that the calorific value of the gases absorbed by bromine is more likely to approach that of the former than the latter. Variation in the amount of hydrocarbon vapour present in different gases is more likely to occur than the large variations in the composition of the olefines which has been often assumed to account for discrepancies between calculated and determined values.

It has been again pointed out that the hydrocarbon vapours form a distinct class of substances to the olefine gases, and these vapours are responsible for an appreciable item in the total calorific value. To ensure these vapours being present in as large an amount as possible, the gas should be removed from the tar as hot as other factors will allow, since there is an equilibrium between tar, gas, and vapour, depending on the temperature (provided other conditions are similar) at which they are in contact. It is not likely that sufficient vapour will be obtained under ordinary carbonising conditions to saturate the gas at the ordinary atmospheric temperature, and if it be so the liquid condensed on cooling would prove a useful solvent for any solid naphthalene which may be deposited.

In conclusion, I desire to express my thanks for the courtesy of Mr. T. Hardie in connection with this investigation.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT ; MACHINERY.

Patents.

Evaporation of saturated solutions ; Apparatus and process for the —— and for the utilisation of the produced vapours. J. B. Vincent, Hamburg, Germany. Eng. Pat. 24,590, Oct. 28, 1912.

Steam under pressure, produced in a suitable generator, actuates a steam jet injector, which exhausts the vapour from the evaporator and forces it into the generator, wherein it is heated and then delivered at a suitable pressure and temperature to the heating coil of the evaporator. The steam generator may be divided into two portions, in one of which, part of the vapour is superheated to a higher degree and used for driving a steam engine, the exhaust steam from which may be passed to the heating coil of the evaporator.—A. S.

Evaporating apparatus. W. A. Seltmann, New Rochelle, N.Y. U.S. Pat. 1,079,669, Nov. 25, 1913.

Liquid is delivered into a suitably heated tank, in which it is evaporated to a paste which is removed by a screw conveyor and discharged on to an endless band conveyor in a second drying chamber. The band conveyor travels first horizontally and then vertically downwards, and a pair of brushes detaches the dried material from the vertical portion and delivers it to the discharge opening. —W. H. C.

Evaporating device rotating in a vessel partly filled with heated liquid. W. Greding. Ger. Pat. 266,970, June 5, 1912.

The rotating device consists of a cylinder composed of several layers of wire netting or gauze, which dips in the liquid and thus exposes a large surface of the latter. Any foam produced is retained by the gauze and carried below the surface of the liquid.—A. S.

Gases : Apparatus for the purification of furnace ——. C. T. A. H. Eckhardt, Hamburg, Germany. Eng. Pat. 26,655, Nov. 20, 1912.

In apparatus of the kind in which the gases pass through a number of horizontal drums in which a scrubbing liquid is agitated by paddles or dashers on a horizontal shaft, the connections are arranged so that the gases enter each drum near the periphery and leave near the axis.—A. T. L.

Drying apparatus ; Tunnel ——. W. Yates and Matthews and Yates, Ltd., Swinton. Eng. Pat. 27,349, Nov. 28, 1912.

A mixture of cool atmospheric air with highly heated furnace gases is drawn into the discharge end of a drying tunnel by an exhaust fan situated at the opposite end, the material to be dried being carried through the tunnel in trucks. A single fan may control the gas flowing through two parallel tunnels.—H. H.

Heating, cooling or drying grain or granular substances : Apparatus for ——. E. Samuelson, Banbury, and J. Backhouse, Bootle. Eng. Pat. 28,609, Dec. 12, 1912.

In apparatus in which the grain is passed down a tower across which a series of rows of horizontal pipes are arranged through which the heating or cooling agent is circulated, in order to increase the efficiency each alternate row of pipes is arranged at an angle with the next, and every row is so arranged that the spaces between the pipes in one row are vertically below or above the pipes in the row next but one.—W. H. C.

Desiccating liquids ; Apparatus for ——. C. E. Gray, Eureka, and A. Jensen, Oakland, Cal. U.S. Pat. 1,078,848, Nov. 18, 1913.

Heated air is introduced tangentially into a cylindrical chamber with a conical bottom and is withdrawn axially, whereby vortex currents are set up. The liquid to be desiccated is discharged in an atomised condition into the centre of the vortex currents, and the separated solid particles fall to the bottom of the cone and are withdrawn.—W. H. C.

Raising and forcing liquids ; Automatic apparatus for ——. C. R. B. Brown, London. Eng. Pat. 27,561, Nov. 30, 1912.

To secure greater efficiency in apparatus of the "Hero's" fountain type in which air is compressed by liquid which flows from an upper to a lower vessel, the air displaced from the upper vessel when the latter is being filled with liquid, instead of being allowed to escape, is compressed and forced into the lower vessel. When the upper vessel is filled the liquid is allowed to flow into the lower vessel, still further compressing the air and finally forcing it into the ejector, where it acts on the liquid and drives it up the rising main.—W. H. C.

Vessels in which inflammable liquid is employed ; Method and apparatus for protecting closed ——. Martini und Hüneke Maschinenbau-Akt.-Ges., and P. Güngerich, Berlin-Steglitz, Germany. Eng. Pat. 15,263, July 2, 1913.

Closed vessels for treating materials with inflammable liquids in presence of air mixed with an inert gas are provided with a safety device adapted to prevent the inflammable liquid from entering the vessel until the pressure of the gas mixture therein reaches a value corresponding to the quantity of protective gas sufficient to prevent the formation of an explosive mixture. When the inert gas is only available at atmospheric pressure, the safety device is controlled according to the degree of vacuum required in the vessel in order to draw in the necessary amount of inert gas.—H. H.

Scale from boilers ; Process of removing ——. T. R. Greenhorne, Glasgow. Eng. Pat. 17,462, July 30, 1913.

The boiler is filled with cold water, carbon dioxide is introduced, and the solution allowed to act, for example, for 48 hours, until the scale is loosened.—H. H.

Sintering ; Method of treating materials for ——. Q. Bent and E. Barnhart, Sparrows Point, Md., and J. B. Ladd, Ardmore, Pa. U.S. Pat. 1,078,988, Nov. 18, 1913.

Material having a tendency to cohere is broken up into a fine state of division and then distributed over the sintering hearth as a loose porous mass of uniform density. —W. H. C.

Filter media ; Process of dislodging slime cakes from ——. C. Butters, Oakland, Cal. U.S. Pat. 1,078,994, Nov. 18, 1913.

The cakes are rendered as dry as possible by continuing the suction after the cake is formed, the vacuum is then cut off, and the cakes are flooded with water from above and washed off the frames.—W. H. C.

Filter for sludges, especially lignite sludge. Ribbertsche Braunkohlen-, Brikett- u. Tonwerke Ribbert und Co. Ger. Pat. 266,910, March 13, 1913.

The sludge is distributed uniformly over a fixed horizontal filter-table, to the underside of which suction is applied, and the residual cake is removed by means of an endless band fitted with scrapers.—A. S.

Separating mixtures of liquids; Process for ——. A. Golodetz, Berlin, Assignor to B. Benedix, Hamburg. U.S. Pat. 1,079,004, Nov. 18, 1913.

A mixture of two liquids is treated with a suitable quantity of a third liquid which forms with one of the constituents a binary homogeneous mixture of minimum boiling point, lower than the boiling point of either of the constituents of the original mixture, and is then subjected to fractional distillation.—W. H. C.

Separation and recovery of specifically lighter liquids from a mixture of liquids of different densities; Apparatus for the ——. B. Lorenzen. Ger. Pat. 266,575, Jan. 5, 1913.

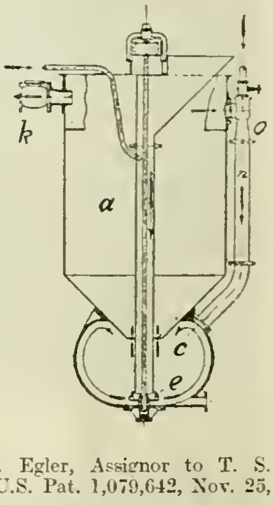
Water is introduced through a pipe into the vessel containing the mixed liquids in order to facilitate separation, and the lighter liquid overflows into an adjacent vessel. In the water supply pipe is an ejector connected with a closed receptacle, which in turn is connected with the vessel into which the lighter liquid overflows. The action of the ejector produces a vacuum in the closed receptacle and hence the lighter liquid is drawn up into the latter at a rate corresponding with the rate of supply of the water.—A. S.

Distilling liquids and fusible solids; Apparatus for ——. J. W. Aylsworth, East Orange, and F. L. Dyer, Montclair, N.J. U.S. Pat. 1,079,093, Nov. 18, 1913.

The materials to be distilled are passed down a vertical column packed with loosely arranged non-volatile material and heated by suitable jackets. The uncondensed distillation products are heated and circulated through the still to assist in carrying away the volatile matter.—W. H. C.

Dissolving sugar and other substances; Apparatus for ——. Maschinenfabrik Grevenbroich (vorm. Langen und Hundhausen). Ger. Pat. 266,335, Dec. 28, 1912.

The apparatus, which works continuously, comprises a dissolving vessel, *c*, and a settling vessel, *a*. The sugar or other material, is introduced at the upper end of the central vertical tube and the solvent, through the side tube connected therewith. The mixture of material and solvent is circulated in the dissolving vessel by means of the rotating device, *e*, in the direction shown by the arrows. The solution gradually rises in *a* and part of it is returned to *c* through the pipe, *n*, which is provided with means for conveying and heating it, *e.g.* with a steam injector, o. The clear solution is discharged continuously through the cock, *k*.—A. S.



Regenerative furnace. N. F. Egler, Assignor to T. S. Blair, jun., Chicago, Ill. U.S. Pat. 1,079,642, Nov. 25, 1913.

A by-pass is arranged between the gas inlet and waste gas outlet ports of the furnace so that part of the waste gas can be returned by means of a pump or fan and, without undergoing any chemical change, mixed with the fresh coke-oven or other gas entering the furnace.
—W. H. C.

Agitating liquids by means of compressed air or a liquid under pressure, with simultaneous heating. Dampfkessel- u. Gasometerfabrik A.-G. vorm. A. Wilke und Co. and Deutsche Teerproduktenvereinigung Ges. m. b. H. Ger. Pat. 266,344, Jan. 30, 1913.

The compressed air or liquid under pressure is introduced in the immediate vicinity of the heating surfaces by which the liquid to be agitated is heated.—A. S.

Vacuum crystallisers and the like; Hydraulic gear for ——. Maschinenfabrik Fritsch und Sohn. Ger. Pat. 266,458, Feb. 23, 1913.

The motion of the pressure cylinders of the hydraulic apparatus, one on either side of the drum, is transmitted to the crystallising drum by means of a wire rope or the like and pulleys, whereby it is possible to turn the drum through an angle of 180° or more.—A. S.

Vacuum; Production of a —— by means of low temperatures. J. E. Lilienfeld, Leipzig, Germany. Eng. Pat. 12,272, May 26, 1913. Under Int. Conv., Aug. 6, 1912.

See Fr. Pat. 458,346 of 1913; this J., 1913, 1094.—T. F. B.

Evaporating and distilling plant. W. Weir, Glasgow. U.S. Pat. 1,079,966, Dec. 2, 1913.

See Eng. Pat. 2813 of 1912; this J., 1912, 708.—T. F. B.

Fibres and the like from liquids; Apparatus for separating and recovering ——. E. V. Chambers and T. C. Hammond, Huddersfield. U.S. Pat. 1,079,975, Dec. 2, 1913.

See Eng. Pat. 7060 of 1912; this J., 1912, 837.—T. F. B.

Stirring and mixing liquids; Apparatus for ——. C. Still, Recklinghausen, Germany. U.S. Pat. 1,080,177, Dec. 2, 1913.

See Eng. Pat. 22,861 of 1910; this J. 1911, 941.—T. F. B.

Absorber and separator for gases and vapours. H. Hey, Dewsbury. U.S. Pat. 1,080,445, Dec. 2, 1913.

See Eng. Pat. 14,652 of 1912; this J., 1913, 780.—T. F. B.

Furnace. G. Wilton, Hendon. U.S. Pat. 1,081,073, Dec. 9, 1913.

See Eng. Pat. 15,459 of 1911; this J., 1912, 320.—T. F. B.

Separating substances of different specific gravities by means of a liquid of intermediate specific gravity; Process and apparatus for ——. A. Gründler. Fr. Pat. 460,225, July 10, 1913. Under Int. Conv., Oct. 29, 1912.

See Eng. Pat. 15,945 of 1913; this J., 1913, 1148.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Oil wells; Premature abandonment of ——. Possibilities of revival. Times Eng. Suppl., Dec. 17, 1913.

The Bureau of Mines of the United States has issued the following, by L. G. Huntley, dealing with the possible causes of the decline of oil wells and with suggested methods of prolonging their yield.

Premature exhaustion.—A part at any rate of the premature exhaustion of the oilfields may be apparent rather than real. There are many circumstances which affect not only the yield of a particular well, but also the wells in a pool of considerable area, and a better understanding of these has enabled pools to be re-started which had been abandoned as exhausted.

Waxy sediment.—One of the most important factors governing the extent and rapidity of the decline of yield of oil wells, is the formation of waxy sediments that obstruct the passage of oil from the sand bed. The petroleum, as found *in situ*, consists chiefly of hydrocarbons ranging from solid wax to light gases, and a partial separation of wax may take place before the petroleum reaches the surface owing to the cooling produced by the rapid volatilisation of the gaseous constituents when the pressure is relieved. The separated wax combines with water and fine rock sediments, clogs the pores of the sand, obstructs the flow of the oil into the well, and is the cause of many failures of wells situated in unexhausted territory.

Loss of pressure. The uncontrolled escape of the gaseous hydrocarbons, besides interfering with the production of an oil well as described, has a further injurious effect from an economical point of view. Each cubic foot of gas in expanding should perform its quota of work by assisting in the expulsion of the liquid petroleum, at the same time retarding the flooding action of water for a considerable period, or until the maximum amount of oil has been recovered. An illustration of the fatal result which may happen if the gas is allowed to drain away too rapidly is afforded by the Hogshooter pool in Oklahoma, where wells were commonly drawn upon to their utmost capacity. The consequence of this practice was that the water under high pressure in the lower part of the productive formation, being unrestrained by the pressure of the gas, flooded one well after another and ultimately ruined the district.

Wasteful competition.—Much waste results from the extravagant methods of production employed by operators (with small leases especially), who fight each other for production. Instances of this are to be found in Oklahoma, where the short-term leases granted by the Government have tempted operators to drill uneconomically with a view to extracting the maximum amount of oil before the leases expire. Methods of this description are attended by many evils, such as drilling more wells than are necessary, pumping too fast, wasting gas pressure (and the gas itself), flooding wells, and pumping one well against another. These practices are not only wasteful in themselves, but also tend to create underground conditions favourable to the encroachment of water.

"*Coming back*" *of districts.*—In certain of the older Pennsylvania and West Virginian oilfields the apparent regeneration of the oil supply led to the belief that oil was continually being formed underground, and that exhaustion was impossible. This belief has caused the useless expenditure of large sums of money. At the same time the intelligent recognition of the true cause of the apparent regeneration points towards a real recuperation of oil areas which have been prematurely abandoned, or which give indications of failure. Many areas which have been rejected as possible sources of oil supply, after closer examination may yet be restored, and add considerably to the world's store of liquid fuel.

Crude oil for the assay furnace. W. G. Haldane. Eng. and Min. J., 1913, **96**, 1073—1074.

A TEST was made with a muffle furnace provided with two low pressure burners in which crude oil, under a head of 6 to 12 in., was atomised by means of an air blast from a 12 in. blower, the latter being driven by a ¼ h.p. high speed induction motor connected with an ordinary lighting circuit, and designed to deliver, through a 2 in. opening, 4000 cub. ft. of air per min. under a pressure of 4 to 5 oz. (7—8½ ins. of water). The furnace contained two muffles side by side, each provided with a separate burner and operated independently, one being used for crucible fusions and the other for cupellation. Both muffles were ready for use 30 mins. after starting, and, in 50 mins. from the start, 40 fusions were made with a total consumption of 1·6 galls. of oil, cupellation being subsequently effected in 35 mins. with an oil consumption of 0·9 gall. Texas crude oil, costing 6 cents (3d.) per gall. was used.—W. E. F. P.

Petroleum spirit (*gasoline*); *Production of —— from natural gas in Galicia.* B. Rozanski. Petroleum, 1913, **9**, 217—224.

ONLY gas that comes directly from the crude petroleum is suitable for the production of gasoline by compression and cooling. Natural gas which contains more than 40 per cent. by vol. of methane is termed "dry" gas and is quite unsuitable for condensation. The richest gas found in America yields about 106 litres of gasoline per 100 cb. m., but on the average not more than 40 to 46 litres are obtained. The Galician natural gases usually contain from 40 to 60 per cent. of practically uncondensable gases (mainly methane and air). A natural gas composed of 60 per cent. of benzine vapours and 40 per cent. of methane, yields in practice only about 15 per cent. of the calculated amount of condensed liquid (*e.g.*, 40 litres instead of 274 litres per 100 cb. m. of the mixture). At the present time the high price of motor spirit should make a yield of 5 litres per 100 cb. m. profitable, provided that the residual gas were used for heating. The original gas ought to have a sp. gr. of not less than 0·800, whereas the gases from the Boryslaw-Tustanowice wells showed a sp. gr. of barely 0·70, and yielded scarcely 2 litres of gasoline per 100 cb. m. In the condensation process the natural gas is first compressed at 3½ atmos. and subsequently at 14 to 28, or even 42 atmos. The cooling is effected by means of water or by the sudden expansion of the compressed gas itself. Good results have also been obtained with ammonia refrigerators. In another process the hot compressed gas leaving the compressors is conducted to the bottom of a steel container charged with naphtha of sp. gr. 0·745. Thence, after absorbing heavy benzine constituents from the naphtha, it passes into the coolers. In this way a heavier and more homogeneous product is obtained. The compressed gasoline is usually colourless or light brown. The American product formerly had a sp. gr. varying from 0·650 to 0·622 (0·720 in the Western oil fields), but that now prepared is usually of sp. gr. 0·730 to 0·770, or almost the same as the Galician gasoline. It consists, in the main, of butanes and pentanes, with a little propane and a certain amount of hexanes, heptanes and perhaps nonanes. Natural gasoline is used in America for mixing with the benzines and gasolines from the refineries for use as a motor spirit, but the mixtures are seldom homogeneous, and cause difficulties in use. A large amount is also used for lighting and heating purposes.—C. A. M.

Hydrocarbons of Utah. C. Bardwell, B. A. Berryman, T. B. Brighton and K. D. Kuhre. J. Ind. Eng. Chem., 1913, **5** 973—976.

THE mineral hydrocarbons which occur most abundantly in Utah are gilsonite, tabbyite, wurtzilite, ozokerite, and rock asphaltum. A brief description of the chief deposits and a review of the literature are given. Some of the uses of the minerals are as follows: Gilsonite (production, 50,000 tons in 1912): paving industry, electrical insulators, roofing materials, waterproofing pipes and aqueducts, preventing corrosion of iron plates of ships' bottoms, coating wire fencing, sea walls, poles, etc., lining tanks for chemicals, paints for smoke-stacks, lubricant for heavy machinery, rubber substitute, binder for briquettes. Tabbyite: compositions for rubber floor mats, rubber paints and roofing materials, filler for rubber mixings for tyres, etc. Wurtzilite (production, 1000 tons per annum): varnishes, roofing compositions, etc. Ozokerite: electrical insulators, altar candles, substitute for beeswax, ointments and the like, waterproofing mixtures, wax dolls, telephone receivers, phonograph records, polishes, electroplating, crayons, sealing wax, etc. Rock asphaltum: paving industry. The results of an experimental investigation of the mineral hydrocarbons mentioned are given chiefly in tables, of which the following shows the solubility of the different materials in various solvents, together with corresponding figures for refined Trinidad pitch and Bermudez asphaltum :—

	Trinidad pitch.	Bermudez asphaltum.	Gilsonite.	Tabbyite.	Wurtzilite.	Ozokerite.	Rock asphaltum.
Amyl alcohol	Insol.	Insol.	Insol.	4	Insol.	Insol.	Insol.
Ether	109	145	∞	46	Insol.	13	14
Ethyl acetate	30	24	5* 3	7* 3	Insol.	1	7* 4
Amyl nitrate	84	39	51	Insol.	5* Insol.	7	16
Amyl acetate	132	37	86	Insol.	Insol.	1	Insol.
Benzene	48	36	71	35	Insol.	18	12
Toluene	39	33	72	57	0·09	very sol.	14
Turpentine	115	116	60	65	45	very sol.	29
Nitrobenzene	39	24	9	14	12* Insol.	Insol.	3
Aniline	3	Insol.	33* Insol.	Insol.	2* Insol.	Insol.	Insol.
Chloroform	10	23	54	33	1·5* 0·96	∞	83
Carbon bisulphide	∞	∞	∞	55	13·45	∞	very sol.
Carbon tetrachloride	∞	∞	44·3	36	1·8	∞	12
62° naphtha	very sol.	63	5	6·8	2·8	7	18
Alcohol	Insol.	Insol.	Insol.	1* Insol.	Insol.	Insol.	Insol.
Propyl alcohol	Insol.	Insol.	1* Insol.	11* Insol.	Insol.	Insol.	Insol.

Note.—The figures represent grms. of material soluble in 100 grms. of cold solvent. * Grms. soluble in 100 grms. of boiling solvent.

—A. S.

Extinguishing fires in lacquer [and gasoline] with sawdust. *See* XIII.

PATENTS.

Briquetting and similar installations; Apparatus for the removal and utilisation of dust in ——. C. Fischer. Ger. Pat. 266,400, Nov. 26, 1912.

The usual dust collectors are connected by a conduit with a special dust separator and the latter with the feed hoppers for the briquetting machine or with a screw conveyor leading to the same; and a high vacuum is used for conveying the dust from one part of the system to another, in order to avoid risk of fire or explosions.—A.S.

Coke, Manufacture of ——. J. Moeller and H. C. Woltereck, London. Eng. Pat. 28,791, Dec. 14, 1912.

Coal, coal dust, slack, lignite, etc., is heated in retorts to 400°—600° C., and highly superheated steam at a pressure of not more than 4 to 5 lb. per sq. in. is passed through the retorts, whereby the coking period is shortened and the yield of volatile products is increased.—A. T. L.

Coke-oven. W. M. Person, Sparrows Point, Md. U.S. Pat. 1,079,062, Nov. 18, 1913.

The combustion flues in the dividing walls between the coking chambers receive gas from separate regenerators, which are connected in groups with a number of primary regenerators.—A. T. L.

Coking coal; Apparatus for ——. H. L. Doherty, New York. U.S. Pat. 1,080,142, Dec. 2, 1913.

The coal is subjected to the direct heating action of a flame produced by the introduction of gas and air into a clear space above the coal in the heating chamber. The lower end of the coking chamber opens into a larger chamber forming a surrounding annular gas chamber at the sides and having a hopper at the bottom leading into a quenching chamber and discharge grate.—H. H.

Gas and coke; Apparatus for making ——. H. Nelsen, Essen-Rüttenscheid, Germany. Eng. Pat. 26,302, Nov. 15, 1912. Under Int. Conv., May 17, 1912.

Regenerators for preheating the air supplied to the inner heating flues of a vertical annular retort are arranged in the central vertical space.—W. H. C.

[Oil] Gas generator. O. H. Ensign, Madison, Wis. U.S. Pat. 1,079,118, Nov. 18, 1913.

Liquid fuel and air under pressure are supplied to a chamber in which gas is generated by the heat liberated by the combustion of part of the fuel. The fuel supply is kept at a constant temperature by a thermostatic device. The fuel injector may be arranged so that the quantity of fuel supplied depends either on the pressure in the gas-generating chamber, or on the difference between that pressure and the pressure of the air supply. Means are provided for "varying the pressure in the chamber relatively to the pressure of the air supply for variations in the quantity of gas produced and for a constant rate of gas production."—A. T. L.

Gas producer. C. M. Garland, Collingswood, N.J., Assignor to Camden Iron Works, Camden, N.J. U.S. Pat. 1,079,234, Nov. 18, 1913.

The fixed upper section of the producer is supported by a framework above a rotating body-portion and a fixed base with annular water-sealed ash-pit and central tuyère. The upper section carries an upward extension of reduced diameter arranged at one side and provided with a charging hopper and a gas outlet connection. A series of slicing-bars, adjustable vertically in the bed of fuel, are supported from a beam carried by the framework above the producer.—A. T. L.

Gas cleaner. A. Ernst, Pittsburgh, Pa. U.S. Pat. 1,079,849, Nov. 25, 1913.

A vertical cylindrical casing supported above a water trough which seals the lower end, is provided with a number of flanges inclined inwards and downwards, the lowest of which has an extension forming an inner cylindrical wall with serrated lower edge just reaching to the water level. The gas is admitted to the annular chamber between this inner wall and the outer casing, and passes through the water-seal into the inner compartment. The gas as it passes up through the casing meets a descending spray of water produced by a jet in the upper part of the casing and a number of rotating fan blades between the inclined flanges. It is finally dried by passing up through suitable material supported on grids in the upper part of the apparatus.—A. T. L.

Hydrocarbon mixtures; Treatment of liquid ——. R. Hense, Charlottenberg. Eng. Pat. 6643, March 18, 1913.

The distillation of the mixture of hydrocarbons, oxidising agents or nitro-compounds, and gum or resin as described in Fr. Pat. 384,946 (this J., 1908, 494) is interrupted when a temperature ranging from about 200° C. to 300°—350° C., according to the composition of the mixture, is reached: the residue is cooled, treated with ozone as concentrated and as free from nitrogen as possible, and after separating any sediment, the distillation continued.—W. H. C.

Gasolene jelly; Process of making ——. J. E. Mitchell, New York. U.S. Pat. 1,079,257, Nov. 18, 1913.

Castile soap, 2 parts, is dissolved and mixed with chloroform, 1 part, glycerin, 2 parts, and ammonia, 1 part. Water, 32 parts, is added to this mixture, the product agitated with 32 times its quantity of gasolene until it solidifies, and the solid product agitated with 16 to 24 times its weight of gasolene.—A. T. L.

Nitrous compounds from mixtures of petroleum and tar; Process for preparing ——. A. Flexer. Fr. Pat. 460,280, July 12, 1913. Under Int. Conv., July 13, 1912.

A mixture of purified petroleum and tar (*e.g.*, 40 parts of purified lamp oil and 6 parts of vegetable tar) is treated with concentrated nitric acid (10 parts); after some hours, the solid resinous mass is separated from the oily liquid, which contains the nitrogenous compounds. The oily product is miscible with oils and with glycerin, and is stated to be emulsifiable with water, especially in presence of alcohol, and to be suitable for use as a disinfectant. The solid product, which is also nitrogenous, can be vulcanised, giving a product somewhat similar to rubber.—T. F. B.

Benzene from petroleum or its distillates. Process for obtaining ——. J. Holegreber. Fr. Pat. 460,827, July 28, 1913.

The vapours of petroleum or its distillates are mixed with hydrogen and passed through metal or other tubes containing catalytic substances, such as suitable metals. The tubes are heated to a temperature of 180°—300° C. The benzene is extracted from the resulting vapours either by physical means or by combining it with aluminium chloride.—T. F. B.

Fuel such as coal and coke; Process for briquetting —— *with paper flock or scraps of paper added in the dry state.* F. Reinold. Fr Pat. 460,942, July 2, 1913.

See Ger. Pat. 266,457 of 1912; this J., 1913, 1149.—T.F.B.

Oil-gas for internal combustion engines; Apparatus for and method of generating ——. F. H. Bates, Philadelphia. Eng. Pat. 29,277, Dec. 19, 1912.

See U.S. Pat. 1,046,541 of 1912; this J., 1913, 77.—T. F. B.

Gas from sewage; Apparatus for the production of ——. C. Birault, Paris. U.S. Pat. 1,080,808, Dec. 9, 1913.

See Eng. Pat. 13,009 of 1912; this J., 1913, 448.—T. F. B.

Coal gas; Method for removing or recovering certain substances from ——. G. H. Hultman, Stockholm. Eng. Pat. 11,758, May 20, 1913.

See U.S. Pat. 1,073,605 of 1913; this J., 1913, 971.—T. F. B.

Tar and ammonia from gases; Recovery of ——. C. Still, Recklinghausen, Germany. U.S. Pat. 1,080,938, Dec. 9, 1913.

See Eng. Pat. 28,072 of 1912; this J., 1913, 590.—T. F. B.

Gas-washer. A. H. Lymn, Westminster. U.S. Pat. 1,081,241, Dec. 9, 1913.

See Eng. Pat. 744 of 1913; this J., 1913, 1147.—T. F. B.

Production of ferrocyanides. [*Recovery of hydrogen cyanide from retort gases.*] Eng. Pat. 27,908. *See* VII.

Bitumen macadam. Eng. Pat. 1459. *See* IX.

Treatment of spent gas-purifying material [*"Cruds d'ammoniaques"*] *to render it applicable directly as a fertiliser.* Fr. Pat. 460,745. *See* XVI.

Calorimeters. Eng. Pat. 27,920. *See* XXIII.

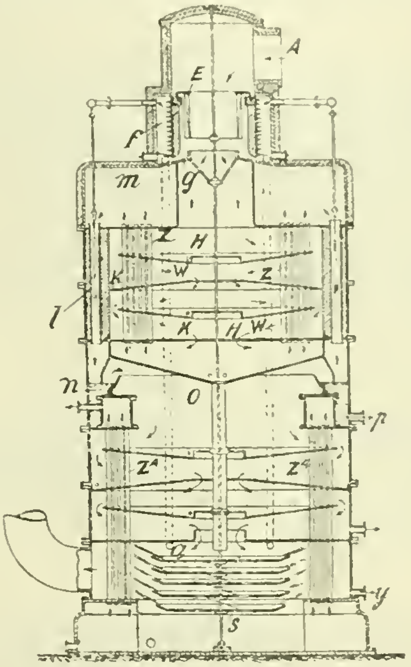
IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Decomposition of betaine by caustic potash. Preparation of hydrocyanic acid by the destructive distillation of beet molasses by the Dessau process. Albers. *See* XVII.

Patents.

Gases from the distillation of carbonaceous substances; Apparatus for the recovery of by-products from ——. J. G. Aarts. Ger. Pat. 266,603, Oct. 31, 1911.

The gas enters the apparatus at A and the tar is separated by a centrifugal device, E, and flows away through *g*. A warm solution of a suitable chemical is introduced into *f*.



The gas passes on to the chamber, H, provided with partitions, *w*, whereby the gas is caused to circulate around the tubes, Z, after which it passes upwards into *m* and then downwards through the conduits, *l*, to which also the solution from the chamber, *f*, is led. Condensed products which separate from the gas in H are led off through the tubes, K. The mixture of liquor and gas from the conduits, *l*, collects in *n*; the gas passes on into the chamber, O, whilst the liquor is discharged through *p*. The tubes, Z^A, in O are cooled by water. The gas is finally discharged from the lowest chamber, *q*. The tar separated in the upper part of the apparatus may be led into *q*, where it is finely divided by the centrifugal device, *s*, thus enabling the tar oils to absorb any benzol still present in the gas. The lighter tar oils, with the absorbed benzol, may be withdrawn through *y*, or the tar as a whole may be allowed to flow out at the bottom.—A. S.

Peat; Process for treating and utilising ——. J. W. Leadbeater. Fr. Pat. 461,092, Aug. 4, 1913. Under Int. Conv., Aug. 13, 1912.

See Eng. Pat. 18,587 of 1912; this J., 1913, 820.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Catalytic reactions at high temperatures and pressures. XXVI. Hydrogenisation of phenols with unsaturated side chains. W. Ipatiew. Ber., 1913, 46, 3589—3593.

In the presence of reduced nickel at 100° C. and about 30—50 atmospheres pressure, phenols with unsaturated

side-chains took up hydrogen to yield phenols with saturated chains. On raising the temperature to about 200° C., this was followed by the addition of six atoms of hydrogen to the benzene nucleus; and also when the phenols were polyhydric by the reduction of methoxy- or hydroxy groups until at most one such group was left. Anethol gave dihydroanethol at 95° C. and hexahydropropylbenzene at 200° C. Eugenol and isoeugenol yielded dihydroeugenol at 92° C. and a mixture of octohydroanethol and octohydroeugenol at 195° C. Methyleugenol gave as final product octohydroanethol. Safrol and isosafrol yielded the same dihydrosafrol at 93° C., and on further reduction an isomeride of octohydroanethol.
—W. H. P.

Methylnaphthalenes. R. Lesser. Annalen, 1913, **402**, 1—51.

The methylnaphthalenes, which are now prepared on a commercial scale in a state of great purity, were nitrated. The α-compound gave a mono- and a trinitro-derivative and the β-compound a mono- and a dinitro-derivative, the mono-nitro derivatives being identified by their corresponding carboxylic acids. The aminomethylnaphthalenes were prepared together with their salts, acetyl- and benzoyl-compounds and phthalimides. 1.4-Aminomethylnaphthalene was condensed with dinitrochlorobenzene and with picryl chloride, but the 1.2-aminomethylnaphthalene only formed addition products with these. The naphthols and quinones were prepared, and also azo-dyestuffs were made from the two aminomethylnaphthalenes.—G. H. F.

Pyrene; A synthesis of ——. M. Freund and K. Fleischer. Annalen, 1913, **402**, 77—81.

The dianhydride of 1.8.4.5-naphthalenetetracarboxylic acid was heated for 3 hours at 170° C. with four times its weight of the diethyl-ester of malonic acid together with twice its weight of zinc chloride, whereby 5.10-diketo-3.8-dihydroxypyrene was formed, which on distillation with zinc dust gave pyrene, recognised by its characteristic picrate, m. pt. 223° C.—G. H. F.

Patent.

Plastic, rubber-like mass suitable for tarring roads and for other purposes; Process for making a ——. Soc. Anon. des Combustibles Industriels. Fr. Pat. 460,943, July 2, 1913. Under Int. Conv., Oct. 28, 1912.

A product very suitable for use in tarring roads, and stated to be insusceptible to atmospheric influences, is obtained by removing from tar the "excess" of naphthalene and naphthalene oils and creosote oils, heating the residue to 90°—200° C., adding anthracene or anthracene oils, and blowing air through the product until the desired consistency is reached.—T. F. B.

Hydrogenation [and reduction]; Catalytic process for ——. A. Brochet. First Addition, dated Oct. 8, 1912, to Fr. Pat. 458,033, July 27, 1912 (see this J., 1913, 1031).

The process of hydrogenation and reduction described in the principal patent can be modified by addition of catalysts of the second order, or of acids or alkalis, etc., in such a way as to modify the velocity of the reaction or to produce different products. Thus, reduction of nitrobenzene by aid of reduced nickel as described gives rise to aniline alone; when caustic soda is present, azoxybenzene is the principal product, whilst this, in turn, is reduced to aniline in neutral media and to azobenzene in presence of caustic soda. The azobenzene can be further reduced to hydrazobenzene in presence of alkali.—T. F. B.

2-Methylanthraquinone; Chloro derivatives of ——. Act.-Ges. f. Anilinfabr. Fr Pat. 460,432, July 16, 1913. Under Int. Conv., Jan. 24 and July 11, 1913.

It is known that 2-methylanthraquinone is converted into chloromethyl derivatives by heating with chlorine under pressure. It has now been found that chloro-methylanthraquinones, containing the chlorine in the anthraquinonyl nucleus, are obtained if 2-methylanthraquinone or a derivative is treated with chlorine or its equivalent in presence of a catalyst, such as iodine. For example, 1-chloro-2-methylanthraquinone is obtained by heating on the water-bath under a reflux condenser, a mixture of 15 parts of 2-methylanthraquinone, 25 parts of nitrobenzene, one part of iodine, and 15 to 20 parts of sulphuryl chloride; the reaction is complete in 8 to 10 hours, and the product is separated by crystallisation and addition of alcohol.—T. F. B.

Aminoanthraquinonesulphonic acid; Process for preparing an ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 460,048, July 4, 1913. Under Int. Conv., Dec. 11, 1912.

See Eng. Pat. 15,028 of 1913; this J., 1913, 937.—T. F. B.

Preparing nitrous compounds from mixtures of petroleum and tar. Fr. Pat. 460,280. *See* IIa.

Obtaining benzene from petroleum or its distillates. Fr. Pat. 460,827. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

Anthocyans; Researches on the ——. *I. The colouring matter of the cornflower.* R. Willstätter and A. E. Everest. Annalen, 1913, **401**, 189—232.

The anthocyans are the blue, violet and red dyestuffs, soluble in water and dilute alcohol but insoluble in ether, which occur in flowers, many fruits and some leaves. They correspond to the yellow plant dyestuffs investigated by A. G. Perkin, to which latter may be given the group name anthoxanthins. The anthocyan of the cornflower exists in different forms in different parts of the plant—a violet form which is the free acid and to which the name *cyanin* is given, a blue form which is the potassium salt, a red form which is an oxonium salt, and a colourless form which results when an aqueous extract of the flower is allowed to stand. The formation of the colourless form can be prevented by adding sodium chloride or sodium nitrate to the solution. The dyestuff, which exists to the extent of about 0·66 per cent. in the dried cornflowers, is isolated by extraction with water or dilute alcohol. It is purified by fractional precipitation with alcohol and finally by crystallisation of the cyanin hydrochloride from alcoholic hydrochloric acid. The product is a glucoside of the formula, $C_{28}H_{33}O_{17}Cl+3H_2O$, and it yields 2 mols. of dextrose and 1 mol. of cyanidin hydrochloride, $C_{16}H_{13}O_7Cl$, on hydrolysis. The salts of cyanidin, unlike those of the glucoside, are soluble in amyl alcohol. Unlike the natural yellow dyestuffs, cyanidin contains a strong salt-forming oxygen atom, probably in a quinonoid ring. Its salts are therefore oxonium salts—the first found in nature, probably. The colour of the anthocyans is dependent on the oxonium group and the decolourisation of solutions on standing or heating, which is a characteristic of this group, appears to be due to the wandering of two atoms of hydrogen, one of which goes off with the anion (*e.g.*, Cl), the other reducing the quinone ring.—J. B.

Methylnaphthalenes. Lesser. *See* III.

Patents.

Carbazole derivatives; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., G. m. b. H., Frankfort, Germany. Eng. Pat. 28,076, Dec. 5, 1912.

Leuco-compounds of indophenols of the carbazole series are produced by treating with sulphites the indophenols derived from *p*-nitrosophenols and carbazole or its N-substituted derivatives. Thus, 4-hydroxyaryl-3-amino-carbazole-monosulphonic acid is obtained by the action of neutral sodium sulphite on the indophenol from carbazole and *p*-nitrosophenol.—T. F. B.

Monoazo dyestuffs for wool; Manufacture of ——. The Mersey Chemical Works, Ltd., London, and F. Ackermann, Berlin-Friedenau, Germany. Eng. Pat. 16,537, July 18, 1913. Addition to Eng. Pat. 13,304, March 3, 1911 (see Fr. Pat. 430,146 of 1911; this J., 1911, 1246).

Dyestuffs which dye wool yellow to orange shades, fast to washing, are obtained by combining diazotised 2.5-dichloroaniline-4-sulphonic acid with a non-sulphonated alkyl-aralkylarylamine of the benzene series, *e.g.*, ethylbenzylaniline.—T. F. B.

Wool dyestuffs of the anthraquinone series, Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 16,827, July 22, 1913. Under Int. Conv., July 23, 1912.

Pyridazone-1-halogenanthrones (see Fr. Pat. 440,303 of 1912; this J., 1912, 809) are treated with ammonia or aliphatic amines; when unsulphonated pyridazonehalogenanthrones are used, it is advisable to use the arylsulphonyl compounds of the bases instead of the free bases, and to remove the acidyl group subsequently. In either case the products are converted into clear yellow or greenish-yellow wool dyestuffs by sulphonation.—T. F. B.

[Azo] *dyestuffs which produce violet to blue shades on the fibre; Process for making* ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated June 25, 1913, to Fr. Pat. 442,697, March 25, 1912. Under Int. Conv., July 23, 1912.

Dyestuffs which produce bluer shades than those described in the principal patent (see Eng. Pat. 9433 of 1911; this J., 1912, 182) are obtained by combining one mol. of a diazoazo compound which contains no amino- or hydroxy-group and one mol. of the diazo compound of 2.5.7- or 2.8.6-aminonaphtholsulphonic acid or their 1-chloro-derivatives, with 2.2′-dinaphthylamine-5.5′-dihydroxy-7.7′-disulphonic acid. The dyestuffs thus produced are developed on the fibre by means of diazotised nitraniline: the resulting violet to blue shades are fast to washing and can be discharged to pure white by hydrosulphites. In a detailed example the diazo-compound obtained from diazotised *p*-nitrobenzene-*o*-sulphonic acid-azo-1-naphthylamine-7-sulphonic acid is given as the diazoazo compound.—T. F. B.

2-*Nitroquinizarin; Process for preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 461,094, Aug. 4, 1913. Under Int. Conv., Aug. 12, 1912.

The treatment of quinizarin with concentrated nitric acid, alone or in presence of sulphuric acid, results in the formation of nitropurpurin, whilst treatment with nitric acid in presence of boric acid or other substance which prevents oxidation, produces no nitration. On the other hand, a new product, 2-nitroquinizarin, is easily obtained by the action of nitric acid on quinizarin in presence of an inert solvent or diluent, such as glacial acetic acid or nitrobenzene. The product consists of brick-red crystals, which dissolve in sulphuric acid to a cerise-red solution without fluorescence: the dyeings on alum-mordanted wool are claret to brown, and on chrome-mordanted wool violet-brown to brown.—T. F. B.

Dyestuffs for wool; Process for making yellow to brown ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated June 17, 1913, to Fr. Pat. 443,809, May 14, 1912 (see this J., 1912, 979). Under Int. Conv., July 6, Oct. 19, and Nov. 16, 1912.

See Ger. Pat. 265,197 of 1912; this J., 1913, 1101. The *p*-aminodiphenylaminesulphonic acid may also be replaced by an aminophenylnaphthylaminesulphonic acid or a derivative thereof.—T. F. B.

Colouring matter suitable for alimentary and other products; Preparation of a harmless ——. P. D. Jacquemin. Fr. Pat. 460,441, Oct. 5, 1912.

The colouring matter is extracted from wine lees by means of acetone, the extracts are evaporated, and the residue treated with sulphuric acid until a soluble product is produced. The resulting colouring matter is said to be especially suitable for colouring food products, but it may also be used for dyeing.—T. F. B.

Disazo dyestuffs for cotton, Process for preparing yellow ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 461,039, Aug. 1, 1913. Under Int. Conv., Jan. 7 and 9 1913.

The tetrazo compound of *m*-tolidine or of *mm′*-dichlorobenzidine is combined with two mols. of a 1-aminophenyl-5-pyrazolone-3-carboxylic acid or of a 1-nitrophenyl-5-pyrazolone-3-carboxylic acid; in the latter case the nitro groups are reduced. The products dye cotton yellow to reddish-yellow shades, which are transformed into orange or bright red by diazotisation on the fibre and development with β-naphthol.—T. F. B.

Sulphur [sulphide] dyes; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4676, Feb. 24, 1913. Addition to Eng. Pat. 11,776, May 17,1912.

See Fr. Pat. 449,983 and Ger. Pat. 264,293 of 1912; this J., 1913, 480, 1004.—T. F. B.

Mordant dyestuffs; Manufacture of green ——. Farbwerke vorm. L. Durand, Huguenin und Co., Basle, Switzerland. Eng. Pat. 14,860, June 27, 1913. Under Int. Conv., July 26, 1912.

See Fr. Pat. 459,681 of 1913; this J., 1913, 1101.—T. F. B.

Vat [anthracene] dyestuff. A. L. Laska and E. J. Rath, Offenbach, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,079,568, Nov. 25, 1913.

See Eng. Pat. 12,152 of 1913; this J., 1913, 906.—T. F. B.

Sulphide dyestuffs for cotton; Process for producing yellow and brown ——. L. Cassella und Co. G. m. b. H. Fr. Pat. 460,256, Sept. 30, 1912.

See Eng. Pats. 22,453 and 29,970 of 1912; this J., 1913, 862.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Patents.

Flax and similar straws; Process of retting ——. The Fibre Corporation, Ltd. Fr. Pat. 460,092, July 7, 1913.

The stems of flax are packed vertically in a reservoir into the top of which a slow and uniform supply of warm water is admitted and forced to travel through the material in currents parallel to the length of the stems, being drawn off at the bottom together with the products extracted by retting. The layer of water which covers the stacks of stems in the reservoir is given a horizontal circulatory motion to ensure uniform distribution and the speed of the downward current is controlled by adjusting the outlet orifices in the bottom of the tank.—J. F. B.

Wood for the manufacture of sulphite cellulose or mechanical pulp; Process for extracting resins from ——. D. Rosenblum, L. Brech and E. Tyborowski. Fr. Pat. 460,472, July 17, 1913.

The wood is digested for 1—5 hours at about 110° C. with water containing solvents of resin capable of forming emulsions or with a solution of ammonia or a mixture of both reagents. The reagents are employed in proportions of 0·5—2 per cent. of the weight of the wood.—J. F. B.

Celluloid, acetyl-cellulose and the like articles ; Process for cleaning and renewing ——. A. Püschel, Leitmeritz, Austria. Eng. Pat. 18,105, Aug. 8, 1913. Under Int. Conv., Jan. 20, 1913.

Celluloid articles which have become dull are immersed for a short time in "English sulphuric acid" at the ordinary temperature, washed, dried and preferably, but not necessarily, steeped in strong alcohol for 15—30 minutes, being finally varnished with one or more coats of camphor-collodion.—J. F. B.

Plastic material [*from soy beans*] *capable of replacing celluloid, suitable for finishing, spinning and weaving ; Transparent, flexible, non-inflammable* ——. P. J. Contant and J. B. F. Perrot. Fr. Pat. 461,007, Aug. 1, 1913.

The latex of the seeds of *Soja hispida* is treated with bases, *e.g.*, ammonia, soda or pyridine in the proportion of 5—10 grms. per litre ; 10—15 grms. of a mixture of acetic, lactic, phosphoric and nitric acids are added at a temperature of 35° C. The material is then heated to boiling in a solution of aluminium sulphate and the reaction is allowed to proceed for 2—8 days. The plastic product obtained is gelatinised by solvents, such as pyridine, acetic acid and resorcinol and may be hardened by formaldehyde.—J. F. B.

Acetylcellulose ; Process for spreading coatings of —— *on fabrics or other materials.* Act.-Ges für Anilin-Fabrikation. Fr. Pat. 461,058, Aug. 2, 1913. Under Int. Conv., Nov. 15, 1912.

The material is coated with a solution of acetylcellulose or nitro-acetylcellulose in a mixture of 90 parts of tetrachloroethane and 10 parts of amyl alcohol or fusel oil. As the two solvents evaporate at an approximately equal rate, the uniform distribution of the coating is facilitated. —J. F. B.

Esparto grass, etc., for paper making ; Bleaching of ——. F. W. Dobson, Tamworth. Eng. Pat. 27,188, Nov. 26, 1912. Addition to Eng. Pat. 3181, Feb. 8, 1911 (this J., 1912, 225).

Esparto grass, boiled and washed in the usual way, is brought into a dry or semi-dry condition and then introduced into a revolving drum previously charged with a mixture of concentrated bleaching liquor and water, the proportions being such that no subsequent draining of the bleached mass is necessary.—J. F. B.

Beating engines for paper making and the like. R. Marx, London. Eng. Pat. 9049, April 17, 1913.

An engine of the Hollander type has a trough with parallel sides and semicircular ends, a wide midfeather with side and end walls parallel to the side and end walls of the trough, and a floor sloping downwards and outwards from the back-fall to a point near the front rise, whilst its inclination to the vertical wall of the midfeather gradually decreases. The pressure of the roll is counterbalanced by levers and sliding weights.—J. F. B.

Paper pulp ; Treatment of ——. [*Beating engine.*] R. Marx, London. Eng. Pat. 10,353, May 2, 1913.

In a beating engine two rolls are provided, one on each side of the midfeather, the rolls being driven independently and capable of separate adjustment as to pressure. The cross-section of the trough is narrowed about the ends of the midfeather but widens out in front of each roll. One roll may be built up of basalt lava or equivalent material, the other being furnished with ordinary beating bars. —J. F. B.

Process for the clarification of effluents. Ger. Pat. 266,998. *See* XIXb.

Preparing aseptically-sterile thread and bandages. Ger. Pat. 266,953. *See* XX.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Dyeing cotton with basic dyestuffs ; Composition of the lake produced in ——. A. Sanin. Kolloid-Zeits., 1913, **5**, 305—310.

The author has shown previously (this J., 1911, 533) that basic dyestuffs and tannin form definite chemical compounds if excess of the dyestuff be used, and adsorption compounds in presence of excess of tannin. The same is true in the case of the interaction of tannin and tartar emetic, a compound $(C_{14}H_9O_9)_2SbOH$, being formed in cold dilute solutions if excess of tannin be avoided. In dyeing cotton with basic dyes the necessary conditions for the formation of definite compounds are present, and experiments with Chrysoidine, Magenta, Crystal Violet, Safranine, and Victoria Blue showed that compounds are formed, 1 mol. of the dyestuff (chloride) combining with 1 mol. of the antimony-tannin compound, with elimination of hydrochloric acid.—A. S.

Patents.

Per compounds ; Process for washing and bleaching with alkaline solutions of ——. Chem. Werke vorm. H. Byk, F. L. Schmidt and R. Grüter, Berlin. Eng. Pat. 9247, April 19, 1913.

The addition of small quantities of a compound of tin or titanium to solutions of per-salts, such as sodium perborate, employed for washing and bleaching, renders the solution more stable on heating. For instance, a solution of 0·2 part of sodium perborate in 200 c.c. to which is added 0·01 part of $SnCl_4,3H_2O$ or 0·02 part of $Ti(SO_4)_2$, may be heated at 80°—85° C. for over 30 minutes with very slight loss of active oxygen.—J. F. B.

Dyeing machines. J. Farrar, Halifax, and A. R. Whitehead, Leeds. Eng. Pat. 28,245, Dec. 7, 1912.

In dye vats of the type in which the vat is divided into a circulating chamber and a compartment for the material (yarn), a pipe is fitted which communicates from outside the vat with a point in the circulating chamber near the circulating paddles, and which serves for the addition of dye liquor to the vat in such a way that the freshly added dye liquor is rapidly mixed with the liquor already in the vat.—J.B.

Dyeing with dyestuffs insoluble in water or water-insoluble leuco compounds of dyestuffs ; Process for ——. R. Wedekind und Co. m. b. H., and M. Iljinsky, Uerdingen, Germany. Eng. Pat. 27,391, Nov. 28, 1912.

See Fr. Pat. 451.533 of 1912 ; this J., 1913, 598.—T. F. B.

Yarn hanks and the like , Apparatus for treating —— *with liquids.* B. Teufer and L. Hermsdorf, Chemnitz, Saxony. Eng. Pat. 12,834, June 2, 1913.

See Fr. Pat. 458,047 of 1913 ; this J., 1913, 1007.—T. F. B.

Fabrics ; Process of producing patterns on ——. M. Freiberger, Budapest, Austria-Hungary. U.S. Pat. 1,080,433, Dec. 2, 1913.

See Eng. Pat. 13,896 of 1908 ; this J., 1909, 472.—T. F. B.

Fabrics and the like ; Process for waterproofing ——. H. and G. T. Oliver. Fr. Pat. 460,226, July 10, 1913.

See Eng. Pat. 21,697 of 1912 ; this J., 1913, 941.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Chromic acid ; Neutralisation of ——. L. Margaillan. Comptes rend., 1913, **157**, 994—995.

The progressive neutralisation of chromic acid by sodium hydroxide was followed by the electrometer method, using an electrode of platinum saturated with hydrogen. The E.M.F. curve was interrupted by two almost vertical portions (instead of one, as with sulphuric acid), corresponding respectively to the addition of one and of two equivalents of alkali.—F. Sodn.

Selenious acid; Colourimetric determination of traces of ——. J. Meyer and W. von Garn. Z. anal. Chem., 1913, **53**, 29—33. (See also this J., 1913, 825.)

Selenious acid liberates iodine from acidified potassium iodide solution, the colloidal selenium which separates intensifying the colour: $H_2SeO_3+4HI=2I_2+3H_2O+Se$. Five c.c. of the solution to be tested, and 5 c.c. of a standard solution, respectively, are placed in 100 c.c. graduated cylinders provided with a stopcock near the bottom. 70 c.c. of purest distilled water, one drop of a protective colloid (*e.g.*, gum arabic) and 5 c.c. of 5 per cent. hydrochloric acid are then added to each cylinder, and after careful mixing, the volume is made up to 99 c.c. One c.c. of 50 per cent. potassium iodide solution is stirred in and after 5 minutes the colours are matched by withdrawing a suitable quantity of liquid from the cylinder in which the colour is strongest. Selenious acid can be determined by this method in solutions containing one part in 1,000,000. —W. R. S.

Thiosulphates; Volumetric determination of —— in presence of sulphites. J. Bodnàr. Z. anal. Chem., 1913, **53**, 37—41.

When silver nitrate is added to a solution containing thiosulphate, the silver thiosulphate first formed changes into sulphide: $Ag_2S_2O_3+H_2O=H_2SO_4+Ag_2S$, one half of the sulphur of the thiosulphate being converted into sulphuric acid. This reaction takes place on standing some time cold, any sulphite present gives silver sulphite which is only decomposed on boiling. 5—10 c.c. (*i.e.*, an excess) of 2 per cent. silver nitrate solution is diluted with 60—70 c.c. of water in a 100 c.c. flask, and the solution to be examined is added under constant agitation. The flask is shaken until the black precipitate has gathered and the liquid is perfectly clear. The volume is then made up and the excess of silver precipitated in 50 c.c. of the filtrate with sodium chloride; the titration is done with $N/20$ alkali and methyl orange. The process may also be used for standardising sodium thiosulphate; chlorides do not interfere.—W. R. S.

Iodides; Iodometric determination of ——. E. Müller and G. Wegelin. Z. anal. Chem., 1913, **53**, 20—28.

The distillation of the iodine liberated from iodides by the action of oxidising agents, such as potassium iodate and sulphuric acid, can be avoided by operating as follows: The solution contained in a stoppered flask is treated with 10 c.c. of 10 per cent. sulphuric acid, sufficient benzene to dissolve the iodine, and an excess of potassium iodate solution. The flask is well shaken, after which a solution of 4 grms. of dehydrated borax is added to neutralise the sulphuric acid. After renewed shaking, 3 grms. of potassium iodide crystals are added, and the solution is titrated under constant agitation with $N/10$ solution of arsenious acid (not thiosulphate), proceeding slowly towards the end.—W. R. S.

Phosphates and silicates; Action of phosgene on natural ——. J. Barlot and E. Chauvenet. Comptes rend., 1913, **157**, 1153—1155.

In continuation of previous work (this J., 1911, 127, 694), the action of phosgene on phosphate and silicate minerals was studied. Vivianite and pyromorphite were attacked at 350° C., and at 500° C. the iron and lead were converted almost instantaneously into chlorides: $3MO,P_2O_5+6COCl_2=2POCl_3+6CO_2+3MCl_2$. Uranite was decomposed very rapidly at 800° C., uranic chloride (volatile) and calcium chloride being formed. Of natural silicates, thorite, gadolinite, and cerite were attacked at about 1000° C. and very rapidly at 1150° C., the chlorides formed being condensed in the cooler parts of the apparatus. Zircon was not attacked until 1250° C. was reached, when the iron volatilised as chloride. On subsequently heating to 1300° C. in a current of phosgene, chlorination proceeded rapidly; the condensed zirconium chloride was contaminated by traces of calcium and magnesium chlorides, but was obtained pure by re-distilling at 500° C. Emerald was not attacked at temperatures up to 1400° C. The action of phosgene at high temperatures was found specially useful for the determination of thorium in monazite and for the preparation of anhydrous chlorides, *e.g.*, uranic chloride from uranite.—A. S.

Alkaline earth metals; New compounds of nitrogen and hydrogen with ——. F. W. Dafert and R. Miklauz. Monatsh. Chem., 1913, **34**, 1685—1712.

By the action of nitrogen or of hydrogen on the pure metals obtained by the method of Guntz (this J., 1910, 1389) the pure nitrides or hydrides were obtained. All the nitrides would react with hydrogen to form compounds of the formula $M''_3N_2H_4$, and such compounds were actually isolated in the cases of calcium and strontium. The barium compound however reacted readily with hydrogen at a comparatively low temperature to give barium hydride and nitrogen. An appreciable quantity of ammonia was also evolved, and as the resulting barium hydride could be converted into nitride by heating in nitrogen, the method might perhaps be used for the synthesis of ammonia. All the metals, hydrides, and nitrides, when heated in a mixture of nitrogen and hydrogen, and the hydrides when heated in pure nitrogen, yielded imides ($M''NH$), which became dark coloured on exposure to light, probably owing to the reaction $4M''NH=M''(NH_2)_2+M''_3N_2$. Imide formation was most prominent in the case of calcium and least so in the case of barium. None of the imides were, however, obtained quite pure. The following tables give the temperatures at which the metals and their nitrides begin to react with nitrogen and hydrogen respectively:—

Metal.	Nitrogen.	Hydrogen.	Nitrides.	Hydrogen
	°C.	°C.		°C.
Calcium ..	410	300	Calcium	230
Strontium	380	215	Strontium ..	270
Barium ..	260	170	Barium	300

—W. H. P.

Nitric oxide; Decomposition of —— at high pressures. E. Briner and N. Boubnoff. J. Chim. Phys., 1913, **11**, 597—631.

Nitric oxide when highly compressed undergoes decomposition in two ways according to the equations: $2NO=N_2+O_2$ and $4NO=2N_2O+O_2$, the second action predominating particularly at low temperatures. The oxygen formed unites with the excess of nitric oxide forming nitrous anhydride and nitrogen peroxide. The reaction velocity is proportional to the concentration (*i.e.*, to the pressure) at a constant temperature, and since the observed velocities agree with the concentrations from 50 to 400 atmospheres, it is justifiable to assume that the decomposition takes place although with extreme slowness at atmospheric pressure.—W. H. P.

Hydrogen peroxide; Preservation of —— by means of acetanilide. A. M. Clover. Amer. J. Pharm., 1913, **85**, 538—545.

The addition of 0·05 per cent. of acetanilide to hydrogen peroxide solution increases the stability to such an extent that only about 2·7 per cent. is decomposed in 5 months. The presence of mineral acids and of salts of the alkalis and alkaline-earths has no influence on the stability of the peroxide solution; traces of copper and iron increase the rate of decomposition.—W. P. S.

Ytterbium; Decomposition of —— into its elements. C. Auer von Welsbach. Monatsh. Chem., 1913, **34**, 1713—1728.

By fractionation of ytterbium the author isolated and purified the compounds of two constituent elements, cassiopeium Cp (At. wt. 175·00) and aldebaranium Ad

(At. wt. 173·00). From the original 500 grms. of ytterbium oxide about 48 grms. of cassiopeium oxide and over 200 grms. of aldebaranium oxide were obtained.
—W. H. P.

Radio-elements; Behaviour of —— in precipitation reactions. K. Fajans and P. Beer. Ber., 1913, **46**, 3486—3497.

It has been shown previously (compare Soddy, this J., 1911, 84) that radioelements which occupy the same place in the periodic system as ordinary elements are chemically identical with such elements and cannot be separated therefrom by any method of fractionation. Experiments with radium E and other radioelements have now led to the general rule that a radioelement will be precipitated in all cases where the chief element of its pleiade (the ordinary element occupying the same place in the periodic system) would be precipitated if present in weighable quantities. For example, radium E, belonging to the bismuth pleiade, is precipitated in all cases where bismuth (in greater concentrations) would be precipitated. Since it has been found that abnormal adsorption phenomena occur much less frequently than would be expected in these precipitation reactions of radio-elements, the general rule given affords a useful means of ascertaining the chemical nature of radio-elements. Experiments with radium A have shown that this is identical chemically with polonium and of the ordinary elements most resembles tellurium, not mercury, as has been supposed by Russell and by von Hevesy. In a solution containing univalent and divalent mercury, together with bismuth, if the latter be precipitated as phosphate in strongly acid solution, it carries down radium A quantitatively, thus separating it from mercury.—A. S.

Radioactive substances; Colloidal solutions of ——. II. F. Paneth. Kolloid-Zeits., 1913, **13**, 297—305. (See also this J., 1913, 789.)

In acid solution all the radioelements examined dialysed with normal velocity, but in neutral solution, polonium and radium E, and in ammoniacal solution, also thorium B dialysed very much more slowly. In acid solution polonium and thorium B travelled almost exclusively to the cathode and in ammoniacal solution to the anode; radium and thorium X travelled to the cathode in both acid and ammoniacal solutions. The particles which travelled to the anode were retained by parchment to a much greater extent than those which travelled to the cathode. The colloidal particles of polonium and radium E in neutral solutions and of thorium B and radium D in ammoniacal solutions must be extraordinarily small, for acid, neutral, and ammoniacal solutions all appeared alike when examined ultramicroscopically.—A. S.

Phosphorus; Modifications of ——. A. Stock and E. Stamm. Ber., 1913, **46**, 3497—3513.

Phosphorus vapour when superheated and then cooled rapidly, condensed partly as red phosphorus (see this J., 1912, 685). Experiments at different temperatures and pressures designed to ascertain some relation between the degree of dissociation of the phosphorus vapour and the quantity of red phosphorus deposited gave inconclusive results quantitatively, but qualitatively the process appeared to comprise first dissociation: $P_4 \rightleftarrows P_2$, and then union of P_4 and P_2 mols. to form mols. of red phosphorus: $xP_2 + yP_4 = P_{2x+4y}$. Red phosphorus exists in the form of vapour, for when heated, with exclusion of light, to 280°—400° C., it distilled and the condensed product in the cooler part of the tube always consisted to a small extent of the red modification; Hittorf's crystalline phosphorus yielded colourless distillates at 300°—350° C. and also when the vapour was heated to 500° C. Contrary to Arctowski's statement (Z. anorg. Chem., 1896, 12, 225), red phosphorus when free from white phosphorus and heated in a vacuum (*i.e.*, with exclusion of air and moisture) was not perceptibly volatile at 100° C. or even at 200° C. The description of Hittorf's phosphorus as "metallic phosphorus" is quite erroneous: the pure product was practically a non-conductor of electricity (See also Wahl, this J., 1913, 288.)—A. S.

Decomposition of betaine by caustic potash. Preparation of hydrocyanic acid by the destructive distillation of beet molasses by the Dessau process. Albers. *See* XVII.

Study of the Pemberton-Kilgore method for determination of phosphoric acid. Hibbard. *See* XXIII.

Volumetric determination of potassium xanthate [and mercury]. Holmberg. *See* XXIII.

Patents.

Sulphuric anhydride; Manufacture of —— by the contact process. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 460,074, July 5, 1913. Under Int. Conv., July 13, 1912.

Compounds of silver and vanadium are employed as catalysts. For example asbestos is impregnated with ammonium metavanadate, then treated with silver nitrate, and washed. Using asbestos containing 20 per cent. of silver vanadate, the sulphur dioxide present in burner gases is, it is stated, converted almost quantitatively into sulphur trioxide at about 520° C.—A. S.

Ammonia [from nitrogen]; Production of ——. R. W. Wallace and E. Wassmer, London. Eng Pat. 18,450, Aug. 10, 1912.

Magnesium or other suitable metal is converted into nitride, and this is divided into two portions, one of which is treated with hydrogen sulphide to form sulphide and ammonium sulphide, and the other with hydrochloric acid to form chloride; the sulphide and chloride are then electrolysed together and the metal obtained again converted into nitride, and so on, the sulphur and chlorine and/or chlorides of sulphur also produced by electrolysis being treated to form hydrogen sulphide and hydrochloric acid. Chloride may, if desired, be introduced from an outside source and only part of the metal converted into nitride.—F. Sodn.

Hydrogen and ammonia: Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 26,770, Nov. 21, 1912.

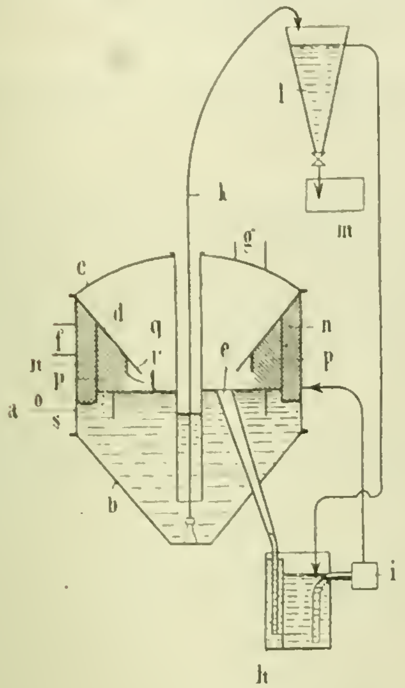
Carbon monoxide and steam are caused to interact at 300°—600° C. under a pressure of 4—40 atmospheres in the presence of a catalyst, such as iron, nickel, or the like, with the production of carbon dioxide and hydrogen, the former being removed by absorption, and the compressed hydrogen being ready for the synthetic production of ammonia under pressure.—O. R.

Chlorides of the alkali metals; Treatment of —— for the obtainment of useful products therefrom. J. A. Kendall, London. Eng. Pat. 26,896, Nov. 22, 1912.

An alkali chloride is heated to about 1100° C. in a nickel or cobalt vessel in the presence of steam and finely divided molybdenum or tungsten. Hydrogen and hydrochloric acid are evolved, and the alkali molybdate or tungstate also formed is reduced in a second stage of the process by means of carbon at 1200°—1300° C. The products of the second stage are alkali metal vapour, carbon monoxide, and metallic molybdenum or tungsten, the latter being then used to treat a fresh charge of alkali chloride. The alkali metal vapour may be condensed, oxidised in the presence of carbon monoxide to form alkali carbonate, or used for the production of cyanides.
—O. R.

Ammonium sulphate; Saturator for the recovery of ——. C. Otto und Co. Ges. m. b. H. Fr. Pat. 459,219, June 13, 1913.

A cylindrical saturator, *a*, with a truncated, conical bottom, *b*, and a dome-shaped cover, *c*, is provided with an overflow, *e*, and an ejector, *k*, which transfers the deposited ammonium sulphate to the funnel-shaped vessel, *l*. The mother liquor escaping from the overflow, *c*, and from the vessel, *l*, runs into a receptacle, *h*, from which a pump, *i*, returns it to the saturator. As soon as the vessel, *l*, is full of wet salt, the latter is introduced into a hydro-extractor, *m*, and centrifuged. Two concentric cylinders divide the saturator into annular compartments, *n*, and *p*, these being bounded at the top by the truncated cone, *d*. The gases enter at *f*, pass below the level of the liquor at *o*, and are deflected upwards by the baffle cylinder, *s*, which also serves to prevent undue agitation of the liquor near the overflow. Passing upwards into the space, *p*, the gases are freed from adhering liquid by the walls, *d* and *t*, and finally impinge horizontally against the central, vertical tube, and so out of the apparatus through *g*. The velocity of the issuing gases is so small that any traces of accompanying mother liquor fall back from *g* into the saturator.—O. R



Electrolysis of halogen alkalis; Process and apparatus for the —— Siemens und Halske A.-G., Berlin. Eng. Pat. 18,102, Aug. 8, 1913. Under Int. Conv., Feb. 20, 1913.

In the electrolysis of alkali halides in apparatus on the "horizontal diaphragm principle," a valve is arranged in the outlet passage of the cathode space, and the hydrogen is maintained under slight pressure, which is almost sufficient to counteract the hydrostatic pressure of the electrolyte above the diaphragm. The speed of filtration is thus regulated and made to correspond with the electric current used, the process allowing of the employment of a very thin filtering medium, such as asbestos fabric.
—O. R.

Ferrocyanides; Production of ——. [*Recovery of hydrogen cyanide from retort gases.*] W. H. Coleman. Eng. Pat. 27,908, Dec. 4, 1912.

Coke-oven or other gases containing hydrocyanic acid are passed through a tower packed with lumps of Cleveland iron ore or other native ferrous compound, through which circulates a solution of sodium carbonate or other suitable alkaline solution or suspension, and the resulting alkali or alkaline-earth ferrocyanide liquor is treated for the recovery of ferrocyanides.—F. Sodn.

Cyanides; Impts. in the process of Marguerille and Sourdeval for the manufacture of ——. F. Gros, P. Goissedet, F. Bouchardy, and M. Fossier. Fr. Pat. 460,684, July 23, 1913.

A mixture of 8 parts of barium carbonate, 3 of carbon (petroleum coke or anthracite), and 2 of tar is moulded into balls and these are heated to 600° C. in gas retorts to recover the tar by distillation. The balls are then placed in an electric furnace heated to 1600° C., and subjected to the action of a gas containing nitrogen, *e.g.*, producer gas or air, whereby barium cyanide is produced. The furnace is an inclined cylinder; at the ends of the middle reaction zone are two rings of carbon electrodes, with intermediate electrodes for use at the beginning of the heating; the charge itself serves to conduct the current when it becomes hot. The cyanide may be subsequently decomposed by steam, with the evolution of ammonia and carbon monoxide and formation of baryta for use again in the process.
—A. S.

Aluminium-bearing materials; Treatment of —— [*for the manufacture of aluminium hydroxide*]. H. P. Bassett, Catonsville, Md. U.S. Pat. 1,079,589, Nov. 25, 1913.

Clay, felspar, slate, or the like, 5 parts, sodium carbonate, 3 parts, and sodium sulphate, 2 parts, are heated together, the product is carbonated, and the soluble portion of the product is carbonated, and the precipitated aluminium hydroxide is recovered.—O. R.

Alumina; Purifying ——. (1) H. F. Chappell, New York. (2) G. E. Cohen, Brooklyn, N.Y., Assignor to H. F. Chappell, New York. U.S. Pats. 1,079,899 and 1,079,900, Nov. 25, 1913.

(1) Alumina is freed from accompanying silica by first heating it to a temperature which renders alumina insoluble in hydrofluoric acid, then subjecting it to the action of hydrofluoric acid and water, and finally heating above 600° C. (2) Alumina is heated to a temperature which renders it insoluble in ammonium bifluoride, this reagent being then used to free the alumina from accompanying silica.—O. R.

Nitrous vapours; Absorption of —— by lime. A.T. Schloesing. Fr. Pat. 460,328, Oct. 2, 1912.

The nitrous vapours present in hot gases coming from an electric furnace are absorbed by means of quicklime at 300°—400° C., the quicklime being produced by burning limestone, either in fragments or in agglomerates, by means of the hot gases containing the nitrous vapours.
—A. S.

Sulphate furnaces; Scrapers for agitators in ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 460,484, July 17, 1913. Under Int. Conv., Feb. 14, 1913.

Claim is made for the use of scrapers of refractory, acid-resistant stone. In the example shown, the scrapers are pieces of stone of chisel-shape, fixed in supports by means of wedges and attached to the arms of the agitator by means of bolts.—A. S.

Sulphur dichloride; Manufacture of ——. Verein Chemischer Fabriken in Mannheim. Fr. Pat. 460,555, July 21, 1913. Under Int. Conv., July 30, 1912.

Sulphur dichloride is prepared by the action of chlorine on sulphur, sulphur monochloride, or other sulphur compounds, at the ordinary temperature, in presence of a catalyst, especially iron filings. Other substances which may be used as catalysts are cobalt, nickel, aluminium, manganese dioxide, anhydrous calcium chloride, and iron chloride.—A. S.

Thorium: Separation of —— from other rare earths. O. Knöfler und Co. Ger. Pat. 266,459, July 3, 1912.

Acid solutions of the rare earths, especially such as are obtained in the working up of monazite, are treated with sebacic acid, whereby thorium is precipitated. (See also this J., 1912, 361.)—A. S.

Per-salts ; Manufacture of ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 266,517, June 24, 1911. Addition to Ger. Pat. 248,683.

The preparation of, for instance, calcium perborate by the interaction of sodium perborate and a calcium salt, as described in the chief patent (see U.S. Pat. 999,497; this J., 1911, 1057) is carried out in presence of such a quantity of hydrogen peroxide that the concentration of the latter remains above 10 per cent. The sodium perborate is preferably dissolved in concentrated hydrogen peroxide, which precipitates the small quantities of compounds of heavy metals always present and which have a prejudicial effect on the stability of the per-salts. After filtering, the solution is treated with a solution of a calcium salt. The hydrogen peroxide prevents appreciable hydrolysis of the precipitated calcium perborate.—A. S.

Potassium carbonate ; Manufacture of —— by the interaction of potassium sulphate and sodium carbonate. Heldburg, A.-G. für Bergbau, bergbauliche und andere industrielle Erzeugnisse. Ger. Pat. 266,786, Jan. 11, 1913.

Potassium sulphate is treated, in aqueous solution, with a large excess of sodium carbonate, at 35°—40° C., whereby there are obtained a solution of potassium carbonate and a double potassium-sodium sulphate, of approximately the composition, $Na_2SO_4,2K_2SO_4$.—A. S.

Gases [oxygen] from solids ; Apparatus for obtaining ——. C. Weston, London. Eng. Pat. 25,326, Nov. 5, 1912.

The apparatus is a modification of that described in Eng. Pat. 15,000 of 1908 (this J., 1909, 884). The retort is provided with cylindrical inlet and discharge throats through each of which passes a rotary stopper of screw or disc form, mounted on an axial shaft ; the material itself forms a seal while being moved into or from the retort. A perforated plate beneath the upper cover serves as a secondary seal, and arms are provided for sweeping the material through the perforations into the body of the retort, in which is a number of distributing arms, superposed spirally. The material is discharged from the retort on to an adjustable platform, which may be hollow for heating or cooling purposes, and passes between crushing rolls, contained in a casing, to an open trough and elevator, thence to a rotary sorting table, and again into the retort if desired. Steam is supplied through nozzles at the base of the retort and gas withdrawn above by a pipe terminating internally in an upward bend covered by a cap. The retort is heated by a spiral surrounding flue connected with the boiler furnace.—F. Sodn.

Hydrogen and oxygen ; Production of —— by electrolytic processes. The Knowles Oxygen Co., Ltd., and R. W. Grant, Wolverhampton. Eng. Pat. 1812, Jan., 22 1913.

The electrolyte is made to undergo a preliminary electrolytic purification, generally with a current of low density, before passing to the cells for the production of oxygen and hydrogen. For this purpose, it may be passed at a suitable rate through a tank having a number of vertical baffle-plates functioning as weirs, of diminishing height towards the outlet ; these serve as positive electrodes, and corresponding suspended plates between them act as negative electrodes. After the preliminary treatment, the electrolyte passes preferably to settling tanks.—F. Sodn.

Hydrogen from water-gas or other gas containing carbon monoxide ; Process for the production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 459,918, July 2, 1913. Under Int. Conv., July 23 and 24, 1912, Feb. 14 and 10, 1913.

The gas is passed, with an excess of steam, over heated finely divided metals of the iron group, especially iron, cobalt, and nickel, or their oxides, and the carbon dioxide formed is eliminated from the gaseous reaction product. The catalyst is best prepared by the addition of appropriate diluents or binding agents, organic or inorganic, which may be such as to give off gas on heating so as to increase the porosity. For example, dry precipitated ferrous carbonate may be made into a plastic mass with lime, water, potassium hydroxide, and ferric nitrate, and the mixture dried and heated to 500° C. A reaction temperature of preferably not over 600° C. is maintained by adjusting the temperature of the gases before they enter the contact chamber.—F. Sodn.

Iodine from caliche ; Recovery of —— and the prevention of corrosion of plant during concentration of caliche. H. L. Sulman, H. F. K. Picard, and Salts Extraction Syndicate, Ltd., London. Eng. Pat. 26,056, Nov. 13, 1912.

Loss of iodine and the corrosion of vats, etc., during the concentration of caliche liquors is prevented by treating these, preferably kept slightly alkaline, with sodium thiosulphate solution or other reducing agent capable of reducing iodates to iodides, and by adding a small quantity of neutral oil or hydrocarbon oil so as to form a surface film. The vessel may also be connected with the negative pole of an electric circuit, of which the positive pole is connected with an anode inserted in the liquid ; a feeble current efficiently protects the cathode surface.—F. Sodn.

Ammonium nitrate ; Process of making —— by the ammonia-soda process. F. A. Freeth, Great Crosby, and H. E. Cocksedge, London. U.S. Pat. 1,081,107, Dec. 9, 1913.

See Eng. Pat. 16,455 of 1910 ; this J., 1911, 1013.—T. F. B.

Ammonia-soda ; Process for making ——. A. Clemm. Fr. Pat. 460,837, July 28, 1913. Under Int. Conv., Dec. 3, 1912.

See Eng. Pat. 16,470 of 1913 ; this J., 1913, 1066.—T. F. B.

Perborates ; Process for the electrolytic manufacture of ——. K. Arndt, Charlottenburg, Assignor to Chem. Fabr. Grünau, Landshoff und Meyer A.-G., Grünau, Germany. U.S. Pat. 1,081,191, Dec. 9, 1913.

See Eng. Pat. 12,536 of 1913 ; this J., 1913, 910.—T. F. B.

Metallic oxides ; Process for the production of light voluminous —— specially suitable for catalytic reactions. F. Bedford, Sleaford, and E. Erdmann, Halle, Germany. Eng. Pat. 27,718, Dec. 2, 1912. Under Int. Conv., Dec. 18, 1911.

See Fr. Pat. 451,155 of 1912 ; this J., 1913, 602.—T. F. B.

Nitrogen oxides ; Apparatus for the preparation of ——. J. S. Island. Fr. Pat. 460,557, July 21, 1913.

See Eng. Pat. 11,363 of 1912 ; this J., 1913, 909.—T. F. B.

Hydrogen ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 27,955, Dec. 4, 1912.

See Fr. Pat. 459,918 of 1913 ; preceding.—T. F. B.

Hydrogen and oxygen from water ; Apparatus for industrially producing —— by electrolysis. Soc. Anon. l'Oxhydrique Française, Paris. Eng. Pat. 18,818, Aug. 19, 1913. Under Int. Conv., Sept. 21, 1912.

See Fr. Pat. 459,967 of 1912 ; this J., 1913, 1156.—T. F. B.

Graphite from worn-out crucibles ; Method of recovering ——. A. Teichmann, Zeitz, Germany. U.S. Pat. 1,080,085, Dec. 2, 1913.

See Ger. Pat. 263,653 of 1912 ; this J., 1913, 1068.—T. F. B.

VIII.—GLASS ; CERAMICS.

Clays [; Classification of ——]. A. Müntz and H. Gaudechon. Comptes rend., 1913, **157**, 968—974.

Suspensions of clays of known concentration were allowed to settle in cylinders of 1 litre capacity, under identical conditions, for varying periods, and the proportion of suspended matter disappearing per hour from the uppermost 250 c.c., determined. Clays from different sources (prepared by Schloesing's method) varied considerably as regards their relative content of particles of any given dimension, the rate of deposition diminishing with time in a characteristic but often irregular manner, and comparative experiments carried out in an electric field led to similar conclusions, although in this case it was the smallest particles which were the most rapidly deposited. It is suggested that fractional deposition, under arbitrary conditions, might form a basis for the classification of clays.—F. Sodn.

Porcelain ; Soft artificial, frit or French ——. A. Granger. Bull. Soc. d'Encour., 1913, 120, 195—247.

A history of the origin and development of the various forms of porcelain, with special regard to those of France and of Sèvres.

Modern soft porcelain, dates from 1879, when Lauth found by analysis that the composition of the ware varied considerably with the firing temperature, owing to volatilisation of alkalis. It was decided to use a more acid frit, and Stas glass which has the composition : SiO_2 77, CaO 10·3, K_2O 7·7, Na_2O 5·05 per cent., was employed, while the marl was replaced by a mixture of chalk and Dreux clay. The figures for the body mixing were : sand 49, Stas glass 27·5, chalk 16·66, Dreux clay 6·86. The chemical composition was : SiO_2 80·31, Al_2O_3 2·62, CaO 13·27, R_2O 3·8 ; which meant that nearly 5 per cent. more silica was introduced at the expense of the lime and alkalis. More recent mixings, used for ware exhibited at the 1900 Exposition, are :—Sand 33, Stas glass 46, chalk 14, Dreux clay 7 ; with a glaze formula : 0·46 Na_2O, 0·54 PbO, 2·5 SiO_2. The ware is fired at cone 4 instead of at cone 7, like Lauth's mixing. Still more recently, kaolin has been substituted for Dreux clay, but the composition is not published. This new ware is called soft kaolin porcelain.
—H. H. S.

Patents.

Glass carboys ; Manufacture of ——. A. Schiller, Berlin-Schöneberg, Germany. Eng. Pat. 13,827, June 14, 1913.

An upper, two intermediate, and a finishing mould are successively used for mechanically blowing glass carboys. The walls of the finishing mould form the natural extension of the outline of the upper mould, and the two intermediate moulds can be raised into position from below, one being slightly wider than the other. The strong lateral projection of the carboy next to the neck is thus formed in the preliminary moulds in the early stages of blowing, and the vessel receives its final shape in the finishing mould without acquiring a " waist."—O. R.

Ceramic products moulded under great pressure ; Process of treating and moistening clays allowing the omission of drying of ——. G. Hidoux and J. Bernheim. Fr. Pat. 460,803, July 28, 1913.

A process of semi-dry moulding of clays and other more or less plastic materials, which consists in preparing these materials by disintegration, artificial drying, grinding and sifting and then moistening them by means of a spray of water so as to prevent the formation of moist lumps. The moistening apparatus consists essentially of a tray turning horizontally on its axis so that a layer of the material is passed under the orifices of the sprinkler and then through juxtaposed ploughs, which ensure mixing of the material without any compression or agglomeration ; the ploughs are preferably arranged in several rows so that the blades of one are zig-zagged with those of the preceding. The clay is moistened with water atomised by compressed air. Clay for the manufacture of bricks, tiles, etc., is thus obtained, containing from 8 to 11 per cent. of water, in a pulverulent condition and free from moist lumps, so that the products obtained by compression of the powder in closed moulds can be immediately transferred to the kiln without intermediate drying.—W. C. H.

Enamelling ; Process and firing oven more especially applicable to ——. O. Zahn. Fr. Pat. 460,104, July 7, 1913. Under Int. Conv., Sept. 25 and Oct. 10, 1912, and Feb. 26, 1913.

To suppress heat at certain points where it would be injurious to enamelled objects fired in a muffle oven, the excess heat may be absorbed by accumulating material or by special cooling devices at these points, or the heat which surrounds the muffle may be prevented from acting on the cover, or part of the muffle—specially the cover—may be treated differently with regard to local heating. These objects are attained by prolonging the side walls of the muffle up to the arch of the heating chamber, by shielding the cover of the muffle with an insulating material to prevent radiation of heat towards the interior ; by diminishing the radiation from the hot gases through the side walls towards the upper part of the muffle by means of insulating or other material or by curving the walls outwards ; by the provision of a cooling conduit, or a space connected with a cooling chamber by suitable valves, above the muffle ; and by applying heat only at certain points and not uniformly over the component parts of the oven.—W. C. H.

IX.—BUILDING MATERIALS.

Portland cement ; Influence of sodium bisulphite on ——. H. Luftschitz. Tonind.-Zeit., 1913, 37, 1986—1987.

Tests on mortar made from [German] standard sand and Portland cement to which sodium bisulphite had been added gave the following mean results :—

Bisulphite, per cent.	Kilos. per sq. cm.					
	Tensile strength.			Compression strength.		
	Days.			Days.		
	7	28	28 (In air after 7)	7	28	28 (In air after 7)
—	26·2	29·8	36·6	210	295	352
0·5	21·6	29·4	41·2	186	239	286
1	17·0	24·9	36·6	128	188	235
2	17·4	20·0	26·0	83	124	152
4	18·6	21·1	18·1	109	133	154

Soluble calcium bisulphite is probably formed.—F. Sodn.

Portland cement clinker ; The constitution of ——. E. D. Campbell. Tonind.-Zeit., 1913, 37, 1907—1910.

A cylindrical disc of Portland cement clinker (about 30 mm. diam., 18 mm. thick), with plane polished surfaces was placed between two thin, similarly polished discs of pure, porous magnesia. Two larger magnesia discs (about 30 mm. diam., 3—4 mm. thick) were placed above and below the smaller discs respectively, and the whole combination, each section of which had been carefully weighed, was heated in a gas furnace to 1475°—1575° C. for from 2½ to 13 hours. The temperature, measured by means of a platinum-rhodium thermo-element, could be maintained constant within 10° C. At the range of temperatures in question Pierce had shown that the celite constituent of Portland cement clinker fused and was absorbed by magnesia, whilst the alite constituent remained solid and crystalline. The weight of the magnesia discs and their chemical composition after the treatment thus afforded means of determining the relative amounts and the approximate chemical composition of alite and celite. The experimental results indicated that celite is a calcium aluminate, which fuses at a little above 1400° C. and in the fluid condition dissolves calcium oxide and calcium orthosilicate, the former being the more soluble, and the two dissolving in fused celite in accordance with the same laws which hold good for saline solutions. Alite is composed mainly of α- or β-calcium orthosilicate with calcium oxide and a certain amount of calcium aluminates and ferrites in solid solution. The amount of calcium oxide in solid solution depends on the total amount of bases present in the mass and on the clinkering temperature, but the solution limit is probably reached when the ratio $CaO : SiO_2$ is that required for the formation of tricalcium silicate.—O. R.

Testing of cement. Precautions required. W. L. Gadd, Concrete Institute. "Times" Eng. Suppl. Dec. 17, 1913.

The author drew attention to fallacies in some of the recognised processes of testing Portland cement, especially in connection with the British standard specification.

Time of setting. The standard specification stipulated that before any sample of cement was submitted to certain tests it "should be spread out for a depth of 3 in. for 24 hours in a temperature of from 58° to 64° F." (14°—18° C.) The object appeared to be to cool the cement to the normal temperature, and to obtain conditions similar to those governing cement which had lain in sacks or casks for two or three weeks. Cooling could, however, be very simply done without exposing the sample to air, and aeration was apt to lead to unreliable results in subsequent setting-time tests. Cement kept in sacks, under ordinary conditions of dry storage, became either slower or quicker in setting, but the result could not be foretold.

The setting time was differently affected when the same cement was aerated or stored in bulk in different localities or at different periods. Pure, dried air had no effect upon the setting time of cement, but the effect of moist air free from carbonic anhydride was distinctly marked, while the acceleration of setting time by absorption of carbonic anhydride was proved.

Fineness. In regard to the British standard specification for the manufacture of wire cloth for sieves, many rolls of cloth which contained the stipulated number of threads, of practically the correct diameter, were hopelessly inaccurate for the purpose of testing cement for fineness. The size or area of the holes in a sieve was the real standard and should be stipulated, the actual diameter of the threads, or their precise number per inch, being of secondary importance. Another point which appeared to be overlooked was the size of the sieve itself. A very finely ground sample gave 3·5 per cent. of residue on a large sieve and 5·6 per cent. on a smaller one—a difference of 37 per cent. of the total.

Specific gravity.—The specific gravity test was still retained in the British standard specification, and was considered to fulfil the functions formerly attached to the bushel weight test—viz., to detect the degree of burning to which the clinker had been subjected. The author agreed with the conclusions reached by Butler that the specific gravity of cement was no indication whatever of proper calcination, but depended upon the age of the cement and the opportunities it had had of absorbing water and carbonic anhydride from the air. In some specifications the specific gravity was directed to be taken after the cement had been dried at 1000° C., but this could have no effect, the lowest temperature for the expulsion of carbonic anhydride being 300° C. For certain doubtful cements the only reliable guide was a chemical analysis, and having this the specific gravity was superfluous.

Standard sand. There was a somewhat general idea that tensile or crushing tests of cement with standard sand represented the best results of which the cement was capable. This was erroneous. The use of standard sand merely gave results which were comparable. The standard sands specified in different countries and the results of a number of tests made with these were given in the paper, and from these it was shown that the crushing resistance of concrete made from the same cement varied not only with the size, but also with the character of the aggregate. Dealing with the autoclave test, the author said it was merely a revival of Erdmeyer's high pressure steam test introduced into Germany about 1881, and rejected by German cement experts as being unreliable and misleading. Quite recently the autoclave test had been subjected to critical examination both in the United States and in Canada, and the conclusions arrived at were that a case for its adoption had not been made out.

Free lime. No theory connected with Portland cement had obtained a stronger hold than the idea that unsoundness of cement was due to free lime locked up within the particles of the ground material. Well-authenticated facts were directly opposed to the theory that expansion of cement was caused by free lime. The author's view was that unsoundness in cement was probably due to the presence of an abnormal silicate, perhaps dicalcium silicate, an unstable compound, and slowly disintegrated with an increase in volume.

Road construction ; Part played by water in macadam ——. W. G. Fearnsides. Trans. Surveyors' Inst., 1913, **46**, 33—80.

Water is an essential constituent of all road constructions and, when present in excess, is most generally responsible for their automatic disintegration and decay. The road surface suffers more from mechanical abrasion by traffic, but the under layers are subject to continuous action by percolating or stagnant water. Roadstones consist largely of felspar, and the less silicious the felspar the more soluble does it prove. Any rock which contains ferrous iron will be "rusted" as well as partially dissolved, and lime when present in rocks will be converted into calcium carbonate. Sulphides are oxidised to sulphates with production of some free sulphuric acid. Solvent action is most destructive and rapid when calcium carbonate present as a cement holding other and less soluble mineral grains together is attacked. For this reason, cement stones from clay districts, calcareous grits, bastard limestones, Green-sand and even Kentish Rag make poor material for underlayers. Igneous rocks, if not partly weathered in the quarry, may be considered as immune for many years. The worst road-materials in common use are the slags, whether as surface or under layer. Turning from the solvent to the physical properties of water, its binding power is an effect of surface tension, and for maximum efficiency the proportion of water should be kept at the optimum. "Potholes" grow by the wear of traffic at those places where by local water-pockets the proportion of water is above the optimum. The road materials which, bound with water, are strongest are those which break into pieces with flat faces readily wetted by water, as for example Derbyshire limestone. Briquettes of crushed road-stone afford a convenient method of testing its binding power. Rocks which have the lowest silica percentage give, when briquetted, the greatest tensile and crushing strength. For use in dry climates, rocks whose strength attains a maximum with little water are suitable, while those which require more water are better fitted for the damp atmosphere and frequent showers of hilly districts. The importance of cambering and draining the site is equal to that of arranging the configuration of the road surface. The effects of dew, especially of dew which distils from below, and of hoar-frost, precipitation of rain and the humidity of the atmosphere, emphasise the need of complete sub-crust drainage. Amongst solids which it does not wet, water acts as an insulator, and must be rigorously eliminated in the making of tar, pitch, asphalt or bitumen macadam before stones and binder are brought together. Slag, otherwise a poor road material, acts well with these binders because, cooled from a state of fusion, it has no moist surface. The author suggests chemical drying by adding to partially dried stones a suitable proportion of quicklime or unslacked cement, in order that the tar or asphalt may make firm contact. In the subsequent discussion, some exception was taken to the author's depreciation of slags.—H. H. S.

Patents.

Bitumen macadam. J. J. Ingham, Bradford. Eng. Pat. 1459, March 18, 1913.

Three parts of tar, 1 part of Trinidad bitumen, and 1 part of "petrol pitch" (German pitch mixed with petrol) are boiled together for about two hours and poured on to 1:

parts of limestone or "steel slag." The mixture is turned over a number of times, allowed to stand for two days, and then turned over again, after which it is ready for application to road surfaces, being preferably put down in three separate layers and well rolled.—O. R.

Portland cement; Application of the waste from sugar-refineries to the manufacture of an artificial ——. Soc. Anon. des Etablissements A. Maguin. Fr. Pat. 460,438, Oct. 4, 1912.

The fine state of division of the precipitated calcium carbonate produced in sugar refining is specially favourable to the manufacture of cement. The waste material is forced into a settling tank and then carried by a screw conveyor to a battery of three mixers in which it is combined with the requisite quantity of clay, and from which a pump forces the slurry into an agitator. This slurry is diverted into a rotary kiln provided with a lining of refractory bricks at the coolest part and of cement clinker at the hottest part. The kiln is fired with a mixture of powdered coal and air under pressure; this coal is obtained by making it pass, after breaking, into a rotary drier and then into a grinding mill with two tubes from which it is caught by the elevators of the automatic stoker. —W. C. H.

Fibrous cement or artificial stones; Process for rendering plates of —— *(electrical) conductors.* A. Göpfert. Fr. Pat. 460,683, July 23, 1913. Under Int. Conv., Sept. 11, 1912.

Plates of fibrous cement, or artificial stones, which are to be covered with an electrolytic deposit, are rendered conducting by means of a conducting material deposited either in the paste of fibrous cement or artificial stone, or during the manufacture of the plates, or in the moulds, or on the finished but not hardened products, in such a way that when hardening takes place, the conducting material combines with the surface of the mass and perfect adhesion of the electrically deposited coating is ensured.—W. C. H.

Ligneous materials; Process of injection and re-agglomeration of ——, *and agglomerations of cork by resin "foam."* A. Blavinhac. Fr. Pat. 460,807, Oct. 14, 1912.

Cork, previously agglomerated by glue, is injected with a solution of resin the degree of fluidity of which is regulated so that it thoroughly penetrates all the cavities, flaws and holes in the cork, and leaves in the angular spaces between the granules sufficient resin to ensure agglomeration of neighbouring particles being secured in case the glue is removed by moisture. The agglomerates are not appreciably increased in weight or in conductivity by the treatment. The solvent of the resin is distilled off and recovered by heating the mass, and the resin left in the form of moss or scum, which conducts less than compact resin. The heating may be increased till incipient distillation or carbonisation of the cork occurs, which still further diminishes the heat conductivity. —W. C. H.

Viscous mass especially for the asphalt industry; Process for preparing a tough ——. J. Goepper and O. Geiger, Obertürkheim, Germany. Eng. Pat. 4896, Feb. 26, 1913.

See Fr. Pat. 450,758 of 1912; this J., 1913, 613.—T. F. B.

Furnace with rotating hearth [for cement, etc.]. Beocsini Cementgyári Unio Részvénytársaság. Fr. Pat. 460,305, May 21, 1913. Under Int. Conv., May 22, 1912.

See Eng. Pat. 11,853 of 1913; this J., 1913, 1070.—T. F. B.

Hydrating various substances [sand lime mixtures, etc.]; Apparatus for ——. E. R. Sutcliffe. Fr. Pat. 460,999, Aug. 1, 1913. Under Int. Conv., Aug. 2, 1912.

See Eng. Pat. 17,936 of 1912; this J., 1913, 828.—T. F. B.

Process for making a plastic rubber-like mass for tarring roads, etc. Fr. Pat. 460,943. *See* III.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Explosives; Use of —— *for removing obstructions in the blast furnace.* H. Schöneweg. Z. ges. Schiess- und Sprengstoffw., 1913, **8**, 415—418.

Obstructions which entirely prevent the passage of the blast can be removed by firing a charge of about 600 grms. of dynamite in a tube, introduced through the wall of the furnace in the neighbourhood of the obstruction; 1—1¼ kilos. are sometimes necessary, and can be used without danger to the furnace if the charge is at least 400—500 mm. from the furnace wall. The tube containing the charge is introduced into a larger tube which has previously been introduced through a hole drilled in the furnace wall, and the charge is fired by a fuse. There should be free play between the two tubes.—A. T. L.

Cast-iron; The influence of carbon and silicon on the mechanical properties of gray ——. F. Wüst and K. Kettenbach. Ferrum, 1913, **11**, 51—54, 65—80.

Test bars prepared from Swedish iron and 75 per cent. ferrosilicon, and containing C 2 to 4 per cent., and Si 0·45 to 3·24 per cent., were examined micrographically and by mechanical tests, and show uniformity with other cast irons. The quantity and form of the graphite present are the determining factors of the mechanical properties. As influencing the form in which graphite separates, the manner of cooling is of importance, this in its turn being dependent on the method of pouring; the proportion of graphite separating, for a given carbon content and method of cooling, increases, as is well known, with the silicon content. Strength and hardness of iron decrease, in general, with increasing graphite. With increasing total carbon and silicon, the strength, in general, diminishes owing to the coarsening of the graphite. The form of graphite most favourable to the mechanical properties is "temper-carbon," occurring in "nests" of irregular shape, in contrast with lamellar-graphite, which breaks up the structure of the iron.—T. St.

Steel; The electric refining of —— *in an induction furnace of special type.* O. Frick. Iron and Steel Inst., Sept. 1913. [Advance proof.]

The author discusses the processes of steel melting and refining, with special reference to the Frick induction furnaces, from the chemical and commercial standpoints, from results obtained at Krupp's works in Essen. The normal frequency of the current employed in the Frick furnaces varies between 15 and 5 cycles for furnaces above 1 to 2 tons capacity, with voltages up to 5000 volts, and even higher for large furnaces. The lining consists of very pure magnesite without any binding agent, and is protected from the cutting action of the slag by introducing powdered magnesite to form a heap in front of the inner wall, against which it is pressed by the inclination and rotation of the bath. The lining has a life of two to three months as a rule. The inclination (5°) and rotation of the bath are sufficient to secure all possible advantages, and are at the same time small enough to obviate the necessity of having too much slag to cover the bath. Special attention is given to keeping down the radiation losses, which are of the greatest importance in electric furnaces. Results obtained from actual working of Kjellin, Frick, and Girod furnaces, working on cold scrap, appear to demonstrate the effectiveness of the design of the Frick furnace and the superiority of the induction type over the arc type. In a run of 6 weeks' duration the output of the Kjellin and Frick furnaces, both of 10 tons capacity, was 696 and 850 tons respectively. Average results with the Frick furnace (10 tons) and the Girod furnace (12 tons) showed the kilowatt-hours per ton of steel to be 600 and 1000 respectively, the loss of power being three times more in the Girod than in the Frick furnace, although the capacity of the latter is only 20 per cent. less. The practical energy-consumption and efficiency of the same three furnaces when treating steel are calculated, assuming a capacity in each case of

12 tons and the power consumption per ton capacity to be 100 kilowatts. The results obtained for percentage efficiency are stated to be :—Girod 40·5, Kjellin 67·6, and Frick 73·6; for daily production in tons :—Girod 159, Kjellin 190, and Frick 250. A 3-ton double-ring furnace for ferro-manganese is able to produce during six days, allowing 23·5 hours lost for stops between heats, 98·7 tons of ferro-manganese, tho practical energy-consumption being 542 kilowatt-hours per ton. A 10-ton furnace for melting cold scrap is able to produce 37 tons in 24 hours, absorbing 950 kilowatts, the practical energy-consumption being 587 kilowatt-hours per ton. In steel refining, the practical energy-consumption will, as a rule, be less than 90 kilowatt-hours per ton of steel. The chemical reactions taking place in the furnace during refining may be carried out in the order :—removing carbon, silicon, phosphorus, and oxygen, recarburising and making alloys with Si, Mn, Ni, Cr, W, and the like.—T. St.

Cementation with mixed carburizing agents. A. Portevin. Mem. Soc. Ing. Civils de France, 1913, **66**, 347—383. (See also Giolotti, this J., 1911, 1017, 1215.)

THE author describes experiments on a practical scale of cementation with mixed agents, *i.e.* with a layer of wood charcoal of considerable thickness through which a current of carbon dioxide is passed at the temperature of cementation. The advantages of this method of cementation are described in detail.—W. H. P.

Chrome-vanadium rolled steel wheels (United States). Times Eng. Suppl., Dec. 17, 1913.

THE Grand Trunk Railroad recently ordered 400 heat-treated chrome-vanadium rolled steel wheels for the tenders of 50 Mikado type locomotives under construction at the Montreal Locomotive Works. The tenders have a capacity of 9,000 gallons of water and 15 tons of coal, making a full load of 172,000 lb., or an average load of 21,500 lb. per wheel. Some of these wheels made by the Standard Steel Works Company and the Carnegie Steel Company were subjected to drop tests as well as to the usual physical and chemical examinations—the first tests of this character made on such wheels. In the drop tests made by the Carnegie Company the anvil of the drop testing machine consisted of a heavy steel circular block recessed in the centre for the reception of the hub, so that the wheel was supported on the rim. The anvil in turn rested on a solid steel base, making an absolutely rigid foundation. The tup weighed 2,000 lb., and was guided between two uprights to ensure a square blow. Two wheels were selected at random for test, one from each of two different heats. The wheel was first placed with the concave face of the plate up, or in a position in which it offered the least resistance to side thrust. In this position it was subjected to two blows at 10 ft. and 25 blows at 16 ft., equivalent to 840,000 ft.-lb., without crack or fracture. The total deflection of the hub was $\frac{1}{4}$ in. The wheel was then reversed with the convex side of the plate up and subjected to five blows from a height of 16 ft. before it broke. The total deflection of the plate was $\frac{9}{16}$ in. The wheel thus withstood a total of 1,000,000 ft.-lb. before cracking or breaking. The second wheel was tested in the same manner except that all the blows were delivered from a height of 16 ft. In this case the total energy expended to break the wheel was 896,000 ft.-lb. Similar tests by the Standard Steel Works Company on their wheels showed an expenditure of 1,254,000 ft.-lb. before cracking or breaking. Physical tests made on various portions of the broken wheels by the American Vanadium Company showed the tensile strength to vary from 118,000 lb. to 150,000 lb. per sq. in. with an elastic limit approximating to 70 to 80 per cent. of the tensile strength. The chemical composition was normal, the chromium and vanadium content averaging about 1 per cent. and 0·16 to 0·20 per cent. respectively, with the carbon varying from 0·55 to 0·65 per cent. Hardness tests made on both sets of wheels by the Brinell and scleroscope methods showed a practically uniform hardness throughout the entire section, the scleroscope hardness being 44 to well below the limit of wear line, with an average Brinell hardness of 286, as made on the Carnegie wheels.

Alloys; Electrolytic separation of —— and their metallographic and mechanical examination. I. Iron nickel alloys deposited at ordinary temperatures. R. Kremann, C. T. Suchy, and R. Maas. Monatsh. Chem., 1913, **34**, 1757—1809.

ON electrolysing solutions containing nickel and ferrous sulphates using iron anodes, iron-nickel alloys separated at the cathode, the ratio of nickel to iron in the deposit being much smaller than in the electrolyte. In neutral electrolytes the ratio Ni : Fe in the deposit increased very slowly when the ratio $NiSO_4 : FeSO_4$ in solution was increased. The composition of the alloy depended also on conditions of deposition. Loose dendritic deposits contained less nickel than massive deposits. In this connection the material of the cathode (iron or carbon) and the current density were of great importance, but small variations in current density which did not greatly affect the coherence of the deposit had no influence on the composition of the alloy. The alloys showed the same brittleness (due to hydrogen) as is exhibited by pure electrolytic iron. Addition of potassium oxalate to the bath caused an increase in the proportion of nickel deposited. After electrolysis had proceeded for some time a greenish grey deposit formed near the cathode which rendered it difficult to obtain the alloys in quantity. In depositing thin layers of iron-nickel alloy on iron, the different expansion coefficients caused the deposits to be only rarely adherent. On adding sulphuric acid to the bath in increasing concentration it first slightly increased and then decreased the proportion of nickel, and finally prevented the deposition of metal entirely at quite a low concentration. When citric acid was added to the electrolyte it was consumed in the electrolysis and the alloy deposited contained from 0·5 to 1·1 per cent. C. Like potassium oxalate, but not so markedly, citric acid seemed to favour the separation of nickel. The cathode mud was not obtained in presence of citric acid, and it was therefore possible to obtain thicker deposits especially on carbon. The metallographic study of the alloys showed considerable analogy with nickel-steel prepared in the usual way, although spherulitic formations were frequent, and structures similar to those of meteorites were often found. The carbon appeared to be present as temper-carbon, somewhat irregularly distributed. There was a distinct lamellation in the direction of the current, but this disappeared on raising to a white heat, with great improvement in the mechanical properties. Hardness tests were also carried out on the alloys, the results being tabulated along with composition and method of preparation.—W. H. P.

Arsenic; Iodometric determination of —— in iron and its ores after precipitation with hypophosphorous acid. L. Brandt. Chem.-Zeit., 1913, **37**, 1445—1447, 1471—1472, 1496—1498.

THE precipitation of arsenic in the elementary form by means of hypophosphorous acid (see Engel and Bernard, this J., 1896, 381) and its subsequent determination iodometrically, can be conducted in relatively large quantities of liquid and without a condenser. On dissolving the precipitate in iodine solution, then adding bicarbonate and titrating in presence of starch, the total iodine consumption is 10I for 2As. The arsenic can also be determined by adding a mixture of potassium iodide and iodate to the precipitate and titrating the iodine liberated. The reactions are as follows: $2As+6I+3H_2O=As_2O_3+6HI$, and then $6HI+KIO_3=3H_2O+KI+6I$, and $6H_3AsO_3+5KI+KIO_3=6KH_2AsO_3+6I+3H_2O$, one atom of arsenic being equivalent to one atom of iodine. This method is more rapid than the other, and nearly as accurate.. On comparing the results of the precipitation and distillation methods, it is found that the latter gives less exact results. Some of the reasons for this have been described previously (this J., 1909, 1169), and it is also found that the presence of small quantities of higher oxides of manganese in iron ores affects the distillation. The method is also suitable for the determination of arsenic in pyrites.—W. H. P.

Cyanidation; Experiments in ——. L. Cohen. Min. and Eng. World, 1913, 933—934. (See also this J., 1912, 437).

A certain ore assaying 0·81 oz. Au showed an extraction of 88·3 per cent. after one hour's agitation: more prolonged agitation (up to 8 hours) resulted in a poorer extraction (85—86 per cent.) with the same cyanide consumption: the decomposition of the cyanide seemed to be the important factor in the rapid solution of the gold, after which some gold was re-precipitated and did not re-dissolve for a long time. Another ore (0·205 oz. Au, 1·74 oz. Ag) was cyanided with and without addition of lime. In the former case the extraction figures were: Au 61·0, Ag 8·0 per cent.; in the latter, Au 85·4, Ag 51·1 per cent., though much hydrocyanic acid was liberated. In some cases minerals present in an ore assisted extraction, and if the dressed products were cyanided separately this would result in a poorer extraction than the treatment of the undressed ore.—W. R. S.

Gold and silver; Assay of ——, *by iron-nail method.* E. J. Hall and C. W. Drury. Eng. and Min. J., 1913, **96**, 1125—1126.

Mixtures of silica and iron pyrites, containing from 6 to 89 per cent. FeS_2, in addition to 48·1 oz. Au (as finely divided metal) and 147·54 oz. Ag (as sulphide) per ton of 2000 lb., were assayed in parallel by the iron-nail, iron-nail and argol, and nitre methods. ½ A.T. (14·58 grms.) of mixture being used in each case; and determinations made of the total- and sulphide-sulphur present in the slags from the iron-nail charges. Except when the sulphide content of the charge was practically all oxidised by the litharge present, low results for silver were obtained by the nail methods; the loss of silver increased with the sulphide content, attaining a maximum of 10 per cent. with charges in which nails alone were used, and of 15 per cent. with those containing both nails and argol. The results for gold by the nail method, with and without argol, were irregular but generally about 1 per cent. low. Uniformly good results for both gold and silver were obtained by the nitre method, although as much as 30 grms. of nitre was necessary for some of the charges. —W. E. F. P.

Platinum metals; Detecting —— *in beads from cupellation.* (*Part II.*) C. O. Bannister and G. Patchin. Inst. Min. and Met., Dec. 18, 1913. [Advance proof.] (See also this J., 1909, 606.)

The presence of platinum metals in cupellation beads can be detected by examining the surface appearance of the cool bead under a low power objective, such as a 1 in. or a ⅔ in. Photographs showing characteristic structures are given. *Platinum.* 1·6 per cent. Pt in silver produces changes visible to the naked eye, and 0·3 per cent. can be detected with certainty under the microscope. The boundaries of the crystals become distorted, and a banded structure develops. The effect of platinum on gold is similar but less marked. Beads containing equal quantities of silver and gold have the "frosted surface" appearance caused by over 2 per cent. Pt. *Iridium* makes the bead more spherical. Under the microscope, the crystal faces appear strongly marked with lines crossing one another after the manner of slip bands. The marks are ascribed to internal stresses resulting from occluded oxygen. The effect due to 0·4 per cent. Ir is clearly visible. *Rhodium.* Traces of rhodium, such as 0·004 per cent., in silver beads, cause a distinct crystallisation visible to the naked eye. With 0·03 per cent. Rh. and upwards, the beads spit persistently, and assume a blue-gray colour. Gold with 0·2 per cent. Rh has a ruby colour, and with 0·8 per cent. is covered with a black film. *Ruthenium* produces a black crystalline deposit at the edge of the bead near the bottom, and gives a "single-sided herring-bone structure" to the surface of the bead. The deposit with 0·004 per cent. Ru is small but distinctly visible to the naked eye. No increased tendency to spit was observed. *Palladium.* The effect is similar to that of platinum, and palladium may be detected by a colouration of the parting acid, even 0·0002 grm. Pd producing a faintly yellow colour. *osmium* up to 2 per cent. gives no characteristic appearance to the silver bead, and *osmiridium* gives similar results to those obtained with iridium alone.—T. St.

Bronzes; Analysis of ——. K. Schenck. Chem.-Zeit., 1913, **37**, 1464.

The sample (1 grm.) is dissolved in as little nitric acid as possible (say 10 c.c.) in a 300 c.c. beaker, the solution evaporated almost to dryness, 200 c.c. of water and 3 c.c. of dilute nitric acid added, the liquid heated to boiling, and after standing overnight the metastannic acid is filtered off and washed with 1 per cent. nitric acid; any foreign metals in this are determined, after weighing, in the usual way. In the filtrate the copper and lead are determined electrolytically, using a rotating electrode, and a current of 2 ampères at 8 volts in the hot solution; after washing, the cathode is dried at 100° C., but the lead peroxide on the anode requires an hour at 180° C. The residual solution is evaporated to small bulk, the iron (and any aluminium) precipitated by ammonia, and after filtering, the solution is evaporated to dryness with a little sodium hydroxide, the residue treated with water and evaporated with sulphuric acid to expel nitric acid, then treated with 150 c.c. of water and 10 grms. of solid sodium hydroxide, and the hot alkaline solution electrolysed as before, the zinc being deposited on the cathode already coated with copper.—J. T. D.

Corundum; Assay for ——, *by mechanical analysis.* W. S. Hutchinson. Min. and Eng. World, 1913, 972.

The corundum content of a hard, crystalline gneiss composed mainly of quartz, felspar and mica and containing up to 8 or 9 per cent. each of red garnet and corundum, the latter occurring as minute grains and as well defined crystals up to ½ in. in length and being usually present in much smaller quantity than the garnet, was determined as follows:—500 grms. of the 4-mesh sample having been "scoured" with water in an iron bucket by means of a wooden block, the mica thus loosened was floated off with water and the residue dried and graded, by sifting, into 7 portions of which the finest passed through a 14-mesh screen. As much as possible of the clean corundum was picked out by hand from each of the six coarser portions, the remainders of which, together with the fine portion, were then mixed, crushed to pass a 30-mesh sieve and "panned" repeatedly to produce a concentrate containing practically the whole of the corundum and garnet. From the dried concentrate (containing about 20 per cent. of quartz and felspar) the garnet was removed by means of an electro-magnet, after which the corundum (sp. gr. about 4) was separated from the residue by means of a heavy liquid (a solution of mercuric iodide in potassium iodide) of sp. gr. 3·1. —W. E. F. P.

Crude oil for the assay furnace. Haldane. *See* IIa.

Protection of iron and steel by paint films. Dubois. *See* XIII.

Diphenylcarbohydrazide as an indicator in the bichromate titration of iron. Brandt. *See* XXIII.

Patents.

Manganese-steel; Method of forming machined shapes of ——. W. S. Potter, New York. U.S. Pat. 1,079,439, Nov. 25, 1913.

To obtain metal with a texture (between a tough, austenitic and a fragile, coarse-grained, martensitic structure) having relatively weak cleavage planes, whereby machining is facilitated, the casting is maintained between 640° and 720° C. for 15—60 mins. per inch of its thickness and then cooled; after machining, it is maintained between 975° and 1075° C. for 5—15 mins. per inch of thickness and then rapidly cooled to below 420° C.—W. E. F. P.

Iron and steel ; Process for the treatment of ——, to form a permanent black finish thereon. W. R. Swan, Bridgeport, Conn. U.S. Pat. 1,079,453, Nov. 25, 1913.

The metal whilst hot and in the presence of copper sulphate, ammonium chloride and glucose, is subjected to the action of superheated steam, then cooled and immersed in heated paraffin oil.—W. E. F. P.

[Steel.] Case-hardening mixture. J. F. Sallows, Lansing, Mich., Assignor to A. O. Blaich, Chicago, Ill. U.S. Pat. 1,079,954, Dec. 2, 1913.

A mixture of 65—70 per cent. of spent tan bark, 12—15 of barium carbonate, 10 of sodium chloride, 8—10 of laked lime and 2½ of ammonium carbonate.—W. E. F. P.

Steel ; Apparatus for manufacturing and refining ——. J. W. Latcher, Edinburg, N.Y. U.S. Pat. 1,080,224, Dec. 2, 1913.

A crucible or pot, lined with refractory material and which can be whirled about its own axis while heated internally by means of a flame projected downwards. —W. E. F. P.

[Lead and zinc] Ores ; Treatment of ——. S. L. Bensusan, London. Eng. Pat. 26,350, Nov. 16, 1912.

The ore or concentrate is fed in a slow and continuous stream into an inclined rotary furnace, where it is roasted and simultaneously subjected to jets of steam. Agglomeration of the ore is thus avoided. The zinc and silver are almost wholly converted into sulphates and may be separated from the lead by leaching. The roasting temperature is attained by the admission of hot gases from a supplementary furnace into the roasting furnace at its discharge end, and the temperature is afterwards regulated by the admission of furnace gases, heated air, or cold air, as required.—T. St.

Zinc compounds ; Process of reducing ——. E. B. Cutten, Erie, Pa. U.S. Pat. 1,080,102, Dec. 2, 1913.

The reduction of oxide or other compound of zinc free from slag-forming material is effected by means of reducing gases or/and carbon at a high temperature and under a pressure sufficient to prevent volatilisation of the metal, which is thus recovered in liquid form.—W. E. F. P.

Metalliferous sands or slimes ; Treatment of ——. A. J. Boult, London. From R. H. Kendall, Marikuppam, India. Eng. Pat. 27,320, Nov. 27, 1912.

A combined settling tank and agitator for the treatment of slimes, consists of a vertical tube in which the pulp is agitated, and a cylindrical settling tank with a conical bottom surrounding the upper part of the agitator. The thick pulp passes from the bottom of the settling tank through adjustable openings into the agitator, and the clear liquid is run off into a launder encircling the settling tank. The pulp is agitated with a suitable solution in the agitator, and is transferred to the next settling tank of a series, by air-lift, or by means of a pump. Arrangements of both kinds are described.—T. St.

Nickel ; Recovery of —— from its ores. H. L. Sulman, H. F. K. Picard, and A. E. Roberts, London. Eng. Pats. 27,626, Nov. 30, 1912, 3814, Feb. 14, and 6703, March 18, 1913.

Freshly crushed garnierite ores are mixed mechanically with a quantity of sulphuric acid (75 to 80 per cent. strength) insufficient to dissolve all the nickel. The mixture becomes hot and the silica dehydrated, and a dry porous mass is left. After addition of water, the pulp is filtered, and the solution, containing sulphates of magnesium, nickel and iron, and small quantities of other substances, is oxidised and then neutralised with calcium carbonate. The solution of nickel and magnesium sulphates is filtered, treated with powdered magnesia or milk of lime, and the precipitated nickel hydroxide is separated and roasted.—T. St.

Aluminium solder. S. R. Bailey, and Navaltum, Ltd., London. Eng. Pats. 27,835, Dec. 3, 1912, and 12,972, June 4, 1913.

Aluminium solders specially designed to withstand the action of sea water are composed of :—(1), Al 1, phosphor tin (5 per cent. P) 0·5, Zn 2, Sn 24, soft solder 0·5 parts by weight ; (2), Al 0·5, Sn 4·25, phosphor tin 0·25 parts by weight.—T. St.

Ores ; Treatment of sulphuretted, oxidised, carbonated and other ——. N. H. M. Dekker, Paris. Eng. Pat. 28,857, Dec. 14, 1912.

The mixed sulphates obtained as described in Eng. Pat. 18,488 of 1911 (this J., 1912, 930) are crystallised and then treated at a particular temperature with a saturated solution of one or more of the sulphates. Certain of the sulphates are thus dissolved, leaving one or more undissolved. The temperature of the separated solution is then altered to bring about a separation of the sulphates present. The treatment of the following mixtures of crystallised sulphates is described :—(1) sodium and iron sulphates, (2) magnesium, sodium, and iron sulphates, and (3) sodium, iron and copper sulphates.—T. St.

Agitating and mixing apparatus for liquid slimes. W. Symmes, Virginia City, Nev., U.S.A. Eng. Pat. 4023, Feb. 17, 1913.

The agitator consists of a cylindrical vessel with a central rotating shaft. From horizontal arms attached to the upper end of the shaft are suspended adjustable air-lift pipes, up which the slime is drawn by suction, and discharged again into the upper part of the vessel—T. St.

Magnetic separator ; Rotary ——. E. C. R. Marks, London. From Maschinenbau-Anstalt Humboldt, Cöln-Kalk, Germany. Eng. Pat. 11,430, May 16, 1913.

The distance between a stationary pole piece and the several polar surfaces of a rotating magnetic ring is adjusted by moving the stationary pole piece in the vertical plane of the movement of the material being treated. The material may thus be made to travel across a magnetic field of uniform strength, or the intensity of the field may be made to increase in the direction of movement across the field.—T. St.

Metal articles ; Compound ——. T. Prescott, Huddersfield, Yorks. Eng. Pat. 19,198, Aug. 25, 1913.

In joining together metals having different melting points, the more easily fusible metal or alloy is covered with a thin sheet of mild steel tinned on both sides, and the metal of higher melting point is then applied in the molten state to the free side of the mild steel sheet. It is essential that the temperature of the molten metal shall not be higher than the melting point of the mild steel. The tin alloys with the steel sheet and with the two metals, and these thus become firmly united. To manufacture cast iron tubes lined with copper or lead, tubes of copper or lead are supported on mandrels, the tinned steel sheet tightly lapped over, and melted cast iron then run round them in vertical moulds.—T. St.

Roasting-furnace. E. J. Fowler, Redwood City, Assignor to Pacific Foundry Co., San Francisco, Cal. U.S. Pat. 1,079,405, Nov. 25, 1913.

A furnace in which the charge is propelled from the highest to the lowest of a series of superposed chambers by means of rotating, hollow rabble-arms actuated from and communicating with a central, hollow shaft through which air is transmitted ; each rabble-arm is closed at its outer end and divided internally, by means of a longitudinal partition, into two communicating channels through each of which, in succession, the air from the shaft passes before entering the roasting chamber. —W. E. F. P.

Copper; Process of hardening ——. Process of treating metals [copper]. J. A. McLarty, Toronto, Canada. U.S. Pats. 1,079,786 and 1,079,787, Nov. 25, 1913.

(1) Copper is coated with a material containing a carbohydrate (sugar), heated to about 1600° F. (871° C.), and allowed to cool out of contact with air. (2) The metal (copper) is exposed while hot to the vapours obtained by heating a mixture containing a fat and a carbohydrate to a temperature below that necessary for the production of carbon monoxide; the mixture and the metal are not in contact.—W. E. F. P.

Ore-reducing process. J. A. McLarty, Toronto, Canada. U.S. Pat. 1,079,788, Nov. 25, 1913.

The ore, at a temperature below red heat (750°—800° F., 399°—427° C.), is subjected to the action of a reducing gas obtained by treating with a hydrocarbon the gases resulting from the combustion of carbonaceous fuel with an excess of air.—W. E. F. P.

Metals; Process of smelting ——. J. D. Hilliard, Albany, N.Y., Assignor to New England Metal and Machine Co., Boston, Mass. U.S. Pat. 1,080,344, Dec. 2, 1913.

The ore, mixed with a solid reducing agent, is progressively heated and partly reduced, without fusion, by means of hot gases, while passing along an inclined, rotating cylinder to a closed melting or reduction chamber heated by electrical means. The upper end of the cylinder has a closed, funnel-shaped extension with a charging opening and an outlet for the withdrawal, by suction, of the gases produced in the chamber.—W. E. F. P.

Tool-steel; High-speed ——. R. Becker, Crefeld, Germany. U.S. Pat. 1,081,263, Dec. 9, 1913.

See Eng. Pat. 27,838 of 1912; this J., 1913, 430.—T.F.B.

Steel; Process for improving the physical properties of ——. V. Stobie. Fr. Pat. 460,151, July 8, 1913. Under Int. Conv., July 9, 1912.

See Eng. Pat. 16,001 of 1912; this J., 1913, 831.—T.F.B.

Steel and compounds of steel; Process for producing a fibrous structure in ——. J. Churchward. Fr. Pat. 460,212, July 10, 1913.

See U.S. Pat. 1,069,387 of 1913; this J., 1913, 870.—T.F.B.

Ores; Process of roasting fine ——. W. Buddeus, Wiesbaden, Germany, Assignor to J. Dern, Salt Lake City, Utah. U.S. Pat. 1,079,897, Nov. 25, 1913.

See Fr. Pat. 425,109 of 1911; this J., 1911, 904.—T. F. B.

Alkali metals; Method of producing ——. J. E. Bucher, Coventry, R. I. U.S. Pat. 1,079,974, Dec. 2, 1913.

See Fr. Pat. 453,086 of 1913; this J., 1913, 756.—T. F. B.

Metal surfaces; Process for producing clean or deoxidised ——. J. A. Hatfield and C. R. Yates, Newport. U.S. Pat. 1,080,059, Dec. 2, 1913.

See Eng. Pat. 27,949 of 1911; this J., 1913, 93.—T. F. B.

Aluminium alloys. W. N. Naylor, Forest Hill, and S. P. Hutton, Beckenham. U.S. Pats. 1,080,155 and 1,080,156, Dec. 2, 1913.

See Eng. Pats. 27,382 of 1911 and 15,689 of 1912; this J., 1912, 994.—T. F. B.

Converter process. O. Thiel, Landstuhl, Germany. U.S. Pat. 1,080,606, Dec. 9, 1913.

See Fr. Pat. 415,042 of 1910; this J., 1910, 1314.—T. F. B.

Smelting or refining of metals and the like in crucibles. H. G. Solomon, London. U.S. Pat. 1,081,164, Dec. 9, 1913.

See Eng. Pat. 9031 of 1911; this J., 1912, 496.—T. F. B.

Stirrers and mechanical furnaces suitable for roasting or for roasting and drying ores and similar substances. O. Spinzig and W. Hommel. Fr. Pat. 460,127, July 3, 1913. Under Int. Conv., July 5, 1912.

See Eng. Pat. 15,778 of 1912; this J., 1913, 915.—T. F. B.

Furnace; Rotary ——. J. Churchward. Fr. Pat. 460,211, July 10, 1913.

See U.S. Pat. 1,069,601 of 1913; this J., 1913, 900.—T. F. B.

Ores; Process and apparatus for treating ——, especially applicable to roasting pyrites before further treatment. E. R. Sutcliffe. Fr. Pat. 460,264, July 11, 1913. Under Int. Conv., July 13, 1912.

See Eng. Pat. 16,450 of 1912; this J., 1913, 1115.—T.F.B.

Barytes; Process for separating —— from minerals. C. J. Greenstreet. Fr. Pat. 460,495, July 15, 1913.

See U.S. Pat. 1,069,545 of 1913; this J., 1913, 871.—T.F.B.

Thallium and rare metals from lead ores; Process and apparatus for separating ——, with simultaneous production of sublimed white lead. Deutsche Felsen Oel Ges. Franzen und Co. Fr. Pat. 460,825, July 28, 1913. Under Int. Conv., July 30, 1912.

See Ger. Pat. 264,526 of 1912; this J., 1913, 1078.—T.F.B.

XI.—ELECTRO-CHEMISTRY.

Application of electricity [and radioactivity] to agriculture. Baker. *See* XVI.

Patents.

Electrodes for electric furnaces. F. Krupp A.-G., Essen, Germany. Eng. Pat. 17,925, Aug. 6, 1913. Under Int. Conv., Sept. 18, 1912.

A metallic water-cooled head fits loosely by means of a screw-threaded shank into a screw-threaded hole in the electrode, and the clearance space between the threads is filled with an easily fusible metal.—B. N.

Thermo-electric element. A. L. Marsh, Assignor to Hoskins Manufacturing Co., Detroit, Mich. U.S. Pat. 1,076,438, Oct. 21, 1913.

The positive thermo-electric element consists of nickel containing from 3 to 5 per cent. Si, with a suitable quantity of manganese added to remove brittleness.—B. N.

Electrolytes; Heating molten ——. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N.J., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 1,080,113, Dec. 2, 1913.

In the electrolysis of molten salts, the heating effect of the current is supplemented by introducing into the electrolyte a hollow body (which may be one of the electrodes) heated internally by an injected gas flame. —W. E. F. P.

Furnace; Electric ——. G. Massip, Levallois-Perret, France. U.S. Pat. 1,080,840, Dec. 9, 1913.

See Eng. Pat. 19,172 of 1912; this J., 1912, 1134.—T. F. B.

Production of hydrogen and oxygen by electrolytic processes. Eng. Pat. 1812. *See* VII.

Process and apparatus for the electrolysis of halogen alkalis. Eng. Pat. 18,102. *See* VII.

Sterilisation or purification of wines, beers, and other similar fermented liquids. Fr. Pat. 460,487. *See* XVIII.

Sterilisation of milk. Eng. Pat. 26,743. *See* XIXa.

Purifying and sterilising liquids. U.S. Pat. 1,079,377. *See* XIXb.

XII.—FATS; OILS; WAXES.

Oils and fats: Report of Committee of Amer. Leather Chemists' Assoc. (1913) *on* ——. J. Amer. Leather Chem. Assoc., 1913, **8**, 496—504. (See also this J., 1913, 37.)

A summary of results obtained by members of the committee on the analysis of "a supposedly pure sulphonated cod oil" and the same oil with the addition of 5 per cent. of mineral oil. *Water.* The distillation method was found more accurate than drying with sand for 16 hours at 95°—100° C. 50 grms. of oil are distilled in a 250—300 c.c. flask with 75 c.c. of xylene saturated with water until the distillate is clear. The condenser is washed with xylene and the volume of water in the distillate measured. *Non-saponifiable matter.* Satisfactory results were obtained by either of the two following methods. (1) 10 grms. of the oil are boiled under a reflux condenser for 60 mins. with 25 c.c. of 10 per cent. alcoholic potash and 100 c.c. of petroleum ether (b. pt. 40°—75° C.), then treated with 100 c.c. of water, cooled, the ether layer washed 3 to 5 times with 100 c.c. of water, the soap solution shaken 3 times with ether, and the combined ether extracts washed with water and evaporated as usual. (2) 5 grms. of oil are treated, in an 8 oz. Erlenmeyer flask, with 5 c.c. of aqueous 50 per cent. caustic potash, 45 c.c. of alcohol, 25 c.c. of petroleum ether and some glass beads. After boiling for an hour or more the mixture is extracted with ether as usual, alcohol being used to break the emulsion. *Combined SO_3.* Accurate results are obtained by boiling 4 grms. of oil with 30 c.c. of hydrochloric acid (1 : 5) for 40 mins. with frequent shaking, and after cooling, shaking with petroleum ether, washing the ethereal layer with water, and precipitating sulphuric acid in the aqueous solution as barium sulphate. The amount of sulphuric acid present as ammonium sulphate, etc., is found by dissolving a weighed quantity of the oil in ether, shaking several times with a few c.c. of strong brine free from sulphates, and determining the sulphuric acid as barium sulphate. *Total fat.* Accurate results are obtained by dissolving 10 grms. of oil in 50 c.c. of water, boiling for 5 mins. with 25 c.c. of hydrochloric acid (1 : 5), cooling, shaking twice with 100 c.c. of ether, washing the ether extract with water and evaporating. The total fatty oil should be calculated from the difference between 100 per cent. and the sum of the water, ash, and unsaponifiable matter. The following is suggested as a specification basis for the purchase of sulphonated oils:—The standard shall be 70 per cent. of total fatty oil. Any oil tendered which tests 71 per cent. or over shall be paid for at a *pro rata* increase calculated as from the 70 per cent. standard. Any oil which tests under 70 per cent. but is 68 per cent. or over shall be subject to a reduction of 1½ times the shortage calculated at *pro rata* price from 70 per cent. If the test falls below 68 per cent. the buyer shall have the right of rejection.—D. J. L.

Whale oil; Production and utilisation of ——. H. T. Offerdahl-Larvik. Ber. deutsch. Pharm. Ges., 1913, 23, 558—569.

The world's total output of whale oil in 1912 was about 1,200,000 barrels (1 barrel=about 170 kilos.), more than half of which came from the Norwegian fisheries. In 1904—1905 the cost of production of each ton of whale oil was about 250 kr. (£13 15s. 6d.); but last year owing to increased wages and cost of fuel, the cost was about 350 kr. (£19 5s. 9d.). After separation of the greater part of the oil the residual flesh and bones are dried at about 300° to 400° C., finely divided and again pressed. They are then again dried, ground up, sifted and mixed in suitable proportions for guano. A good sample should contain 10 to 12 per cent. of nitrogen, and 14 to 15 per cent. of phosphoric acid, with not more than 2 to 3 per cent. of oil. A whale of average size yields 40 to 50 sacks (of 100 kilos.) of guano of this composition, worth about 10 to 12 M. per sack (5s.—6s. per cwt.). Until seven years ago there was only a limited demand for whale oil, which was mainly used for the production of glycerin and fatty acids. It is now hydrogenated, exclusively for soap-making, but in the author's opinion hardened whale oil is suitable for food. With regard to the small amount of nickel present in the hardened oil, experiments showed that when 0·5 grm. of nickel powder was taken daily no ill-effects were experienced, and that 99·8 per cent. of the metal was rapidly excreted from the system. Hardened whale oils were free from bacteria.—C. A. M.

Oleic acids; Isomeric ——. A. Eckert and O. Halla. Monatsh. Chem., 1913, **34**, 1815—1824.

Hydriodic acid was absorbed by 2.3-oleic acid with the formation of β-iodostearic acid. When the latter was treated with alcoholic potassium hydroxide solution only traces of 2.3-oleic acid were formed, the bulk being converted into the isomeric 3.4-oleic acid. In like manner this new acid was transformed into a 4.5-oleic acid. The iodine values of these isomeric acids, in which the double linkage had been moved further from the carboxyl group, differed widely from the normal value (89·4) of oleic acid: (2.3-oleic acid, 9·04; 3.4-oleic acid, 16·27; and 4.5-oleic acid, 26·96).—C. A. M.

Radium emanation; Action of —— *on lipase.* E. K. Marshall, jun., and L. G. Rowntree. J. Biol. Chem., 1913, **16**, 379—384.

The rate of decomposition of ethyl butyrate by the lipolytic enzymes of pig's liver and castor oil seeds, was not accelerated, but possibly slightly retarded, by the influence of radium emanation.—J. H. L.

Para rubber seed oil. [*Suitability for linoleum manufacture.*] Fritz. *See* XIII.

Detection of beef and mutton fats in lard. Bömer. *See* XIXa.

Sulpho-derivatives of stearic acid. Eckert and Halla. *See* XX.

Organosols of metals of the platinum group and of hydroxides of divalent platinum and palladium. Amberger. *See* XX.

Patents.

Catalytic material [*for hydrogenating oils*]; *Process of making* ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,078,541, Nov. 11, 1913.

Unreduced material, preferably containing a reducible metallic derivative, is conveyed through a zone of hydrogen or other reducing gas, maintained at a reducing temperature and free from catalyser "toxins," and the pyrophoric catalysing material produced is transferred to a body of oil, without deleterious contact with air.—F. Sodn.

Reduction or hydrogenation of organic compounds, especially the fatty acids and their compounds; Process of the ——. K. H. Wimmer, Bremen, Germany, and E. B. Higgins, Wallasey. U.S. Pat. 1,081,182, Dec. 9, 1913.

See Fr. Pat. 441,097 of 1912; this J., 1912, 826.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Iron and steel; Protection of —— *by paint films.* N. A. Dubois. J. Ind. Eng. Chem., 1913, **5**, 968—971.

Comparative tests made with five paints of exactly the same composition except that in one case a pure linseed oil vehicle was used, whereas in the others the vehicle contained 5, 10, 20 and 30 per cent. respectively of "kauri mixing varnish," indicated that the films given by the paints at the two ends of the series were inferior to those given by the intermediate paints, *i.e.*, with increasing additions of "kauri mixing varnish," the protective effect of the paint film increased up to a certain point and then diminished. "Blue lead" gave results similar in many ways to those obtained with red lead when used as a priming coat for iron and steel; and by proper selection of sizes of particles in accordance with the law of minimum voids, the protective power of red lead paints was considerably improved. Experimental results indicated that the efficacy of the paint film depended mainly on its impermeability to gases and water vapour rather than to the chemical nature of the pigment, and the supposed rust-inhibiting properties of certain alkaline or basic pigments are probably due to the formation of a small quantity of a metallic soap, which lessens the permeability of the paint film.—A. S.

Oleoresins of Jeffrey and singleleaf pines. A. W. Schorger. J. Ind. Eng. Chem., 1913, **5**, 971—973.

The oleoresin of the singleleaf pine (*Pinus monophylla*) yielded 19·00 per cent. of volatile oil, 79·63 of colophony (grade N), 0·11 of "trash," needles, bark, etc., and 1·26 per cent. of water. The oil (sp. gr. 0·8721—0·8733 at 15° C., n^{15}_{D} = 1·4732—1·4733, a^{25}_{D} = +14·41° to +17·26°) contained 80—85 per cent. of *d*-*a*-pinene, 4—5 of *l*- or i-limonene, and 4—6 per cent. of *d*-cadinene. The colophony (acid value, 155·9, saponif. value, 163·3) contained 7·22 per cent. of resene, and resin acids (m. pt. 129°—130° C., completely liquid at 135° C.), isomeric with abietic acid. The oleoresin of the Jeffrey pine (*P. jeffreyi*) yielded, on the average, 9·96 per cent. of volatile oil, 87·88 of colophony, 0·47 of "trash," and 1·69 per cent. of water. The oil (sp. gr. 0·6951—0·7110 at 15° C., n^{15}_{D} = 1·3927—1·4060) contained about 95 per cent. of *n*-heptane and 5 per cent. of an aldehyde, probably citronellal. The colophony (acid value, 147·6; saponif. value, 178·1) contained 12·5 per cent. of resene, and resin acids (m. pt. 170°—171° C.) isomeric with abietic acid. (See also this J., 1912, 938.) —A. S.

Finnish pine oil: Examination of the first runnings of ——. O. Aschan. Z. angew. Chem., 1913, **26**, 709—713. (Compare this J., 1907, 1151, and 1898, 237.)

The following substances were found to be present in the fraction of Finnish pine oil boiling below 60° C.:—Acetaldehyde, acetone, furane, sylvane, propionic aldehyde, and a hydrocarbon, C_5H_{10}, forming about one-half of the fraction boiling at 28·5° to 29·5° C. The theory of wood distillation is discussed, and the author considers that these constituents of the pine oil are formed from the cellulose and other carbohydrates and the lignin in the wood, and not from the resins and terpenes. The difference between the tars from pine and from other woods is due to the presence in the pine-wood tar of partially decomposed pine resins.—A. T. L.

Para rubber seed oil. [*Suitability for linoleum manufacture.*] F. Fritz. Chem. Rev. Fett Ind., 1913, **20**, 295.

The oil has an iodine value (Wijs) of about 141 and can be converted without difficulty into a mass resembling linoxyn from linseed oil. In one experiment a dry friable oxidation product was obtained which was found (by Fahrion's petroleum ether method; this J., 1891, 1015), to contain 32·6 per cent. of non-oxidised acids and 52·7 per cent. of oxidised acids. When Para rubber-seed oil is heated to 200°—210° C. with 1 per cent. of metallic magnesium and then cooled, it sets to a transparent slightly sticky mass. A similar reaction is given by linseed oil and certain other drying oils.—R. G. P.

Fires in lacquer [*and gasoline*]; *Extinguishing* —— *with sawdust.* Factory Mutual Laboratories. Oil, Paint and Drug Rep., Dec. 8, 1913, 34.

Sawdust was found to extinguish burning inflammable liquids such as gasoline and lacquer very effectively and speedily, the efficiency being further increased by the addition of sodium bicarbonate. The sawdust floated on the liquids and blanketed the flames; it took fire only with difficulty and then burned without flame, so that it did not cause re-ignition. It was found to be immaterial whether the sawdust was moist or dry, or whether derived from hard or soft woods.—T. St.

Patents.

Protective covering to be applied as a paint. J. H. Williams, Litherland, and F. Hayes, Seaforth, Lancs. Eng. Pat. 1256, Jan. 16, 1913.

Finely ground Portland cement (20 vols.) is mixed with milk (80 vols.) and the mixture passed through a very fine sieve. Linseed oil and pigments are then added, and the whole is heated. The resulting paint is particularly suitable for coating iron and steel structures. Finely powdered asbestos may be added to make the paint fire resisting, and glue to increase the tenacity. As an example, such a paint may consist finally of:—Milk and cement 60, linseed oil 12, pigment 25, asbestos 3 per cent. —T. St.

Paint mills or the like. T., J. R., and H. N. Torrance, and Torrance and Sons Ltd., Bitton, Gloucester. Eng. Pat. 14,559, June 24, 1913. Addition to Eng. Pat. 14,733, June 24, 1912 (this J., 1913, 798).

An improved form of the paint mill previously described, designed to give greater strength and rigidity. The throw of the lower convex grinding member is variable, and its adjustment relative to the stationary upper concave member is effected from several points simultaneously by a single operation. The paint is mixed before grinding by means of paddles worked through gearing from the main shaft, and the several gears are arranged to work in oil baths. Peripheral and surface scrapers are actuated from a common member on a swivel shaft in synchronism with the wavering grinding member.—T. St.

White lead; Process of producing ——. E. Euston, St. Louis, Mo. U.S. Pat. 1,079,481, Nov. 25, 1913.

An approximately neutral solution of lead acetate is treated with carbon dioxide, and basic lead acetate is introduced into the solution at a rate proportional to the precipitation of white lead.—O. R.

[*Waterproofing and insulating*] *Composition.* T. D. Kelly, Southend-on-Sea, Essex. Eng. Pat. 21,943, Oct. 18, 1912.

From 10 to 30 per cent. of a mixture in equal proportions of gummy resins obtained from woody or cellulose materials, and a non-drying vegetable oil, is added to linseed or tungseed oil (or a mineral oil to which glycerin has been added), and the whole heated quickly to about 550° F. (288° C.), and then allowed to cool. An insulating, water- and heat-proof glue is prepared by adding from 2 to 30 per cent. of a mixture of Portland or magnesium cement and metallic oxides to the liquid composition. —T. St.

Compositions for impregnating or coating surfaces, binding colours, and addition to colours, principally for the purpose of rust prevention: Manufacture of ——. R. Eberhard, Munich, Germany. Eng. Pat. 27,894, Dec. 3, 1912.

See Fr. Pat. 451,719 of 1912; this J., 1913, 666.—T. F. B.

Lacquers and varnishes; Process for the manufacture of ——. A. Cohn, Neukölln, Germany. U.S. Pat. 1,080,100, Dec. 2, 1913.

See Fr. Pat. 441,703 of 1912; this J., 1912, 886.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Preparation of [vulcanised] —— for analysis. L. Archbutt. Analyst, 1913, 38, 550—554.

The rubber grinding apparatus described consists of two solid grooved gun-metal rollers, 4 ins. long and 2½ ins. diam., mounted in bearings in a strong steel frame, which is provided with setting-up screws for adjusting the distance between the rollers. The grooves are V-shaped, 18 to the inch and $\frac{1}{20}$ in. deep, with rather sharp, smooth edges. The rollers can be geared together in the ratio 2 : 3, or the back roller may be fixed. The rubber is first cut up into pieces about ⅛ in. thick: these are passed between the rollers about three times with the wheels in gear, then with the back roller fixed. The character of the "powder" obtained varies from a "fine non-adherent powder" in the case of (*e.g.*) a rubber washer, containing 52 per cent. of mineral matter, to "very adherent particles" in the case of "very elastic black tubing" containing 1 per cent. of mineral matter. Prolonged grinding results in an increase in acetone extract, but not in alkali extract, though in the time required for preparing any of the samples referred to (not more than 10 mins.) there is no appreciable change in the amount of acetone-soluble material. Figures are quoted showing that eight hours extraction with acetone (in a Soxhlet extractor) is sufficient for all practical purposes.—E. W. L.

Para rubber seed oil. [Suitability for linoleum manufacture.] Fritz. *See* XIII.

Patents.

Rubber and other matters soluble in hydrocarbons, Process and apparatus for purifying natural and regenerated ——. H. Debauge, Paris. Eng. Pat. 8040, April 5, 1913. Under Int. Conv., April 13, 1912. Addition to Eng. Pat. 1976 of 1912, dated Feb. 3, 1911.

See Addition of April 13, 1912, to Fr. Pat. 426,457 of 1911; this J., 1912, 1043.—T. F. B.

Preparing nitrous compounds from mixtures of petroleum and tar. Fr. Pat. 460,280. *See* IIa.

XV.—LEATHER; BONE; HORN; GLUE.

Report of the Committee of Amer. Leather Chemists' Assoc. (1913) on oils and fats. See XII.

Patent.

Tanning material and method of making same. M. Hönig, Brünn, Austria-Hungary. U.S. Pat. 1,080,970, Dec. 9, 1913.

See Fr. Pat. 413,849 of 1910; this J., 1910, 1121.—T. F. B.

XVI.—SOILS; FERTILISERS.

Lime requirement of soils; Determination of the ——. J. A. Bizzell and T. L. Lyon. J. Ind. Eng. Chem., 1913, 5, 1011—1012.

Twenty-five grms. of the air-dried soil are digested with 50 c.c. of boiled water and 50 c.c. of $N/10$ baryta for 1 hour on the water-bath, then treated with 150 c.c. of water and 5 grms. of ammonium chloride, the liberated ammonia determined, and from the result the amount of baryta (or equivalent quantity of lime) absorbed by the soil is calculated, after allowing for the amount of ammonia liberated in a control determination without the baryta. —A. S.

Experimental results obtained of recent years by the section of Agricultural Chemistry of the Central Agricultural Experiment Station at Stockholm. H. G. Söderbaum. Bull. Agric. Intell. and Plant Diseases, 1913, 4, 1677—1681.

Nitrogenous manures. Wheat and rye were both more sensitive to cyanamide than were oats, *i.e.* dressings of cyanamide—even when applied a week before sowing—killed the majority of the plants in the case of wheat and rye. Only after sowing again did the plants develop normally. With oats the increased yield produced by cyanamide was nearly as good as that with sodium nitrate. With wheat and rye, the increase though marked was much less. Cyanamide manuring produced a straw with a remarkably high nitrogen content. Calcium nitrate was inferior to sodium nitrate with wheat, but equal to it with oats and rye. Dicyandiamide gave unmistakable poisoning with oats and a fall in yield. Dicyandiamidine sulphate or phosphate also caused the crops to be sickly and to develop very scantily. With oats ammonium sulphate gave as a rule better results than sodium nitrate. With barley a mixture of the two gave somewhat better results than nitrate alone, although ammonium sulphate alone was much inferior to nitrate. With rye ammonium sulphate was somewhat superior to nitrate, though with wheat the reverse was the case. Carrots and potatoes profited equally by either nitrate or ammonium sulphate. As a top dressing a mixture of cyanamide and calcium nitrate (2 of cyanamide to 1 of nitrate) gave better results with oats than either manure separately: even double doses showed no cyanamide poisoning when applied a week before sowing. All mixtures containing cyanamide were injurious when used as top dressings after the plants had appeared, although nitrates had a better effect when used in this way. With turnips ammonium sulphate was distinctly superior to sodium nitrate, giving 45 per cent. more fresh roots and 27 per cent. more dry matter.

Phosphatic manures. Using oats and barley, experiments extending over five years with superphosphate, precipitated bicalcium phosphate and tricalcium phosphate and steam bone flour, showed superiority of the lighter soluble phosphates. The superphosphate and bicalcium phosphate were about equal to each other and both superior to the other two, even in cases where the less soluble phosphates had been nearly as good as superphosphate in the first year. Calcium carbonate had little effect on the soluble phosphates during the five years, but it decreased and nearly obliterated the action of the other two phosphates. Partial replacement of sodium nitrate by ammonium sulphate always slightly increased the action of the less soluble phosphates. In these experiments the lower direct effect of the less soluble phosphates was not compensated by more favourable after effects. Taking the action of superphosphate as 100 the effect of Tunis phosphate on oats was 22, that of precipitated bone phosphate 111—117. Electrolytically precipitated bicalcium phosphate (Palmaer phosphate) gave a less favourable action than the normally precipitated product. Artificial iron phosphate gave about one-fifth of the superphosphate effect, and Bernard phosphate, prepared by calcination of low-grade crude phosphate, showed no effect at all. Nitrophosphate ("*Nitrat-phosphat*") obtained by treating crude phosphates with nitric acid, mainly a dicalcium phosphate but containing 3·6 per cent. N, had an action approximately the same as that of superphosphate.

Various other fertilisers. Nitroammonia lime ("*Nitrammonkalk*"), obtained by the action of quicklime on sewage sludge, owed most of its action to the lime it contained. Common salt gave good results with oats in a sandy soil not deficient in potash, when used with ammonium sulphate or sodium nitrate, but not with ammonium chloride. A so-called "radioactive catalytic" manure, consisting mainly of potassium silicate and alumina used in conjunction with nitrogen, phosphoric acid and potash, although harmless, never gave any definite beneficial effect. Experiments with oats grown with various manures in powdered Swedish granite, showed that the granite was able to supply the lime and potash requirements but no nitrogen and only very little phosphorus. —W. H. P.

Drilling manures; Results of —— in Hungary. C. Kerpely. Bull. Agric. Intell. and Plant Diseases, 1913, **4**, 1696—1703.

Using a machine which drilled seed and manure, superphosphate applied with the seed had no injurious action on germination either in wet or dry seasons, even when quantities as large as 232 lb. per acre were applied. The corrosive action was only observed when the seeds were not sufficiently dried before sowing. Experiments on barley and oats showed that as much as 93 lb. of sodium nitrate per acre, could be added to the superphosphate without impairing germination. As a rule drilling was much more profitable than broadcasting because of the economy of manure, half the usual quantity being generally sufficient. Manuring in the drill did not, however, produce better results in the second year, but it was not difficult to repeat the application each year, since there was no extra labour. This method of manuring gave special increases in the yield of straw. In the dry season of 1911, the advantage of drilling the superphosphate was specially evident and there appeared to be sufficient moisture both for germination and decomposition of the manure. Manuring in drills had also usually a beneficial effect on the weight per bushel of the grain. With sugarbeets in particular, drilling appeared to have a favourable effect when broadcasting had none, and mixtures of superphosphate, sodium nitrate and 40 per cent. potash salts were applied without harmful effect on germination and with greatly improved yield.—W. H. P.

Electricity [and radioactivity]; Application of —— to agriculture. T. Thorne Baker. J. Roy. Soc. Arts, 1913, **62**, 70—78.

An account of the application of high-tension electric currents to the land by means of overhead wires for the purpose of increasing the yield of crops. It is stated that Lodge-Newman plants have been recently supplied to the Departments of Agriculture of the United States and of Egypt for experimental purposes: for 25—30 acres the capital outlay is £200, but only £300 for an area of double the size. Experimental work has also been done on the effect of radioactivity, the waste material from the manufacture of radium being used, mixed with ordinary soil. Good results have been obtained by mixing 1 part of radioactive material (2 mgrms. Ra per ton) with 10 of soil: with considerably larger quantities the yield was diminished and growth retarded. Some crops were benefited to a much greater degree than others: good results have been obtained with radishes and wheat, but much less marked improvement with cress: in the case of radishes the sugar content also was markedly increased. It is stated that owing to the successful development of the processes of Kent-Smith and Rolfe and of Sommer, comparatively poor residues from carnotite could be treated profitably for the extraction of radium, and that the supply of radium in the near future on a comparatively large scale was assured. The cost of the radioactive treatment of the soil would be about 10s.—15s. per acre. (See also this J., 1913, 1165.)—A. S.

Study of the Pemberton-Kilgore method for determination of phosphoric acid. Hibbard. *See* XXIII.

Patents.

Superphosphate: Method of manufacturing double ——. T. L. Willson and M. M. Haff, Ottawa, Canada. U.S. Pat. 1,078,887, Nov. 18, 1913.

Claim is made for adding pyrophosphoric acid to natural phosphate rock and for the production of "normally dry and set double superphosphates."—F. Sodn.

Phosphates: Apparatus for converting mineral and artificial —— into products soluble in citric acid and suitable for use as fertilisers. Lothringer Portlandzementwerke. Ger. Pat. 266,935, Dec. 20, 1910.

The discharge end of a rotary kiln opens directly into a shaft furnace, the fusion zone of which is in a constricted portion not far below the outlet of the rotary kiln. The material, preheated in the rotary kiln, is melted in the shaft furnace, at temperatures of 1500° C. or higher, by means of blast flames, and the fused material flows down a shoot to a quenching device comprising rollers and water jets.—A. S.

Gas-purifying material ["Cruds d'ammoniaques"]; Treatment of spent —— to render it applicable directly as a fertiliser. E. Bodin, H. Dupont, and M. Riom. Fr. Pat. 460,745, July 25, 1913. Under Int. Conv., Nov. 6, 1912.

The material is ground to a paste with water and then dried at 160°—180° C. in a strong current of air, whereby tarry matters, naphthalene, phenolic compounds, and part of the sulphur are removed, leaving a product containing cyanides, ferro- and ferri-cyanides, thiocyanates and some free sulphur, which can be applied directly as a nitrogenous fertiliser.—A. S.

Peat; Treatment of —— for use as a fertiliser or for other purposes. W. B. Bottomley. Fr. Pat. 460,078, July 5, 1913. Under Int. Conv., July 27, 1912.

See Eng. Pat. 17,487 of 1912; this J., 1913, 878.—**T. F. B.**

XVII.—SUGARS; STARCHES; GUMS.

Diffusion juice; Acidity of ——. H. Pellet. Bull. Assoc. Chim. Sucr., 1913, **31**, 296—300.

Using litmus paper as indicator, the acidity of normal diffusion juice expressed as H_2SO_4, varied from 3 to 7 grms. per hectolitre. At times the juice was approximately neutral and, in one case, a slightly alkaline juice was observed. With phenolphthalein as indicator, the acidities were from 4 to 6 times higher, and in the author's opinion these indications should not be accepted. When beetroots were tried in Egypt some years ago the diffusion juice was always alkaline, notwithstanding the purity of the Nile water. Zamaron also has observed an alkaline beetroot juice in Spain.—L. J. de W.

Reducing sugars; New method for the determination of small amounts of —— in the presence of a large proportion of sucrose. H. Pellet. Bull. Assoc. Chim. Sucr., 1913, **31**, 183—205.

In the usual volumetric or gravimetric determination of small quantities of reducing sugars in presence of a large quantities of sucrose (*e.g.*, in high-grade or refined sugars) by means of Fehling's solution, an appreciable amount of sucrose may be decomposed, leading to the precipitation of an excessive quantity of cuprous oxide. Accurate results may be obtained by using Fehling's solution containing a comparatively small amount of sodium hydroxide and heating at about 60° C. *Fehling's solution* (10 c.c. = 0·05 grm. of invert sugar): (a) 34·64 grms. of crystallised copper sulphate per 500 c.c.; (b) 180 grms. of Rochelle salt and 60 grms. of sodium hydroxide per 500 c.c.; equal volumes of the two solutions are mixed together just before use. *Standard solution of invert sugar* (1 c.c. = 0·005 grm. of invert sugar): 20 c.c. of the Fehling's solution, 20 c.c. of the sugar solution to be tested (containing less than 0·10 grm. of reducing sugars), and 10 c.c. of water, are heated to 60°—62° C. for 10 minutes, and the precipitated cuprous oxide determined, preferably by adding 50 c.c. of cold water, filtering twice through a small filter previously moistened with hot water, calcining the precipitate in a muffle furnace (not over a gas burner or alcohol lamp), and weighing as cupric oxide. The conversion factor (usually 0·453) is determined by a control test with the standard invert sugar solution, and the weight of copper retained by the paper is also ascertained and deducted. For rapid work the cuprous oxide may be collected on a disc of filter paper of definite size, and the depth of colour estimated by comparison with a series of papers prepared with increasing amounts of the standard invert sugar solution under similar conditions.—J. P. O.

Reducing sugars; Action of alkali carbonates on ——, under the influence of heat. H. Pellet. Bull. Assoc. Chim. Sucr., 1913, 31, 317—322.

The alkalinity of juice after the second carbonatation, as well as after sulphitation, is almost entirely due to carbonates, and it was found that sodium carbonate like caustic alkalis caused the destruction of reducing sugar with production of a brown colour and loss of alkalinity on concentrating the solution. A solution alkaline to phenolphthalein but neutral to litmus was found to be still capable of acting destructively on reducing sugars.
—L. J. de W.

Betaine; Decomposition of —— by caustic potash. Preparation of hydrocyanic acid by the destructive distillation of beet molasses by the Dessau process. F. Albers. Chem.-Zeit., 1913, **37**, 1533—1534, 1545—1547.

The production of hydrogen cyanide by the Dessau process (see Eng. Pat. 7171 of 1895, this J., 1896, 114; H. Ost, Z. angew. Chem., 1906, 609) is based on the interaction at high temperatures of ammonia and methylamines evolved in the destructive distillation of waste beet molasses (see Voerkelius, this J., 1909, 1122). In view of the high proportion (about 15 per cent.) of betaine in waste molasses, the author has studied the formation of amines from this compound on heating with caustic potash, waste molasses being alkaline in reaction. When heated to 200°—220° C. in presence of potassium hydroxide, betaine yields about ⅓ of its nitrogen in the form of trimethylamine, the only volatile product formed besides carbon dioxide. The residue contains a compound which forms a hydrochloride, $C_4H_9O_2N,HCl$, melting at 187°—189° C., and a platinichloride, $(C_4H_9O_2N,HCl)_2PtCl_4$. The yield of this compound (weighed as hydrochloride) is 50—60 per cent. of the betaine. At 300°—315° C. the new compound evolves the whole of its nitrogen as monomethylamine. When a solution containing betaine and potassium hydroxide is introduced drop by drop into a retort heated to 500°—540° C., the betaine is decomposed entirely into volatile products with the exception of some carbon dioxide fixed by the alkali. Trimethylamine is formed (in relatively smaller amounts than at 220° C.) together with monomethylamine and ammonia, the last being produced by decomposition of the two amines. These three bases together contain about 85 per cent. of the nitrogen of the betaine. Part of the remaining 15 per cent. is probably free nitrogen produced by dissociation of the amines and ammonia, and is not available for the production of hydrogen cyanide. A much larger proportion of elementary nitrogen must be produced at the higher temperatures employed in the Dessau process. Besides nitrogenous products, betaine yields at 500°—540° C. considerable quantities of hydrogen and methane and some carbon monoxide and dioxide. The amines interact with hydrogen to some extent at this temperature, and give rise to ammonia and methane.
—J. H. L.

Fucitol. E. Votocek and R. Potmesil. Ber., 1913, **46**, 3653—3655.

Fucose was prepared by Tollen's method (this J., 1900, 160) from the sea-weed, *Fucus vesiculosus* (yield 33 grms. from 10 kilos. as compared with 3—3½ grms. obtained by Tollens and Widtsoe from 4 kilos. of *Fucus serratus*), and was then reduced by means of sodium amalgam, yielding an alcohol, *fucitol*, $C_6H_{14}O_5$, m.pt., 153°—154° C., which was the optical antipode of rhodeitol (this J., 1906, 549). In presence of borax in aqueous solution its rotatory power was $[\alpha]^{20}_{D}=+4{\cdot}7$, and when mixed with an equivalent quantity of rhodeitol in hot alcoholic solution, it yielded racemic fucitol (*d,l*-rhodeitol), m.pt. 168°—170° C.—A. S.

Preserving meat and other food products [by means of sugar]. Vasseux. *See* XIXa.

Patents.

[*Sugar.*] *Defecator.* M. B. Cresswell, Des Moines, Iowa. U.S. Pat. 1,075,629, Oct. 14, 1913.

A tank is divided by a partition into a boiling compartment and a "dead-chamber." The former is fitted with a heating system consisting of a steam coil connected by a valved pipe with a perforated tube. The jets of steam from the perforated tube force the syrup or juice from the inlet end of the boiling compartment to the further end and through an opening in the partition into the "dead-chamber," where it encounters an inclined baffle-plate. The heavier impurities are deposited in a pocket in the boiling compartment and at the bottom of the "dead-chamber," whilst the scum is scraped from the surface of the syrup at the baffle-plate. The syrup returns as an under-current from the "dead-chamber" to the boiling compartment. When the current of juice has been started, the supply of steam to the perforated tube is cut off. The apparatus renders unnecessary the use of defecating agents, such as clay, infusorial earth, or lime.
—L. E.

[*Sugar.*] *Evaporator; Finishing* ——. M. B. Cresswell, Des Moines, Iowa. U.S. Pat. 1,075,630, Oct. 14, 1913.

The apparatus comprises a boiling tank containing a steam coil, and a contiguous skimming tank the bottom of which is at a higher level than that of the boiling tank. An opening in the wall common to the two tanks extends to the bottom of the skimming tank and the latter contains an inclined baffle-plate. Partially refined syrup, such as that described in U.S. Pat. 1,075,629 (see preceding abstract) is admitted to the boiling tank and preferably to the level of the bottom of the skimming tank. On being heated, the syrup expands and part flows into the skimming tank, carrying the scum with it. The scum is scraped over the baffle-plate to a drain, and the cooled syrup returns as an undercurrent to the boiling tank, a transverse bar near the bottom of the opening serving to hold back any floating scum.—L. E

Sugar; Apparatus for washing —— in centrifugal machines. Sugar Centrifugal Discharger Co. Fr. Pat. 460,234, July 10, 1913.

A fan-shaped spray of water is ejected, from a perforated nozzle, against the sugar at the rotating wall of the centrifuge. A regulating device arrests the discharge of water after a predetermined period. An automatic oscillatory motion is imparted to the perforated nozzle in order to distribute the separate jets uniformly over the wall of sugar. The angular adjustment of the nozzle can be altered so as to adapt the vertical dimensions of the spray at the wall of the centrifuge to the height of the sugar. The volume of water ejected can be regulated by closing some of the perforations by means of an adjustable plate.
—J. H. L.

Molasses, Process for the desaccharification of —— and the boiling of syrups. A. Gräntzdörffer and A. List. Fr. Pat. 460,192, July 9, 1913.

In the boiling of syrups a mixture of molasses with a solution of sugar is added after the formation of grain, and the boiling is then continued in the ordinary way. It is claimed that the quality of the sugar is improved and that the added molasses is partially desaccharified.—J. H. L.

Starchy materials; Apparatus for washing disintegrated ——. W. H. Uhland Ges. m. b. H. Ger. Pat. 267,199, June 29, 1911.

The starchy material is introduced into a perforated trough mounted above a collecting trough. Brushes fixed to rotating arms engage the inner side of the perforated trough and lift the material and bring it under jets through which the washing water is delivered. The collecting trough is divided into compartments. Water is delivered to the jet above the first compartment, from which the washed material is withdrawn, but the jets above the other compartments are supplied with washing water withdrawn from tho preceding compartments.—A. S.

Fermentable sugars ; Process for producing ——. Standard Alcohol Co. Fr. Pat. 460,084, July 7, 1913. Under Int. Conv., July 15, 1912.

See U.S. Pat. 1,056,161 of 1913 ; this J., 1913, 441.—T.F.B.

Sugars from cellulose ; Process for producing ——. Standard Alcohol Co. Fr. Pat. 460,085, July 7, 1913. Under Int. Conv., July 15, 1912.

See U.S. Pat. 1,056,162 of 1913 ; this J., 1913, 441.—T. F. B.

Fermentable sugars ; Process for producing ——. Standard Alcohol Co. Fr. Pat. 460,086, July 7, 1913. Under Int. Conv., July 15, 1912.

See U.S. Pat. 1,056,163 of 1913 ; this J., 1913, 441.—T. F. B.

Apparatus for dissolving sugar and other substances. Ger. Pat. 266,335. *See* I.

Application of the waste from sugar refineries to the manufacture of artificial Portland cement. Fr. Pat. 460,438. *See* IX.

XVIII.—FERMENTATION INDUSTRIES.

Maltase of beer yeast ; Conditions of activity of the ——. *II. Action of maltase on α-methylglucoside, and the affinity-constant of the enzyme.* P. Rona and L. Michaelis. Biochem. Zeits., 1913, **58** 148—157. (See also this J., 1913, 1123.)

The enzyme of bottom fermentation yeast which hydrolyses α-methylglucoside, exerts its maximum activity in solutions of almost, if not quite, the same ionic concentration (p_H lies between 5·8 and 6·6) as the optimum already found for the hydrolysis of maltose (*loc. cit.*). The affinity-constant of the enzyme with respect to α-methylglucoside is 11·1, a value appreciably lower than that (*viz.*, 60) found for invertase with respect to sucrose (see Michaelis and Menten, this J., 1913, 442).—J. H. L.

Yeast fermentation without sugar. XIII. Formation of aldehyde during the fermentation of hexoses and the so-called auto-fermentation. C. Neuberg and J. Kerb. Biochem. Zeits., 1913, **58**, 158—170. (See also this J. 1912, 893 ; 1913, 102, 620, 803.)

The quantity of acetaldehyde produced by alcoholic fermentation, even in presence of zinc chloride (see Kostytschew, this J., 1912, 553, 741 ; 1913, 207) amounts to only 0·05—0·2 per cent. of the sugar fermented, and does not justify the theory that the whole of the alcohol is formed by reduction of aldehyde. There is no proof that the small quantities of aldehyde found are derived solely from decomposed sugar. The experiments of Kostytschew on the reduction of aldehyde to alcohol by yeast are inexact owing to errors of method, such as the use of sodium bisulphite for the separation of aldehyde from alcohol. Aldehyde can be accurately titrated in presence of alcohol by Ripper's method (see this J., 1901, 288), and the alcohol can be determined by the method of Nicloux (see this J., 1897, 473, 566).—J. H. L.

Alcoholic fermentation ; Influence of mercury on ——. P. Nottin. Comptes rend., 1913, **157**, 1005—1008.

Contact of mercury with fermenting wort retards fermentation but increases the yeast crop produced. The former effect is due to the formation of minute quantities of mercury salts, and the latter to a physical action of the metal in preventing supersaturation of the liquid by carbon dioxide as the result of which reproduction of the yeast proceeds more freely.—J. H. L.

Hop bitter substances ; Determination of —— *by cold extraction with carbon tetrachloride.* R. Seibriger. Woch. Brau., 1913, **30**, 610.

The minced hops are treated with carbon tetrachloride as previously described (this J., 1913, 442), save that extraction is continued for 2½ hours to insure complete solution of the bitter substances in the case of moist hops The titration is effected with phenolphthalein as indicator. The first portion (3—4 grms.) of the minced hops from the mincing machine is used for determining the moisture by drying for 3 hours at 105° C. A portion of the bulk of the minced material is also used for a moisture determination, the value found being employed in calculating the percentage of bitter substances referred to the dry hops. —L. E.

Sulphurous anhydride in wines ; Determination of the total ——. L. Lévy. Ann. Falsif., 1913, **6**, 595.

A mixture of 50 c.c. of the wine and 2 grms. of barium dioxide is allowed to stand overnight in a stoppered, conical flask of about 150 c.c. capacity, then treated with hydrochloric acid until no more gas is evolved, and then with ammonium chloride. After heating to boiling, the precipitate is filtered off, washed with a dilute solution of ammonium chloride, dried and ignited. The difference between the weight of this precipitate and that of the barium sulphate corresponding to the sulphuric acid originally present in 50 c.c. of the wine, multiplied by 0·25, represents the amount of sulphurous anhydride in 50 c.c. —L. E.

Biochemical synthesis of glucosides of polyhydric alcohols ; α-glucosides of glycerol and glycol. Bourquelot and Bridel. *See* XX.

Ferro- and ferricyanide salts of betaine. [*Isolation of betaine from molasses residues.*] Roeder. *See* XX.

Patents.

Sterilisation or purification of wines, beers and other similar fermented liquids ; Process and apparatus for the ——. A. Shelmerdine and F. C. Lewis. Fr. Pat. 460,487, July 17, 1913.

The liquid passes along one or more tubes, preferably of glass, in which electrodes are inserted at relatively long distances. An alternating current of very high E.M.F. (*e.g.*, 3000 volts) is employed.—J. H. L.

Grain ; Treatment of —— *in the production of malt.* R. E. Chichester. Fr. Pat. 460,858, July 29, 1913. Under Int. Conv., Aug. 2, 1912.

See Eng. Pat. 17,904 of 1912 ; this J., 1913, 804.—T. F. B.

Colouring matter suitable for alimentary and other products. Fr. Pat. 460,441. *See* IV.

XIXa.—FOODS.

Benzoic acid ; Detection and determination of —— *in milk and cream.* E. Hinks. Analyst, 1913, **38**, 555—558.

Qualitative. 25 c.c. of milk, or 10—20 grms. of cream, are heated with an equal volume of concentrated hydrochloric acid, as in the Werner-Schmidt method for the estimation of fat, until the precipitated curd is completely dissolved. The mixture is cooled and shaken with 25 c.c. of a mixture of methylated ether (1 vol.) and petroleum spirit (2 vols.). The ethereal solution is separated, 1 drop of ammonia solution added, then 5 c.c. of water. The mixture is shaken, the aqueous layer separated, heated for a few minutes on the water-bath to expel excess of ammonia and tested for benzoic acid with ferric chloride in the usual manner.

Quantitative. The same quantities of milk or cream and acid as above, are heated under a reflux condenser. The mixture is cooled and extracted three times with

20 c.c. of a mixture of equal volumes of ether and petroleum spirit. The ethereal extracts are made alkaline with ammonia solution, 10 c.c. of water added, and the mixture shaken; the aqueous layer is separated, and the alkaline extraction is repeated twice. The bulked aqueous extracts are acidified with hydrochloric acid and extracted 3 times with mixed ether and petroleum spirit as before. These final extracts are allowed to evaporate spontaneously, and the residue dried to constant weight (24 hrs.) in a desiccator. The benzoic acid is then volatilised by heating at 100° C. (an hour or two) the loss in weight representing the amount present. The method gives a close approximation to accuracy in the second place of decimals. The presence of boric acid does not interfere with the method, which has also been applied to butter. Butter may be treated direct as in the case of cream, or the aqueous portion may be separated, the fat shaken several times with hot sodium bicarbonate solution, and the mixed washings and aqueous portions digested with hydrochloric acid.—E. W. L.

Preserving meat and other food products ; Practical and economical method of—— [by means of sugar]. A. Vasseux. Bull. Assoc. Chim. Sucr., 1913, **31**, 180—182.

Good results have been obtained by the author in the preservation of meat by covering with powdered sugar. During the first few days of the treatment, water is absorbed by the sugar; the resulting syrup is drawn off and re-crystallized. When the syrup has drained away, the meat is again sprinkled with powdered sugar, after which it may be preserved indefinitely with, it is stated, no alteration in quality. Fish may be treated in the same manner.—J. P. O.

Lard ; Detection of beef and mutton fats in ——. A. Bömer. Z. Unters. Nahr. Genussm., 1913, **26**, 559—618.

The method is based upon the differences in the m. pts. of the characteristic glycerides of lard and of beef and mutton fats as compared with the m. pts. of the respective fatty acids. The difference between the m. pt. of α-palmito-distearin from lard and its separated fatty acids is 5·2° C., whilst in the case of the β-palmito-distearin of beef and mutton fats the difference is only 0·1° C. Fifty grms. of the melted lard are dissolved in 50 c.c. of ether and crystallised at about 15° C. The crystals are pressed between filter paper, recrystallised from 50 c.c. of ether and again dried with filter paper. In the case of pure lards the glycerides thus obtained usually melt at 63° to 64° C., whilst those from lards containing beef fat, etc. have usually a lower m. pt. Should the m. pt. be below 61° C. the recrystallisation must be repeated until the m. pt. is above 61° C. In the case of soft oily lards a mixture of 3 to 4 parts of ether with 1 part of alcohol or anhydrous acetone is useful for the first crystallisation. The fatty acids are separated from part of the deposit, and the m. pts. of the glycerides and fatty acids simultaneously determined. In the case of glycerides melting between 61° and 65° C. a lard must be regarded as adulterated with beef or mutton fat or with hydrogenated oil when the m. pt. of the glycerides added to twice the difference between the m. pts. of the glycerides and their fatty acids is lower than 71° C. With glycerides melting between 60° and 61° C. the presence of foreign fat is certain when the difference between the m. pts. is less than 5° C. and with glycerides melting from 65° to 68·5° C. when the difference is less than 3° C. For the detection of hardened (hydrogenated) oils the method may be used in conjunction with the phytosteryl acetate test.—C. A. M.

Coffee ; Investigations on ——. T. Rözsenyi. Chem.-Zeit., 1913, **37**, 1482—1484.

To determine the proportion of adulterant (cereals) added to ground coffee, advantage may be taken of the fact that coffee ash is strongly alkaline whereas that of cereals is almost neutral. The alkalinity of the ash from five samples (Portorico, Mocca, Ceylon, Santos, Domingo) closely averaged 50 c.c. of N/1-acid per 100 grms. of roasted coffee, that of various substitutes under the same conditions, about 1 c.c. The ash in the five samples amounted to between 4·06 and 4·80 per cent. Artificial mixtures gave the following alkalinities :—

50%	Mocca	+	50%	barley	:	24·5 c.c.
75%	,,	+	25%	malt	:	37·6 ,,
50%	,,	+	50%	rye	:	25·0 ,,
20%	Ceyloa	+	80%	barley	:	8·5 ,,
10%	Santos	+	90%	,,	:	4·9 ,,

The unground roasted beans can be extracted fairly well with water for the manufacture of coffee extract, and the exhausted beans dried, glazed, and sold for fresh coffee. In this treatment the coffee loses 10 per cent. in weight and 40 per cent. of its ash, and the adulteration is detected by the determination of the latter.—W. R. S.

Chicory ; Detection of —— in decoctions of chicory and coffee. C. H. La Wall and L. Forman. Amer. J. Pharm., 1913, **85**, 535—538.

The determination of the cupric-reducing power affords a means of detecting the presence of chicory in coffee (see Tatlock and Thomson; this J., 1910, 138). The extractives of roasted coffee contain from 1·92 to 2·64 per cent. of reducing sugars whilst the extractives of roasted chicory contain from 25·2 to 27·7 per cent. Therefore, when the extractives of a coffee decoction yield more than 3 per cent. of their weight of reducing sugars the presence of chicory is indicated. The addition of cane sugar to the coffee does not affect the results and its presence may be detected by a polarimetric examination.—W. P. S.

Patents.

Milk ; Sterilisation of ——. A. Shelmerdine, Liverpool. Eng. Pat. 26,743, Nov. 21, 1912.

The milk is passed at a temperature of 50°—65° C. through a glass tube of $\frac{3}{4}$—1 in. diam., and during its passage is subjected to the action of an alternating current of about 1·5 kilowatts and 3000 volts. The electrodes are placed at distances of from 12 to 20 in. on enlarged parts of the tube. The milk passes under the edge of each electrode and taps or plugs are provided for emptying the enlarged parts, when required. Modified forms of the apparatus are also described.—W. P. S.

Fruit ; Process of preserving uncooked ——. W. P. Thompson, Liverpool. From R. Oliver, Marseilles. Eng. Pat. 5999, Mar. 11, 1913.

The fruit is immersed in a solution containing about 1 kilo. of crystallised sodium bisulphite per 100 litres of water; 3 kilos. of sodium chloride may also be added. If it is desired to preserve the fruit for more than 1 year, it is, after this period, immersed in a 1 per cent. solution of sulphur dioxide. For apricots and peaches, a dilute solution of calcium sulphite may be employed.—W. P. S.

Coffee extract ; Process of making ——. J. T. Davis, Assignor to Davis Oil Refining Co., San Francisco, Cal. U.S. Pat. 1,079,474, Nov. 25, 1913.

Ground roasted coffee is extracted with water at a temperature not exceeding 170° F. (76° C.) and the extract is evaporated below 170° F. and under reduced pressure. —W. P. S.

Milk ; Process and apparatus for sterilising ——. A. Shelmerdine. Fr. Pat. 460,315, June 13, 1913. Under Int. Conv., Nov. 21, 1912.

See Eng. Pat. 26,743 of 1912; preceding.—T. F. B.

Flour ; Process for ageing and bleaching ——. J. A. Wesener. Fr. Pat. 460,776, July 26, 1913.

See U.S. Pat. 1,071,977 of 1913; this J., 1913, 957.—T. F. B.

Coffee extract ; Process for producing a ——. K. von Vietinghoff. Fr. Pat. 460,949, July 8, 1913.

See Eng. Pat. 10,262 of 1913; this J., 1913, 804.—T. F. B.

Cereal coffee or coffee substitutes and process for making them. J. H. Kellogg. Fr. Pat. 460,978, July 31, 1913.

See U.S. Pats. 1,069,265, 1,069,266, 1,069,267, and 1,069,268 of 1913; this J., 1913, 880.—T. F. B.

Colouring matter suitable for alimentary and other products. Fr. Pat. 460,441. *See* IV.

XIXb.—WATER PURIFICATION; SANITATION.

Oxygen in water; Winkler's method for the determination of ——; the effect of nitrite and its prevention. F. E. Hale and T. W. Melia. J. Ind. Eng. Chem., 1913, **5**, 976—980.

Winkler's method (this J., 1889, 727) gave sufficiently accurate results in presence of such quantities of nitrite as are ordinarily present in waters. The disturbing effect of larger quantities of nitrite was satisfactorily counteracted by the addition of sodium acetate crystals or a strong solution of potassium acetate to neutralise the hydrochloric acid before exposing the solution to the air.—A. S.

Patents.

Artificial zeolites and other compounds used for softening water; Apparatus for cleansing or revivifying —— and for other like chemical treatments. F. R. Webb, Randalstown, Ireland. Eng. Pat. 27,415, Nov. 28, 1912.

The supply of water is cut off from the chamber containing the bed of artificial zeolites and, when the level of the water has sunk to the upper surface of the bed, the outlet is also closed. A 10 per cent. solution of sodium chloride is then admitted and after passing slowly through the bed of zeolites, is discharged through a pipe fitted with a valve controlled by a rocking lever; one arm of this lever is hollow and through it the liquid passes into a ball provided with an adjustable orifice. When the level of liquid in the chamber sinks to the surface of the zeolite bed this ball empties, the arm tilts, and a valve on the water supply pipe is opened so that the chamber is filled to a definite level. The ball then fills, the lever falls over and the chamber is emptied, whilst the water supply is cut off. These operations are repeated. The lever also operates a ratchet wheel, so that after the reagent has been removed by the alternate filling and emptying of the chamber, the lever arm becomes fixed and water is allowed to flow through the bed until the latter is completely cleaned. —W. P. S.

Filtering with sand or gravel; Vessel for —— designed for the purification of residuary waters charged with fatty materials or natural waters charged with iron salt in solution. Puech, Chabal et Cie., Paris. Eng. Pat. 9746, April 25, 1913. Under Int. Conv., Nov. 19, 1912.

Two series of perforated pipes are arranged in the filtering vessel, one below and the other above the layer of sand or gravel. Air is forced periodically through the lower pipes in order to cleanse the filtering material, whilst a continuous supply of air under pressure is introduced into the water through the upper pipes so that fatty substances are carried to the surface and prevented from coming into contact with the sand or gravel.—W. P. S.

Sewage and the like; Apparatus for purifying ——. P. Bunzel, Cöthen, Germany. U.S. Pat. 1,079,391, Nov. 25, 1913.

A number of settling tanks communicate through horizontal sliding valves with sludge conduits below. The latter are fitted with removable ends for discharging the sludge; the water separated from the sludge collects in a transverse channel. Means are provided for supplying water to the conduits after the sludge has been discharged, and the end covers are replaced before the valves are reopened.—W. P. S.

Sewage disposal. L. T. Leet, Reading, Pa., Assignor to Water and Sewage Purification Co., New York. U.S. Pat. 1,079,569, Nov. 25, 1913.

Sewage is separated into two portions, one liquid and the other containing a high percentage of solids; the latter portion is conducted to a closed septic tank where it undergoes liquefaction. The effluent from the septic tank is mixed with the liquid portion of the sewage, and the mixture is subjected to an oxidising treatment.—W. P. S.

Clarification of effluents; Process for the ——. F. Wellensiek. Ger. Pat. 266,998, Jan. 18, 1913.

The effluent is treated first with an alkaline solution of the humic substances separated from the waste lyes from the manufacture of cellulose from straw or wood, and then with basic or acid salts or other precipitants, *e.g.*, milk of lime or aluminium sulphate.—A. S.

Combustible matter; Extracting or sorting —— from refuse. G. Hidoux and J. Bernheim, Paris. Eng. Pat. 6998, March 22, 1913.

After separating any very large pieces, the refuse is passed through a pair of crushing rolls and then over a vibrating sieve, the distance between the wires of the sieve being twice that between the rolls. It is stated that the combustible material is only flattened out by the rolls and remains on the sieve whilst the incombustible material is crushed and passes through. Several pairs of rolls and sieves are used in succession, each succeeding pair of rolls being set closer together and each succeeding sieve having smaller meshes.—W. H. C.

Liquids; Apparatus for sterilising ——. J. S. Forbes, Philadelphia, U.S.A. Eng. Pat. 9976, April 28, 1913.

Three cylindrical vessels are arranged one within the other, with narrow intervening spaces; the upper edges of the vessels are flanged and fit one over the other, the innermost vessel being the tallest. The outer vessel is provided with a central tube extending through the bottom and central tubes in the other vessels fit over the first tube. The liquid is delivered from a constant level device into a funnel which conducts it into the space between the central tubes of the inner vessels; it then passes through the space between the walls of these vessels to a heater, overflows from the latter and is conducted to the space between the outer vessel and the next inner one, finally passing up the inner central space and escaping through the central tube.—W. P. S.

Liquids; Method of purifying and sterilising ——. G. W. Swinburne, East Orange, N.J., Assignor to Sterilisation Co. U.S. Pat. 1,079,377, Nov. 25, 1913.

Sewage or other liquid containing a chloride is passed through an electrolysing apparatus and is then allowed to remain at rest until the products of the electrolysis have acted on the liquid.—W. P. S.

Liquids; Apparatus for sterilising —— by means of ultraviolet rays. O. Linker, Leipzig, Germany. U.S. Pat. 1,079,503, Nov. 25, 1913.

The tube conveying the liquid to be sterilised passes through a central passage extending throughout the length of a mercury-vapour lamp; one end of the tube is then turned backwards in the form of a spiral round the outer wall of the lamp. The tube is out of contact with the walls of the lamp and is sealed into each end of the passage so that a dead-air space is provided between the inner wall of the lamp and the tube.—W. P. S.

Preparing nitrous compounds from mixtures of petroleum and tar. Fr. Pat. 460,280. *See* IIa.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Belladonna plants ; Individual variation in the alkaloidal content of ——. A. F. Sievers. J. Agric. Research, 1913, **1**, 129—146.

So far as the percentage of alkaloids present in belladonna leaves and the quantity of material available were concerned, the best time for picking the leaves was from the period of flowering till the early berries began to ripen. There appeared to be no relation between the appearance of the plant and the alkaloidal content of the leaves. The variation of the percentage of alkaloids in the leaves of different plants was very large. A number of plants with leaves rich in alkaloids in one season were found to have equally good leaves in the following season. The same held with regard to plants with leaves of a low alkaloidal content.—F. Shdn.

Strychnine ; Some non-acid oxidation products of ——. H. Leuchs and G. Schwaebel. Ber., 1913, **46**, 3693—3699.

Solid permanganate and a solution of strychnine in chloroform were added slowly to a large volume of acetone at 15°—20° C. The sludge was treated with a solution of ammonium chloride. The ammoniacal aqueous liquor was separated, acidified and extracted with chloroform. The acid oxidation products were removed by means of a solution of potassium bicarbonate. The chloroform on evaporation left a resinous residue, which after prolonged boiling with benzene became powdery. This was crystallised from alcohol, from which it separated in clear domed prisms, $C_{19}H_{18}O_4N_2$, which melted with decomposition at 320° C. The benzene solution was treated with light petroleum and the precipitate dissolved in hydrochloric acid and mixed with methyl alcohol. On recrystallisation from alcohol it had the composition, $C_{18}H_{19}O_3N_2Cl,H_2O$, and melted at 296°—300° C. with decomposition. The corresponding base appeared to be readily soluble in water. The manganese dioxide sludge was also treated with sulphur dioxide in the presence of chloroform. After removal of the acids by means of potassium bicarbonate, a crystalline product was isolated from the chloroform. This crystallised from alcohol in light yellow leaflets having the composition, $C_{21}H_{22}O_5N_2$, and melting with decomposition at 252°—255° C. All the above substances had a bitter taste and gave the characteristic strychnine reaction with chromic acid.
—F. Shdn.

Physostigmine. I. F. Straus. Annalen, 1913, **401**, 350—376. (See also this J., 1912, 509.)

The gold salt of physostigmine melted with decomposition at 163°—165° C., and the platinum salt at 150° C. Eseroline benzoate crystallised from ether in characteristic rosettes, m.pt. 155°—156° C. Eseroline was obtained by the distillation of physostigmine in a high vacuum. Eseroline methiodide was converted by a special method into the ammonium base, which was heated to above 200° C. in a vacuum. A solid distilled over which was purified by crystallising from ether. The substance, which was styled *physostigmol*, had the composition, $C_{11}H_{11}ON$, and melted at 107·5—108° C. It was phenolic in character and contained one methyl grouping attached to the nitrogen atom. During the distillation of the above ammonium base tri- and dimethylamine were produced.
—F. Shdn.

Glucosides of polyhydric alcohols ; Biochemical synthesis of —— *; a-glucosides of glycerol and glycol.* E. Bourquelot and M. Bridel. Comptes rend., 1913, **157**, 1024—1027.

When aqueous solutions containing dextrose together with glycerol or glycol are treated with α-glucosidase (see this J., 1913, 251, 762), synthesis of α-glycerylglucosides and α-glycylglucosides slowly takes place. The higher the concentration of glycerol or glycol, *cæteris paribus*, the longer is the time required for the attainment of equilibrium in the solution, and the greater is the quantity of glucosides produced. The activity of α-glucosidase is destroyed by 30 per cent. aqueous solutions of monohydric alcohols (*loc. cit.*) and by 60 per cent. solutions of glycol, whilst glycerol has no injurious action even at a concentration of 90 per cent.—J. H. L.

Essential oils , Constituents of ——. *Calamus oil.* F. W. Semmler and K. E. Spornitz. Ber., 1913, **46**, 3700—3707.

A small sample of calamus oil with the following characters, b. pt. 55°—170° C. at 12·5 mm., sp. gr. 0·9569 at 20° C., $n_D=1{\cdot}5070$, $\alpha_D=+20°$, was fractionated. A fraction was separated boiling between 150°—160° C. at 13 mm., which gave an acetate, $C_{17}H_{28}O_2$, with the characters, b. pt. 155°—163° C. at 12 mm., sp. gr. 0·9727 at 17° C., $n_D=1{\cdot}51004$ and $\alpha_D=+4°$. In a larger quantity of Russian calamus oil, pinene, camphene and camphor were detected. The bicyclic sesquiterpene, calamene (a naphthalene derivative), was also separated and purified. Its characters were : b. pt. 123°—126° C. at 10·5 mm., sp. gr. 0·9224 at 20°/19° C., $\alpha_D=+5°$, $n_D=1{\cdot}50572$. When reduced with hydrogen in the presence of platinum, an optically inactive hydrocarbon, $C_{15}H_{28}$, was produced which boiled at 123°—125° C. at 10 mm. A higher fraction of the oil had the characters : b. pt. 150°—160° C. at 13 mm., sp. gr. 0·96115 at 28° C., $n_D=1{\cdot}5098$, and appeared to be a sesquiterpene alcohol, $C_{15}H_{24}O$, which could not be esterified owing to the readiness with which water split off, with formation of a hydrocarbon $C_{15}H_{22}$, the characters of which were : b. pt. 136°—143° C. at 15 mm., sp. gr. 0·9324 at 20°/19° C., $n_D=1{\cdot}52317$, $\alpha_D=+6°$.
—F. Shdn.

Citronella oil ; Transformation of —— *into rose oil.* P. Barbier and R. Locquin. Comptes rend., 1913, **157**, 1114—1118.

The researches of Barbier and Bouveault and of Barbier and Léser (this J., 1896, 469 ; 1900, 769) showed that *l*-rhodinol (the alcohol of pelargonium and French rose oils) and *d*-citronellol are stereoisomerides of the formulæ : $CH_2:C(CH_3).(CH_2)_3.CH(CH_3).CH_2.CH_2OH$ and $(CH_3)_2C:CH.(CH_2)_2.CH(CH_3).CH_2.CH_2OH$ respectively. In spite of this, it is still widely held, especially in Germany, that *l* rhodinol and *d*-citronellol are optical antipodes. It is now shown that it is possible to obtain rhodinol from citronellol or citronellal, and that the product has similar properties to those of natural rhodinol, including a pronounced odour of fresh roses, except that it is dextrorotatory to the same degree as *l*-citronellol is lævo-rotatory. The following methods of transformation were used :—The acetic ester of citronellol was converted into the acetobromo-hydrin by treatment with hydrobromic acid in acetic acid solution, and the product was saponified. Citronellal (from citronella oil) was converted into citronellic acid by way of the oxime and nitrile, the acid was treated with thionyl chloride in benzene solution, the product poured into alcohol, the resulting hydrochloride of ethyl citronellate (rhodinate) treated with sodium acetate and acetic acid, and the product reduced with sodium and alcohol. Citronellol was hydrated by means of 30 per cent. sulphuric acid, and the resulting 3.7-dimethyloctanediol-1.7, $(CH_3)_2:C(OH).(CH_2)_3.CH(CH_3).CH_2.CH_2OH$, dehydrated by heating with 5 per cent. sulphuric acid, and the product rectified. The results described afford an explanation of the facts that the same derivatives are frequently obtained starting from *d*-citronellol or *l*-rhodinol respectively and also of the more or less pronounced odour of rhodinol frequently observed in commercial citronellol. All three rhodinols are now known : *l*-rhodinol occurring in pelargonium and rose oils, *d*-rhodinol obtained as described above from *d*-citronellal (the principal constituent of citronella oil), and *i*-rhodinol prepared by Bouveault and Gourmand (this J., 1904, 759) by reduction of synthetic ethyl rhodinate. (See also this J., 1896, 292, 373 ; 1897, 823 ; 1898, 267, 486.)—A. S.

Olibanum oil; Constituents of——. E. Fromm and E. Autin. Annalen, 1913, **401**, 253—262.

A quantity of "terpene-free" olibanum oil with the characters: b. pt. 70° C. at 12 mm., sp. gr. 0·9685 at 15° C., $\alpha_D=+20°\,48'$, was fractionated by distillation. Two main fractions were separated boiling at 210°—211° C. and 200° C. respectively. The former fraction had the composition $C_{10}H_{16}O$ and consisted principally of a compound styled *olilanol* which resembled a mixture of a ketone and an alcohol in its behaviour. When oxidised by means of cold neutral permanganate solution, *d*-borneol and an acid were produced. The latter when purified had the composition $C_9H_{14}O_3$, and melted at 130° C. after crystallising from water. It appeared to be identical with the pinononic acid obtained by Kerschbaum (Ber., 1900, **33**, 891) by the oxidation of verbenone. A small amount of a volatile acid, $C_{10}H_{16}O_4$, was also formed during the oxidation.—F. Shdn.

Douglas fir leaf oil. A. W. Schorger. J. Amer. Chem. Soc., 1913, **35**, 1895—1897.

Six samples of leaves of the Douglas fir (*Pseudotsuga taxifolia*, Britt.) distilled in California yielded from 0·11 to 0·20 per cent. of oil, average 0·163 per cent. The oils gave the following figures: sp. gr. at 15° C., 0·8727—0·8759; $n_D=1{\cdot}4758$—$1{\cdot}4780$; $\alpha^{20}_D=-17{\cdot}02°$ to $-22{\cdot}17°$; acid value 0·65—1·10; ester value 11·13—24·25; ester value after acetylation 27·50—51·78. The oil consisted principally of *l*-α pinene 25 per cent. and *l*-β pinene 48 per cent., with about 6 per cent. each of borneol, bornyl acetate, and *i*- or *l*-limonene; together with furfural and other unidentified constituents.—R. G. P.

Camphor dissolved in 90 per cent. alcohol; Specific optical rotatory power of——. H. Malosse. J. Pharm. Chim., 1913, **8**. 505—506.

Observations were made of the optical rotation of camphor dissolved in 90 per cent. alcohol at 20° C., the strength of the solution varying between 3 and 37 per cent. The results led to the following formulæ, where *c* represents grms. of camphor in 100 c.c. of solution, *p* the percentage of camphor and *q* the percentage of solvent in the solution:

$$[\alpha]^{20}_D=38{\cdot}7+0{\cdot}1532c$$
$$[\alpha]^{20}_D=38{\cdot}7+0{\cdot}1344p$$
$$[\alpha]^{20}_D=52{\cdot}14-0{\cdot}1344q$$

—F. Shdn.

Ferro- and ferricyanide salts of betaine. [*Isolation of betaine from molasses residues.*] G. Roeder. Ber., 1913, **46**, 3724—3727.

On mixing concentrated aqueous solutions of betaine hydrochloride and potassium ferro- or ferricyanide, the corresponding betaine salts were precipitated. The salts were very slightly soluble in alcohol, and decomposed with the formation of hydrogen cyanide when boiled with water. The composition altered when they were washed with methyl alcohol and ether. Betaine ferrocyanide, $FeC_6N_6H_4,4C_5H_{11}O_2N,2H_2O$, was a white powder, whilst the ferricyanide $FeC_4N_6H_3,3C_5H_{11}O_2N,2H_2O$, formed canary yellow leaflets with jagged edges. The latter salt could be crystallised from water. The formation of these salts was used to isolate betaine hydrochloride from residues of molasses. The latter were acidified with hydrochloric acid, precipitated by the addition of methyl alcohol, and filtered. The filtrate was treated with ferrocyanic acid or potassium ferrocyanide. The crude betaine ferrocyanide was suspended in alcohol and decomposed by means of hydrogen chloride, when betaine hydrochloride was produced in the solid form. Pyridine and trigonelline also formed yellow salts with ferro- or ferricyanic acid.—F. Shdn.

Stearic acid; Sulpho-derivatives of——. A. Eckert and O. Halla. Monatsh. Chem., 1913, **34**, 1811—1813.

Mercaptanostearic acid, $C_{16}H_3CHSH.COOH$, m. pt. 74° C., was obtained by heating α-bromostearic acid with an alcoholic solution of sodium hydrosulphide. On oxidation with alcoholic iodine solution it yielded the corresponding disulphide, $[C_{16}H_{33}CH(COOH)]_2S_2$, (m. pt. 70° to 71° C.), whilst potassium permanganate oxidised it to an impure sulphostearic acid.—C. A. M.

Per-acids from organic acids and hydrogen peroxide, Formation of——. J. D'Ans and W. Frey. Z. anorg. Chem., 1913, **84**, 145—164.

Systematic experiments on the direct production of per-acetic acid from acetic acid and hydrogen peroxide (this J., 1912, 1200), with and without catalysts, have shown that the process of per-acid formation is exothermic and that the velocity constant diminishes as reaction proceeds towards equilibrium. The formation of per-propionic and per-butyric acids is analogous to that of per-acetic acid, but in the production of per-formic acid, stable equilibrium is not reached owing to the decomposition of this acid into carbon dioxide and water. Phosphoric and hydrofluoric acids have a smaller accelerating effect than sulphuric and nitric acids.—F. Sodn.

Organosols of metals of the platinum group and of hydroxides of divalent platinum and palladium. C. Amberger. Kolloid-Zeits., 1913, **13**, 310—317.

Using wool fat in the manner described previously for the preparation of organosols of silver and gold (this J., 1912, 1006, 1007), the author has prepared organosols of palladium, platinum, palladous hydroxide, palladium oleate, and platinous hydroxide. In the preparation of the metallic organosols, hydrazine hydrate was used as reducing agent. The palladium organosols (8·9 to 16 per cent. Pd) had pronounced catalytic activity; small quantities dissolved in fatty oils were capable of transferring hydrogen to the unsaturated glycerides of the oil, with the formation of so-called hardened oils. The platinum organosols contained 8·14—18·4 per cent. Pt. The hydroxide organosols were prepared by the interaction of the corresponding chlorides and sodium carbonate and the palladium oleate organosol from the chloride and potassium oleate in presence of wool fat. A solution of the palladous hydroxide organosol in paraffin oil has been introduced as a therapeutic agent under the name of "Leptynol."—A. S.

Patents.

Hexa-amino-arsenobenzene; Manufacture of——. C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. Eng. Pat. 7488, March 29, 1913. Under Int. Conv., April 1, 1912.

4-Amino-3.5-dinitrobenzene-1-arsinic acid is reduced to 3.4.5.3′.4′.5′-hexa-amino-arsenobenzene by treatment with acid reducing agents, such as tin or stannous chloride and hydrochloric acid. The free base is very unstable, rapidly becoming dark coloured in air; it is insoluble in the usual organic solvents, but soluble in dilute acids. It is stated to possess a very powerful spirillocide effect. with comparatively small toxicity (see also Eng. Pat. 8041 of 1913; this J., 1913, 1170).—T. F. B.

Dinitro-methylnitraminophenylarsinic acids; Art of making derivatives of——. L. Ach, Mannheim, and A. Rothmann, Heidelberg, Assignors to C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. U.S. Pat. 1,081,079, Dec. 9, 1913.

A dinitro-methylnitraminophenylarsinic acid (see U.S. Pat. 1.075,279 of 1913; this J., 1913, 1128) is treated with a reducing agent, *e.g.*, tin and hydrochloric acid. In this way a di(methylamino)-tetra-amino-arsenobenzene ($CH_3NH:NH_2:NH_2:As=4:3:5:1$), melting with decomposition at about 95° C., is produced.—T. F. B.

Organic arsenic compounds; Process for preparing—— H. Bart. Ger. Pat. 267,082, March 26, 1912.

Organic arsines prepared by electrolytic reduction are treated with sulphurous acid. The products may be used for medicinal purposes or for the preparation of therapeutic compounds. The process is described as applied to 3-carboxy-ethylamino-4-hydroxyphenylarsine, obtained by electrolytic reduction of the corresponding arsinic acid.—T. F. B.

Alkali salts of aromatic stibinic acids; Process for preparing neutral, soluble ——. Chem. Fabr. von Heyden. Ger. Pat. 267,083, Aug. 6, 1912.

One mol. of an aromatic stibinic acid is neutralised by means of less than one mol. of an alkali. The neutralised solutions may be evaporated to dryness or precipitated by means of salt solution or an organic solvent miscible with water, *e.g.*, alcohol. Alkaline solutions of stibinic acids may be treated with precipitants, such as alkali hydroxide solutions or concentrated solutions of alkali salts of inorganic acids, and the precipitate washed until both the residue and the washings are neutral. The alkali salts thus obtained may be further purified by treatment with methyl alcohol.—T. F. B.

2-Phenylquinoline-4-carboxylic acid and its derivatives; Manufacture of sulphonic acids of ——. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 16,482, July 17, 1913. Under Int. Conv., Oct. 8. 1912.

The sulphonic acids of 2-phenylquinoline-4-carboxylic acid and its nuclear substitution products are obtained by the usual methods of sulphonation. They have therapeutic properties similar to those of the 2-phenylquinoline-4-carboxylic acids from which they are derived, but they have the advantage of being soluble in warm water and having a pleasant acid taste.—T. F. B.

Tuberculosis; Substance for the treatment of —— and process of making said substance. B. S. Paschall, Seattle, Wash. U.S. Pat. 1,078,873, Nov. 18, 1913.

Tubercle bacilli are dried and powdered and the fats and waxes therein are saponified: the mixture is filtered, the filtrate evaporated, and the residue dissolved in a suitable solvent. The fatty acids are now precipitated and redissolved until they are sufficiently pure, and they are finally dissolved in a liquid which forms compounds soluble in water. When injected into animals or men, the products are said to produce a lipolytic ferment capable of dissolving a sufficient portion of the waxy protective substances elaborated by tubercle bacilli, so that the micro-organism itself is destroyed.—T. F. B.

Casein preparations; Process for producing ——. A. A. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America. U.S. Pat. 1,080.204, Dec. 2, 1913.

A slightly acid solution of about five parts of a simple glycerophosphate is mixed with powdered casein containing water, corresponding to 100 parts of dry casein, and the product is dried and powdered.—T. F. B.

Dimethylaminohydroxymethane and dimethylamine; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 460,429, July 16, 1913. Under Int. Conv., Aug. 6 and Nov. 30, 1912, and Feb. 18, 1913.

The halogen addition compounds of trimethylamine (*e.g.*, the dichloride) are treated with water and then with alkaline substances, or with alkaline solutions, or trimethylamine or one of its salts is treated with water and a halogen or a hypohalogenous acid or salt thereof; in each case dimethylaminohydroxymethane, $HO.CH_2.N(CH_3)_2$, is produced. Dimethylamine or dimethylaminohydroxymethane can also be obtained by treating a salt of trimethylamine with two mols. of hypohalogenite, and converting the halogenated dimethylamine thus produced into dimethylamine by reduction, or into dimethylaminohydroxymethane by means of an alkali.—T. F. B.

Acetaldehyde from acetylene; Process for preparing ——. Consortium f. Elektrochemische Industrie. Fr. Pat. 460,553, July 21, 1913.

The conversion of acetylene into acetaldehyde by means of solutions of mercury salts is retarded, after the reaction has been proceeding for some time, by the accumulation of aldehyde vapour in the gas mixture over the solution. The process can be carried out rapidly and continuously, without retardation, by passing acetylene in excess through mercury salt solutions, extracting the aldehyde from the gas immediately, and again passing the acetylene through the solution. The process described in Fr. Pat. 455,370 (this J., 1913, 959) is considerably accelerated by this modification; it is also possible to use stronger acids than are there indicated without risk of the formation of resinous compounds. This method is especially applicable to processes in which the acetylene is introduced into hot solutions of mercury salts, so that the aldehyde distils off as soon as it is formed.—T. F. B.

Acetic acid from acetaldehyde; Process for producing ——. Consortium f. Elektrochem. Industrie. Fr. Pat. 460,971, July 25, 1913.

The conversion of acetaldehyde into acetic acid by oxygen is accelerated by the addition of small quantities of manganese compounds; the reaction is not explosive, as is the case when compounds of chromium, vanadium, cerium, etc., are used as accelerators. *Example.* A current of dry oxygen is passed into a mixture of 300 kilos. of pure acetaldehyde and 2 kilos. of manganese acetate in a pure aluminium vessel provided with a stirrer and a cooling jacket: the manganese salt dissolves in the aldehyde, and the solution absorbs oxygen very energetically, the heat evolved being removed by external cooling. After 10 to 20 hours the absorption is complete and the acid is distilled. Air may be used in place of oxygen, and the gases may be introduced under pressure; acetic acid or other solvent may be added to the aldehyde, if desired.
—T. F. B.

Per-acids from aldehydes; Process for preparing ——. Consortium f. Elektrochem. Industrie. Fr. Pat. 460,972, July 25, 1913.

It is known that the autoxidation of aldehydes gives rise to the formation of per-acids, which, however, react with excess of aldehyde forming the lower acid. It has been found that this reduction of the per-acid can be prevented by lowering the temperature, and also that it is greatly accelerated by the presence of certain impurities in the aldehyde, especially manganese compounds and water. The per-acid may be separated from the aldehyde by converting it into a salt, *e.g.*, by adding calcium carbonate, or by freezing, or the aldehyde may be separated by means of a current of air or by distillation at as low a temperature as possible. *Example.* Dry oxygen is passed into freshly distilled acetaldehyde, cooled to a temperature of —10° to —20° C. When absorption of oxygen has ceased, the excess of aldehyde is distilled off at a temperature about 0° C. The peracetic acid remains as a crystalline mass. The absorption of oxygen can be accelerated by the influence of chemically active light rays, *e.g.*, from a mercury vapour lamp, and also by addition of small quantities of catalysts, such as compounds of chromium, cobalt, iron, uranium, and vanadium.
—T. F. B.

Scopolamine solutions; Process for preparing stable ——. W. Straub. Ger. Pat. 266,415, May 29, 1913.

Scopolamine solutions may be rendered stable by addition of a high molecular polyhydric alcohol.—T. F. B.

Ferrous compounds of monoamino acids; Process for preparing ——. F. Hoffmann-La Roche und Co. Ger. Pat. 266,522, March 16, 1913. Addition to Ger. Pat. 264,390 (see this J., 1913, 1032).

Mono-amino acids or peptones, other than glutamic acid, are converted into ferrous compounds by heating with metallic iron, air being excluded.—T. F. B.

Glycerophosphoric acid and a carbohydrate [*maltose*]; *Process for preparing a soluble, crystalline compound of* ——. E. Jacoby. Ger. Pat. 266,576, Aug. 4, 1912.

Condensation of glycerophosphoric acid and maltose may be effected by heating the substances to about 110° C.; the product is obtained in solid, crystalline, soluble form by cooling.—T. F. B.

Mercury compound of the pyrazolone series; Process for preparing a ——. L. Givaudan and E. Scheitlin. Ger. Pat. 266,578, May 12, 1912. Addition to Ger. Pat. 261,081.

Compounds containing more mercury than those prepared according to the principal patent (see this J., 1913, 768) are obtained by the action of mercuric oxide on 1-phenyl-2.3-dimethyl-4-sulphamino-5-pyrazolone in presence of an alkali bisulphite. The products are said to contain from 65 to 68 per cent. of mercury.—T. F. B.

Silver-albumin compounds soluble in water; Process for preparing ——. A. Dering. Ger. Pat. 266,655, Oct. 22, 1911.

The silver salts of lysalbinic or protalbinic acids are treated with aqueous solutions of hexamethylenetetramine, and the double compounds are separated from the resulting solutions either by evaporation, preferably in a vacuum, or by precipitation with alcohol or other organic solvent. The products are stated to possess powerful bactericidal properties.—T. F. B.

Hexamethylenetetramine-methyl thiocyanate; Process for preparing ——. K. H. Schmitz. Ger. Pat. 266,788, Feb. 4, 1913.

A double compound of methyl thiocyanate with hexamethylenetetramine may be obtained either by the interaction of the components, with or without addition of a solvent, or by treating hexamethylenetetramine with the methyl ester of an inorganic or organic acid and decomposing the intermediate compound by means of an easily soluble thiocyanate. The new compound may be used for medicinal purposes.—T. F. B.

Aseptically-sterile thread and bandages; Process for preparing ——. R. Graf. Ger. Pat. 266,953, Dec. 1, 1912.

The material is treated with Peru balsam, to render it free from bacteria and to give it bactericidal properties, at the same time making it permanently flexible.—T. F. B.

Alkaloids of ipecacuanha; Process for obtaining the ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 267,219, July 5, 1912.

The alkaloids are extracted from the crude material in the form of their salts, by means of an organic solvent, such as chloroform, carbon tetrachloride, or benzene, preferably with the addition of a small quantity of alcohol; the salts are precipitated from the solution by means of ether or other suitable substance. In this process the decomposition of some of the alkaloids, which occurs when alkali is used for the extraction, is avoided.—T. F. B.

Alkaloids and alkaloidal salts; Processes of extracting, purifying or preventing the solution of ——. J. U. Lloyd, Cincinnati, U.S.A. Eng. Pat. 27,378, Nov. 28, 1912. Under Int. Conv., Feb. 23, 1912.

See U.S. Pat. 1,048,712 of 1912; this J., 1913, 161.—T.F.B.

Terpene hydrocarbons from terpene hydrohalogenides; Process for the manufacture of ——. A. Meyer, Mulhausen, Alsace. Eng. Pat. 28,497, Dec. 10, 1912. Under Int. Conv., Feb. 22, 1912.

See Fr. Pat. 451,645 of 1912; this J., 1913, 625. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 10,783 and 25,453 of 1907.—T. F. B.

Preparation of mercury; Process for producing an effective ——. L. Givaudan, Vernier, and E. Scheitlin, Basle, Switzerland. Eng. Pat. 29,066, Dec. 17, 1912. Under Int. Conv., Dec. 20, 1911.

See Ger. Pat. 261,081 of 1911; this J., 1913, 768.—T. F. B.

Tobacco; Process of treating ——. D. A. Gallagher and W. A. Miller, York, Pa., U.S.A. Eng. Pat. 10,557, May 5, 1913.

See U.S. Pat. 1,062,093 of 1913; this J., 1913, 672.—T. F. B.

Isoprene; Process for manufacturing ——. C. K. F. L. Gross, Bevön, Norway. Eng. Pat. 13,825, June 14, 1913. Under Int. Conv., June 15, 1912.

See Fr. Pat. 459,988 of 1913; this J., 1913, 1129.—T. F. B.

Erythrene, its homologues and derivatives; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated June 17, 1913, to Fr. Pat. 425,967, Feb. 11, 1911. Under Int. Conv., July 25, 1912.

See Ger. Pat. 262,884 of 1912; this J., 1913, 924.—T. F. B.

Unsaturated hydrocarbons; Process for making ——. F. E. Matthews, H. J. W. Bliss, and H. M. Elder. Fr. Pat. 460,573, July 21, 1913. Under Int. Conv., July 24, 1912.

See Eng. Pat. 17,234 of 1912; this J., 1913, 884.—T. F. B.

Strontium salt of cholic acid. R. Werner, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,081,178, Dec. 9, 1913.

See Ger. Pat. 254,530 of 1911; this J., 1913, 110.—T. F. B.

Amino- and diamino-ketones; Process for preparing aliphatic ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated June 13, 1913, to Fr. Pat. 450,543, Oct. 28, 1912. Under Int. Conv., June 20, 1912.

See Eng. Pat. 14,231 of 1913; this J., 1913, 1128.—T.F.B.

Betaine salts; Process for making ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 460,478, July 17, 1913. Under Int. Conv., Jan. 30, 1913.

See Eng. Pat. 16,710 of 1913; this J., 1913, 990.—T. F. B.

Hydrogenating unsaturated substances; Process for ——. R. Lessing. Fr. Pat. 460,771, July 26, 1913. Under Int. Conv., Aug. 19, 1912.

See Eng. Pat. 18,998 of 1912; this J., 1913, 917.—T.F.B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Absorption spectra of sulphurous acid and sulphites. (*Prelim. Note.*) R. Wright. Chem. Soc. Proc., 1913, **29**, 339.

While comparing the absorption spectra of various acids and of their salts, it was found that the absorption of sulphurous acid is characterised by a band in the ultraviolet, the sodium salt exhibiting only general absorption. It is thought that this is most probably due to a difference in structure between the acid and its salt. A parallel case is to be found in the behaviour of chromic acid, where a strong acid differs in visible colour from its salts.

Patents.

Photographic printing paper. J. J. C. M. Sury. Fr. Pat. 460,426, July 16, 1913.

A non-porous, sized or varnished paper support is supplied with a coating of a colloid in which is suspended a colourless, inert powder, such as powdered glass, very fine sand, etc. The paper is sensitised by means of an alkali bichromate, exposed and developed in water as usual, and dusted with a black or coloured powder mixed with fine sand, etc. The colour is said to adhere only to the parts from which the colloid has not been removed.—T. F. B.

Photographs in colours; Process for producing ——, and products resulting therefrom. The Hess-Ives Co. Fr. Pat. 461,078, Aug. 4, 1913. Under Int. Conv., Aug. 5, 1912.

In the preparation of photographs in colours by superposition of stained transparent relief positives, it is proposed to incorporate in the sensitive colloid for the positive, before exposure, a soluble, non-actinic colouring matter which will retard the penetration of the light and render the relief extremely delicate; by this means, a sufficiently slight and uniform penetration of the colouring matter is assured during the subsequent staining. A collodion containing camphor, and prepared by means of amyl acetate, may be used as the adhesive for joining together the coloured positives.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Use of explosives for removing obstructions in the blast-furnace. Schöneweg. *See* X.

Patents.

Explosives; Safety ——. E. Herz, Vienna. Eng. Pat. 11,809, May 21, 1913.

Pentaerythrite-tetranitrate (preferably about 15 per cent.) is added to ammonium nitrate explosives, in order to produce easily detonating safety explosives of great density.—T. St.

Detonators; Manufacture of ——. C. Claessen. First Addition, dated July 7, 1913, to Fr. Pat. 459,979, May 29, 1913 (this J., 1913, 1171).

Instead of the mercury fulminate or mixture of mercury fulminate and potassium chlorate used as described in the chief patent, black powder, guncotton, smokeless powder, picrates, perchlorate explosives, etc., may be employed. —A. S.

2.4.6.2′.4′.6′-Hexanitrodiphenyl sulphide: Process for preparing —— and its use in making explosives. Sprengstoff A.-G. Carbonit. Fr. Pat. 460,571, July 21, 1913.

Two mols. of 1-chloro-2.4.6-trinitrobenzene react with one mol. of sodium thiosulphate in presence of water, 2.4.6.2.′4.′6′-hexanitrodiphenyl sulphide being formed according to the equation, $2.C_6H_2(NO_2)_3Cl+Na_2S_2O_3+H_2O=2NaCl+H_2SO_4+[C_6H_2(NO_2)_3]_2S$. The sulphuric acid formed must be neutralised, *e.g.* by addition of an alkali or alkaline-earth carbonate to the reaction mixture. Yields of 90 per cent. of the theoretical quantity are said to be obtained by boiling the components in presence of alcohol. The use of more than one mol. of thiosulphate to two mols. of chlorotrinitrobenzene gives rise to a dark coloured product. The crystallised or compressed product may be used in the preparation of explosives, either alone or mixed with other nitro-hydrocarbons, oxygen-carriers, etc.—T. F. B.

Match-splint material; Process of treating ——. W. A. Fairburn, Short Hills, N.J., Assignor to The Diamond Match Co., Chicago, Ill. U.S. Pat. 1,079,119, Nov. 18, 1913.

To prevent glowing after the matches are extinguished, the match splint material is impregnated with an oxide of phosphorus by exposing it to the fumes generated by gently heating phosphorus in a limited supply of air, and is then exposed to the air.—A. T. L.

Explosives. R. Kolowratnik, Peggau, Austria. Eng. Pat. 26,884, Nov. 22, 1912.

See Fr. Pat. 452,554 of 1912; this J., 1913, 674.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Iron; Diphenylcarbohydrazide as an indicator in the bichromate titration of ——. L. Brandt. Z. anal. Chem., 1913, **53**, 1—20.

One grm. of ore is dissolved in 50 c.c. of strong hydrochloric acid, reduced with stannous chloride solution, and the excess of the latter destroyed by mercuric chloride as usual. The solution is poured into 1·5 litre of water and 75 c.c. of manganese sulphate mixture, and after addition of 5 c.c. of indicator, titrated with bichromate until the purple colour changes into a pure green due to chromic chloride. The amount of hydrochloric acid present should be equivalent to 20—25 c.c. of acid of 1·19 sp. gr. The indicator is prepared by dissolving 0·1 grm. of symmetrical diphenylcarbohydrazide, $CO(NH.NH.C_6H_5)_2$, in 35 c.c. of strong acetic acid and breaking up the lumps by means of a glass rod; the volume is then made up to 100 c.c. with distilled water. It can be kept for several days; the solid reagent deteriorates after 1—1½ years. The method has been tested with satisfactory results for quantities of 0·05—0·74 grm. of iron. Platinum (from the crucible, if a bisulphate fusion is made) causes high results and a bad end-point. Arsenic does not interfere if below 0·75 per cent., while copper lowers the result as in the case of the Zimmermann-Reinhardt method.—W. R. S.

Chromium: Determination of —— as chromic oxide. G. Rothaug. Z. anorg. Chem., 1913, **84**, 165—189.

The gravimetric determination of chromium as oxide is found invariably to give somewhat high results owing to the absorption by the precipitate, during ignition, of a small proportion of atmospheric oxygen, with the formation of chromic chromate ($Cr_2O_3,3CrO_3$). Accuracy is secured, however, by igniting in a current of hydrogen. —F. Sodn.

Silica; Dehydration and recovery of ——, in analysis. F. A. Gooch, F. C. Reckert, and S. B. Kuzirian. Amer. J. Sci., 1913, 36, 598—604.

The difficulty of bringing to constant weight by ignition the silica separated in the ordinary way from fusions by acidifying and evaporating to dryness, arises not from the retention of water by the silica, but from its containing some substance slowly volatilised or decomposed by heat. This substance is usually sodium chloride, and it is converted into sodium silicate by ignition. After treatment of the silica by hydrofluoric and sulphuric acids, this remains as sodium sulphate; and from the weight of this residue the equivalent weight of sodium oxide must be calculated to correct the actual weighings. The authors confirm the generally accepted fact that after a fusion the silica cannot be completely recovered except by two successive evaporations and filtrations.—J. T. D.

Phosphoric acid; Study of the Pemberton-Kilgore method for determination of ——. P. L. Hibbard. J. Ind. Eng. Chem., 1913, **5**, 998—1009.

The effect of varied experimental conditions on the volumetric determination of phosphoric acid by titration of the yellow molybdate precipitate with alkali (this J., 1894, 176, 667; 1895, 303, 511), was studied. Minute details of the conditions found necessary for obtaining the best results are given, together with a bibliography of previous work on the subject. (See also this J., 1913, 738, 898.)—A. S.

Potassium xanthate [*and mercury*]; *Volumetric determination of* ——. B. Holmberg. Ber., 1913, **46**, 3853—3859.

If a solution of potassium xanthate be treated with a known excess of $N/10$ hydrochloric acid and left for 10 mins. to ensure the complete decomposition (into alcohol and carbon bisulphide) of the liberated xanthic acid, the excess of hydrochloric acid may be titrated with baryta in presence of phenolphthalein or methyl red, and the quantity of xanthate calculated. The method may be utilised for the determination of metals, especially mercury, which form insoluble xanthates, an excess of a standardised solution of potassium xanthate being added and then the excess determined as described above. In the case of mercuric bromide, chloride or sulphate, it is not necessary to filter off the mercuric xanthate, but this must be done in the case of mercuric iodide, as mercuric xanthate is decomposed slowly by acids in presence of iodides Provided no other metal which forms an insoluble xanthate and no oxidising agents (*e.g.* nitric acid) are present, mercury can be determined in this way more rapidly and simply than by any other method. Potassium xanthate keeps well in dry air and can be readily purified by recrystallisation from absolute alcohol.—A. S.

Nitrogen in nitro-bodies by Kjeldahl's method; Bohn-Schmidt reaction in the benzene series, and the determination of ——. A. Eckert. Monats. Chem., 1913, 34, 1957—1964.

By the action of sulphur sesquioxide (*i.e.* of a solution of sulphur in fuming sulphuric acid) on 20 grms. of nitrobenzene in the cold, a mixture of amino- and imino-compounds was produced, and the ease with which the nitro-group is reduced led the author to apply the method in the Kjeldahl analysis of nitro-compounds. A large number of aromatic nitro-compounds gave excellent results after warming for one hour on the water-bath with 0·4 grm. of sulphur and 15 to 20 c.c. of 30 to 40 per cent. fuming sulphuric acid. The aliphatic nitro-compounds and inorganic nitrates, however, yielded low results by this method.—W. H. P.

Crude oil for the assay furnace. Haldane. *See* IIa.

Colourimetric determination of traces of selenious acid. Meyer and von Garn. *See* VII.

Volumetric determination of thiosulphates in presence of sulphites. Bodnár. *See* VII.

Iodometric determination of iodides. Müller and Wegelin. *See* VII.

Iodometric determination of arsenic in iron and its ores after precipitation with hypophosphorous acid. Brandt. *See* X.

Assay of gold and silver by the iron-nail method. Hall and Drury. *See* X.

Cupellation experiments. (*Part II.*). *Detection of the platinum metals in cupellation beads.* Bannister and Patchin. *See* X

Analysis of bronzes. Schenck. *See* X.

Assay for corundum by mechanical analysis. Hutchinson. *See* X.

Report of Committee of Amer. Leather Chemists' Assoc. (1913) *on oils and fats.* *See* XII.

Preparation of [*vulcanised*] *rubber for analysis.* Archbutt. *See* XIV.

Determination of the lime requirement of soils. Bizzell and Lyon. *See* XVI.

Determination of small amounts of reducing sugars in the presence of a large proportion of sucrose. Pellet *See* XVII.

Determination of hop bitter substances by cold extraction with carbon tetrachloride. Seibriger. *See* XVIII.

Determination of the total sulphurous anhydride in wines. Lévy. *See* XVIII.

Detection and determination of benzoic acid in milk and cream. Hinks. *See* XIXa.

Detection of beef and mutton fats in lard. Bömer. *See* XIXa.

Investigations on coffee. Rözsenyi. *See* XIXa.

Detection of chicory in decoctions of chicory and coffee. La Wall and Forman. *See* XIXa.

Winkler's method for the determination of oxygen in water; effect of nitrite and its prevention. Hale and Melia. *See* XIXb.

Specific optical rotatory power of camphor dissolved in 90 per cent. alcohol. Malosse. *See* XX.

Patents.

[*Gas*] *Calorimeters.* J. F. Simmance and J. Abady, London. Eng. Pat. 27,920 of 1912, date of Appl., May 30, 1913.

In order that the gas and the air for combustion in a continuous flow calorimeter may be saturated with water vapour and at the same temperature as the cold water entering or the products leaving the calorimeter, the burner is enclosed in a box at the base to which the air is led through a long down-pipe into which the overflow from the constant-level water-supply tank is admitted through a sprinkler at the top, and the gas is passed through a meter of the wet type and then through a coil in the burner box.—A. T. L.

Pyrometer; Optical ——. J. Churchward. Fr. Pat. 460,210, July 10, 1913.

See U.S. Pat. 1,069,318 of 1913; this J., 1913, 928.—T. F. B.

Thermo-electric element. U.S. Pat. 1,076,438. *See* XI.

XXIV.—MISCELLANEOUS ABSTRACTS.

Autoxidations. VI. Chemical action of light. XXVIII. G. Ciamician and P. Silber Ber., 1913, **46**, 3894—3899.

It has been shown previously by several investigators that substances which alone are not autoxidisable may become oxidised in presence of substances which readily undergo autoxidation. Further examples of this phenomenon are given. Ethyl and amyl alcohols, glycerol, mannitol, dextrose, and naphthalene are not oxidised when exposed to light in the presence of oxygen; but if an easily autoxidisable substance such as toluene or *m*- or *p*-xylene be added, then both substances are oxidised when exposed under similar conditions.—A. S.

Books Received.

Studio Microscopico e Chimico pel Riconoscimento delle Fibre Vegetali, Lane, Peli, Pelliccie, Sete Naturali, Sete Artificiali. Analisi Quantitativa dei Tessuti ed altri Manufatti Tessili. Di A. Solaro. U. Hoepli, Milan. 1914. Price L. 25.

This work (13¾ by 8⅞ ins.) on the microscopical and chemical examination of animal and vegetable fibres and the analysis of textiles contains 417 pages of subject matter, including 400 photomicrographs and 30 tables, and also an alphabetical index and a bibliography. The arrangement of the text is as follows: General part, dealing with the use of the microscope, the preparation of microchemical and chemical reagents, and the general distinctive characters of animal and vegetable fibres and artificial silks. Part I. Vegetable fibres, comprising descriptions of the specific characters and properties of the different vegetable fibres. Part II. Animal fibres: wools, hairs or furs. Part III. Animal fibres: natural silks. Part IV. Artificial silks. Appendix. Quantitative analysis of textiles, including methods for dyed mixed fabrics of cotton and wool; cotton and natural and artificial silks; wool and natural and artificial silks; cotton, wool and silk, etc.

Studien ueber Schutzkolloide. Erste Reihe: Stärke als Schutzkolloid. I: Ueber kolloides Silber. II: Ueber kollodes Gold. A. Gutbier and E. Weingärtner. Kolloidchemische Beihefte. Band V. Heft 6. Verlag von T. Steinkopff. Dresden and Leipzig. 1913. Price M. 1.20.

This work contains 58 pages, 9$\frac{3}{16}$ by 6$\frac{3}{16}$ ins., and relates to the behaviour and action of starch as a protective colloid in the case of silver and gold sols.

Les Classiques de la Science. Publiés sous la direction de MM. H. Abraham, H. Gautier, H. Le Chatelier, J. Lemoine. Libraire Armand Colin, 103, Boulevard Saint-Michel, Paris. 1913.

I. L'Air, L'Acide Carbonique et L'Eau. Mémoires de Dumas—Stas—Boussingault. Price 1 fr. 30.

Volume (7¾ by 5 ins.) containing 104 pages of subject matter with 4 plate illustrations outside the text. The text is classified as follows:—I. Biographical sketches of Dumas, Stas, and Boussingault. II. Dumas and Boussingault's researches on the exact composition of atmospheric air. III. Dumas and Stas's researches on the atomic weight of carbon. IV. Stas's new researches on the atomic weight of carbon. V. Dumas' researches on the composition of water.

II. Mesure de la Vitesse de la Lumière. Etude optique des Surfaces. Mémoires de Léon Foucault. Price 1 fr. 30.

Volume (7¾ by 5 ins.) containing 123 pages of subject matter with 3 sheets of illustrations, besides 30 figures in the text. The subject matter is classified under two heads:—I. Measurement of the velocity of light. II. Optical study of surfaces.

III. Eau Oxygénée et Ozone. Mémoires de Thénard, Schoenbein, De Marignac, Soret, Troost, Hautefeuille, Chappuis. Price 1 fr. 20.

Volume (7¾ by 5 ins.) containing 111 pages of subject matter with one sheet of engravings. The subject matter is classified under two heads:—I. Hydrogen peroxide. II. Ozone.

IV. Molécules, Atomes, et Notations Chimiques. Mémoires de Gay-Lussac—Avogadre—Ampère—Dumas—Gaudin—Gerhardt. Price 1 fr. 20.

Volume (7¾ by 5 ins.) containing 116 pages of subject matter, with 1 plate of illustrations outside the text. The text is classified as follows:—I. Gay-Lussac. Combination between gases. II. Avogadro. Determination of the relative masses of the elementary molecules of substances and the proportions in which they enter into combination. III. Ampère. Determination of the proportions in which bodies combine according to the number and the respective disposition of the molecules. IV. Dumas. On some points regarding the atomic theory. V. Gaudin. Structure of definite inorganic bodies. VI. Dumas. Chemical notation. VII. Gerhardt. General review of the notation and arrangement of formulæ.

Year Book of Pharmacy, comprising Abstracts of papers relating to Pharmacy, Materia medica, and Chemistry contributed to British and Foreign Journals from July, 1912, to June 30, 1913, with the Transactions of the British Pharmaceutical Conference at the fiftieth Annual Meeting held in London, July 21—24, 1913. Editors, J. O. Braithwaite and R. R. Bennett. Compiler of New Remedies Section, F. W. Gamble. J. and A. Churchill, 7, Great Marlborough Street. 1913. Price 10s. 6d.

Volume (8¾ by 5¾ ins.) containing 624 pages of subject matter, list of members since June, 1912, and list of home members, followed by Indexes (alphabetical) of subjects and authors. As a frontispiece a portrait is given of Mr. J. C. Umney, the President, 1912-1913. The work is divided into two parts, the first being devoted to abstracts of articles in home and foreign journals, the second, to the transactions of the Pharmaceutical Society and of the British Pharmaceutical Conference (1912—1913).

Die Gerbstoffe. Botanisch-Chemische Monographie der Tannide. Von Dr. J. Dekker, Direktor der Abteilung "Handelsmuseum" des Niederländischen Kolonial-Instituts. Gebrüder Borntraeger's Verlag. Berlin. W. 35. Schönberger Ufer 12a. 1913. Price M. 20.

Volume (10⅜ by 7¼ ins.), containing 586 pages of subject matter, with 3 illustrations, and alphabetical indexes of authors and subjects. The work is dedicated by the author to Emil Fischer, and it is a compendium of the researches that have been made in connection with the subject of tanning agents and tanning, in the years commencing with 1754, and ending with present date. These investigations are arranged under the annual dates progressively, the names of the investigators and authors coming first, and following in alphabetical sequence, under the several years. Thus, for each year there is a separate alphabetically arranged list of tannin researches, etc. This occupies Chapter I. of the work. Chapter II. is devoted to the distribution of the tannins in the vegetable kingdom. III. Physiology and methods of investigation. IV. The chemistry of the tannins. V. Quantitative analysis. VI. Tanning and dyeing.

Who's Who in Science (International), 1914. Edited by H. H. Stephenson. J. and A. Churchill, 7, Great Marlborough Street, London. 1913. Price 10s. net.

A biographical dictionary and directory combined, forming a volume 9½ by 6 ins. The volume contains 662 pages of subject matter, commencing with a list of abbreviations used, an Obituary (1913), and condensed tabulated lists of the world's universities. The biographies, alphabetically arranged, now follow, and continue from page 119 to 621. These are followed and the work concluded, by a classified index of names of scientists arranged under the different branches of pure and applied science represented, and in the different countries to which they belong.

Mines and Quarries. General Report, with Statistics for 1912, by the Chief Inspector of Mines. Part II.—Labour. [Cd. 7166.] Wyman & Sons, Fetter Lane, E.C. Price 2s.

This publication contains a general report and statistics relating to persons employed and accidents at mines and quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts.

Mineral Products of the United States: Review of Conditions and Output. By E. W. Parker. With a Summary of Mineral Production in 1912 by W. T. Thom. U.S. Geological Survey, Washington.

The Production of Copper, Gold, Lead, Nickel, Silver, Zinc, and other Metals in Canada during 1912. By C. T. Cartwright. Canada Dept. of Mines. Mines Branch. Bulletin No. 256.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *L'Orfèvre*, J.: La pratique des moteurs Diésel, 24 planches, in-8°. E. Monroty. Paris. 1913. 15 fr.

Lüders, Prof. J.: Der Dieselmythus. Quellenmässige Geschichte der Entstehg. des heut. Oelmotors. (236 S. m. 12 Fig.) Lex 8°. Berlin, M. Krayn. 1913. M. 4.50.

IIa. *White*, A. H.: Technical gas and fuel analysis. N.Y., McGraw-Hill. c. 10+276 p. il. tabs. 8°. 1913. $2.

IIb. *Dieterich*, G.: Tabellen zur Ermittelung der stündlichen Wärmeverluste. (V, 89 S.) 33×24·5 cm. München, R. Oldenbourg. 1913. Cloth M. 20.

V. *Cotton Mill*: How to Build, Equip and Operate a, in the United States. 8vo. Spon. London. 1913. Net 15s.

Neu, H.: La chaleur et l'humidification dans le travail des textiles. ill., in-8°. J. Merand, Lille. 1913. 7 fr. 50.

Radcliffe, J. W.: The Manufacture of Woollen and Worsted Yarns. Cr. 8vo., pp. 358. Emmott. London. 1913. Net 5s.

VI. *Blackwood*, W.: Calico Engraving. A Practical Text-Book. 8vo, pp. 292. C. Griffin. London. 1913. Net 10s. 6d.

Roggenhofer, G.: Die Wäscherei in ihrem ganzen Umfange. Bearb. nach den neuesten Erfahrgn. auf dem Gebiete der chem. u. Nasswäscherei unter Mitwirkg. bewährter Fachmänner. 2., verm. u. verb. Aufl. (XII, 443 S. m. 282 Abbildgn.) gr. 8°. Wittenberg, A. Ziemsen. 1914. Cloth M. 7.50.

VII. *Flamm*, L., u. H. *Mache*: Ueber die Quantitative Messung der Radiumemanation im Schutzringplattenkondensator. (2. Mitteilg.). (8 S.) gr. 8°. Wien. A. Holder. 1913. 26 Pf.

Hess, Dr. V. F.: Ueber den Ursprung der durchdringenden Strahlung (25 S.) gr. 8°. Wien. A. Holder. 1913. 78 Pf.

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——Ueber die chemischen Wirkungen der durchdringenden Radiumstrahlung. 6. Der Einfluss der durchdring. Strahlen auf die Iodide der alkal. Erden. (24 S.). gr. 8°. Wien. A. Holder. 1913. 68 Pf.

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Kofler, M.: Löslichkeit der Ra-Emanation in wässerigen Salzlösungen. (7 S. m. 2 Fig.). gr. 8°. Wien. A. Holder. 1913. 44 Pf.

Meyer, S.: Ueber die Lebensdauer v. Uran u. Radium. (10 S.). gr. 8°. Wien. A. Holder. 1913. 34 Pf.

——Bemerkungen ueber die Löslichkeit v. Radiumemanation u. anderen Gasen in Flüssigkeiten. (14 S. m. 4 Fig.). gr. 8°. Wien. A. Holder. 1913. 60 Pf.

Paneth, F.: Ueber kolloide Lösungen radioaktiver Substanzen. (6 S.). gr. 8°. Wien. A. Holder. 1913. 26 Pf.

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VIII. *Magne*, L.: Décor. de la terre, poteries, faïences céramique. Coll. L'art appliqué aux métiers, 130 ill., in-8°. H. Laurens. Paris. 1913. 6 fr.

IX. *Baker*, I. O.: A Treatise on Roads and Pavements. 2nd Edition. Enlarged. 8vo. Chapman & Hall. London. 1913. Net 21s.

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X. *Earl*, T. C.: Gold Dredging. Illustrated. 8vo, pp 224. Spon. London. 1913. Net 20s.

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Geschichtliches u. Betrachtungen üb. alte u. neue Kalkulations-Methoden, die Arbeits-Verträge u. die Akkord-Gedinge, Giessereiverbands-Verträge, Preiskurant u. Grundpreise, Tabellen üb. Gusseisen-Konstruktionsteile nebst Mathematisches-Physikalisches. 5. Aufl. (VII, 276 S. m. 73 Fig.) 8°. Essen, G. D. Baedeker. 1913. Cloth M. 5.

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Ranfaldi, F. : Sulla titanite di Val Giuf e minerali che l'accompagnano. Roma, 4°, p. 23, con tavole. 1913. Lire 3.50.

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XIII. *Kaunhowen*, F. : Der Bernstein in Ostpreussen. (80 S.) Lex. 8°. Berlin (N. 4, Invalidenstr. 44), Vertriebsstelle der königl. geolog. Landesanstalt. 1913. M. 2.50.

XV. *Taggart*, J. A. : The glue book ; how to select, prepare and use glue. [Hamilton, O., Republican Pub. Co.] c. 85 p. il. 12°. 1913. $1.

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Snyder, H. : The Chemistry of Plant and Animal Life. 3rd ed. revised. Cr. 8vo. Macmillan. London. 1913. Net 6s. 6d.

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XIXA. *Codex alimentarius austriacus* : Nachträge, veröffentlicht v. der Kommission zur Hrsg. des "Codex alimentarius austriacus." Nr. 4. (9 S.) Lex 8°. Wien, Hof-u. Staatsdruckerei. 1913. Pf. 30.

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* Compiled by H. Grevel & Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

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PROF. E. C. C. BALY IN THE CHAIR.

THE HURTER MEMORIAL LECTURE, "MODERN CHEMICAL INDUSTRY."

BY PROF. FRITZ HABER.

It is a special honour to me to speak here in appreciation of a man who recognised and represented the importance of physical thinking in applied chemistry at a time when almost without exception technical chemists declined to take this view.

Thirty years ago, when Hurter's activity was at its height, the centre point of chemical industry was the Leblanc soda process. Here in England a number of technical methods for the manufacture of sulphuric acid and Glauber's salt, bleaching powder, soda, potash and the alkalis had been developed up to a remarkable standard. It is impossible to admire too much the richness of inventive genius and the clearness of judgment which the technical chemists of this period developed in your country. The world has learned of them how to convert chemical laboratory reactions into industrial technical processes and how to build up a system of analytical controls which enables the manager to follow the chemical change in a complicated system of reactions on a large scale.

The picture that technical chemistry exhibits to-day is quite different from that of thirty years ago. There is more brilliancy around the accomplishment of the organic than of the inorganic industries. The replacement of natural dyes by the products of coal tar, the extension of our medical resources by the manufacture of synthetic medicines, has gone far to extend the appreciation of chemical work and to produce the general conviction that chemistry is an inexhaustible field of economic possibilities. Indeed, one natural product after another falls into the domain of chemical synthesis, and chemistry is becoming the important factor in the economy of the tropical products which are used for industrial purposes. As soon as the price of such a product exceeds a certain limit organic chemistry enters the field and synthesises it in Western Europe. Thus indigo has succumbed to the onslaught of organic chemistry. Tanning materials at present are in a struggle with the condensation products of formaldehyde and phenolsulphonic acids. Camphor could only maintain its position by large price reduction, and the prospect of synthetic rubber holds down the would-be inflated prices of the natural product. The basis of this marked development in organic chemical industries is the combined working of science and technology. The fact and the success of this intermingling is so obvious that we need not dwell on the point.

In the territory of inorganic technical chemistry things are somewhat different. Here also a great change has taken place. The historical sulphuric acid and soda processes have lost much ground to the ammonia-soda and electrolytic processes, and to the contact process. New branches of industries have taken root and grown up. In this field, however, the connection between scientific and technical progress is neither so obvious nor so well recognised as in the realm of industrial organic chemistry. The reason lies in this, that the advance in inorganic science, during the last decade or two, has resulted less in the discovery of new facts which had direct technical applications, than in the unravelling and working out of new theoretical views. In fact, the introduction of physical laws and physical methods into the working sphere of inorganic chemistry has led to the greatest scientific progress. The invasion of physics into chemistry has produced the splendid development of physical chemistry, the basis of which is the second law of thermodynamics, the phase rule, and the theory of electrolytic dissociation. The introduction of the electroscope into chemical analysis has opened up the new chemical world of radioactivity. Now, in my opinion, inorganic chemical industries can gain almost as much by regarding their problems from a physical point of view as organic industries do by the application of structural considerations.

I do not think it will be out of place in this lecture if I speak of one or two inorganic technical questions and lay stress on the physical considerations which bear on them. I may be permitted to pass by many of the current examples of the part played by physical chemistry in technical chemistry owing to their general recognition and go on to speak of a few industrial cases with which I have come in contact during the last year or two.

During the last few years a not very obvious property of stannic acid has become the source of a new inorganic industry. Iron cooking utensils are coated on the inner side with a white enamel* which must contain no poisonous material; owing to its relatively low coefficient of expansion it must be very thin so as not to crack and chip away when the iron expands through rise of temperature. It must have a low melting point so that the iron does not lose its shape when it is coated with the melted enamel. A glass is therefore used which has nearly the following constitution: Borax 26 per cent.; quartz, 17 per cent.; felspar, 34 per cent.; sodium silico-fluoride, 13 per cent.; soda, 4 per cent.; saltpetre, 3 per cent.; kaolin, 3 per cent. The constituent parts are melted together; the fused mass is ground with water and some plastic clay to a thin paste of suitable thickness for even coating, then dried on the iron and heated to a temperature of 800° C. for about a minute, whereby fluxing of the enamel is attained. That is roughly the technology of enamelled iron. But such an enamel is too transparent. For the thin coating, which it is necessary to use on the iron, permits the dark colour of the background to be seen. It is desirable to add something which, in small quantities, will render the enamel quite opaque, and which will at the same time give it a clear white colour. The only satisfactory substance up to the present has been stannic acid. The requisite amount for a given surface is small, about one-half gram being required per square decimeter, but the employment of enamelled iron utensils is so great that 3 million kilos. of stannic acid are used yearly for this purpose. In earlier times about double the amount of stannic acid was used per unit area, as it was mixed and melted with the other constituents of the glass, and not, as at present, added to the enamel paste before the baking process.

The substitution of stannic acid by an equally efficient and non-poisonous but cheaper clouding medium has long been sought for by the enamel industry. Many and various substances have been tried and now it seems as if the problem has been solved.

The naturally occurring zirconium silicate is treated by alkali and a product of roughly the following composition is obtained: ZrO_2, 83 per cent.; TiO_2, 4 per cent.; SiO_2, 9 per cent.; Na_2O 2 per cent., the remainder being water. This impure zirconium oxide is replacing stannic acid. It is used in the same quantities and in the same way.

The development of this new industrial process has brought forward the question as to whether the specific property of the product is due to the oxide of zirconium or to some peculiar physical state that it possesses which could be imparted to other substances or perhaps to the impurities contained besides the oxide of zirconium. These questions are solved by some simple considerations.

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* See Paut Raudau, "Die Fabrikation des Emails und das Emaillieren," Wien und Leipzig, 1909; Julius Grünwald, "Theorie und Praxis der Blech- und Gassemailindustrie," Leipzig, 1908, and "Chemische Technologie der Email-Rohmaterialien," Dresden, 1911; further "Ausgewählte Kapitel aus der Emailliertechnik," herausgegeben von der Redaction des Sprechsaals. Coburg, 1912.

Zirconium oxide is like tin oxide, namely, when in large crystals, a transparent colourless body. Now to render a glass opaque by the intermixture of particles of such a body the two substances must have different indices of refraction. The greater the difference, the greater will be the specific power of the particles to render the glass opaque. Now, the easily melting glasses which are used for enamels have a coefficient of refraction in the neighbourhood of 1·5. Natural tin oxide has the refractive index—for yellow light—of 1·9966 or 2·0799, according to the axis chosen. Its refractive power is therefore far greater than that of the glass. This property accounts for its utility in making enamels opaque.* Natural zirconium silicate has very similar refractive indices, being only about one unit smaller in the first place of decimals. Calculating from the well known additive properties of molecular refraction we find that the removal of the relatively feebly refracting silica from the zirconium silicate will increase its coefficient so that pure zirconium oxide will have a refractivity about 10 per cent. greater than pure tin oxide. Thus we may expect that zirconium oxide with or without the above-mentioned impurities of the technical product acts like tin oxide if it is equally finely divided in the glass. Differences will, however, appear if one of the oxides dissolves in the enamel to a much greater extent than the other. The fact that only half the tin oxide is required when it is not melted with the enamel, but only mixed with it before roasting, shows that it is not so much a question of solubility, but of the rate at which it dissolves. Now the oxide dissolves only after the melting of the glass and the melting is stopped the moment the heat coming from above renders the surface mirror-smooth. Thus there is only time for a limited solvent action of the glass to take place. From this we gather that an equally small quantity of suitably calcined zirconium oxide or of tin oxide will probably render the enamel equally opaque. With voluminous zirconium oxide prepared by heating pure commercial zirconium nitrate to 800° this conclusion was easily proved by a few experiments. Some minor points about the composition of the enamel would have to be considered if we would go into the subject more fully.† The former difficulty of finding empirically a substitute for tin oxide is now made plain by inspection of a table of refractive indices, because we find that the oxides of tin and zirconium have peculiarly large indices among the substances which are colourless, stable at high temperature and non-poisonous. The oxide of titanium which forms a small part of the technical product would be even better alone, because of its still larger refractive index, but the enamels made opaque by it show a yellowish colour.

I will now pass from the zirconium oxide to its accompanying mineral monazite sand and speak for a moment of a new factor in its industrial treatment. Since the introduction of the Welsbach mantle for lighting purposes, monazite sand has been worked up in large quantities for the production of thorium nitrate. In the last two years a new and very peculiar question has arisen for this industry by the demand of the medical profession for radioactive substances which give penetrating γ-rays. There are in a thousand metric tons of the usual monazite sand containing 5 per cent. of thorium oxide, according to the current radioactive figures, 18 milligrammes of such a radioactive substance. The value of these few milligrammes in a sufficiently concentrated form exceeds the value of any other substance known and covers the original cost of the 1000 tons of monazite sand. Now, the problem was to get these few milligrammes out of the thousand tons in the normal thorium extraction process. This extremely valuable substance is the mesothorium I. of Dr. Hahn, which by changing into mesothorium II. becomes a much more powerful source of γ-rays than radium itself in equilibrium with its products.

The problem is solved by the addition of 0·1 per cent. of barium to the sand before treating it with sulphuric acid in the usual way. In due course we get a radioactive deposit of barium sulphate rendered impure with SiO_2, TiO_2, lead, and rare earths. These impurities must be separated by four distinct chemical processes, resulting finally in the regaining of barium sulphate with radioactive impurities only. This product is then concentrated by the ordinary methods using the chloride, carbonate, and bromide of barium, up to the γ-ray activity of pure radium bromide, or in excess thereof. One might certainly expect from such a complicated process that the largest part of the 18 mgr. would be lost. The real result however is found by comparing, using the α-ray method, the amount of mesothorium in the final concentrate and in thorium in equilibrium with its transformation products. Dr. Keetman and Dr. Mayer have done so* and obtained the astounding result, that the figures are nearly the same. How is that to be explained? The sand always contains a small amount of uranium (say 0·1 per cent.) and in consequence its equivalent of radium, which is saved together with the mesothorium. The amount of radium in the sand and in the final concentrate is determined by using the emanation method of estimation. Keetman and Mayer have also made this comparison and found an equally quantitative agreement. This yield also is almost theoretical. The quantity by weight of the radium is much greater than that of the mesothorium in the sand as well as in the final product. The final radioactive product of the 1000 tons shows a γ-radiation equivalent to 2200 mgrms. of $RaBr_2$, three-tenths of which come from the bulk of real $RaBr_2$, while seven-tenths are due to the small admixture of the much more powerful mesothorium bromide. We have learnt from Soddy and Fajans that radioactive elements occurring on the same place of the periodic system are inseparable by any chemical means. Therefore, according to this rule the quantitative extraction of mesothorium follows from the quantitative extraction of the larger mass of radium. That the latter accompanies the barium fully is usually explained by the greater insolubility of the radium sulphate and their isomorphism.

I wonder whether this explanation will be final. Perhaps adsorption plays an important part, even in case the sulphates should be able to dissolve into each other in the solid state like alcohol and water in the liquid state. Diffusion is so extremely slow with solids, that the surface phenomena become more prominent in all rapid changes. The work done by Ritzel† here at Liverpool in this laboratory on the suggestion of Donnan induces us to regard adsorption as the primary step even in the case that a solid solution can be formed. Now there are certain facts stated quite recently by Fajans and Beer,‡ which suggest a near connection between adsorption and chemical affinity. On the other hand we have learnt from Braggs' new brilliant investigations, that the ordinary solid crystalline salts are not systems in which one anion and one cation form a molecule which is separated from the next, but that one cation is probably bound to all the surrounding anions and one anion to all the surrounding cations. In consequence of that, we may feel inclined to consider the possibility of chemical forces acting between the atoms or ions in the surface of the solid precipitates and the molecules or ions in the final layer of the surrounding liquid, *i.e.* in the adsorption layer. We may remember that there are good reasons for the belief that chemical forces are of electrical character and we know from electro-osmosis and similar phenomena that electrical forces are always acting between the surface of the solids and the adjacent layer of fluid. Adsorption phenomena, which are especially instructive with radioactive substances owing to our being able to detect the presence of minute quantities, may thus perhaps be brought in close connection with chemical affinities.

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* So far as I am informed, this view is not mentioned in the literature of enamel. But I have recently found that Wilhelm Ostwald, in his "Malerbriefe," Leipzig, 1904, explains the property of white lead of giving the greatest opacity for painting by help of the analogous consideration for oil and carbonate of lead.

† See D. R. P. 189364; Bela Havas "Ueber Eisenblechemaille," Karlsruhe 1910 (Doctor-Dissertation); Hartmann "Zirkonemail," München 1910 (Doctor-Dissertation); Weiss, Zeitschrift für anorganische Chemie 1910, **65**, p. 218.

* Private communication.

† Zeitschrift für physikalische Chemie, **67**, 724.

‡ Berichte der Deutschen Chemischen Gesellschaft, **46**, 3486.

The working up of the rare earths presents many physical-chemical points of interest. It is tempting to speak of the electrolytic preparation of the so-called "Mischmetall" containing 80–90 per cent. cerium (the rest consisting of didymium and lanthanum) and its use for patent lighters, or about the manufacture of pure fluorides of the rare earths used for the salted arc to make the light white, or of the special properties which a thorium nitrate must show in order to give good Welsbach mantles. I will just consider one point more in detail because it is a good example how the same simple consideration elucidates problems in very different branches of chemical working. The splendid reasoning of Le Chatelier explained the property of the Welsbach mantle in producing more light when heated by a Bunsen flame than any other radiator, as being due to the fact of the transparency of its substance in the infra-red region. In virtue of this transparency the mantle is unable to give off the heat imparted to it by the burning gas by the emission of heat wave energy. At the same temperature the Welsbach mantle radiates no more light than other substances, but in a given flame it gets hotter and more nearly approaches the temperature of the flame than does any other substance owing to this lack of heat radiation. From this state of things high light economy results, as we get with gas of a heating power of 5000 grm. cal., one Hefner candle-power for an hour with the consumption of 0·8—0·9 l. of coal gas using the inverted type of burner which, as it is known, affords a certain amount of previous heating. Now, by using a compressed air burner we can increase the economy to 0·6 l. of gas per Hefner candle-power with the same gas without more previous heating than in the former case. At first sight we may be led to think that the compressed air flame is hotter, but on closer consideration it will be evident that this is wrong. A Bunsen flame consists of two extremely thin reaction zones, the internal cone and the external one, the latter being used for heating the Welsbach mantle. In the internal cone the admixed air burns in an excess of gas, whilst in the outer cone the burning components undergo complete combustion with the air, forming CO_2 and water. The position of the outer cone is fixed by the fact that in this zone the quantity of oxygen present must be exactly the theoretical amount required for complete combustion. Here, as there is no excess of air, the temperature only depends on the calorific value of the gas and the specific heat of the products of combustion, and is therefore at the maximum attainable with this gas and air. Thus the temperature of a blow pipe, using air, and gas of the same composition cannot exceed this maximum. Nevertheless the mantle does get hotter in the blow pipe as is proved by the fact of increased economy. We do not even need this special observation of the mantle, as everyone knows from elementary experience that things can be heated to a much higher temperature in a blow pipe than they can in a Bunsen flame. Now, why is this the case? An explanation has been suggested in the fact that as the blow pipe has a smaller flame, the production of heat takes place in a more confined region. But this fact is really no explanation as we do not heat a geometrical space, but a quantity of gas, and we have just proved that it is impossible to get it hotter than it becomes in the outer cone of a Bunsen flame. To find the proper explanation we must consider a phenomenon that has no very obvious connection with this subject, namely the dissolving of crystals in water. On this subject we have the theory inaugurated by Noyes and Whitney, and developed by Nernst, which states that the layer of liquid in contact with the crystal always consists of saturated solution. This saturated layer is continually losing its dissolved substance to the unsaturated further removed layers and at the same time being resaturated from the surface of the crystal. If the liquid is stirred this surface layer remains without motion, as the external friction is very much greater than the internal, while the neighbouring layers have progressively increasing velocities. Now, for the sake of simplicity we may imagine this system of layers of increasing velocities replaced by a stationary layer in contact at one side with the crystal and on the other with the bulk of the solution uniformly moved by the stirrer. Thus, this stationary layer is a region through which diffusion of the dissolved substance takes place and the rate of solution is determined by the amount of substance which diffuses in unit time through this layer. The quicker the stirring is, the thinner is the stationary layer, the shorter is the distance for diffusion and the greater the rate of solution. Bearing in mind that diffusion and conduction of heat are entirely analogous processes, and that both phenomena follow the same differential equations, we at once arrive at the theory of the blow pipe, by introducing this simplifying conception of a stationary layer of gas on the surface of the heated body immersed in the rapidly moving gases of the flame. We see that the temperature of the solid body depends on the gain of heat by conduction through this stationary layer of gas and upon the equally large loss of heat due to radiation. The quicker the flow of the gas, the thinner will be the stationary layer; the thinner the layer, the greater will be the flow of heat and the higher the temperature of the body. Thus the difference in the velocities of the hot gases at equal temperature accounts for the higher efficiency of the blow pipe.[*]

The study of flames and the process of combustion and the possible uses of the products of combustion constitute a favourite field for a physical-chemical consideration.

Among the processes for utilising the products of combustion in chemical industries the action of generator gas on alkaline solutions stands out. The old method of making oxalic acid was by the action of fused alkalis on wood, and formic acid was got by splitting off of CO_2 from the oxalic acid. To-day these processes have disappeared. Formic acid is obtained by the action of carbon monoxide, in the form of generator gas, on alkali, and oxalic acid is made from formic acid by heating its salts and decomposing them into hydrogen and salts of oxalic acid. Berthelot discovered this action of CO on alkali as long as 50 years ago and has done much research on this subject. His view was that the caustic alkalis combine with CO best in presence of a little water but always at a very slow rate. In order to quicken up the reaction later on CO at high pressure was used and Berthelot's concentrated solutions were replaced by solid alkali. This was developed into a technical process in which wet generator gas under pressure acted upon slowly shaken pieces of solid alkali; but finally it was found more expedient to replace the solid alkali by a dilute solution which has the surprising property at high temperature of acting much more quickly than concentrated solutions. This is the most modern form of the technical process.

This reaction has been studied in my laboratory.[†] The question was first whether the reaction goes on between water vapour and gaseous CO, or between dissolved CO and the constituents of the solution. Experiment proved the latter to be the case. Thus the speed depends upon the concentration of the dissolved CO which is used by the reaction and replaced from the atmosphere above. Under equal conditions of stirring and temperature the speed is strictly proportional to the partial pressure of CO in the gas-room. At low temperatures the reaction is extremely slow, and moderate stirring of the gas and solution is all that is required to keep the solution saturated with CO. Stronger stirring is without influence. Under these circumstances a high concentration of alkali helps to a comparatively rapid chemical change, but the reaction velocity is always far below that required for a technical process. Heating, as usual, increases the reaction velocity very much, and above 100° it becomes difficult to keep the solution saturated with CO by stirring. At 160° to 170° we cannot arrive at a point where stronger stirring would not materially increase the progress of the reaction. In this region of temperature the velocity of reaction meets the technical requirements, provided the absorbing liquid is brought into extremely close contact with the current of generator gas. Concerning the influence of the concentration of the alkali upon the speed of reaction, we find that from 100° upwards solutions containing about 10 per cent. of alkali become more and more marked by a high rate compared with stronger as well as weaker solutions under the same conditions of temperature and stirring. At 160°, for instance, the 10 per cent. solution works 15 times better than a 43 per cent. one. The suggestion that the 10 per cent. solution becomes best intermixed with the gas by the stirrer in virtue of an especially small surface tension is not supported by measurements of this constant at high temperature,* and this point remains unsettled for the present. The older form of the process which works with solid alkali and the newer using the solution are seen now in very close connection. In the older form the gas used in a wet state produces by virtue of its water vapour a thin coating of concentrated solution of caustic alkali on the surface in which the CO dissolves and reacts as it does in the new process. Perhaps this industrial application illustrates very effectively the influence of temperature and stirring upon reaction velocity. Is it not remarkable that the same alkali which helps us so often to separate CO_2 from CO by the formation of carbonate in gas analysis is able under other conditions to separate perfectly the CO from the nitrogen of the generator gas?

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[*] See Haber and Le Rossignol, Zeitschrift für physikalische Chemie, **66**, 195. The influence of the rate of flow of the flame gases upon the temperature of an immersed body has first been mentioned by Féry, Comp. rend. **137**, 909; see Haber, Zeitschrift für physikalische Chemie, **68**, 752.

[†] Friedrich A. Weber, "Über die Einwirkung von Kohlenoxyd auf Natronlauge" (Doctor-Dissertation), Karlsruhe, 1908. Gorton R. Fonda, "Über die Einwirkung von Kohlenoxyd auf Laugen," (Doctor-Dissertation), Karlsruhe, 1910.

Returning to the subject of flames we find that there is to-day much interest connected with the question of the possibilities of developing their power of fixation of nitrogen. Our usual flames give only very small traces of nitrous products by burning in air at ordinary pressure. In the case of the acetylene flame, which is very hot, a distinct yield can be obtained under ordinary pressure by the combustion with an air enriched with oxygen.† With other gas flames the combined application of air enriched with oxygen and of high pressure in the combustion chamber produces the same effect.‡ The interest in the utilisation of this behaviour for the production of nitric acid results from the fact that the question of fixation of nitrogen is a very burning one. It may be interesting to look more closely into this problem. The more the agricultural conditions in the world develop in such a way that the agricultural products are not used in the place of their growth, the greater becomes the necessity for the addition of fixed nitrogen to the soil. Plants take up fixed nitrogen from the soil and animals get it from the plants, both without increasing or decreasing its quantity; but if corn and meat are exported from the place of production, the ground does not regain the nitrogen which it has given up.

It is true that there is a certain natural replacement of nitrogen. First in the track of lightning free nitrogen is fixed to a certain extent and the rain carries it down from the atmosphere into the soil. Besides this there are in the soil nitrifying bacteria which transform free nitrogen into the fixed state. But they are very sparsely distributed, and there seems no way of increasing their number. The earlier rational agriculturist made use of the special property of leguminosae which grow nitrifying bacteria on its root nobules. These natural aids are now insufficient. The yearly deficit in fixed nitrogen is characterised by the fact that the world's demand for fixed nitrogen amounts to three-quarters of a million tons, by far the largest consumer being agriculture. Nowadays, this requirement is supplied mostly from two sources: the main bulk from the Chilian fields in the form of saltpetre and a smaller part from coal in the form of ammonium sulphate. A few years ago anxiety arose whether the Chilian fields would be sufficient to meet the ever increasing demands for more than a few years to come. To-day we are confident that they will last at least till to the middle of our century, even at the present rate of increase of demand. But when we are told that the Chilian factories have replaced their old and primitive methods by new and very efficient ones and at the same time see that the price continues on its upward course, we realise that the richest and most accessible seams have been exhausted. Therefore the economic future does not look very cheerful, unless a powerful rival steps in.

In regard to the natural store of nitrogen in coal which averages a little over one per cent., it is obvious that it is completely lost in burning and only to a small extent, say one-fifth, regained in coking when by-product ovens are used. In Germany these are almost universal. Here in England the older beehive type, which loses the whole nitrogen, has so far not been completely replaced, and in America up till now they are only employed to a small extent. Though the beehive oven will without doubt be universally replaced owing to this saving of fixed nitrogen, the increase of the supply of fixed nitrogen that is to be expected from this substitution will meet the increase in demand only for a very short time. These circumstances afford a tremendous stimulus to chemistry in its efforts to fix nitrogen, of which we have a limitless supply in the atmopshere. Elementary nitrogen is everywhere at our disposal. Its separation from oxygen is brought about by various methods which only cost something like a farthing per kilo. Against that, fixed nitrogen in the form of Chile saltpetre or ammonium sulphate from the by-product coke ovens has a value of more than a shilling a kilo. This price gives a very high working-margin and makes possible and practicable quite a number of chemical fixation processes. Now, this is not the first time chemists have tackled this question. When Solvay's soda process came with its demand for ammonia Ludwig Mond attempted to solve the question. He took the lines suggested by Bunsen and Playfair and followed in the steps of Margueritte and Sourdeval, by heating together coal, nitrogen, and barium carbonate for the production of cyanide which can be decomposed into ammonia. But Mond gave up this process after a detailed study. He returned to the supply of fixed nitrogen in the coal, and increased the yield to 70 per cent. by the introduction of what is known now as the Mond gas process. This process is continually spreading, as a market is found for the gas of low calorific value which is the other product of the process. In view of this development we may ask what modern aids allow us to carry through with success the task abandoned by Mond and to find satisfactory methods for the fixation of atmospheric nitrogen on a large scale. The answer is obvious if we consider the various processes which have lately been introduced into the technical world.

First of all, we must mention processes which make use of electric energy on a large scale. The first process imitates the example of nature which produces nitrous products in the track of lightning from the nitrogen and oxygen of the air, by producing a high tension arc in a closed vessel through which air is passed. The foundation of this ingenious method has been laid here in England. Cavendish was the first to get nitrous products from air by help of the spark. Sir William Crookes recommended the use of the high tension arc. Lord Rayleigh and later on McDougall and Howles determined the yield under varying conditions. The technical forms which have risen to importance are connected with the names of Birkeland and Eyde, Pauling, and Schönherr. They have in common the conception that the technical process must be based upon the use of large amounts of air and electric energy in one single arc flame, and that this problem can only be successfully solved if the discharge is spread out. For this enlarging of the arc Pauling uses a stream of air moving at a high velocity which is blown against the point where the arc strikes between narrow electrodes. Birkeland and Eyde gain the same effect by a strong magnetic field. Schönherr ingeniously uses a steady column of discharge of many metres length which is produced and kept steady by an ascending whirlwind of air, which surrounds the arc. Factories have been started at different places, on the largest scale in Norway. They rapidly captured the small market for nitrites, but in the large field of nitrates the production has not come up to expectations. The obstacle that hampers this industry is the fact that the production of fixed nitrogen referred to the kilowatt-hour does not exceed 16 grms., and that this small yield is only obtained in the form of gases containing no more than 2½ per cent. of nitric oxide. These unfavourable results are due to the fact that the thermodynamic equilibrium between $N_2.O_2$ and NO has an unfortunate value at all accessible temperatures. The importance of this equilibrium has been pointed out by Muthmann and Hofer, and exact figures for the equilibrium have since been estimated in a very ingenious way by Nernst. The following table gives the percentage amount of nitric oxide which according to him characterises the equilibrium :—

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* Unpublished results.

† See Haber and Hodsman, Zeitschrift für physikalische Chemie, **67**, 383 (1909).

‡ See Haber and Coates, Zeitschrift für physikalische Chemie, **69**, 337 (1909); Wolokitin, Zeitschrift für Electrochemie, **16**, 814.

TABLE I.

Percentage amount of NO in equilibrium with air.

% NO		°C.
0·1	....	1230
0·5	....	1660
1·0	....	1930
1·5	....	2140
2·0	....	2300
3·0	....	2590
4·0	....	2840
5·0	....	3060

It is obvious that even at the temperature of the arc only a small fraction can combine with the oxygen unless we may surpass the thermodynamic equilibrium by direct transformation of electric energy into chemical energy. Now experiments carried out in my laboratory have proved that to be possible with small arcs,* but there is not much hope of doing so under technical conditions. The upshot of this is that this electric fixation of nitrogen grows up only at places where exceedingly cheap power is available. This is not the case in the chief industrial countries. Conditions are more favourable in the case of the process of Frank and Caro. They fix 50 grms. of N_2 by use of 1 kilowatt-hour, everything included. The electric power is used in this case for the purpose of making CaC_2 from CaO and coal, the CaC_2 being able after an initial heating to form spontaneously the so-called calcium cyanamide. There are 36,000 tons of N_2 fixed yearly by this method. The calcium cyanamide can either be used as a fertiliser, or split up by steam with the production of ammonia.

A similar amount of energy is said to be necessary in the Serpek process, which apparently is not yet commercially working on a large scale. It is based upon the change of aluminium oxide with carbon and nitrogen into aluminium nitride. Electrical energy is here required, as in the processes mentioned before, for the production of the temperature necessary for rapid reaction. Starting from bauxite and treating it according to the well-known Bayer process to produce the alumina, the Serpek process may be introduced as the first step with the result that the valuable ammonia is obtained as a by-product.

We see that all these processes owe their success to the use of electric energy. The high tension arc requires an extravagant amount and the two other processes require, though much less, still a considerable amount. On closer inspection we find that this fact is the reflex of the values, which the underlying thermodynamic equilibria possess. In the reaction, $N_2+O_2=2NO$; the right side of the equation which contains the desired fixed nitrogen is thermodynamically less favoured than in the reactions, $Al_2O_3+6C+N_2=2AlN+6CO$; and $CaO+3C=CaC_2+CO$; $CaC_2+N_2=CaCN_2+C$. But in all three cases the reaction would, in virtue of its thermodynamical properties, never proceed spontaneously at low temperature. High temperature produces the chemical forces required.

In consequence of that, electric energy can be replaced theoretically by other means of obtaining high temperatures. That is the reason why the question of application of flames comes in for the production of nitric oxide from air. But it is clear that the values of the equilibrium between N_2,O_2 and NO which are so unfavourable even at the temperature of the arc will be a still greater obstacle at the lower temperatures of flames and explosions. The subject has been studied for some time in my laboratory. To give an example we arrived at one molecule of NO with production of 16 molecules of carbonic acid from carbon monoxide. But such results are only obtainable by a large use of the comparatively expensive oxygen to enrich the air and increase the combustion temperature.

Certainly there are enough examples of chemical processes which work successfully on a large scale in spite of the fact that the chemical forces under ordinary conditions are striving to produce the reverse change, from the final products back to the raw materials. The ammonia soda process is an outstanding example. It produces calcium chloride and soda which if simply brought in contact would return to the original form of sodium chloride and calcium carbonate. But in general those reactions are more easily converted into technical processes which are backed by chemical forces tending to change the raw materials into the desired products.

This consideration led our attention some years ago to the reaction of nitrogen and hydrogen to form ammonia. The heat of combination has, according to thermochemistry, a positive value, which proves that it is only due to lack of reaction velocity that the gases do not unite at ordinary temperature. It is true that these favourable values of chemical forces become most unfavourable with increasing temperature. It does not need a very high temperature to make the thermodynamical value of the equilibrium a marked hindrance for any appreciable production of ammonia from its elements. Theory teaches us and experiment has proved that the best mixture of N_2 and H_2 for the production of NH_3 has the value of 1 : 3. But with this most favourable mixture the limit of percentage of NH_3 attainable under ordinary pressure is at higher temperatures very small, as will be seen from the first column of this table :—

TABLE II.

Percentage amount of NH_3 in the equilibrium of the reaction $N_2+3H_2=NH_3$.

Pressure in atmospheres	Temperature °C.				
	550°	650°	750°	850°	950°
1	0·0769	0·0321	0·0159	0·0089	0·0055
100	6·70	3·02	1·54	0·874	0·542
200	11·9	5·71	2·99	1·68	1·07

Especially as the temperature approaches the value of 1000°, for which we easily found effective catalysts, the yield is minute. Some hundred degrees below, the much larger though still small amounts given in the table were formerly inaccessible because of the lack of catalysts effective in the neighbourhood of 500°.

At first sight one might think that the thermodynamic situation is still worse for the synthesis of ammonia than for the combination of N_2 and O_2, because the values of the equilibrium content of NH_3 are much smaller than those for the equilibrium content of NO in air given before. But theory shows a way out of this difficulty in the case of ammonia which is not open in the other case. The NO equilibrium is independent of pressure because the number of molecules is the same on both sides of the equation. In the case of ammonia, however, the number of molecules decreases from 4 to 2,

$$\underbrace{N_2+3H_2}_{\text{4 molecules}} = \underbrace{2NH_3}_{\text{2 molecules}}$$

and therefore according to thermodynamics the attainable percentage of NH_3 in equilibrium is proportional to the working pressure over a wide range. Consequently the values of the equilibrium percentage at 100 or 200 atm.

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* See Haber und Koenig, Zeitschrift für Electrochemie, **13**, 725 (1907); **14**, 689 (1908); **16**, 789 (1910). Holwech und Koenig, Zeitschrift für Electrochemie, **16** 803 (1910).

pressure shows a very different aspect, as will be seen from the second and third columns of the table.

It is obvious that technical synthesis is possible if we can succeed in reaching the equilibrium at such pressure and in a short enough time. The current of N_2 and H_2 must circulate in such a way that the ammonia formed by the passage over the catalyst is removed by absorption or cooling before it again passes, mixed with fresh supply of reacting gases. This is the method that was carried through first on a small scale and is now being applied on a large scale. It was necessary to get familiar with the technique of reaction in flowing gases at high pressures. Then catalysts had to be found and studied. The task was somewhat troublesome and I cannot emphasize enough the valuable aid of your countryman Robert Le Rossignol, who was working with me on this question.* Earlier experiments had given us the idea that the elements of best catalytic power for producing ammonia from the gases are akin to our first catalysers manganese, iron, chromium and nickel. Thus we tried the metals of the three last groups of the periodic system till we hit upon osmium and uranium. The osmium proved very effective, if used in a very finely divided state which is easiest obtained by heating osmyl-diamine chloride. The uranium is advantageously used in the form of carbide which in the current of nitrogen and hydrogen changes into nitride which forms a very highly catalytic powder. With these contact substances it was found possible to work in the temperature region of 500° to 600° at high pressures, so that the equilibrium was nearly maintained with a high rate of flow of the gas. The very high pressure limits the space which may be filled with the catalyst. But more than 1 kg. of ammonia is easily produced per hour for each litre of catalyser space. The reaction itself produces the necessary heat because 13,000 gr. cal. are set free in this range of temperature by the formation of 1 gr. equivalent of ammonia from the elements. The Badische Anilin and Soda Company have taken over and further developed our results. Starting from the observation that contaminations in certain cases increase the catalytic activity in such heterogenous reactions, they have been able to raise the activity of poorer catalysts to that of osmium and uranium. The result was only obtained after a careful study of the influence of small impurities, some of which are useful while others, even when present in the smallest traces, act as poisons. They overcame certain difficulties in the construction of high pressure furnaces which became apparent by prolonged working. They developed the purification methods for the hydrogen which became necessary with the replacement of our electrolytic gas by the impure hydrogen from coal. It seems that the task of managing the process on the largest scale has now been carried through satisfactorily.

Reviewing the whole question of the fixation of nitrogen from an economic standpoint, stress must be laid upon the fact, that there is no reason why all these processes mentioned should not flourish at the same time. The demand is so large that all the efforts in the different directions will certainly not meet it for some time. Considering the subject from the technical point of view the progress compared with Mond's result is obviously due to the introduction of high temperatures and high pressures: *i.e.* new physical aids. But looking into the matter from the general standpoint we recognise that the thermodynamic equilibrium questions play the deciding part. Theoretical consideration never replaces experiments, but points out and circumscribes the field in which experiment will probably be fruitful.

There is still a large field to be covered by applied inorganic chemistry, and I trust that the combination of experimental skill in chemical work with physical thinking will lead technical chemists to great results.

THE FIRE-DAMP WHISTLE.

At the conclusion of the Lecture, Prof. Haber gave the following account of his fire-damp whistle, illustrating his remarks with a practical demonstration of the instrument.

Endeavours have been made for a long time to invent forms of apparatus which will reveal the presence of fire-damp in coal mines. Amongst people who have a practical acquaintance with the subject there exists a consensus of opinion that such instruments can be of real service only when they are of such a small and handy form that the miners can carry them and use them conveniently. Practical people are also unanimous in the opinion that the miner is not in a position to employ a measuring apparatus, but that he must receive from the instrument in question a distinct *signal*, enabling him to recognise the presence of fire-damp and approximately estimate its amount. The Davy safety-lamp satisfies these conditions, inasmuch as it yields a direct signal and one which enables the miner to estimate roughly the amount of fire-damp present. A Davy's safety-lamp fed with benzine and with its wick turned down exhibits in air containing methane an aureole round the flame, which is visible as soon as the proportion of methane reaches 1½ per cent., and which increases rapidly in size and visibility as the proportion of methane increases. So far as the recognition of methane is concerned this apparatus satisfies all the requirements of the practical miner. It has however the serious defect that the indicator employed is a flame, which under certain circumstances can ignite the fire-damp. Statistics prove that such a danger is really present, since they show that more than one-half of all the fire-damp explosions occurring in coal mines are due to ignition of the fire-damp by the lamps. This is the reason why endeavours are being made to obtain another sort of fire-damp indicator. So long as the flame of the Davy lamp is employed for the purposes of illumination so long will it naturally be used as an indicator of fire-damp. Since however the employment of portable electric lamps has become possible the necessity for another form of danger signal has been felt.

The "Fire-damp Whistle" is an instrument for detecting by acoustic means the presence of fire-damp. The idea of employing an acoustic apparatus for this purpose was first broached by your fellow-countryman, Professor Forbes, in 1880. His suggestion has been followed by several others, but none of them has met with acceptance by practical miners. The reason for their failure is to be found in the fact that the proposed apparatus did not take the form of small, handy and portable instruments, and that they were ill-adapted to withstand the rough usage of daily work in coal mines. Recourse was therefore had to other means, but it is very difficult to suggest any principle which possesses such great advantages as the acoustic one. If methane were not at ordinary temperatures so chemically sluggish one might employ its chemical reactions for the purpose in hand. Methane reacts, however, with sufficient rapidity only at high temperatures, and the high temperature involves the possibility of that ignition which one must at all costs avoid. Led by these considerations Dr. Leiser and I have endeavoured to develop the acoustic method. The fire-damp whistle which I show you here is the result. As you see, it consists of a brass cylinder 25 cms. long and 6 cms. in diameter. Inside the brass cylinder are two small pipes which are tuned to give the same note in air. They are blown by one and the same current of air, which is provided by a hand pump. This hand pump is simply the outer sleeve of the brass cylinder. Both pipes are provided with membranes, which prevent the operating air current from entering the pipe-tubes (resonators). The space beyond the membrane forms therefore, in the case of each pipe a closed gas chamber, the nature of the gas contained in which determines the pitch of the note given by the pipe. In the case of one pipe the gas chamber is filled with pure air outside the mine, this air remaining unchanged during the sojourn in the mine. Into the closed chamber of the other pipe can be brought the air of the mine, purified from dust, moisture, and carbon dioxide by a cartridge of soda lime. If the mine air contains methane then on sounding the two pipes by means of the sleeve-pump beats are heard whose frequency increases with the proportion of methane in the air of the mine. The beating of the notes of the two pipes produces a characteristic "trill" when the methane content approximates to the explosion limit.

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* See Haber and Le Rossignol, Zeitschrift für Electrochemie, **14**, 181, 513, 688, **19**, 53. Ber. d. d. Chem. Ges., **40**, 2146.

London Section.

Meeting held at Burlington House, on Monday, January 5th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

MONAZITES FROM SOME NEW LOCALITIES.

BY SYDNEY J. JOHNSTONE, B.SC. (LOND.). SCIENTIFIC AND TECHNICAL DEPARTMENT, IMPERIAL INSTITUTE.

The mineral monazite is composed essentially of phosphates of the cerium and lanthanum earths, but also contains invariably a certain proportion of thoria, and hence forms the principal commercial source of the thorium nitrate employed in making the mantles used for incandescent gas lighting.

Monazite crystallises in the monoclinic system, and varies in colour from pale yellow to dark reddish brown or occasionally black. Its specific gravity is usually about 5·2 but sometimes samples are met with, such as those described later on from Ceylon, having a specific gravity of nearly 5·5.

A large proportion of the monazite used industrially is obtained from deposits in Brazil, where the annual production of sand containing 90 per cent. of monazite exceeds 6000 metric tons. The most extensively worked deposits in Brazil are the naturally concentrated sands on certain parts of the sea coast, and the monazite separated from these, contains on the average from 5·0 to 7·0 per cent. of thoria. The less important deposits inland yield monazite containing from 4·0 to 5·7 per cent. of thoria.[1]

During the past two years an important contribution to the world's production of monazite sand has been made by the native State of Travancore in India. The output in 1911 amounted to 811 tons valued at £24,044 and in 1912 this had increased to 1,135 tons valued at £41,419.

In the course of the mineral surveys conducted in recent years in connection with the Imperial Institute in Ceylon, Southern Nigeria, Northern Nigeria, and Nyasaland, many concentrates have been obtained which proved to contain monazite. The occurrence of this mineral had not previously been recorded from these countries, and particulars of the occurrences will be found in the official reports on these surveys which are published periodically in the Miscellaneous Series of Colonial Reports (London: Wyman and Sons). Similar concentrates have also been received at the Imperial Institute from Travancore and from Malaya. Analyses of monazites from all these sources have been made.

The materials received at the Imperial Institute have been mostly in the form of sands already concentrated by washing. They contained numerous minerals other than monazite, and in such cases the monazites were separated from the concentrates by electro-magnetic[2] or electrostatic[3] means. In a few cases, the monazite examined consisted of a single fragment weighing several grams.

Method of analysis.

The results given in this paper have been obtained by the method outlined below which has been arranged so that the complete analysis, with the exception of the determination of the phosphoric acid, can be performed, if necessary, on one portion of the specimen.

The general principles involved in the methods of estimation used are not entirely new, but the general scheme has been evolved by the author and has been carefully tested during a period of over five years. The methods used may be briefly described as embodying Glaser's[4] oxalate method for the separation of the rare earths, Fresenius and Hintz's[5] thiosulphate method for the separation of thoria, and Mosander's chlorine method[6] for the separation of ceria.

One to two grams of the monazite was finely ground, the loss on ignition determined and the residue digested with 5 c.c. of concentrated sulphuric acid for 2 to 3 hours. After cooling, the syrupy mixture of sulphates was poured into 100 c.c. of cold water and allowed to stand for half an hour. Heating at this stage to accelerate solution is inadvisable, as it sometimes causes the precipitation of a more hydrated thorium sulphate. After being filtered off and washed, the insoluble residue was again digested with sulphuric acid, washed, ignited and weighed. The silica in this residue was estimated by evaporation with hydrofluoric and sulphuric acids and the residue then remaining, which rarely exceeded 0·1 per cent., was examined separately for bases.

Total rare earths.—The combined sulphuric acid filtrates were made up to about 600 c.c., nearly neutralised with ammonia, acidified with about 10 c.c. of hydrochloric acid, and the rare earths precipitated by ammonium oxalate. After standing for 12 hours the rare earth oxalates were filtered off, ignited, re-dissolved, re-precipitated, and after standing, again filtered and well washed with a 1 per cent. solution of ammonium oxalate acidified with hydrochloric acid. The precipitate, after thorough ignition, was weighed as "total rare earths."

The filtrates from the oxalate precipitation were examined for further traces of rare earths, by evaporation nearly to dryness with nitric acid, solution of the residue in hydrochloric acid and precipitation in small bulk with ammonium oxalate. Any rare earths found were re-precipitated and added to the quantity found above.

Iron, aluminium, calcium and phosphoric acid.—The filtrate from the precipitations with ammonium oxalate was treated by Glaser's method (*loc. cit.*) for the estimation of iron aluminium, calcium and phosphoric acid (see p. 56).

Thoria.—Much work has been done during recent years on the estimation of thoria, and criticisms of several of the more important methods published have been made by Metzger.[7] The modification of the method of Fresenius and Hintz, employed by the author, has been used by him during the past five years with satisfactory results, and this method is essentially the same as the one adopted by buyers of monazite sand for industrial use. The "total rare earth" oxides obtained as described above were dissolved in hydrochloric acid, the solution diluted to 200 c.c. and heated to boiling; it was then nearly neutralised with ammonia, about 5 grams of sodium thiosulphate added, and boiled for half-an-hour. After standing at a temperature just below boiling for 8 to 10 hours, the precipitated basic thorium thiosulphate was filtered off, washed, dissolved in strong hydrochloric acid, and after nearly neutralising, re-precipitated by sodium thiosulphate. This precipitate was dissolved in hydrochloric acid and after filtering from the sulphur was precipitated as oxalate and weighed as thoria (ThO_2). In order to recover the small amount of thoria which sometimes passes into the thiosulphate filtrate it was found necessary to evaporate the solution with nitric acid. The rare earths were then precipitated as hydroxides, dissolved in hydrochloric acid and again treated with sodium thiosulphate, the thoria obtained being added to that already found. It was found that the recovery of the rare earths from the thiosulphate filtrate by precipitation with ammonia, as recommended by Metzger,[8] was in some cases incomplete unless the thiosulphate had been previously decomposed by means of acid.

Yttrium earths.—The total thiosulphate filtrates were evaporated to a low bulk and the thiosulphate destroyed by nitric acid as before. The solution was evaporated to dryness, the residue dissolved in a few c.c. of hydrochloric acid, diluted, and the remaining rare earths precipitated as oxalates. The precipitate was carefully washed free from sulphates, ignited, dissolved in concentrated hydrochloric acid and evaporated to dryness on the water bath. The residue so obtained was dissolved in 5 c.c. of water and about 200 c.c. of a saturated solution of potassium sulphate added, together with 5 grms. of finely powdered solid potassium sulphate. After standing for 12 hours, with occasional agitation, the precipitate of double sulphates of potassium with the cerium and lanthanum earths was filtered from the soluble yttrium earth sulphates and washed with a saturated solution of potassium sulphate. This precipitation was repeated on the insoluble sulphates. The yttrium earths in the combined filtrates were precipitated by a slight excess of ammonia, filtered, re-dissolved in hydrochloric acid, precipitated as oxalates and weighed as yttrium earth oxides (Y_2O_3, etc.).

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[1] Mineral Industry, 1909, **18**, 537.
[2] T. Crook, Science Progress, 1907, **2**, 30.
[3] T. Crook, Mineralogical Magazine, 1909, **15**, 260; 1911, **16**, 109.
[4] Chem. Zeit. 1896, **43**, 612.
[5] Zeits. anal. Chem. 1896, **35**, 525.
[6] Journ. prakt. Chem. 1843, **30**, 276.
[7] Journ. Amer. Chem. Soc. 1902, **24**, 901.
[8] Metzger (*loc. cit.*).

Ceria, lanthana, etc.—The precipitated double sulphates obtained as described in the preceding paragraphs were transferred, with the filter paper, to a beaker and boiled with 400 c.c. of water and 5 c.c. of hydrochloric acid until dissolved. The separation of the ceria from the other rare earth oxides present was effected by the following modification of Mosander's method. The earths were precipitated by ammonia, filtered, washed, dissolved in hydrochloric acid and the solution diluted to about 200 c.c. The solution was neutralised with potassium hydroxide and about 2 grams excess added. A current of chlorine was passed through the solution until the cerium had been converted into the hydrated peroxide and the lanthanum and allied earths had passed into the solution, which then reacted acid. The solution, which contained an excess of chlorine, was diluted to 400 c.c., allowed to stand for several hours, and filtered. After washing, the precipitate was redissolved, the potassium hydroxide and chlorine treatment repeated twice and the cerium finally precipitated as oxalate and weighed as the oxide CeO_2.

The filtrates, containing the remaining rare earths, were evaporated to a low bulk with hydrochloric acid, and the lanthanum and didymium earths precipitated as oxalates The precipitate after filtration was decomposed with nitric acid, the earths re-precipitated as oxalates, and after ignition weighed as the oxides, La_2O_3, etc.

Phosphoric acid. As mentioned on p. 55 the phosphoric acid can be determined in the residue remaining after the removal of the rare earths, but it has been found more convenient to carry out this determination on a separate portion of the original sample in the following manner. Half a gram of the finely ground monazite was fused with 5 to 7 grams of potassium carbonate in a platinum crucible for about 2 hours. The "melt" was dissolved in water, filtered, and after washing about a dozen times with one per cent. potassium carbonate solution the insoluble matter was ignited, again fused with potassium carbonate and the treatment repeated as long as any more phosphoric acid was extracted. Usually two fusions were sufficient. The combined filtrates were acidified with nitric acid, the phosphoric acid precipitated first as ammonium phosphomolybdate and finally as magnesium ammonium phosphate and after ignition weighed as $Mg_2P_2O_7$.

The accuracy of the above methods of analysis was tested by the examination of solutions of mixed rare earth salts of known purity. In these solutions the rare earths were present in about the same proportions as they occur in monazite sand. The results thus obtained are shown in the following table :—

TABLE 1.

Rare earth salt used.	Strength of solution.	Volume of solution taken.	Weight of salt taken.	Weight found.		Error.	
				Expt. 1.	Expt. 2.	Expt. 1.	Expt. 2.
	Grms. per litre.	C.C.	gram.	gram.	gram.	gram.	gram.
Thorium nitrate	$Tho_2=2{\cdot}1471$	50	0·1073	0·1068	0·1070	—0·0005	—0·0003
Cerium nitrate	$Ce_2O_3=10{\cdot}1491$	50	0·5074	0·5057	0·5064	—0·0017	—0·0010
Lanthanum and didymium chlorides	La_2O_3, etc. $=11{\cdot}3950$	50	0·5697	0·5688	0·5691	—0·0009	—0·0006
Yttrium earth chlorides	Y_2O_3, etc. $=2{\cdot}5880$	10	0·0258	0·0249	0·0254	—0·0009	—0·0004
Sodium phosphate	$P_2O_5=9{\cdot}7146$	50	0·4857	0·4864	—	+0·0007	—

The results obtained in the analyses of these new monazites are shown in the following tables :—

TABLE 2.—*Ceylon Monazite.*

Locality.	1. Monazite pebble from Aninkanda Morawak Korle.	2. Monazite pebble from Muladiwanella Durayakanda, Gilimale.	3. Sand from Niriella ganga.	4. Monazite pebble from Ratnapura.	5. Monazite pebble from Ratnapura.
Thoria .... ThO_2	9·75	9·49	10·75	10·29	28·20
Ceria .... Ce_2O_3	27·51	27·15	26·71	27·37	20·65
Lanthana and allied oxides .... La_2O_3, etc.	29·59	29·59	30·06	30·13	21·63
Yttria and allied oxides .... Y_2O_3, etc.	2·54	3·93	1·46	2·14	0·94
Ferric oxide .... Fe_2O_3	1·27	0·87	1·09	0·81	1·13
Alumina .... Al_2O_3	0·61	0·17	0·70	0·17	0·29
Lime .... CaO	—	0·45	0·85	0·41	0·10
Silica .... SiO_2	1·78	1·67	2·47	1·03	6·09
Phosphoric acid .... P_2O_5	26·12	26·12	24·61	27·67	20·20
Loss on ignition	0·59	0·48	0·93	0·20	—
Specific gravity	5·20	5·25	—	5·23	5·47

From these results and numerous partial analyses made at the Imperial Institute it is evident that the Ceylon monazite usually contains about 10 per cent. of thoria, which is nearly double the amount found in the monazite of Brazil. It must be mentioned, however, that as little as 5 per cent. of thoria has been found, by the author, in certain monazite sands from Ceylon, but material of this character appears to be of somewhat infrequent occurrence. Occasionally, specimens are met with having an unusually high specific gravity and a correspondingly high percentage of thoria, which it will be seen has reached over 28 per cent. (column 5 in Table 2). The Ceylon monazite in general is very similar in composition to one of the Norwegian varieties the analysis of which is given in Table 7.

Travancore Monazite.

Two specimens of this monazite gave the following results :—

TABLE 3.

	No. 1. Per cent.	No. 2*. Per cent.
Thoria	10·22	8·65
Ceria	31·90	61·11
Lanthana and allied oxides	28·00	
Yttria and allied oxides	0·46	0·62
Ferric oxide	1·50	1·09
Alumina	0·17	0·12
Lime	0·20	0·13
Silica	0·90	1·00
Phosphoric acid	26·82	26·50
Loss on ignition	0·46	0·45

* Isolated from a concentrate supplied by Mr. I. C. Chacko, B.Sc., State Geologist, Travancore.

These analyses show that the monazite of Travancore contains a high percentage of thoria approaching that of ordinary Ceylon monazite. According to E. White[1] from 6 to 14 per cent. of thoria has been found in Travancore monazite.

Malayan Monazite.

Monazite sand has been found in many localities in the Federated Malay States and the protected States of Kedah and Kelantan in association with alluvial tinstone.[2]

In Table 4 are the results of analyses of samples of typical monazites from this source received at the Imperial Institute.

These results show that there are wide variations in the percentage of thoria in monazite from Malaya, from the Perak specimen containing only 3·4 per cent. to that from Kelantan, which contained over 9 per cent. and is superior in this respect to the average Brazilian material.

Nyasaland Monazite.

The following are the results of an analysis of monazite separated from a concentrate obtained from a stream at Namalundo Hill, near Chiromo, in the Nyasaland Protectorate :—

TABLE 5.

	Per cent.
Thoria	7·10
Ceria	32·52
Lanthana and allied oxides	26·91
Yttria and allied oxides	1·50
Ferric oxide	1·10
Alumina	0·20
Lime	0·32
Silica	1·66
Phosphoric acid	28·16
Loss on ignition	0·25

TABLE 6.—*Nigerian Monazite.*

	Northern Nigeria.			Southern Nigeria.		
Number.	1.	2.	3.	4.	5.	6.
Locality.	Ekole.	Kadera, Central Province.	Jarawa river, Naraguta.	Iboboto stream, Nsan-Oban track.	Between Iboboto stream and Ebara river.	Ebara river.
Thoria	5·00	3·20	8·00	6·19	2·30	5·50
Ceria	30·72	36·53	30·50	30·38	34·58	31·40
Lanthana and allied oxides	30·02	30·00	28·80	29·60	29·83	29·20
Yttria and allied oxides	2·74	0·39	1·43	1·33	1·29	2·00
Ferric oxide	3·00	1·20	0·81	1·50	1·80	0·75
Alumina	0·35	0·10	0·20	0·10	—	0·05
Lime	0·15	0·21	0·17	0·16	0·19	0·10
Silica	1·20	0·63	1·79	0·85	0·73	0·82
Phosphoric acid	26·29	28·29	28·16	29·70	29·71	29·92
Loss on ignition	0·25	0·20	0·21	0·33	0·21	0·44

TABLE 4.

Locality.	No. 1.* Pahang.	No. 2.* Puchong Babi, river Kenring, Perak.	No. 3.* Kulim, Kedah.	No. 4. Kelantan.
Thoria	8·38	3·40	3·53	9·41
Ceria	25·46	33·74	64·05	
Lanthana and allied oxides	32·72	32·53		60·00
Yttria and allied oxides	2·80	0·91	2·40	2·82
Ferric oxide	0·84	0·65	0·64	1.13
Alumina	2·78	0·03	0·07	
Lime	0·61	0·33	0·17	0·29
Silica	0·92	1·45	1·08	2·20
Phosphoric acid	23·92	26·58	27·87	23·71
Loss on ignition	1·28	0·94	0·52	0·94

* Isolated from concentrates supplied by Mr J. B. Scrivener, M.A., F.G.S., State Geologist, Federated Malay States.

From the results of numerous partial analyses made at the Imperial Institute, by the author, on other samples of monazite from Nyasaland, it would appear that the average thoria content is about 6 per cent.

It would appear from analyses Nos. 4 and 5 above that monazite from different parts of the same locality and apparently derived from the same source, may contain widely different percentages of thoria, but further work is necessary to confirm this point, which is of some considerable scientific and commercial importance, particularly as monazite of the grade of sample No. 5 would not repay export to Europe. The above results show that the percentage of thoria in monazite from Nigeria may vary between fairly wide limits. The average thoria content of a large number of Nigerian monazites examined by the author is 5·5 per cent. for those from Northern Nigeria and 5·8 per cent. those from Southern Nigeria. The results show that these monazites, as a whole, are nearly as rich in thoria as those exported from Brazil.

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[1] " Thorium and its Compounds," p. 10.

[2] Bull. Imp. Inst., 1906, 4, 301 ; 1911, 9, 99.

For comparison with the foregoing results the following analyses of other monazites may be given :—

TABLE 7.

	1. Brazil.		2. United States.		3. Canada.	4. Australia.	5. S. Norway.
—	Espirito Santo.	Aleohaca, Bahia.	Amelia County, Virginia.	Burke County, North Carolina.	Ottawa County, Quebec.	Emmaville, New South Wales.	—
Thoria	6·06	6·50	14·23	6·49	12·60	1·23	9·34
Ceria	62·12	61·40	29·89	31·38	24·80	36·64	28·06
Lanthana and allied oxides			26·66	30·88	26·41	30·21	29·60
Yttria and allied oxides	0·80	0·70	—	—	4·76	—	1·82
Ferric oxide	0·97	1·50	—	—	1·07	—	0·66
Alumina	0·10	0·08	—	—	—	3·11	0·16
Lime	0·21	0·30	—	—	1·54	—	0·53
Silica	0·75	0·64	2·85	1·40	0·91	3·21	1·65
Phosphoric acid	28·50	28·46	26·12	29·28	26·86	25·09	28·27
Loss on ignition	0·38	0·64	0·67	0·20	0·78	—	0·21

1. S. J. Johnstone. 2. S. L. Penfield, Amer. Jour. Sci., 1882, **24**, 250. 3. F. A. Genth, Amer. Jour. Sci., 1889, **38**, 203.
4. C. Watt, Min. Res. New South Wales, p. 86 (Sydney, 1901). 5. C. W. Blomstrand, Geol. Föreningens Förhandt, 1887, **9**, 160.

The Constitution of Monazite.

The question of the state of combination of the thoria in monazite has received attention from various investigators.

Penfield[1] has suggested that monazite is a normal phosphate of the cerium earths and that thoria is present as an impurity, probably as the silicate thorite, and supports his view with numerous analyses, which show the ratios $(Ce,La,Di)_2O_3 : P_2O_5 = 1 : 1$ and $ThO_2 : SiO_2 = 1 : 1$. He also reported the occurrence in monazite of a substance which appeared "resinous" under the microscope and which he considered to be thorite. This view is supported by evidence adduced by Rammelsberg,[2] Dunnington[3] and others. Blomstrand,[4] on the other hand, considers that the mineral is a normal tribasic phosphate and that the excess of bases is combined with silica thus :—

$$m(3RO,P_2O_5)+2RO,SiO_2+pH_2O$$

where m may vary from 5 to 20 and p is less than 1. He does not support Penfield's thorite theory, but considers rather that thoria is a primary constituent of the mineral, occurring as phosphate in isomorphous admixture with the cerium phosphate. He attributes the presence of silica to alteration by silicious waters.

Kress and Metzger,[5] from a consideration of numerous partial analyses of monazite from Norway and North Carolina, conclude that thoria is present as phosphate and that the silica belongs to some unidentified silicate other than normal thorium silicate, but in almost every case they record percentages of silica which increase with those of the thoria. They could not detect the presence of the "resinous" constituent mentioned by Penfield.

In considering this question in relation to the analyses now presented, it is evident that those made on sand grains cannot be considered owing to the risk of inclusion, in the sample examined, of quartz in minute particles or dust. In these circumstances the only analyses in this communication available for discussion are those made on massive monazites from Ceylon. When these analyses are considered in relation to the views quoted above it is evident that they do not support Penfield's theory, for in no case is there sufficient silica present to combine with *all* the thoria to form the normal silicate ThO_2,SiO_2.

As regards the theory of Kress and Metzger (who do not support their conclusions by complete analyses) that the thoria is all present as phosphate, the analyses given in this paper do not show sufficient phosphoric acid to combine with the remaining cerium earths. Thus it would have to be concluded, if the theory of these authors be adopted, that part of the cerium earths is present as silicate or as oxides and on this point, at present, no evidence is available.

An attempt was made to detect the presence of thorium silicate in monazite by taking advantage of the fact that thorite, when reduced to the same state of subdivision, is more readily soluble in hot concentrated nitric acid than is monazite. 1·8 gram of finely ground Ceylon monazite containing 10 per cent. of thoria was heated for half an hour with concentrated nitric acid and the rare earths estimated in the filtrate. The experiment was repeated, using concentrated hydrochloric acid in place of nitric acid. The following is a summary of the results obtained :—

	Weight of rare earths in solution.	Weight of thoria in solution.	Ratio of thoria to rare earths extracted.	Ratio of thoria to rare earths in mineral.
	gram.	gram.	per cent.	per cent.
Nitric acid	0·1130	0·0223	19·7	14·03
Hydrochloric acid	0·2200	0·0390	17 7	14·03

These results indicate that the thorium constituent is slightly more readily attacked by concentrated acids than the cerium earth phosphates, but the difference is not sufficiently great to make an efficient separation possible. The results indicate, however, that there is in monazite a thorium constituent which is more readily soluble in nitric or hydrochloric acid than the cerium earth phosphates.

Further experiments showed that natural hydrated thorium silicate, in the form of the mineral thorite, shows practically no difference, as regards its behaviour with acids, from ignited artificial thorium and cerium phosphate.

It does not appear likely that experiments designed to separate thorium silicate from thorium phosphate and cerium phosphate will, even if successful, prove of general application to monazite, as experiments have shown that the solubility of thorite in acids is to a very large extent dependent on the state of hydration of the mineral. Thorites containing from 2 to 6 per cent. of combined water are attacked by nitric acid with the greatest difficulty, whilst those containing over 8 per cent. of water are readily decomposed.

From the results of the analyses given in this paper it is seen that the combined water in monazite varies between 0·2 and 1·2 per cent.

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[1] Penfield, Amer. Journ. Sci., 1882, **24**, 250 ; 1888, **36**, 322.
[2] Rammelsberg, Zeits für Kryst., 1879, **3**, 101.
[3] Dunnington, Amer. Chem. Journ., 1882, **4**, 138.
[4] Blomstrand, Zeits. für Kryst, 1887, **6**, 160 ; 1892, **20**, 367.
[5] O. Kress and F. J. Metzger, J. Amer. Chem. Soc.; 1909, **31**, 640.

It would therefore appear that if the problem is to be attacked from a solubility standpoint it would be necessary to consider the relative rates of solution of cerium phosphate and silicate and of thorium phosphate and silicate in nitric acid. Unfortunately, the available minerals containing these compounds occur in various degrees of hydration and are therefore not of service in this connection.

The author is indebted to Mr. G. S. Blake, B.Sc.(Lond.), A.R.S.M., for the analysis of sample No. 1 in Table 2, and to Mr. J. Shelton, F.I.C., for the analysis of sample No. 4 in Table 4. Thanks are also due to Mr. G. M. Davies, B.Sc. (Lond.), F.G.S., for the separation from the crude sands of the monazites dealt with in this paper.

Discussion.

Mr. E. **White** said that the figures for the thorium contents which were given in the books had to be regarded with suspicion. The earlier figures were of very doubtful accuracy before they were standardised and brought down to the present condition of knowledge. Mr. Johnstone had referred to his figures for the analysis of monazite from Travancore. It was true that the highest was 14 and the lowest 5 or 6 per cent. of thorium oxide, but the most remarkable specimen which had come under his notice was one from South Africa in the massive form, which although perfectly free from other minerals contained only about 1½ per cent. of thorium oxide. The Nigerian samples were interesting, but he understood that transport was difficult, so that unless a mineral was very rich it was not of commercial value in Europe on account of the freight. Serious efforts were being made to find some outlet for the other rare earths which were present in monazite sand. The use of cerium alloyed with iron in pocket pipe lighters appeared to provide an outlet for a large quantity of cerium, which was obtained as a by-product in the manufacture of thorium. A comparatively small quantity of cerium was used for medicinal purposes. Efforts were being made to utilise cerium on account of its forming two oxides, but at the present time it had not found very much use in that direction, and he believed that about three-fourths of the cerium remained practically unused.

Mr. W. F. **Reid** said that many years ago he was investigating the minerals of the Argentine Republic for the Government there, and, among other things, examined a number of sands. His party was driven by stress of weather out of the Argentine on to the Uruguayan coast, which was just opposite on the River Plate, and there he found a lot of pink sand in layers. He had kept samples weighing four or five pounds, and had quite recently handed them over to an expert, who had found a considerable proportion of monazite, zircons, and other minerals. The supply was almost inexhaustible although it could not be obtained all at once. There was hardly any tide, but there were frequent rises of the river, and whenever it rose the water left a pink blush on the sand. It was this pink sand that contained a considerable percentage of monazite. Whether it would be remunerative to work or not he did not know. The best samples were from Punta Caballos, on the Urugrayan bank.

The **Chairman** said that the presence of such a quantity of lanthanum was interesting. There was a great deal to be done in connection with the so-called rare metals and their alloys. In the case of cerium, the iron-cerium alloy seemed to be the only practical one at present, although other metals would alloy with cerium.

Mr. **Johnstone**, in reply, said that he strongly endorsed Mr. White's remarks regarding the unreliability of certain of the older analyses of monazite, both on account of the methods used for the determination of thoria and the impurity of the sample examined. He thought it was highly desirable that the method of analysis of rare earths and the purity of the sample examined should be stated clearly. He had found on record analyses of supposed pure monazite which included several per cent. of zirconia and oxides of tantalum and tin; obviously those were not samples of pure monazite.

THE ELECTRICAL CONDUCTIVITY OF MILK DURING ITS CONCENTRATION, WITH SUGGESTIONS FOR A PRACTICAL METHOD OF DETERMINING THE END POINT IN THE MANUFACTURE OF SWEETENED CONDENSED MILK.

BY LILIAS C. JACKSON, LESLIE McNAB, AND A. C. H. ROTHERA.

(Biochemical Department, University of Melbourne.)

The electrical conductivity of milk is determined by two sets of opposing factors; (1) the carriage of electrical charges by the ionised salts, and (2) the resistance offered by the proteins, fat, sugar, colloidal calcium phosphate, etc. In normal fresh milk the non-ionised salts, sugar, protein, and fat diminish the conductivity value by 12 per cent., or thereabouts. The effect of the protein alone, which has been accurately estimated, is 2·56 per cent. of the conductivity value for every 1 per cent. protein present in the milk.

It is therefore of interest to determine what is the effect on the conductivity, of concentrating the milk. Since the degree of ionisation becomes less on concentrating the salts, and the obstruction offered by the other solids becomes very great, it is almost certain that, with increasing concentration of the milk, there will be a gradual diminution in the increase of electrical conductivity, and ultimately a reversal, when the electrical conductivity will decrease for a further increase in the concentration of the milk.

In a series of experiments, 500 grms. of separated milk was concentrated at a temperature not exceeding 40° C. in a large distillation flask, fitted with condenser, and exhausted by an ordinary water pump. The electrical conductivity of the milk was measured at intervals. Following are the results of one such experiment:—

October 20th, 1911. Separated morning's milk (500 grms.): Total solids, 9·17 per cent.; sugar, 6·30 per cent.; fat, 0·35 per cent.; protein, 2·67 per cent.; ash, 0·80 per cent. Electrical conductivity, K=0·00570.

Sample.	Weight of concentrated milk.	Calculated solids.	Electrical conductivity.
	grms.	per cent.	
I.	223	20·21	K=0·00903
II.	203	22·21	K=0·00946
III.	172	26·15	K=0·00978
IV.	163	27·68	K=0·00983
V.	153	29·53	K=0·00978
VI.	126	35·86	K=0·00946

The turn in the conductivity values comes with sample IV., containing 27·68 per cent. total solids, and 8·01 per cent. protein.

The following is a summary of five such experiments all performed with the milk from the same cow. The figures are for the turning point in the conductivity values.

	Total solids.	Protein.	Electrical conductivity.
	per cent.	per cent.	
Oct. 13th—Morning	29·58	—	K=0·00912
Oct. 17th—Morning	27·36	8·4	K=0·00827
Oct. 20th—Morning	27·68	8·01	K=0·00983
Oct. 27th—Morning	29·43	7·86	K=0·00956
Oct. 30th—Evening	32·80	9·55	K=0·00992

It may be said that the maximum electrical conductivity is obtained when the separated morning's milk is concentrated to 28 per cent. total solids with 8 per cent. protein. The evening milk gives higher figures.

The actual total solids and protein were not determined in the condensed samples, the figures being obtained by calculation. Thus, the measurement of electrical conductivity will be of no value in determining the degree of concentration of a separated unsweetened milk, because the concentration may increase considerably between

25 per cent. and 30 per cent. total solids, with very little alteration of the conductivity.

It is quite different, however, with a sweetened milk concentrated to the degree which is usual in the manufacture of condensed milk. With full fat, and with added cane sugar equivalent approximately to 16 lb. sugar per 100 lb. milk, the reversal of the conductivity comes at the start of the process of concentration. When the concentration reaches the necessary degree for the production of sweetened condensed milk, the electrical conductivity decreases rapidly for each increase in concentration of the milk.

The following experiment will illustrate this point:—26th July, 1913, Bought morning milk. Fat 3·7 per cent. Protein 3·21 per cent. To 562 grms. milk was added 90 grms. sugar, making 652 grms. in all. A sample having been taken for the measurement of electrical conductivity, concentration was commenced on 630 grms. sweetened milk.

	Weight of milk and sugar.	Protein.	Electrical conductivity.
	grms.	per cent.	
Original	630	2·76	K=0·00321
Sample I.	602	2·88	K=0·00321
,, II.	574	3·03	K=0·00323
,, III.	474	3·67	K=0·00321
,, IV.	427	4·07	K=0·00311
,, V.	333	5·27	K=0·00245
,, VI.	293	5·93	K=0·00188
,, VII.	216	8·05	K=0·00034

NOTE.—The protein percentages represent the amount of protein in the combined milk and sugar.

The turning point of the conductivity comes with sample II., when only 56 grms. of water have been removed. Towards the end of the concentration the electrical conductivity decreases most markedly with each further removal of water. Consequently there is the necessary element of sensitiveness, permitting the measurement of the electrical conductivity as an indication of the degree of concentration.

The end point in the manufacture of sweetened condensed milk.

In a report issued during 1912, under the direction of the Local Government Board (England), the author, Dr. F. J. Coutts, says in discussing the control of the concentration process: "The determination of the precise moment at which to stop the condensing process requires skill and judgment"; and after discussing methods employed to determine the right degree of concentration, he adds: "It is not surprising, therefore, that variations exist." Determination of density by the hydrometer is in common use, but is unsatisfactory. The viscosity of the condensed milk makes it difficult to use it accurately. Viscosity measurements have been tried, but are inadequate as a means of determining the amount of concentration. The really accurate method is to condense to a given weight, but this is impracticable on the manufacturers' scale.

It is proposed, therefore, to discuss the measurement of electrical conductivity as a means of determining the degree of concentration, and to outline a method for its practical application.

The manufacturer of condensed milk deals with very large volumes of milk from numberless cows. Individual variations in composition will therefore vanish, and all morning milks will approximate to a standard, except for variations produced by climatic changes, and by the gradual progress of the season. The same will be true of evening milks, though here the general composition will be somewhat richer than with morning milk.

The variations in electrical conductivity of bulk milk from many cows have been determined in Melbourne (Australia) during four months of the year (Nov., Dec., Feb., March) with very great and sudden variations in temperature and humidity. The extreme figures were:

Minimum K = 0·00549. *Maximum* K = 0·00587.

The milks, however, with the higher conductivities were more concentrated milks, obtained during hot dry spells. With added cane sugar they may be looked upon, therefore, as equivalent to the poorer milks of wet cold weather slightly concentrated. On theoretical considerations, then, the turning point in the conductivity figures will come earlier with the richer milks, and so compensate for the fact that they are richer. In fact, the taking of electrical conductivity as a measure of the degree of concentration, will lead to the process being stopped slightly earlier when richer milks are being condensed.

If a direct measurement of the conductivity of the milk in the vacuum pan be made it will have to be corrected for the variations in temperature of the vacuum pan and contents. This correction can, however, be made by employing a resistance, whose variation with temperature shall be the same as the variation in resistance of the condensed milk itself.

This resistance must then be placed in the vacuum pan side by side with the conductivity cell which is being employed to take the resistance of the concentrating milk. The resistance chosen is a closed cell filled with a sample of condensed milk. The ratio of closed resistance cell to open "conductivity" cell, when each is filled with the same fluid at the same temperature, is determined, and it is then known that when this ratio becomes established during a concentration process, the fluid in the open cell (the milk, that is, which is being concentrated) must have the same resistance (and therefore electrical conductivity) as the condensed milk sample in the closed cell.

Naturally the resistance cell would be filled by the manufacturer with what he considers one of his best samples of condensed milk.

The method as just outlined has been tested in the laboratory and found to give satisfactory results on a small scale, the average error in ten experiments being ±0·3 per cent., and the maxamum error ±0·5 per cent. This maximum error, in terms of the percentage of water in the finished condensed milk, would represent a figure of, say, 26·00 per cent. water instead of 26·45 per cent. This is a considerably greater degree of accuracy than is usually obtained in manufacturing practice.

Consequently it may be said that, from theoretical considerations supported by experimental work in the laboratory, there is every reason to think that the measurement of electrical resistance or conductivity should furnish an accurate method of following the progress of concentration in the manufacture of sweetened condensed milk.

If the resistance cell were filled each week with a sample of what the manufacturer considered to be his best product of the previous week, the control of the manufacturing process would be gradually and progressively adjusted to seasonable changes in the milk.

It is hoped that the possibility of using a new and more accurate method in the manufacture of sweetened condensed milk may interest some of those concerned with that industry, and lead to electrical conductivity methods being given a trial in factory practice.

New York Section.

Meeting held at Rumford Hall, Chemists' Building, on Friday, November 21st, 1913.

MR. G. W. THOMPSON IN THE CHAIR.

A PECULIAR DUST EXPLOSION.

BY WILLIAM M. GROSVENOR, PH.D.

A question frequently of great interest is whether what is called a "dust explosion" really is primarily an explosion or primarily a fire followed at some later stage in proceedings by an explosion of some chamber wherein the quantity of reacting materials is sufficient and the products of combustion are sufficiently confined. Combustions of dust and air that result in so-called "explosions" generally begin at such points and create such havoc as to render exact analysis of the various stages of the reaction difficult, if not impossible. What renders this case of peculiar interest is that four excellent observers were present at the start of the trouble—two in fact saw the initiation of the combustion wave—and yet survived to bear witness. Fortunately, also, these men were not handicapped with imaginations, scientific or otherwise, and merely saw what they saw and told the story and stuck to it.

One Sunday morning two men were cleaning out a cylindrical starch dryer preparatory to some repairs. The dryer consisted of a horizontal drum of 2 in. wood, 4 ft. diameter, 20 ft. long, headed at each end, provided at one end with a 12 in. × 16 in. manhole and a 17 in. × 17 in. air inlet, provided at the other with a 17 in. × 17 in. air outlet. It also had a 10 in. inlet for starch on the upper side at one end and a similar outlet on the bottom at the other end. In the axis of this cylinder was a shaft having numerous arms carrying at their outer ends blocks of wood serving as shoes to lift and drop the starch through the hot air, also serving by their angular set to progress the starch slowly along the dryer from the inlet to the outlet end. The dryer being repaired was the lowest of a set of three, one above another, and part of a large installation of several such sets side by side. The three vertically above one another forming a set, were all connected at one end with the hot air supply duct and at the other with the exhaust duct. The various sets all connected to a large common air supply fan and a common exhaust fan. The lowest of the north set (the one being cleaned) stood about 18 in. clear above the floor, and all those involved were located in a 20 ft. × 40 ft. brick walled building—2 storeys factory construction without pillars, and having a heavy plank tar paper and gravel roof. The two cleaners had entered this lower left hand dryer and, owing to a breakdown in the city electric service, had cleaned out most of the starch in the dark. Being well used to the work, they had made a thorough job of it. To make sure that everything was well cleaned, one of them brought an ordinary lantern (against posted regulations) into the dryer, and they went over it again with counter brushes, working from the inlet end toward the outlet, and were almost through when the foreman came into the room by the door A, almost opposite the open manhole of the dryer being cleaned, spoke to his son (a pipefitter), who was lying on his back under the dryer tightening up a fitting, and then poked his head into the open manhole of the dryer and spoke to the two cleaners. The foreman then passed the ends of the other sets and started to open the door, B, to leave the building, when a rushing sound caused him to look around, and he saw a tongue of flame thrusting out from the manhole. He turned about as the tongue extended and started to duck under it, but it reached the wall opposite the manhole, mushroomed out, and he found himself enveloped in an atmosphere of flame through which he reached the door by which he had entered and thus made his escape, though severely burned. The son lying on his back under the dryer first noticed a roll of flame coming down around the side of the dryer cylinder, dropped his wrench, rolled over on his face and crawled out through the door, somewhat burned but not severely. Meanwhile the two cleaners were at the centre of disturbance. When the foreman spoke to them the Italian was squatting at the far end of the dryer facing the end with a counter brush, drawing the last of the starch that had been swept along to that end. The lantern was on the cleaned floor of the dryer at his back about 3 ft. from the end, and the German was standing stooped over the lantern about 5 ft. from the end and between the lantern and the manhole. Just as the foreman left the manhole and proceeded past the ends of the other dryers, the Italian reached his brush up into the inclined air outlet to brush off some starch, and may have knocked down a quantity of fine dust accumulated on the walls of the duct. A cloud of dust fell around his knees and spread back past him to the lantern. The German saw the dust reach the lantern, noticed the particles circulating round and round it, and then, as he put it, "the air all round the lantern took fire," the flame enveloped him and he started for the manhole, climbing over the stirring arms as fast as he could go. The Italian's first sight of the flame wave was as it advanced past his elbow from behind, flowing up the pipe and up around his shoulders and head. He describes its velocity, by movement of his hands, as about 2 ft. a second. He tipped himself over backward regardless of the lantern and, lying on his back, kicked and pulled himself head first the length of the dryer between the arms, started out of the manhole head first, reversed, and came out feet first. Both men describe the atmosphere in the dryer as first a mass of flame for a moment, followed by smoky blackness. These two men were seriously burned, the German most of all. None of the men found any obstruction to his path (except the arms inside the dryer), none heard any noise or explosion or felt any shock or blow, none showed any signs of mechanical injury (other than burns). All could see and hear and speak perfectly, and remained perfectly conscious throughout (although of course confused and uncertain in their purposes and movements after they got out). A passer-by on the railroad track about 150 ft. away felt a push of air, heard a "woof" like a big cough, and glanced over at the building to see the walls and windows jumping out, the roof lifted, and a 10,000 gallon water tank from the corner of the roof jumping bodily out into the lot. The fireman from the boiler house opposite the adjoining corner of the building heard a dull explosion followed by a crash, stepped to the door, and saw the walls down to within 3 ft. of the ground at the corner on which the tank had stood, and sloping diagonally up to points just below the roof line at the two adjoining corners. The dryer in which the men were burned was practically uninjured; the edges of the wooden shoes on the stirrer were slightly charred, as were the edges of the chimes and the manhole. The middle and bottom dryers of the other two sets were damaged, the heads blown out, some of the iron hoops broken and some of the staves cracked. Part of the automatic sprinklers in this room let go by fusion, not breakage, and deluged everything. The floor of the second storey fell on the tops of the dryers and sustained the wreckage of the roof, the mass taking fire, but being quickly extinguished by the sprinkler jets, most of the pipes of which were not broken.* Several pipes, including the big air conduit, fell between the ends of the dryers and the door out of which the foreman passed.

The times required for repeating the various movements of the men in escaping were carefully determined: Foreman, 5—8 seconds; son, 5—8 seconds; German and Italian, 15—20 seconds. The wreckage was carefully examined. No evidence of violence was apparent until the connecting pipes were passed and the flame had reached some chamber that enclosed a considerable volume well supplied with dust, *e.g.* the second storey room into which the rush of air ahead of the flame would have swept much dust from the pipes, or the other dryers covered everywhere inside with dust. The floor of the second storey, as indicated by markings on the ends of the girders, appeared to have been blown downward, the walls outward, most forcibly at the top, but also with some push from the gases in the first floor room. Neither timbers nor bricks were shattered—only broken in falling or pulling apart. At no point was there any evidence of the violence characteristic of the detonative wave, which calculation indicates would be about 6138 ft. per second or the accompanying pressure of 890 lb. per sq. in.

A study was made of the behaviour of the specially fine and dry dust collected from beams and other places where air-levigated material might lodge, and afterward specially dried. It was burned in falling from a hundred mesh screen, and of course burned quietly. The velocity of flame propagation through such a mass could easily be measured with approximate correctness upward or downward, and showed little increment. Burned in a 2-inch glass tube rotated and rapidly tapped, the flame velocity became constant at about 3 ft. per second, slow enough to be easily followed in its progress. Dummy dryers were made of several sizes and sifted starch dust ignited in them by a free flame, and the push of the flame wave roughly determined. In no case was it possible at or near the centre of propagation to get anything approaching an explosion. A No. 8 du Pont detonator failed to give markedly different results exploded in the confined dust in the absence of great quantities of admixed air.

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* It is perhaps opportune to point out the advantage of true w.i. pipe and malleable fittings for all sprinkler connections.

Let us review the facts. Two men at the centre of propagation suffered no mechanical injury. A third passed through the wave without being knocked down after it had travelled more than 20 ft. All three, some seconds after the initiation of the wave, passed without obstruction through a space which the explosion caused to be obstructed by pipe, etc. Only when the flame passed through conduits for a distance of 20 to 40 ft. and entered well dusted chambers, well-confined for their size, after a lapse of 10—20 seconds did "explosion" occur. Nowhere was the shattering effect of detonation observable, no "crack" was heard, and the only mechanical damage was of the "bursting" variety, found exerted only in chambers above described. The theoretical maximum velocity of the starch air detonating wave, if it were possible to initiate it, is so low as to be less than that of $CH_4+O_3+N_5$, which can barely propagate itself, and goes out sometimes by itself and more like that of $CH_4+O_3+N_{24}$, which burns but cannot be detonated. We were compelled to the conclusion that, for this material at least, explosion in any proper sense was necessarily preceded for some distance and an easily appreciable time by fire consuming the product of manufacture; that explosion finally supervened only as a result of gradual fire, accompanied by the temporary restraint in some container of the normal and gradual expansion of the combustible products, and that explosion actually occurred only when the container walls let go and permitted the sudden and violent expansion of these combustion products.

When the original ignition takes place in a container of large capacity the final effect follows quickly, and the impression conveyed may be that the dust and air mixture "exploded" because the giving way of the container when it explodes follows so quickly upon the fire, but the fire itself is without violence or detonative "crack." In long tight tunnels of large dust capacity it might be possible to create sufficient pressure after prolonged combustion to initiate a detonative wave but, with starch at least, this seems very doubtful both theoretically and from the results of practical tests. It is believed that no so called "starch explosion" can be other than the ultimate explosion of containing walls that have yielded to the gradually though perhaps rapidly accumulated pressure of the combustion products. The same conclusion seems to be justified (theoretically at least) for many other kinds of combustible dusts.

Discussion.

Dr. A. A. **Breneman** stated that almost every explosion presented features of peculiarity, some of which were extremely difficult to explain or understand. It was often necessary to reach a conclusion rather as a choice of alternatives than as a conclusion that could be fixed upon with certainty. It was therefore very interesting to have a record of such an explosion in which practically all stages of the explosion were under direct observation by surviving witnesses, even the first initiation of the flame wave. As to the question whether detonation could occur in dust explosions, he was in some doubt, since in certain coal mine explosions where the flame had travelled over 1000 ft., cumulative pressures and mechanical effects had been observed which seemed to indicate the initiation of a detonative wave. With coal, therefore, the question was still open to discussion, but he was not prepared to speak with regard to starch. One noticeable thing about all dust explosions was the extraordinary heat and consequent inflammatory effects produced by dust explosions as distinguished from explosions of gas mixtures. Whether this was due to the more condensed form of the combustible or to the impingement of the solid particles during the act of combustion, was difficult to say, but it was certainly a fact very generally observed that dust explosions were much more likely to lead to fires than the explosions of gas. One peculiar form of dust, finely divided metallic particles such as aluminium in flash-light powders, remained to be considered. In that case there could not be the transmission of flame by gaseous products evolved from the solid, so that it remained to be proved, either experimentally or by some terrible accident, whether the evolution of gas was necessary in order to account for the transmission of flame in dust explosions, or whether the transmission could take place from solid particle to solid particle.

Dr. L. H. **Baekeland** stated that one possible cause for explosions was always to be considered where a powdered material was being handled, viz., the friction between powder and other solids with which it might come in contact. Within his experience one very serious explosion had been caused by the static electricity generated through the contact of a material flowing down a wooden chute, and all recurrence of the phenomena had been prevented by installing metallic conveying chutes. This point was well recognised by those who happened to have had the experience, but he thought it should be brought to the attention of younger chemical engineers undertaking the design of plants where such material might be evolved.

Dr. W. M. **Grosvenor**, replying to Dr. Breneman, said that one great difference between coal dust explosions and explosions of the usual commercial dusts lay in the fact that coal dust was almost invariably accompanied by more or less gas evolved from the seams which, though it might not be present in large enough quantity to sustain a detonative wave, would of course enormously increase the rate of increment in the flame velocity, and probably serve in many cases to initiate detonation in mixtures of dust and air that would be incapable of reaching a detonating velocity without the presence of the gas. Furthermore, in considering starch particularly it was to be remembered that we were not dealing with the material containing 60 per cent. of combustible, but to some extent the $C_6H_{10}O_5$ molecule was six parts of combustible loaded in advance with five parts of water to be evaporated before combustion temperatures could be reached. This probably accounted for the low calculated velocity of detonation, because it gave a low heat of combustion. Unquestionably dust flames gave every evidence of a heating effect out of all proportion to the actual flame temperature, but it did not seem necessary to assume any considerable contact of the heated dust particles with the walls, nor any peculiar action of the dust particles in promoting a form of Bohn combustion in the gases, because if the precise mechanism of the transmission of heat from the exploding gases to the walls, timbers, or surrounding combustible material were considered, an all-sufficient difference would be apparent. When dealing with a mixture of combustible gases the only method of heat transference available was convection from the thin skin of gas in immediate contact with the wall, and the rise in temperature of the walls would necessarily be slow, however high the temperature of the gases, because it would be necessary continuously to replace by convection the cooled skin in order to raise the temperature of the wall surface. Against this action there would be the conductive capacity of the material constituting the wall, so that some time would be required before the immediate surface of the wall could reach an inflaming temperature. As compared with this the dust explosion presents an enormously greater rate of transfer, because the heated gases were loaded with incandescent solid particles, which, unlike the gases, were capable of transmitting heat at an enormous rate by radiation and transmitting it immediately to the surface of the wall, quickly raising the temperature to the inflaming point before the slow conduction of the wall material would have appreciable effect. For that reason it would probably be found that an explosion of metallic dust once initiated would be self-sustaining, because the radiating power of the dust particles at the front of the wave would be sufficient to raise the temperature of adjoining particles just ahead of the wave to that point where they were quite capable of being inflamed with the surrounding oxygen. It was his recollection that such explosions had occurred.

Commenting on Dr. Baekeland's recommendation, Dr. Grosvenor emphasised the necessity for caution as to the likelihood of explosion due to static causes, particularly in handling di-electric material. In one instance it had been found necessary to clothe completely every part of the machines coming in contact with a di-electric material, with a sort of metal skin, and to provide means like brushes or fixed connections for grounding carefully all of these parts to the water or steam mains.

Obituary.

W. POPPLEWELL BLOXAM.

W. P. Bloxam was born in 1860, and was the son of Dr. William Bloxam. He was educated at King's College School, and later took the B.Sc. degree of London University. Subsequently he became assistant to his uncle, Prof. Chas. Bloxam, at King's College. W. P. Bloxam's first appointment was at the Royal Naval College, Greenwich, where he was for 12 years demonstrator in the Chemical Laboratory. Later, he undertook research work on the anti-toxins, at the College of Physicians and Surgeons, and in 1901, he was sent to the Presidency College, Madras, as Professor of Chemistry. From Madras, he subsequently proceeded to the North of India to investigate the cultivation and production of indigo at the Dalsingh Serai Research Laboratory. After two years thus spent, he returned to England and was sent by the India Office to continue his researches in conjunction with A. G. Perkin, F.R.S., at Leeds University. After three years in Leeds he returned to London, and was appointed Scientific Adviser to the Sulphate of Ammonia Committee. He died December 26, 1913, aged 53 years. (W. P. Bloxam's more important work on the indigo question is referred to in this J., 1901, 746; 1906, 735; 1908, 597; 1909, 516; 1910, 872.)

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Superheating steam. P. St. G. Kirke and Bonecourt Surface Combustion, Ltd., London. Eng. Pat. 25,054, Nov. 1, 1912.

Steam generated by boilers such as described in Eng. Pats. 4362, 11,865, and 17,560 of 1910, 2404 of 1911, and 5936 of 1912 (this J., 1911, 406, 731; 1912, 110) which utilise the intense combustion of a mixture of fuel and air in contact with incandescent porous refractory material as described in Eng. Pats. 25,808 and 29,430 of 1909 (this J., 1910, 1448), is superheated by passing it through U-tubes or the equivalent introduced into the end portions of the boiler tubes.—H. H.

Evaporating liquids; Rotary dryers for ——. H. B. P. Humphries and J. B. Donald, London. Eng. Pat. 28,902, Dec. 16, 1912.

The liquid (tanning extracts, milk, calcium acetate solution, etc.) is led to the inner surface of a hollow steam-jacketed drum which rotates about a horizontal axis and is open at the ends. A flange at each end of the drum retains the liquid. The solid residue is continuously removed by a scraper and conveyor which passes through one of the open ends. The drum may be enclosed in a casing for vacuum working.—A. T. L.

Evaporating pans or *surfaces for brine and the like.* R. Stein, Hanover, Germany. Eng. Pat. 9570, April 23, 1913.

Salt pans are coated with a layer 2 to 3 cm. thick of "Fama" asbestos composition, which is composed of magnesite, magnesium chloride, asbestos fibre, and substances such as talc or infusorial earth. This material is applied in the form of a paste and may be reinforced by embedding in it metal wire or gauze. The pans may be formed wholly of this material, a thickness of 3 cm. being used. The material provides a smooth surface which does not contaminate the salt or cause it to "burn."
—A. T. L.

Concentration, evaporation and incineration of liquids such as soda lyes, residual liquors and other solutions; Furnace for the continuous ——. F. Woleský and R. Voleský. Fr. Pat. 460,559, July 21, 1913. Under Int. Conv., Aug. 14, 1912.

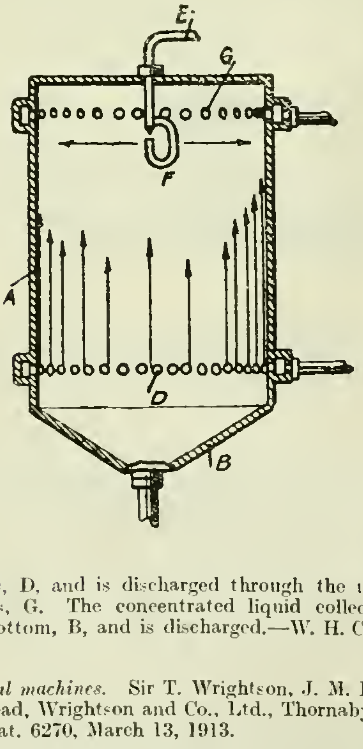
The apparatus consists of a tower at the sides of the base of which are suitable furnaces from which the hot gases pass upwards. At the top of the tower is a pan evaporator open above and having passages for the gas around and through it. Below are placed a series of superposed annular pans with radial extensions projecting inwards so that the gases pass upwards between the outside of the annulus and the tower and also up through the quadrant-shaped spaces between the radial extensions. Below each annular pan is a bridge or grating of refractory bricks or metal bars, crossed at right angles. The liquor from the pans overflows on to these gratings and is further concentrated. The liquid is fed into the top pan, and after undergoing a preliminary concentration there, flows into a vertical pipe which passes down outside of the tower and from which it flows by valve-controlled branches which pass through the tower to the centre of each annular pan.
—W. H. C.

Desiccation of liquids and other analogous substances; Process and apparatus for the ——. M. Töpler. Fr. Pat. 460,992, July 31, 1913. Under Int. Conv., May 6, June 10 and 20, 1913.

The liquid is projected by a current of compressed air in a horizontal direction and in a very fine state of division into a chamber so that each particle of atomised liquid remains separate and follows the path of its trajectory to the bottom of the chamber. Jets of air or other drying medium are delivered both above and below the stream of atomised particles either at an angle to or parallel with the stream, so that each particle remains surrounded by the drying medium during the whole time of its fall and is thus very rapidly converted into a dry powder at a low temperature, below 40° C. The dried powder is removed by a travelling belt placed a short distance above the floor of the chamber. The outlets for the moisture-laden air are in the side of the chamber below the belt. During the process the particles may be subjected to the action of ultra-violet rays or treated in other ways to effect sterilisation or chemical change.—W. H. C.

Evaporation and concentration of solutions and effecting chemical reactions; Apparatus for ——. G. A. Krause. Fr. Pat. 460,895, July 30, 1913. Under Int. Conv., July 31, 1912.

The liquid is fed into the vessel, A, through the atomiser, E, F, and is evaporated by a current of hot air or other suitable medium which enters through the lower ring of orifices, D, and is discharged through the upper ring of orifices, G. The concentrated liquid collects in the conical bottom, B, and is discharged.—W. H. C.



Centrifugal machines. Sir T. Wrightson, J. M. Ringquist, and Head, Wrightson and Co., Ltd., Thornaby-on-Tees. Eng. Pat. 6270, March 13, 1913.

The material is slowly introduced into a concave vessel or trough having its concavity directed towards an axis about which it is revolved, the axes or longer edges of the trough or troughs being parallel to the axis of rotation. The material is led into the troughs through a stationary axial pipe connected to a number of radial pipes, and it enters either the top or bottom ends of the troughs. Within each trough works a slowly revolving scraper. When in operation the separated liquid overflows at the end of the trough opposite to the supply pipe, the edge of the end partition being somewhat below the general level of the edges of the trough, and is thrown by centrifugal force into an annular collecting channel. The separated solids are forced by the scrapers over the longer edges of the troughs and discharged by centrifugal force into a surrounding casing. In a modified form, the troughs are formed by an endless belt of porous material passing round rollers, the liquid in this case passing through the belt and the solid being discharged as soon as it is brought by the movement of the belt to the side remote from the axis of rotation.—H. H.

Inflammable liquids; Method of and apparatus for conveying —— by means of a neutral liquid. B. E. D. Kilburn, London. From Martini und Hüneke Maschinenbau-Akt.-Ges., Berlin. Eng. Pat. 22,400, Oct. 4, 1913.

Petrol, etc., is discharged from a tank by the admission thereto of water or other neutral liquid from an upper tank connected by a siphon with the petrol tank. The petrol supply pipe is surrounded by a safety jacket which is connected with the uppermost point of the siphon, so that in the event of breakage, air would be admitted to the siphon and further discharge of petrol prevented. The petrol discharge cock is connected with a three-way cock on the siphon, controlling a by-pass opening to the atmosphere, so that when the discharge cock is closed, the water at the bottom of the petrol tank is subjected to atmospheric pressure only.—H. H.

Storage or conveyance of [inflammable] liquids. Martini und Hüneke Maschinenbau-Akt.-Ges., Berlin. Eng. Pat. 22,515, Oct. 6, 1913. Under Int. Conv., Oct. 5, 1912.

In conveying an inflammable liquid under pressure through a pipe line, it is necessary to prevent the outflow of liquid in the event of the breakage of the pipe. The liquid is forced through the pipe by admitting water to the storage tank. The pipe is jacketed and the water flows through the whole length of the jacket before entering the tank. In the event of breakage, the supply of water is thus stopped. The water is led to the storage tank by a branch from the highest point of the jacket, so that after breakage there is no temporary flow due to hydrostatic pressure.—A. T. L.

Vacuum-dryers; Method of feeding material to or from ——. F. J. Stokes, Philadelphia, Pa. U.S. Pat. 1,080,602, Dec. 9, 1913.

The material is caused to pack against the inlet and outlet valves so as to form a seal when the valve is opened. —W. H. C.

Dryer; Rotary ——. L. F. Griswold and C. B. Smith, Cleveland, Ohio. U.S. Pat. 1,080,629, Dec. 9, 1913.

The material is fed from a shoot by means of a screw-conveyor through an eccentrically disposed hollow trunnion into a cylinder which is rotated eccentrically and obliquely within an outer chamber. Heated gases from a furnace are discharged into the front end of the chamber from below and pass along and enter the lower end of the rotating cylinder through a second eccentric hollow trunnion and are withdrawn by a fan through a branch on the feed shoot. The dried material is discharged into a receptacle at the lower rear end of the outer chamber. —W. H. C.

Dryer; Centrifugal ——. J. V. Kranebiel, Williamsville, N.Y. U.S. Pat. 1,080,700, Dec. 9, 1913.

A flexible strip of material is wound upon a vertical shaft and the articles to be dried are placed between the folds of the material. Means are provided for preventing the strip from unwinding, and the whole is rotated, the centrifugal force serving to drive the moisture out of the articles.—W. H. C.

Nodulising materials; Mechanism for ——. L. P. Ross, Standish, N.Y., Assignor to Northern Iron Co. U.S. Pat. 1,081,063, Dec. 9, 1913.

An inclined rotary furnace is fitted with separable sections provided with communicating water passages. The ends of different sections communicate through hollow rings fixed to the furnace, and water is supplied to the movable rings from stationary hollow rings within which the movable rings revolve.—T. St.

Smoke-separator. C. F. Holmes, Assignor to J. Friebis, Beaumont, Tex. U.S. Pat. 1,081,116, Dec. 9, 1913.

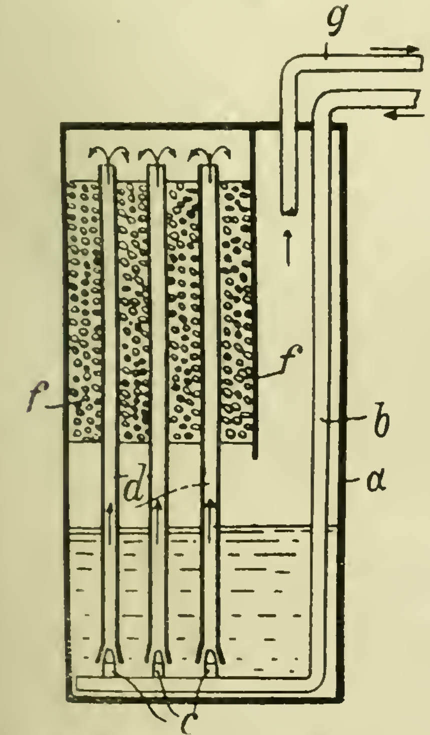
The smoke and gases from the apparatus are drawn through a flume by a suction fan situated at the end remote from the apparatus, and are discharged under water in a precipitating tank. Water is delivered in jets into the latter, whose contents can be discharged through a valve at the bottom into a settling tank. The flume is provided with a series of connected cooling coils arranged vertically and transversely, water being supplied to the coils at the outlet end of the flume. The bottom of the flume is provided with openings, and transverse, inclined, deflecting plates, and underneath are arranged soot-receiving receptacles.—T. St.

Separating suspended solids from liquids; Process and apparatus for ——. A. Jarraud. Fr. Pat. 460,170, July 9, 1913.

The mixture is placed in a series of filter vats in a chamber. Hertzian waves are caused to pass through the liquid from a set of wires stretched across the upper part of the chamber over the vats to a second set of wires stretched across the chamber below the vats and at the same time the chamber is cooled, whereby, it is stated, the finely divided solid particles become agglomerated so that they can subsequently be easily filtered off.—W. H. C.

Saturation, absorption, purification, decomposition and synthesis; Physico-chemical apparatus for ——. P. L. J. Mignet. Fr. Pat. 460,877, Oct. 15, 1912.

A casing, *a*, has an inlet tube, *b*, through which the gas or air enters under pressure and escapes through the nozzles, *c*. The gas or air passes up the tubes, *d*, which act as air lifts, carrying the liquid with it, and the mixture returns downwards through the annular channels, *f*, which are packed with suitable materials. The gas finally escapes through the tube, *g*.—W. H. C.



Separating mixed liquefied gases; Process of ——. A. C. Morrison, Chicago. Eng. Pat. 29,383, Dec. 20, 1912.

See U.S. Pat. 1,056,043 of 1913; this J., 1913, 426.—T.F.B.

Fractional distillation. M. A. Rosanoff, Worcester, Mass., U.S.A. Eng. Pat. 9654, April 23, 1912. Under Int. Conv., April 29, 1911.

See Fr. Pat. 443,054 of 1912; this J., 1912, 1020.—T.F.B.

Distilling apparatus. E. A. R. Chenard, Cognac, France. Eng. Pat. 15,625, July 7, 1913. Addition to Eng. Pat. 10,783 of 1913, dated May 7, 1912.

See Addition of July 8, 1912, to Fr. Pat. 443,499 of 1912; this J., 1913, 184.—T. F. B.

Separating liquids from separated solids; Process of recovering ——. F. I. du Pont, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington. U.S. Pat. 1,081,949, Dec. 23, 1913.

See Eng. Pat. 17,602 of 1910; this J., 1911, 1037.—T.F.B.

Smoke from furnaces and the like; Apparatus for the treatment of ——. W. L. Thomas, Wheatley, Assignor to The Smoke Eliminator Synd., Ltd., London. U.S. Pat. 1,082,245, Dec. 23, 1913.

See Eng. Pat. 28,976 of 1910; this J., 1912, 216.—T. F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Dunn pulverised coal burner; The ——. G. A. Rونsh. Metall. and Chem. Eng., 1914, 12, 19—20.

This burner was devised especially to ensure uniform feed of the powdered coal. Essentially it consists of a feed pipe through which the coal is conveyed from the storage bin, by means of a feed screw, to a perforated plate; the perforations in the plate and the rate of feed are so adjusted that the coal just reaches the end of the perforated plate. Immediately below this plate is the usual air nozzle. The mixture of coal dust and air is ignited by the heat radiated from the furnace walls. When used for firing cement kilns, only about two-thirds of the air, necessary for combustion, is supplied at the nozzle itself, the remainder being provided nearer the kiln from a pipe which passes through the hot clinker. The substitution of these burners for oil burners is said to have resulted in a saving of about 75 per cent. of the cost of fuel for calcining, whilst the capacity of the kiln was increased by about 25 per cent.—T. F. B.

Gas retorts; The corrosion of ——. Times Eng. Suppl., Jan. 7, 1914, 2. (See also Zinck, this J., 1913, 1000.)

Careful observations of the extent of corrosion are being made with the retorts in use at the Nechells gasworks of the Birmingham Corporation. Although most of the corrosion of the fireclay material of the retorts may be due to the presence of sodium chloride, it is the total soluble salts, and not necessarily the chlorides alone, which are responsible for the damage. Furthermore the simple presence of chlorides is not a true indication of the possible corrosive effect of the coal on the retorts. A number of coal analyses showed that the proportion of chlorides present might differ by over 100 per cent.; this may be due to imperfect washing of the coals at the collieries, or to the same washing water being used over and over again and gradually becoming more and more concentrated in soluble salts. Not only so far as the fireclay material is concerned is the presence of excessive quantities of chlorides undesirable, but recent experience with intermittent vertical retorts has shown that "pitching-up" in the hydraulic main may be partly attributed to the same compounds. An examination of the pitch so formed showed that the chief binding material was ammonium chloride. Arrangements were accordingly made to run both hot water and tar through the hydraulic main, the former taking up the chlorides before they could come into contact with the tar. In this way no trouble was experienced with the pitch for a period of six weeks, whereas formerly three days of freedom had been the limit. Removal of the ammonium chloride by washing in this manner introduces the possibility of being able to recover the ammonia of coal to a large extent as chloride instead of as sulphate, which at present is the common practice. In view of the relative values of the two substances, the recovery of ammonium chloride should be a profitable process, for the present prices are from £27 to £44 per ton, according to quality, whereas sulphate fluctuates in the neighbourhood of £13. As regards the chloride water drawn off from the hydraulic main, however, it is a question whether the removal of the various impurities, sulphocyanide, and traces of iron, and finally concentration and crystallization, might not be too costly.

Naphthalene problem: The —— in America. J. Gas Lighting, 1913, **124**, 950—952.

A Committee of the American Gas Institute submitted a number of questions to gas companies using all the different methods of making coal-gas, and obtained full replies in nine cases. The crude gas from vertical retorts and from chamber ovens contained comparatively little naphthalene. The tar from vertical retorts was practically free from naphthalene, the quantity present in the tar from chamber ovens was low, and in the tar from inclined and horizontal retorts, high. The production of naphthalene was increased by using light charges. Water-gas tar was used for extracting naphthalene in all cases, the quantity varying from 0·05 to 0·25 galls. per 1000 cb. ft. of gas. Water-gas tar itself was liable to contain much naphthalene if the superheater had been operated above 1380° F. (749° C.). In one case, the purified gas contained an average of 282 grains of naphthalene per 1000 cb. ft. without causing trouble in the distributing system. Stoppages were often cleared by the use of steam and gasoline, but a copious stream of boiling water or a heavy oil such as crude oil was preferable. It is suggested that in laying-out new plant, chamber ovens, vertical retorts, or long horizontal retorts should be adopted, the gas should be thoroughly cooled at the works, and cataract washer-coolers and a simple naphthalene washer should be used. When coal-gas is distributed alone and is not enriched, a cooling plant located at the outlet of the works, so that there is no further cooling in the mains, is suggested, in order to prevent crystallisation of naphthalene following upon the condensation of water from the gas.—A. T. L.

Oil fuel; The future of ——. B. Redwood. J. Roy. Soc. Arts, 1913, **62**, 103—116.

The world's output of petroleum has increased from 22,000,000 metric tons in 1901, to 46,500,000 metric tons in 1911, or from 2·8 to 4·3 per cent. of the world's output of coal. The principal sources of petroleum are shown in the following table :—

	Percentage of total output.		
	1910.	1911.	1912.
United States	63·52	63·30	63·25
Russia	21·82	19·45	19·37
Mexico	1·01	4·03	4·71
Rumania	3·07	3·32	3·70
Dutch East Indies	3·26	3·50	3·09
Galicia	4·00	3·15	2·43
India	1·84	1·83	2·03
Other countries	1·48	1·42	1·42

The demand is increasing more rapidly than the supply and the course of future developments depends upon the extent to which supplies can be increased, and also upon the manner in which the oil is used. The supply from Russia is likely to increase in 1914, and there are large areas still undeveloped. The supply from Mexico will become much more important, but it may be entirely absorbed by the increasing demand in the United States. There has been a very great increase in production in California, and this State is being rapidly transformed from an agricultural to a manufacturing country. Increased supplies may also be expected from the Dutch East Indies, Roumania, Peru, Alberta, Persia and Trinidad. Oil fuel is at present used as motor spirit, in place of coal for raising steam, and in Diesel and semi-Diesel engines. The increasing demand is most marked in the case of motor spirit, and methods of increasing the yield of petrol, of obtaining motor spirit from coal-tar and from shale oil, and the use of alcohol in place of petrol are discussed (compare this J., 1913, 819). The consumption of petroleum for naval purposes is rapidly increasing, the oil being used both for raising steam and for driving Diesel engines. All new warships for the U.S. Navy are designed for oil-fuel, and an area of about 100 sq. m. of oil-bearing lands in California has been set aside as a reserve supply. Large quantities of oil-fuel are used on locomotives on the Russian State Railways, and the advantages are such that oil would be largely used in this country if adequate supplies could be obtained at a moderate price. In view of the limited supplies, the principal development in the near future, apart from naval requirements, will be in the use of Diesel and semi-Diesel engines, since the high thermal efficiency of these engines makes it profitable to use oil fuel at a price which would be prohibitive for steam raising. If the market value of oil fuel becomes established on this basis, it will not be possible to use oil largely in place of coal for raising steam.—A. T. L.

Mineral oils: The constituents of high-boiling ——. J. Marcusson. Mitt. Kgl. Materialprüf., 1913, **31**, 301—318.

The author endeavours to answer by a process of elimination the question—which of the constituents of a mineral oil is responsible for the lubricating power. It is known already that the removal of cyclic and alicyclic unsaturated hydrocarbons by the formolite reaction increases the fluidity (this J., 1911, 842 and 1913, 589). The olefines hardly come into consideration as they are present in very small amounts in high-boiling oils: the best machine oils show always a low iodine value. Of the saturated hydrocarbons, which react neither with formaldehyde nor with iodine (paraffins and naphthenes), the paraffins may be eliminated as their fluidity and lubricating value is known to be low compared with the simplest naphthene. (The addition of solid paraffin to an oil lowers its value considerably.) The simple naphthenes occur mainly in the fractions below 300° C. in petroleum distillation, also a consideration of the elementary analysis of good machine oils, after removal of the bulk of the unsaturated bodies by the formolite reaction, shows that the residue must consist mainly of polynaphthenes. The high-boiling fractions of petroleum show a molecular weight of 300 to 400, and 350 corresponds to a polynaphthene containing 25 atoms of carbon. Such hydrocarbons must be the main cause of the lubricating power of a high-boiling oil. A similar process of elimination brings the author to the conclusion that the optical activity also of the high-boiling oils is due to the polynaphthenes.—J. B.

Petroleum oil and mineral wax; Analysis of ——. H. Kantorowicz. Chem.-Zeit., 1913, **37**, 1394—1396; 1438—1441; 1565—1567; 1594—1595.

Determination of asphaltum in mineral oil.—Asphaltum is insoluble in boiling ethyl acetate, whereas petroleum oil, paraffin wax and ceresin are readily soluble. Five grms. of the oil are boiled with reflux condenser for 15 minutes with 220 c.c. of ethyl acetate, the liquid filtered hot, and the residue boiled with successive portions (20 c.c.) of the solvent, until the washings (about 300 c.c.) are colourless. The residue of asphaltum is then dissolved in hot benzene, the solution evaporated in a weighed glass basin, and the residue weighed. The results are lower than those obtained by the alcohol-ether method, since the residue in that case consists of a mixture of asphaltum and ceresin. The amount of asphaltum insoluble in petroleum benzine ought also to be determined. As a rule American cylinder oils contain asphaltum insoluble in ethyl acetate, but not in benzine, whilst other oils (*e.g.* Roumanian, Russian) yield a large residue with benzine, but little with ethyl acetate. *Determination of ceresin and paraffin wax.*—Paraffin wax may be separated from petroleum oil, without preliminary distillation, by means of propyl acetate at a low temperature, the oil remaining in solution at −20° C. Five grms. of the petroleum residue (freed from petroleum spirit and light oils) are boiled for 15. mins. under a reflux condenser with 40 times the volume of ethyl acetate, and the asphaltum separated as described above, the filter being extracted with the solvent in Lehmann's apparatus. The filtrate, extract and washings are evaporated, the last traces of ethyl acetate removed in a current of air, and the residue dissolved in 40 c.c. of boiling propyl acetate. The solution is cooled to −20° C., filtered at −20° C. in Holde's apparatus and the residue washed with 80 c.c. of the solvent at the same temperature, after which it is dissolved in hot benzene, the solution evaporated, and the residue of paraffin wax and ceresin heated until constant in weight. With the exception of a trace of colouring matter it is pure. The results are invariably higher than those given by the alcohol-ether method after distillation, the difference (loss on distillation) being about 1·4 per cent. *Differentiation of natural and artificial vaseline.*—Artificial vaseline, prepared by mixing ceresin with vaseline oil, yields on treatment with propyl acetate a hard paraffin wax, which when repeatedly washed with boiling alcohol, becomes harder, quite solid and colourless, through the removal of waxes of lower m. pt. Natural vaseline, however, leaves a yellow residue, from which boiling alcohol dissolves a solid white wax, leaving a viscid yellow substance melting below 0° C. *Examination of bitumen.*—Separation of asphaltum by treating the bitumen with a mixture of benzene and petroleum benzine is incomplete, but quantitative results may be obtained by extracting the sample for several days with ethyl acetate. This dissolves the oil and resinous constituents, and on extracting the residue with benzene, hard asphaltum is dissolved and inorganic constituents are left. For example, 52 per cent. of hard asphaltum was thus separated from a natural asphaltum, whilst a petroleum pitch yielded 20 per cent. *Examination of ceresin and ozokerite.*—For the precipitation of ceresin 1 grm. of the sample is dissolved (beneath a reflux condenser) in 100 c.c. of boiling propyl acetate, and the solution cooled to 30° C. and kept at that temperature for 10 mins., after which the mass is rapidly filtered and pressed with a spatula. The residue is dissolved in boiling benzene, the solution evaporated, and the residue of ceresin dried for 10 minutes at 105° C., weighed and its m. pt. determined (capillary tube method). The m. pt. of the dissolved paraffin wax is also determined fter drying for 10 mins. at 105° C. Crude ozokerite is reed from asphaltum by extraction with ethyl acetate n Lehmann's apparatus, the extract evaporated, and the eresin determined in the residue by treatment with ropyl acetate as described. *Oxidisability of mineral oils.*—The usual tests as to the formation of tar, resinification, tc., are made in comparison with the determination of the ecrease in weight on heating, and determination of the sphaltum both by the petroleum benzine and ethyl acetate ethods. The loss in weight is conveniently determined a closed apparatus with an outer chamber in which a itable liquid may be heated, whilst a weighed quantity of e oil (50 to 60 grms.) is placed in a glass dish in an inner hamber, with an inlet and outlet for a current of air or ert gas. For testing machine oils the sample is heated for hours at 218° C. and for 8½ hours at 133° to 135° C., whilst linder oils are heated for 8 hours at 218° C. The lower mperature is obtained by charging the outer chamber th xylene or a suitable petroleum fraction, whilst phthalene is suitable for obtaining the higher temrature.—C. A. M.

phthenic acids and sodium naphthenate. J. Davidsohn. Z. angew. Chem., 1914, 27, 2—4.

E mean molecular weight of naphthenic acids is almost same as that of the fatty acids of cocoanut oil and m-kernel oil. Like the latter acids, a portion of phthenic acids is volatile in steam; the acids so volatid have a mean mol. wt. of 213·7, corresponding to an d value of 262. Compared with other sodium soaps, oanut and palm-kernel oil soaps require large quantities salt for their separation from solutions; the sodium p from naphthenic acid requires even more salt, comparative figures being: cocoanut oil soap, 13·1; palm-kernel oil soap, 10·9; naphthenic acid soap, 20·9. Sodium naphthenate also resembles cocoanut and palm-kernel oil soaps in its high lathering power and its low hydrolytic dissociation; these properties would indicate its suitability for many purposes, especially in the textile industry, such as for silk boiling, where a soap with a mild action is required.—T. F. B.

Use of pulverised coal in metallurgical furnaces. Lord. *See* X.

Patents.

Screening or grading and conveying coal, coke, and other materials; Method of and means for ——. R. S. Benson, Middleton St. George, Durham, and Head, Wrightson and Co., Ltd., Thornaby-on-Tees, Yorks. Eng. Pat. 28,115, Dec. 5, 1912.

The material is fed on to a perforated tray hinged at the discharge end to a conveyor trough reciprocating beneath it, and connected at the supply end with the trough by a bell crank lever adapted to impart a vertically reciprocating movement in addition to the horizontal one. Or, the trough may be perforated and arranged above the tray, which in this case is attached by bell crank levers at both ends; the smaller pieces fall through on to the tray where they are subjected to a further screening action.—H. H.

Coal-washing plant. R. Thomson, Hamilton, Lanarkshire. Eng. Pat. 4451, Feb. 21, 1913.

The sediment from coal-washing liquors is removed from the settling tank by means of dredger buckets while the liquid is pumped on to a filter bed having a vacuum chamber beneath. The invention is analogous to that described in Eng. Pat. 28,548 of 1911 (this J., 1912, 1114).—H. H.

Briquette fuel; Artificial ——. E. Eaton, London. Eng. Pat. 7643, April 1, 1913.

Briquettes made according to Eng. Pat. 6981 of 1912 (this J., 1913, 187) are formed from the following mixture, viz.: 60 lb. of ground chalk damped with 3 lb. of crude oil or petroleum, 30 lb. of small coal or ground peat or coke, and 10 lb. of solidified tar.—H. H.

Briquettes; Manufacture of —— *from coke dust, alone or mixed with wood waste.* J. Alexander. Fr. Pat. 461,065, Aug. 2, 1913.

To ensure the removal of all air from the pores of the coke, a very fluid tar is used as binder, and the mass is briquetted under a pressure of 100 atmospheres. A suitable material is the tar obtained in making gas from oil, and the soot deposited in the oil-gas retorts and in the pipes may be added with the tar. The absence of air from the pores of the briquettes enables them to burn without disintegration.—A. T. L.

Coke oven heated by blast-furnace gas or producer gas; Regenerative ——. Soc. Générale de Fours à Coke, Systèmes Lecocq. Fr. Pat. 460,399, July 15, 1913. Under Int. Conv., Sept. 4, 1912.

In order to ensure the distribution of air and gas in a simple manner, and to permit of the independent control of air and gas to each combustion chamber, four sole flues arranged beneath each oven chamber are connected in pairs with the regenerators so that two serve for air and two for gas, whilst the four flues beneath the adjacent oven chamber serve for the passage of the combustion products. The regenerators are arranged beneath the oven in the manner described in Fr. Pat. 457,674 (this J., 1913, 1000), alternate regenerators serving for air and gas. Each regenerator is connected by one conduit with two of the sole flues, and separate dampers are provided for regulating the openings from this conduit to each of the sole flues.—A. T. L.

[Vertical retort] oven for production of gas and coke. H. Koppers. Fr. Pat. 460,517, July 18, 1913. Under Int. Conv., July 30, 1912 and June 18, 1913.

The vertical retorts are surrounded by horizontal heating flues, and horizontal regenerators are arranged at opposite sides of the group of retorts, or, in another construction, all at one side. The heating gases enter and leave the horizontal flues by way of chambers extending through the whole height of the oven, and horizontal dampers are provided so that the regenerators may be divided into separate superposed compartments which are regulated independently in order to obtain the desired zones of different temperatures.— A. T. L.

Combustible gas from liquid fuel; Generation of ——. C. D. McCourt, Streatham Common, Surrey, and Radiant-Heating, Ltd., London. In part from C. E. Lucke, New York. Eng. Pats. 19,909, Aug. 31, 1912, and 5005, Feb. 27, 1913.

A spray of liquid fuel is introduced into a chamber containing a mass of refractory material where it commingles with highly heated inert gases flowing from a furnace burning a mixture of fuel and air or oxygen in the proportions for complete combustion as described in Eng. Pat. 29,430 of 1909 (this J., 1910, 1448). The combustion of the fuel for supplying the hot gases may take place either in the same chamber as that in which the fuel is vaporised, or separate intercommunicating chambers in close proximity to one another may be employed. The fuel spray may come into contact with the hot gases and be partially vaporised and decomposed thereby before entering the mass of porous material.—H. H.

Gas producers. A. Franks and G. Sanders, Dagenham, Essex. Eng. Pat. 28,936, Dec. 16, 1912.

The fuel is distributed towards the walls of the producer by a cone centrally situated beneath the hopper, and the gases are drawn off from the hollow space which forms in the body of fuel beneath the cone. The steam and air enter through annular grate bars completely surrounding the lower portion of the producer, so that combustion occurs uniformly from the lower circumference up through the central portions of the fuel, while a ring of unburnt fuel surrounds the burning mass in the middle and upper sections of the producer. The producer is open at the bottom, the contents being supported by the ashes resting upon the floor of the water-seal.—H. H.

Oil fired furnaces and oil-gas producers. W. M. and M. M. Burdon, Bellshill, Lanarkshire. Eng. Pat. 1767, Jan. 22, 1913.

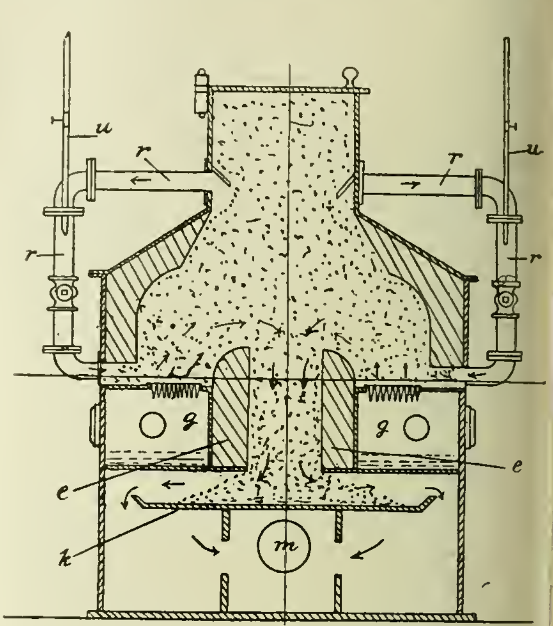
The invention is a development of that described in Eng. Pats. 27,348 and 29,522 of 1910, and 14,657 of 1911, and consists in heating furnaces, etc., by causing air in a state of gyration to mix with heated oil and then flow through a heated vaporising retort direct into the furnace or chamber to be heated. The gyrating air impinges against a jet of oil at the outer end of the vaporising retort so as to produce a spray which is carried forward in a spiral path through the retort. A portion of the waste gases from the furnace, etc., is utilised for heating the oil and the retort.—H. H.

Gas producer for raw fuels. E. Ragot and P. P. Hervotte. Fr. Pat. 461,081, Aug. 4, 1913.

A vertical metal retort, open at its upper, wider end, is arranged in the lower part of the producer chamber, and is connected at its lower end with a horizontal cylindrical gas outlet chamber beneath the hearth of the producer. Air is admitted at the bottom of the fuel column in the producer, and producer gas is made by the upward passage of the air through the fuel in the annular space around the retort. The fresh fuel above the level of the top of the retort is partially coked, and that portion of the fuel which descends through the retort is coked completely.—A. T. L.

Gas producers. S. F. Home, Dublin. Eng. Pat. 1783, Jan. 22, 1913.

The producer is rectangular in form and has two walls, *e*, passing through it from side to side. The air is introduced into vaporising chambers, *g*, formed between the walls, *e*, and the outer casing, and passes first in a vertical, then in a horizontal, and finally in a downward direction through the central portion of the fuel. The tar, etc., evolved from the upper portion of the fuel is led back into the combustion zone through pipes, *r*, containing injectors, *u*, for accelerating the flow, these being operated by exhaust engine gases or the like. The ashes pass from the deflector, *k*, into a liquid seal chamber, while the gas generated is drawn off through an outlet, *m*. The apparatus is intended more particularly for use with bituminous fuels, peat, sawdust, waste wood or other fuels giving large quantities of hydrocarbon gases.—H. H.



Gas; Method of and apparatus for washing and cooling ——. E. F. Lloyd, Detroit, Mich. U.S. Pat. 1,081,455. Dec. 16, 1913.

The gas and the washing liquor, which is at a lowe temperature, pass in opposite directions through a scrubbe provided with suitable baffles for removing the impuritie from the gas, the liquor from the bottom of the scrubbe being separated from the solid impurities and passe together with and in the same direction as the washe gas through a cooler.—A. T. L.

Mineral oils and similar products; Process and apparatu for the distillation of ——. K. Kubierschky. Fr. Pat 460,156, July 8, 1913.

In distilling crude oil by the introduction of superheate steam, any steam not condensed with the oil vapours bein returned to the superheater and passed again through th still, it is proposed, in order to prevent the accumulatio of light oils in the vapours, to withdraw a part of the stea and add fresh steam on the way to the superheater. Th steam which is withdrawn contains light oil vapours an is passed through a rectifying column and dephlegmat in which it meets the crude oil and serves to separa therefrom the products of low boiling point, so that t superheated steam in the distillation column meets on an oil distilling above 100° C. Preferably, the crude is heated first in the dephlegmator and then in a tubul heater through which passes the residues from the di tillation column. The oil then enters the rectifyi column, and after meeting the vapours as described, serves as cooling liquid for the vapours coming direct from the distillation column, whereby it is further heated. The oil is next passed through a second tubular heater, heated by the residues from the distillation column, and is finally admitted at 170° C. to the top of this column, meeting superheated steam at 400° C. which is admitted at the base of the column.—A. T. L.

Peat, turf, and the like ; Process for removing water from ——. A. Browne, London. From P. Roth, Berlin. Eng. Pat. 28,834, Dec. 14, 1912.

See Fr. Pat. 451,864 of 1912 ; this J., 1913, 690.—T. F. B.

Fuel mixture. G. E. Heyl and T. T. Baker, London. U.S. Pat. 1,081,739, Dec. 16, 1913.

See Eng. Pat. 4570 of 1913 ; this J., 1913, 903.—T. F. B.

Petroleum or other hydrocarbon oils ; Process of treating ——. S. Wohle, Assignor to The Wohle Mineral Oil Products (1910), Ltd., London. U.S. Pat. 1,081,801, Dec. 16, 1913.

See Fr. Pat. 414,928 of 1910 ; this J., 1910, 1293.—T. F. B.

Machines for testing the lubricating properties of oils and greases. Eng. Pat. 29,086. *See* XII.

Process of manufacturing a consistent grease. Fr. Pat. 460,418. *See* XII.

Method and devices [calorimeter] for measuring the heating value of fuels. Eng. Pat. 22,514. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Incandescence mantles, rare earths and their radio-active by-products. E. Stern. Z. angew. Chem., 1913, **26**, 806—815.

Incandescence mantles are composed of 97—99 per cent. of thorium oxide, 0·8—2·8 per cent. of cerium oxide and a few tenths of a per cent. of beryllium and aluminium oxides. The higher proportion of ceria is used for mantles for high-pressure gas burners. The traces of other oxides mentioned impart strength by producing a partial sintering of the deposit. The mechanical distribution of the deposit, or surface development, is determined by the textile thread employed. Cotton, with short but fine fibres, gives a very porous but weak mantle, liable also to distortions due to sintering: ramie is much longer and coarser and gives a strong mantle with sufficiently developed surface more stable in the flame ; the continuous filament of artificial silk imparts great elasticity, and its coarseness gives stability of form without impairing luminosity. The ash content of the textile yarn must be very low (0·02—0·03 per cent.). The mantle industry consumes 300 tons of thorium nitrate per annum, representing about 3300 tons of monazite sand. The by-products include over 1000 tons of cerium oxide, of which only 3 tons are required by the mantle industry. A ton of sand, costing £30, contains 2·5 mgrms. of radio-active mesothorium of which 2 mgrms. (value £30) are recoverable. Thus 6 grms. of mesothorium are available as a by-product, but much larger quantities are likely o be required for therapeutic purposes. Since the mantle industry cannot absorb more thorium, the extraction of arger quantities of mesothorium depends on the profitable tilisation of the cerium. Of the 1000 tons of cerium xide now procured, 200 tons are employed for the manuacture of sparking alloys for cigar lighters, etc. The erium is obtained by electrolysis of the fused chloride. further 300 tons are used in the form of the fluoride for mpregnating arc-light carbons. It is suggested that a conderable outlet for cerium compounds might be found the weighting of silk. The dyeing and photographic dustries take small quantities of cerium salts. In commercial mesothorium, 25 per cent. of the radioactivity is due to radium which cannot be separated. Weight for weight, mesothorium is 300 times more active than radium, but it breaks down in a much shorter time. One of its most useful products is thorium X which is 200,000 times more active than radium and can be obtained in the form of solutions of any desired strength. The γ-rays of mesothorium are distinguished by a very high penetrating power.—J. F. B.

Patents.

Heating of fluids. C. D. McCourt and Radiant-Heating, Ltd., London. Eng. Pat. 22,305, Oct. 1, 1912.

In heating fluids by means of "surface combustion" as described in Eng. Pats. 25,808 and 29,430 of 1909, 4362, 11,865, and 17,650 of 1910, 625 and 2404 of 1911, 5936 and 19,490 of 1912 (this J., 1910, 1448 ; 1911, 406, 731, 1070 ; 1912, 110, 178 ; and 1913, 936), hot gases formed by "surface combustion" are passed through a body of refractory material, or combustible gases are burned therein by "surface combustion," and the fluid to be heated is forced through another body of refractory material which is arranged so as to be heated by the former. For example, either body of refractory material may envelop the other, and one of them may consist of a serpentine pipe packed with a suitable material.—A. T. L.

Cobalt filament for electric [incandescence] lamps ; Manufacture of ——. K. Tanimura. Fr. Pat. 460,093, July 7, 1913. Under Int. Conv., July 17, 1912.

A solution of cellulose prepared by heating together 3 grms. of cotton, 10·3 grms. of zinc chloride, 5 grms. of cobaltic oxide, 5 grms. of manganese sulphate, and 0·7 grm. of hydrochloric acid, is squirted into alcohol, the filament is washed with water, dried, cut into lengths, and wound on a carbon bobbin, which is then wrapped in paper and packed with graphite in a crucible. The latter is exhausted and is heated to incandescence for 20 hours. Finally, the filament is coated with carbon by passing through it an alternating current at 400 volts, in an atmosphere containing light hydrocarbons.—A. T. L.

Tungsten or alloys of tungsten ; Manufacture of filaments of ——. E. A. Krüger. Fr. Pat. 460,556, July 21, 1913.

Tungsten powder is mixed with a little carbon and with boric acid, moistened with water, and formed into rods. These are dried, heated for a time at 1000° to 1200° C., and then heated to as high a temperature as possible, in a current of hydrogen, by means of an electric current, until the particles of tungsten bind together. The rods are then rolled and drawn into filaments. By strongly heating the latter in a vacuum, the boron may be expelled, and filaments of pure tungsten formed. These must be mechanically treated to render them again homogeneous. To lessen the wear of the diamonds of the draw-plate, the wires may first be heated in air or oxygen, when an outer layer of tungstic oxide, and inner porous layers are formed, which act as lubricants ; or the tungstic oxide may be removed, and the underlying porous layers rubbed with talc or with powdered metals of high melting point, such as thorium, zirconium, cerium, etc.—T. St.

Electric incandescence lamps ; Process for liberating gases or vapours from chemical compounds in ——. Siemens und Halske Akt.-Ges. Fr. Pat. 460,913, July 31, 1913. Under Int. Conv., Aug. 2, 1912.

In lamps of the kind in which a small quantity of a suitable substance, such as silver chloride, alone or mixed with iron or nickel powder, is present in the bulb, and is heated when the lamp is in use so as to liberate traces of chlorine gas, the chloride, etc., is heated by a special filament or wire instead of by the lamp filament. The heating filament is usually in series with the lamp filament, and may consist of an iron or nickel wire passing through a tube which contains the chloride. This wire is itself attacked by the chlorine and becomes gradually thinner, so that as the chloride is used up, the temperature of the heating filament is increased and the rate of production of chlorine is kept constant.—A. T. L.

Electric incandescence lamps ; Refractory bodies for —— and process for manufacturing same. E. Podszus. Fr. Pat. 461,038, Aug. 1, 1913. Under Int. Conv., Aug. 12, 1912.

Refractory bodies composed of thorium oxide, zirconium oxide, boron nitride, etc., which are used as supports for metallic filaments, or as incandescence bodies, are conductors only when heated, and suffer decomposition during the passage of the current, so that the filament which is wound upon the refractory body is rapidly destroyed. According to the present patent, the refractory body is rendered quite stable by removing the last traces of impurities. For this purpose, the materials are very thoroughly purified, and the refractory bodies, which should be thin, are heated in a muffle to 2000° C. and afterwards in an electric arc, or in a mercury vapour lamp, in an atmosphere of hydrogen or the rare gases. —A. T. L.

III.—TAR AND TAR PRODUCTS.

Vacuum tar. A. Pictet and M. Bouvier. Comptes rend., 1913, **157**, 1436—1439. (See also this J., 1913, 1098.)

It was not found possible to isolate definite compounds from vacuum tar (obtained by the distillation of coal in a vacuum at a low temperature) by fractional distillation. Some of the fractions examined consisted of mixtures of saturated and unsaturated hydrocarbons and oxygenated compounds. The latter were very sparingly soluble in water, insoluble in alkalis, readily acetylated or benzoylated, and formed white sodium compounds. They had an odour resembling that of menthol and in all probability were hydroaromatic alcohols, representing intermediate products in the formation of the phenols of ordinary coal tar. After removing these alcohols by treatment with sodium and unsaturated hydrocarbons by treatment with fuming sulphuric acid, the residual saturated hydrocarbons were fractionated. Two of the fractions which appeared homogeneous had the characters : $C_{10}H_{20}$, b.pt. 172°—174° C., sp. gr. 0·7765 at 23° C., $n_{D}^{23}=1{\cdot}4196$; $C_{11}H_{22}$, b.pt. 189°—191° C., sp. gr. 0·7838 at 22° C., $n_{D}^{22}=1{\cdot}4234$. These hydrocarbons had a faint odour of petroleum and were practically identical with hydrocarbons of the same composition isolated by Mabery from Canadian petroleum, but differed from the decanaphthene and endecanaphthene isolated by Markownikoff from Baku petroleum. The hydrocarbon, $C_{10}H_{20}$, was identified as hexahydrodurene (1.2.4.5-tetramethylcyclohexane), and as the other hydrocarbon, $C_{11}H_{22}$, has very similar properties it is probably hexahydropentamethylbenzene.—A. S.

Tetraphenylethane ; Contributions to the study of diphenylcarbinol : the preparation of symmetrical ——. P. Sabatier and M. Murat. Comptes rend., 1913, **157**, 1496—1500.

Diphenylcarbinol should be formed by acting with water on the Grignard reaction product $(C_6H_5)_2.CH.OMgBr$ (from benzaldehyde and phenylmagnesium bromide, or from formic ester and 2 mols. of phenylmagnesium bromide). Instead, however, there results only a trace of the carbinol, but considerable quantities of benzophenone, diphenylmethane and *sym.*-tetraphenylethane, *i.e.*, on the one hand hydrogenation, on the other dehydrogenation of the diphenylcarbinol seems to have taken place. Experiments with benzophenone and various aliphatic-magnesium compounds gave analogous results, no tertiary alcohol being formed. According to the view expressed above, metallic catalysts, whether of hydrogenation or dehydrogenation should have the same action on diphenylcarbinol, and in fact, copper at 350° C. gave benzophenone and tetraphenylethane ; thoria at 420° C. gave benzophenone, diphenylmethane and tetraphenylethane. By the action of the dehydrogenating catalyst, thorium, at 420° C. on a mixture of the vapours of diphenylcarbinol and methyl alcohol a total reduction to diphenylmethane was effected. With ethyl alcohol in addition to diphenylmethane a little benzophenone and tetraphenylethane were formed.—J. B.

New synthesis of higher phenols. [Isomerides of hydro-urushiol dimethyl ether.] Majim and Nakamura. *See* XIII.

Patents.

p-Nitrosophenylglycine and process for the manufacture of the same. J. D. Riedel Akt.-Ges., Berlin-Britz, Germany. Eng. Pat. 22,694, Oct. 8, 1913. Under Int. Conv., Oct. 8, 1912.

p-Nitrosophenylglycine is obtained directly, and in good yield, from commercial phenylglycine by treatment with a nitrite, nitrous acid, or nitrosyl chloride in presence of fuming hydrochloric acid. The nitrosamine of phenylglycine or its esters is not converted into the *p*-nitroso compound by treatment with alcoholic hydrochloric acid according to Fischer and Hepp's process. *p*-Nitrosophenylglycine is a brown powder, practically insoluble in ether, alcohol, and water ; it is soluble in ammonia, forming a stable deep green solution from which intense green crystals of the ammonium salt can be separated by addition of alcohol.—T. F. B.

Arylides of 2.3-[hydr]oxynaphthoic acid ; manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Greisheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 23,732, Oct. 20, 1913. Addition to Eng. Pat. 13,237, June 7, 1913 (see this J., 1913, 1060).

The arylides of 2.3-hydroxynaphthoic acid are obtained by heating the acid with a non-nitrated arylamine in presence of a dehydrating agent and an indifferent solvent or suspending agent. The preparation of the anilide, 2.5-dichloro-anilide, and β-naphthalide, and of the compound with 2.4-toluylenediamine, is described in detail. —T. F. B.

β-Nitro compounds of acyl-p-diaminoanthraquinones ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 267,445, Oct. 10, 1912.

An acyl compound of *p*-diaminoanthraquinone is treated with aqueous nitric acid in presence of an indifferent diluent, at a temperature above 25° C.—T. F. B.

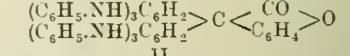
1-Chloro-anthraquinone ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 267,544, July 15, 1911.

1-Anthraquinonesulphonic acid or one of its salts is heated to a high temperature with thionyl chloride ; the sulphochloride is formed as an intermediate compound, which loses sulphur dioxide and is converted into 1-chloroanthraquinone.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

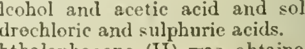
Halogenated phthaleins ; Action of aniline on ——. W Scharwin. J. Russ. Phys.-Chem. Ges., 1913, **45**, 875—890. Chem. Zentr., 1913, **2**, 2126—2127.

By heating Eosin with aniline in a sealed tube at 180°—200° C. for 5 hours, treating the product successively wit steam, dilute acid, and alkali, dissolving in alcohol, an re-precipitating with water, hexaphenylhexa-aminofluoran (I) was obtained as a dark violet blue powder, easil



$$O<^{(C_6H_5.NH)_3C_6H}_{(C_6H_5.NH)_3C_6H}>C<^{CO}_{C_6H_4}>O$$

I.



$$^{(C_6H_5.NH)_3C_6H_2}_{(C_6H_5.NH)_3C_6H_2}>C<^{CO}_{C_6H_4}>O$$

II.

soluble in alcohol and acetic acid and soluble in co centrated hydrochloric and sulphuric acids. Hexapheny hexa-aminophthalophenone (II) was obtained as a bl violet powder from 10 grms. of tetrabromophenolphthalein and 50 grms. of aniline in a similar manner, and a halogenated hexaphenylhexa-aminofluoran was likewise obtained from commercial Phloxin and aniline. All three compounds can be sulphonated with fuming sulphuric acid (12 per cent. SO_3) and dye wool and silk dark violet blue shades.—A. S.

Patents.

Vat [anthracene] colouring matters; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,818, June 2, 1913.

The green vat dyestuffs obtained by oxidation of dibenzanthrone, with or without subsequent reduction, and followed by heating, preferably in presence of a solvent and a condensing agent (see Eng. Pat. 14,498 of 1912; this J., 1913, 593), are converted into new vat dyestuffs by treatment with bromine. The bromine may be introduced either during or after the formation of the dyestuff from dibenzanthrone. The products dye cotton somewhat more yellowish shades of green than those produced by the unbrominated dyestuff.—T. F. B.

Azo dyes; Process for producing yellow ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,029, Nov. 3, 1913. Under Int. Conv., May 15, 1913.

An easily soluble dyestuff, which dyes cotton pure greenish-yellow shades, is obtained by combining the diazo compound of *p*-aminophenylphenthiazole-sulphocarboxylic acid with aceto-acetanilide. The thiazole compound is prepared by oxidising acetyldehydrothiotoluidinesulphonic acid with permanganate and eliminating the acetyl group from the product. In place of the carboxylic acid mentioned, other carboxylic acids may be used, obtainable from dehydrothiotoluidine, its homologues and substitution products, or from the corresponding polythiazoles, and the aceto-acetanilide may be replaced by any other aceto-acetarylide.—T. F. B.

Colouring matters of the anthraquinone series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 5534, March 5, 1913.

See Fr. Pat. 459,105 of 1913; this J., 1913, 1101.—T. F. B.

Wool-dyestuffs; Manufacture of brownish-yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning, and R. Schmidlin, Höchst on Maine, Germany. Eng. Pat. 14,952, June 28, 1913. Addition to Eng. Pat. 13,672 of 1912, dated July 25, 1911.

See Ger. Pat. 265,197 of 1912 and Addition to Fr. Pat. 443,809; this J., 1913, 1101; 1914, 19.—T. F. B.

Sulphur [sulphide] dye; Green ——. *Green colouring-matter containing sulphur. Olive-green sulphur dye.* J. Flachslaender and K. P. Grälert, Elberfeld, and M. Buff, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,081,598, 1,081,599, and 1,081,600, Dec. 16, 1913.

See Ger. Pats. 254,328 and 254,304 of 1911; this J., 1913, 189.—T. F. B.

Sulphur [sulphide] dye; Catechu-brown ——. *Brown sulphur colouring matter.* J. Flachslaender and K. P. Gralert, Elberfeld, and M. Buff, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,081,601 and 1,081,602, Dec. 16, 1913.

See Ger. Pats. 253,934 of 1911 and 253,239 of 1912; this J., 1913, 80, 16.—T. F. B.

Sulphur [sulphide] dye; Blue ——. A. Thauss, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,081,638, Dec. 16, 1913.

See Fr. Pat. 450,420 of 1912; this J., 1913, 593.—T. F. B.

Monoazo dyestuffs for wool, fast to washing, and process for producing them. Act.-Ges. f. Anilinfabr. First Addition, dated July 3, 1913, to Fr. Pat. 430,146, May 26, 1911. Under Int. Conv., Nov. 8, 1912.

See Eng. Pat. 16,537 of 1913; this J., 1914, 19.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Spruce wood; Action of chlorine on ——. E. Heuser and R. Sieber. Z. angew. Chem., 1913, **26**, 801—806.

Moist spruce wood containing: moisture, 12·05; ash, 0·2; fat and resin, 1·24; cellulose, 58·16 per cent., was rasped, steamed in a Gooch crucible, cooled to 0° C. and chlorinated by the method described by Renker (this J., 1909, 1269). Four successive treatments with chlorine of half an hour each, with intermediate extractions with boiling sodium sulphite, were necessary to obtain a cellulose completely free from lignin reactions. The amount of hydrochloric acid formed and the loss of weight of the material after extraction with sodium sulphite were determined after each chlorination, at first with half-hourly treatments with the gas and subsequently with hourly treatments; observations extended over a period of 22 hours' chlorination, when the cellulose was completely reduced to a powdery oxycellulose. At the limiting stage of 2 hours, hydrochloric acid equivalent to 31·1 per cent. of chlorine on the dry ash- and resin-free wood had been formed, mostly in the first hour. After this stage, the formation of hydrochloric acid and the loss in weight of the cellulose were very small. So long as lignin was present in the material, the cellulose appeared to be protected from the oxidising action of the gas and the production of oxycellulose was almost negligible. Later, there was a large production of oxycellulose but the effect on the yield of cellulose was very small. As tests for lignin, the phloroglucinol and aniline reactions were not characteristic and disappeared after a short treatment with chlorine. More reliable tests were Maule's reaction (permanganate and ammonia), dark colouration with concentrated sulphuric acid, orange colouration with chlorine gas, yellow microchemical stain with zinc chloride-iodine and, to a certain extent, the ferric ferricyanide reaction. With 2 hours' chlorination and 31·1 per cent. of chlorine converted into hydrochloric acid, the fixation of chlorine by the fibre substance was only 9·47 per cent.; no other acid products were detected and, since very little oxycellulose was produced, it is to be inferred that, while a portion of the lignin was chlorinated, another portion suffered complete oxidation. Lignin chloride was isolated by extraction with alcohol, but with a yield of only 7·1 per cent. on the dry wood. Analysis of this chloride showed C 47·03, H 4·59, Cl 22·66 per cent. It was probably not a simple substance but a mixture of chloro derivatives; it did not yield pyrogallol derivatives nor any furfural on distillation with acid; on fusion with alkali large quantities of oxalic acid were produced.
—J. F. B.

Spirit from wood; Production of ——. R. von Demuth. Z. angew. Chem., 1913, **26**, 786—792.

The author gives a brief history of the subject and a bibliography and a description of the working of the process of Tomlinson and Ewen (U.S. Pats. 1,032,392 and 1,032,440—1,032,450; this J., 1912, 832) at the factory of the Du Pont de Nemours Powder Co., Georgetown, S. Carolina, U.S.A., erected in 1910. Sulphurous acid as a hydrolysing agent gave unsatisfactory results and sulphuric acid was substituted for it. Simonsen (this J., 1898, 365, 481, 1164) obtained good results with sulphuric acid on the laboratory scale and the failure of his process on the large scale was due to the use of too much water. In the American process hydrolysis is effected under pressure in rotary spherical digesters, whereby good results are obtained with considerably smaller quantities of water and acid than those used by Simonsen. The steel digesters are lined with acid-proof material and the contents are heated by direct steam. After rather more than 1 hour, when about one-half of the cellulose is saccharified, the steam is blown off; if the digestion be prolonged, decomposition of the sugar occurs. The hydrolysed wood is conveyed to a diffusion battery similar to that employed in sugar manufacture, and after extraction of the sugar, the residue is pressed, and used as fuel. The solution is partly neutralised with lime, clarified by settling, fermented with yeast cultivated in a mash of rye and malt, and then distilled. Owing to lack of cooling water the yields were unfavourable in the summer months, but in the winter months the yield corresponded to 7·3 litres of 100 per cent. alcohol per 100 kilos. of wood dry substance. Moreover, owing to American excise restrictions, it was not possible to supply sufficient nutrient materials to the yeast, and experiments of the authors indicated that the yield could be increased to 9·5 litres of alcohol per 100 kilos. if these restrictions were removed. Besides the alcohol there were obtained: oil of turpentine (0·2—0·3 kilo. per 1000 kilos. of wood dry substance), calcium sulphate, fusel oil, spent wash, and a residue of rye, malt, yeast, etc.. from the fermented wort, containing 3·5 per cent. of nitrogen. At the present time about 2 million litres of alcohol (100 per cent.) are produced annually at the Georgetown factory.—A. S.

Fabrics; Inflammability of ——. Daily Express, Jan. 24, 1914. [T.R.]

Regulations published recently under the Fabrics (Misdescription) Act, 1913, prescribe the following test for inflammability: "A textile fabric shall be deemed to conform to the standard of non-inflammability if, when tested in accordance with the prescribed method of testing, it is not set alight, or, if set alight, burns without a flame or with a flame which does not spread but converges and dies out. The prescribed method of testing shall be as follows:—A sample of the fabric measuring not less than one square yard shall be taken, and, after it has been four times in succession thoroughly washed with soap and water, dried and ironed, shall be suspended vertically without folds or creases, and so that the lower edge shall not be a selvedge or a folded edge. The flame of a wax taper not less than one-eighth of an inch or more than three-sixteenths of an inch in thickness shall then be brought in contact with the fabric at its lower edge, and shall be kept in contact for not less than twelve or more than fifteen seconds."

Examination of rosin size. Marcusson *See* XIII.

Patents.

Drying pulp and the like; Apparatus for ——. H. P. Coe, New York. Eng. Pat. 16,712, July 21, 1913.

Improvements in apparatus for drying sheets of pulp, relating to the method of driving the rollers which feed the sheets into the drying chamber, the arrangement of the air ducts and flues, and the provision at the entrance of the machine of a lifting table provided with a bed of rollers, which table facilitates the introduction of wet material into the machine at the different feeder levels. J. B.

Sizing [for paper] and method of preparing same. A. A. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America. U.S. Pat. 1,080,143, Dec. 2, 1913.

One part of an alkaline (sodium) silicate is mixed with about 25 parts of modified starch, and the mixture dissolved by heating with a liquid.—E. W. L.

Artificial threads, filaments, or other shaped objects from copper cellulose solution; Process for the manufacture of ——. Verein. Glanzstoff-Fabriken A.-G., Elberfeld, and E. Bronnert, Mülhausen-Dornach, Germany. Eng. Pat. 4922, Feb. 26, 1913. Under Int. Conv., Sept. 2, 1912.

See Fr. Pat. 454,811 of 1913; this J., 1913, 865.—T. F. B.

Cellulose acetate; Manufacture of ——. F. Paschke, Assignor to Safety Celluloid Co., Ltd., London. U.S. Pat. 1,082,167, Dec. 23, 1913.

See Eng. Pat. 15,868 of 1912; this J., 1913, 192.—T. F. B.

Non-inflammable solutions of cellulose nitrates, utilisable as lacquers. Fr. Pat. 461,034. *See* XIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Oxidation; The recognition of the beginning of ——. *A contribution to the analysis of bleaching liquors.* F. H. Thies. Färber-Zeit., 1913, **24**, 525—527.

The fact that the white produced by the bleaching process is mainly dependent on the kier boiling renders the valuation of bleach-liquors by practical tests impossible. The decolourisation, more or less, of a scale of indigo dyeings has been suggested, but the author considers that the best method of direct estimation is by measuring the oxidising effect of the bleach-liquor on the fibre itself. The author uses a colourimetric comparison of the dyeings obtained on the treated material by steeping it in a 0·1 per cent. solution of Methylene Blue at 90°—100° C. Low degrees of oxidation can be thus compared with the assistance of a scale prepared by partially precipitating solutions of ammoniacal copper sulphate, details for the preparation of which are given. A graphical representation is given of some experiments on the effect of the time and temperature factors in such oxidations, as indicated by the weakening of the fibre.—J. B.

Silk-weighting; The theory of ——. P. Heermann. Mitt. kgl. Materialprüf.. 1913, **31**, 289—301. (See also this J., 1904, 820 and 1911, 1007.)

In opposition to Ley (Chem.-Zeit., 1912, 1405 and 1466), the author re-affirms that with pure materials (stannic chloride and disodium phosphate) and quite neutral silk, the basicity of the baths is unaffected by the weighting process as such. After the pinking process the fibre contains almost pure stannic hydroxide, which reacts with hot phosphate solution thus:

$$Sn(OH)_4 + Na_2HPO_4 = Sn(ONa)_2HPO_4 + 2H_2O.$$

The double phosphate is only stable in the presence of alkali phosphate and is hydrolysed on washing:

$$Sn(ONa)_2HPO_4 \rightarrow Sn(OH)_2HPO_4 + 2NaOH.$$

The free alkali is neutralised by the excess of phosphate in the wash water: $Na_2HPO_4 + NaOH = Na_3PO_4 + H_2O$. No acidification of the phosphate bath can result except from acid carried over by the silk. The third of the above reactions, which shows the disposal of the free alkali, explains Ley's inability to find free caustic soda. The author has observed an increased alkali content in the phosphate present in the wash water as against the phosphate present in the bath.—J. B.

Naphthenic acid and sodium naphthenate. Davidsohn. *See* IIa.

Natural water and the catalytic action of some colloidal substances at great dilution [in tanning and dyeing]. Sommerhoff. *See* XV.

Patents.

Fibrous materials; Process for degreasing raw or manufactured —— *by means of fat solvents.* C. Netz und Co. Ger. Pat. 267,487, Feb. 14, 1913.

Dichloro-ethylene or trichloro-ethylene is used as a degreasing agent, either alone or mixed with other fat solvents. These solvents remove the surface fat, but appear only to penetrate very slightly the interior of the fibre.—T. F. B.

Bleaching; Process of ——. A. J. Rossi, Niagara Falls, N.J., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,080,718, Dec. 9, 1913.

MATERIAL is bleached by means of a mixture of titanous and ferrous chlorides, which can be made by dissolving iron and titanium, or an alloy of the two, in dilute hydrochloric acid and filtering the solution.—J. B.

Titanous salts; Treating [bleaching] materials with solutions of ——. C. M. E. Schroeder, Rutherford, N.J., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,080,721, Dec. 9, 1913.

MATERIAL is bleached by immersing it in a bath containing metallic titanium, titanium and iron, or a titanium-iron alloy, and an acid solvent of titanium and iron, *e.g.*, hydrochloric acid.—J. B.

Dyeing and bleaching machines. C. Callebaut and J. de Blicquy, Brussels, Belgium. Eng. Pat. 24,722, Oct. 30, 1913.

IN machines for dyeing tops or similar material in ball form, the circulation cylinders are provided with removable linings to allow for the accommodation of balls of varying diameter.—J. B.

[Dyeing and bleaching.] Apparatus for treating yarn with a liquid. H. Hablützel. Fr. Pat. 460,829, July 28, 1913. Under Int. Conv., Aug. 12, 1912.

THE yarn is suspended on sticks in a vat over which runs a carriage having a pair of endless chains provided with hooks to pick up the yarn sticks as the carriage travels along. The path of the endless chains is so arranged that a stick full of yarn is picked up as the carriage approaches it, raised partially out of the vat and then dropped back into the vat on the other side of the carriage. When the dyeing operation is over, another carriage provided with a pair of inclined endless chains runs along the vat, picking up the yarn, raising it out of the vat and draining it, finally dropping it on to a table, whence it is removed by hand.—J. B.

Silk; Process of weighting ——. M. Günther. Fr. Pat. 460,137, July 8, 1913. Under Int. Conv., July 8, 1912.

TITANIUM salts are employed in conjunction with the salts of tin, zirconium, or the rare earths.—J. B.

Fast shades on vegetable fibres; Production of —— *and dyestuffs therefor.* H. Levinstein, J. Baddiley and Levinstein, Ltd., Blackley. Eng. Pat. 28,296, Dec. 7, 1912.

AN extension of Eng. Pat. 27,525 of 1912 (this J., 1913, 1005) for the production of dyestuffs giving fast shades on after treatment with formaldehyde, using certain other diamines, and other extra-nuclear amino derivatives of 2-amino-5-naphthol-7-sulphonic acid, in addition to those specified in the first patent.—J. B.

Dyeing apparatus; Indigo ——. C. Becker, Ilkley, and H. Mueller, Ben Rhydding. Eng. Pat. 6075, March 11, 1913.

THE material (loose fibre, slubbing, roving or yarn) is contained in a basket within and hinged to one side of the dye-vat, which is provided with a circulating apparatus, the upper or entrance pipe of which is below the surface of the liquor. When the material is impregnated, the basket or cage is tilted up out of the bath so as to discharge the material directly to squeezing rollers at the side of the vat.—J. B.

Ice-colours on cotton yarn, cops, cross-reels and loose cotton; Process for producing ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 17,279, July 28, 1913. Addition to Eng. Pat. 6379 of 1912 (this J., 1912, 635).

DEVELOPED dyestuffs are produced by padding the material with an arylamide of 2.3-hydroxynaphthoic acid and combining with a diazo compound of an unsulphonated amine without intermediate drying. The anilide of 2.3-hydroxynaphthoic acid, for example, applied in caustic soda solution, gives with the diazo compound from *p*-nitro-*o*-toluidine a scarlet red, with that from *o*-anisidine a red, and with that from α-naphthylamine a dark red.—J. B.

Dyeing machine. F. H. Rogers, London. From Psarski Dyeing Machine Co., North-West Cleveland, Ohio, U.S.A. Eng. Pat. 18,303, Aug. 12, 1913.

THE material is contained in a hemispherical vessel, uniformly perforated, which is provided with a flat lid, perforated only in the neighbourhood of its centre. The dye-liquor is circulated through the perforations in the hemispherical bottom and out through the perforations about the centre of the lid, the arrangement of the perforations being such that in penetrating through the mass of the material every portion of the dye-liquor travels approximately the same distance.—J. B.

Dyeing, washing, cleansing and otherwise treating yarn in hanks; Process and apparatus for ——. J. Schlumpf. Second Addition, dated June 16, 1913, to Fr. Pat. 421,183, Oct. 7, 1910 (this J. 1911, 486; 1912, 227.)

IMPROVEMENTS in the mechanical arrangements for dyeing hanks as described in the chief patent.—J. B.

Dyeing hair and fur; Process of ——. Act.-Ges. für Anilinfabr. Fr. Pat. 460,566, July 21, 1913. Under Int. Conv., Oct. 10, 1912.

A PERSULPHATE is used for developing oxidation colours on hair. Brighter colours are obtained than with the usual oxidising agent, *p*-toluylenediamine giving, for example, beautiful blonde to brown shades.—J. B.

Printing textile fabrics. H. Levinstein and Levinstein, Ltd., Blackley. Eng. Pats. 29,021, Dec. 17, 1912 and 1123, Jan. 15, 1913.

A SUBSTANTIVE dyestuff capable of forming an insoluble compound when heated with formaldehyde is printed together with a thickening agent and formaldehyde or a substance capable of liberating formaldehyde on steaming, such as hexamethylenetetramine. On steaming shades are produced which are fast to washing. Dyestuffs containing 1 or 2 mols. of resorcinol are preferred.—J. B.

Sizing threads or yarns; Apparatus for —— *or like operations.* Wilcock, Wood and Co., and F. W. Bottomley, Shipley. Eng. Pat. 3080, Feb. 6, 1913.

THE trough of the sizing machine is connected with a reservoir in which is a weighted block, the upward or downward motion of which causes the liquor to run to or fro between the trough and the reservoir. In this way the trough can be emptied or filled without a stoppage of the running threads.—J. B.

Cellulose finishing preparation. Soc. Industrielle des Téléphones. Fr. Pat. 260,915, Oct. 16, 1912.

To a cellulose solution, such as is used for coating aeroplane fabric or for electrical insulation, an inert substance is added, for instance barium sulphate, zinc sulphate or oxide, magnesium oxide, etc. Colouring matter may be added and the coating may be varnished after application. —J. B.

Scalding, bleaching, dyeing, oxidising, washing, and drying textile materials as they are discharged from spinning machines; Method of and apparatus for ——. P. J. Grandsire fils, Darnétal, France. Eng. Pat. 16,005, July 11, 1913. Under Int. Conv., July 31, 1912.

SEE Fr. Pat. 448,248 of 1912; this J., 1913, 423.—T. F. B.

Vat-dyestuff compounds suited for dyeing. R. Wedekind und Co. m. b. H., and M. Iljinsky, Uerdingen on Rhine, Germany. Eng. Pat. 28,656, Dec. 12, 1912.

SEE Fr. Pat. 453,427 of 1913; this J., 1913, 746.—T. F. B.

Fixing dyestuffs, pigments, or metallic powders on textile fibres; Processes for ——. R. B. Ransford, London. From Soc. de la Manufacture d'Indiennes Emile Zundel, Moscow. Eng. Pat. 714, Jan. 9, 1913.

See Fr. Pat. 452,677 of 1912; this J., 1913, 653.—T. F. B.

Dyeing and printing; Process of ——. C. Möllenhoff, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,081,621, Dec. 16, 1913.

See Fr. Pat. 409,748 of 1909; this J., 1910, 753.—T. F. B.

Stabilising caustic alkaline solutions of hydrogen peroxide, and utilising the stabilised solutions for bleaching. Fr. Pat. 460,959. *See* VII.

Fireproofing composition. U.S. Pat. 1,080,966. *See* IX.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Arsenic in sulphuric and hydrochloric acids; Rapid method of determining ——. H. Koelsch. Chem.-Zeit., 1914, **38**, 5.

Twenty-five c.c. of sulphuric acid (or 100 c.c. of hydrochloric acid) are boiled with 200 c.c. of water and 5 c.c. of potassium iodide solution (50 grms. per litre) until the liquid is only yellow or faint brown, then after addition of 5 c.c. of sodium sulphite solution (25 grms. of crystalline salt per litre), boiling is continued for 5 mins., the liquid diluted to about 700 c.c., made nearly neutral to methyl orange with caustic alkali, treated with sodium bicarbonate, and titrated with $N/10$ iodine solution. Small amounts of nitric acid are negligible, but larger quantities and the presence of substances that react with iodine in alkaline solution render the method useless. For a gravimetric determination the diluted acid is treated with iodide and sulphite as described, and the reduced arsenic precipitated from the hot liquid by means of sodium sulphide solution (40 grms. per litre). The precipitate is separated, dissolved in ammoniacal hydrogen peroxide, and the arsenic precipitated as magnesium ammonium arsenate. The results were in close agreement with those obtained by standard methods.—C. A. M.

Nitrous anhydride; Intermediate formation of —— by the action of oxygen on nitric oxide. Behaviour of nitrous anhydride towards potassium hydroxide. G. Klinger. Z. angew. Chem., 1914, **27**, 7—8.

Dry nitrous anhydride is absorbed quantitatively by concentrated sulphuric acid and by dry potassium hydroxide, without evolution of nitric oxide: when a solution of alkali hydroxide or the moist solid is used, absorption is not complete. Again, when nitric oxide mixed with a large excess of oxygen is passed over dry potassium hydroxide, the volume contraction is always 1¼ times the volume of nitric oxide present: hence, the reaction, $4NO+O_2=2N_2O_3$, must take place, and not $2NO+O_2=2NO_2$. It follows that nitrous anhydride is the first product of the action of oxygen on nitric oxide, the peroxide being formed from the anhydride as the second stage of the reaction (see also Lunge, this J., 1905, 131; 1906, 533; Raschig, this J., 1905, 923; 1907, 965; 1911, 168).—T. F. B.

Natural soda deposits of Africa, with some notes on the alkali trade. J. Watson. J. Chem., Met., and Min. Soc., S. Africa, 1913, **14**, 235—242.

The paper contains a survey of soda deposits in Africa with special reference to the soda-lake at Zoutpan, 25 miles N. of Pretoria. The deposit is now being worked by South African Alkali, Limited. The crude soda, dried in the sun, contains about 61 per cent. of carbonate and 6 per cent. of chloride; after calcination a sample showed 67 per cent. of carbonate and 17 of chloride. The author suggests the use of the crude soda as a substitute for lime in gold mining. He believes that the greater solubility of soda and sodium sulphate as compared with lime and calcium sulphate would save time, and avoid the deposition of sulphate in the mill service water pipes. Furthermore, calcium sulphate is a cyanicide while sodium sulphate is not. The paper concludes with a review of the possibilities of the alkali industry in S. Africa.—W. H. P.

Chloride solutions; Electrolysis of —— with a mercury cathode. E. A. Le Sueur. Amer. Inst. Chem. Eng. Metall. and Chem. Eng., 1914, **12**, 61.

Preliminary experiments have led to the conclusion that the best type of electrolytic alkali cell with mercury cathode, is that in which the under side of the mercury is used as the electrode, leaving the upper side out of contact with the electrolyte. Owing to its low specific gravity, the alkali metal amalgam would then tend to rise to the surface of the mercury, and could be removed periodically. —T. F. B.

Sulphur and potassium hydroxide in aqueous solutions, The reaction between ——. H. V. Tartar. J. Amer. Chem. Soc., 1913, **35**, 1741—1747.

When sulphur is heated with aqueous solutions of potassium hydroxide, the primary reaction, *i.e.*, when sulphur is not present in excess, is represented by the equation, $6KOH+8S=2K_2S_3+K_2S_2O_3+3H_2O$. When sulphur is present in excess, a secondary reaction occurs, in which it combines with the potassium trisulphide to form pentasulphide; it is possible that the tetrasulphide is formed as an intermediate product. The nature of the reaction is not affected by variations of temperature (below 100° C.) and concentration of the solution. All the experiments were carried out in presence of hydrogen, and in the subsequent operations contact with air was avoided as far as possible. The potassium present as thiosulphate and the sulphur as polysulphide, thiosulphate, sulphite, and sulphate were determined by methods outlined by Haywood (see page 99,) whilst potassium combined as polysulphide was determined by a slightly modified form of the volumetric zinc method, it being found that when an ammoniacal solution of zinc chloride is added to a solution of a potassium polysulphide, the corresponding zinc polysulphide is formed.—T. F. B.

Cadmium; Researches on ——. [Cadmium-ammonium sulphates.] M. Veres. Comptes rend., 1914, **158**, 39—40.

The double sulphates, $2CdSO_4,(NH_4)_2SO_4$ and $CdSO_4,(NH_4)_2SO_4,6H_2O$, were prepared, the former by heating ammonium bisulphate with one-fifth of its weight of crystallised cadmium sulphate to 300° C. and removing the excess of bisulphate by means of 85 per cent. alcohol; and the latter by slow evaporation of an aqueous solution of $2CdSO_4,(NH_4)_2SO_4$. When $2CdSO_4,(NH_4)_2SO_4$ was heated with concentrated sulphuric acid at 100° C., then treated successively with glacial acetic acid and with ether for the removal of the sulphuric acid, the ammonium sulphate was removed as well, leaving rhombic crystals of anhydrous cadmium sulphate.—A. S.

Phosphates and oxides; Action of phosgene on ——. J. Riban. Comptes rend., 1913, **157**, 1432—1433.

With reference to the recent work of Barlot and Chauvenet (this J., 1914, 21), the author points out that he showed in 1882 (this J., 1883, 177) that by the action of a mixture of carbon monoxide and chlorine on tricalcium phosphate, in presence of carbon as a catalyst, a mixture of phosphorus oxychloride and calcium chloride was produced: $Ca_3(PO_4)_2+6CO+12Cl=2POCl_3+6CO_2+3CaCl_2$, and that a similar reaction could be applied to the manufacture of aluminium chloride.—A. S.

Perchlorates of aluminium, chromium, and magnesium. R. F. Weinland and F. Ensgraber. Z. anorg. Chem., 1913, **84**, 368—372.

Aluminium perchlorate (hexahydrate) was prepared by dissolving aluminium chloride-hexahydrate in aqueous

perchloric acid, heating until hydrogen chloride ceased to be evolved, and concentrating *in vacuo* over sulphuric acid; and corresponding chromium and magnesium salts, like ferric perchlorate, by concentrating respective solutions of the oxide in perchloric acid; nonahydrated chromic perchlorate was obtained by operating at the temperature of the water-bath. The products are crystalline and very hygroscopic. Sodium tetraperchloratoaluminate, $[Al(ClO_4)_4]Na,12H_2O$, was prepared by concentrating a solution of aluminium oxide and sodium perchlorate in aqueous perchloric acid; it is analogous to the similarly produced iron compound, but no corresponding perchloratochromate could be obtained.
—F. Sodn.

Chromic oxide jellies. E. H. Bunce and L. S. Finch. J. Phys. Chem., 1913, **17**, 769—779.

An empirical investigation of the conditions of formation of chromic oxide jellies. Chromic chloride or sulphate gave a jelly with caustic soda or potash or ammonia in the presence of sufficient sodium acetate. With a considerable excess of caustic alkali a green jelly was produced; with a small excess, or with ammonia in any excess, a violet jelly. Sodium oxalate, potassium bitartrate and citric acid could not be substituted for sodium acetate. Freezing and agitation were detrimental to the formation of jellies. The jellies when dried were not reversible. No jelly was formed on adding potassium hydroxide alone to solutions of chromic nitrate, chloride or sulphate, although in the case of the sulphate a viscous solution was obtained on long standing. Chrome alum, however, gave a jelly with sodium or potassium hydroxide alone, but not with ammonia, even in the presence of sodium acetate.—J. B.

Rare earths: Dimethylphosphates of ——. J. C. Morgan and C. James. Chem. News, 1914, **109**, 13—15.

The dimethylphosphates of a number of rare-earth metals were prepared and their use for fractional precipitation or crystallisation studied. Dimethylphosphoric acid was prepared by Schiff's method (Chem. Centr., 1857, 761, 864), methyl alcohol (250 c.c.) being added, drop by drop, to 200 c.c. of phosphorus oxychloride, kept at 25°—30° C. After 1—1½ hours the syrupy liquid was heated to expel hydrochloric acid and methyl chloride, then diluted, neutralised with barium carbonate, filtered from barium phosphate, digested with the calculated quantity of sulphuric acid at 95° C., and filtered from barium sulphate, leaving a solution of dimethylphosphoric acid. The rare earth salts were prepared by dissolving the oxide, hydroxide or carbonate in the acid solution: their crystalline form and solubilities are shown in the following table:—

Dimethylphosphate of:	Crystalline form.	Parts dissolved by 100 parts of water:	
		at 25° C.	at 95° C.
Lanthanum ...	Hexagonal crystals	103·7	—
Cerium	.. plates	79·6	65
Praseodymium .	.. ..	64·1	—
Neodymium ...	.. ..	56·1	22·3
Samarium	.. prisms	35·2	10·8
Gadolinium ...	Long needles	23·0	6·7
Yttrium	.. ..	2·8	0·55
Erbium	.. ..	1·78	—
Ytterbium	.. ..	1·2	0·25

In using the dimethylphosphates for the separation of the rare earths, fractional precipitation was effected by heating the aqueous solution to progressively higher temperatures up to 95° C., and the final filtrate was subjected to fractional crystallisation. The method proved to be much quicker than those known hitherto. Lanthanum, cerium, praseodymium, and neodymium were at once left in the final mother liquor: samarium, europium, and gadolinium were much less soluble, but more soluble than terbium, dysprosium, and holmium; erbium, thulium, yttrium, ytterbium, etc., collected in the least soluble fractions. The solubilities of the dimethylphosphates being the reverse of the usual type, the method proved useful for the rapid purification of many of the rare earths, *e.g.*, for the removal of traces of neodymium from samarium.—A. S.

Thallium, lithium, caesium, and rubidium nitrites. W. C. Ball and H. H. Abram. Chem. Soc. Trans., 1913, **103**, 2130—2134.

All the above-mentioned nitrites are most readily obtained by allowing the sulphate of the metal to react with barium nitrite. Cæsium nitrite and rubidium nitrite resemble potassium nitrite. Rubidium nitrite is remarkably deliquescent, only slightly soluble in hot alcohol and practically insoluble in acetone. It is therefore best prepared by precipitation from its aqueous solution with alcohol. Thallous nitrite is a soft crystalline substance of deep orange red colour. It melts without decomposition, and at a higher temperature evolves red fumes and leaves a yellow residue. Lithium nitrite crystallises with 1 mol. H_2O. It is very soluble in hot alcohol even when anhydrous. It melts in its water of crystallisation below 100° C., and only loses water slowly at this temperature. At 160° C. it loses water rapidly and also evolves traces of oxides of nitrogen.—W. H. P.

Bismuthinitrites. W. C. Ball and H. H. Abram. Chem. Soc. Trans., 1913, 103, 2110—2130. (See also this J., 1905, 686; 1910, 46, 902.)

The bismuthinitrites of the univalent metals fall into two classes of the general formulæ $X_3Bi(NO_2)_6$ and $X_2YBi(NO_2)_6$, where X represents ammonium, potassium, rubidium, cæsium or thallium and Y either lithium, sodium or silver. Of the twenty possible compounds the authors have obtained all but $(NH_4)_3Bi(NO_2)_6$. A further series, containing nickel in addition to a metal of the X series, can be obtained by adding a nickel salt to a solution of the nitrite of the metal in the presence of bismuth. The bismuthinitrites resemble the cobaltinitrites in formulæ, colour, solubility, etc., in many cases. The bismuthinitrites are all easily hydrolysed and it is therefore impossible to purify them by washing with water. The nitrites used in their preparation must be entirely free from chlorides and as free from alkali as possible. The existence of the above series explains to some extent the separation of sodium from potassium in the presence of cæsium and bismuth nitrite. Sodium cæsium bismuthinitrite is relatively insoluble, while potassium cæsium bismuthinitrite is not formed at all.—W. H. P.

Radium D: Alleged separation of —— from lead in radio-active lead by means of the Grignard reaction. C. Staehling. Comptes rend., 1913, 157, 1430—1432.

The author repeated the experiments of Hofmann and Wölfl (Ber., 1907, 2425), but were unable to obtain any evidence of the separation of radium D from lead.—A. S.

Cyanamide: Polymerisation of —— to dicyandiamide in aqueous solution. G. Grube and J. Krüger. Z. physik. Chem., 1913, 86, 65—105.

The polymerisation of cyanamide to dicyandiamide in aqueous solution was accelerated by addition of alkali, but whilst within the limits studied the velocity of polymerisation increased continuously with increasing additions of ammonia, in the case of sodium hydroxide and calcium hydroxide, it increased up to a maximum and then decreased again as the concentration of the alkali was increased. Polymerisation appeared to be due to the union of undissociated cyanamide with cyanamide ions to form monobasic dicyandiamide ions:

$$CNNH_2 + CNNH' \rightarrow C_2N_2N_2H_3',$$

since for a given concentration of total cyanamide, polymerisation proceeded most rapidly in a solution in which the concentrations of undissociated cyanamide and of cyanamide ions were equal. The dissociation constant of cyanamide was found to be of the order 10^{-11} and that of dicyandiamide 10^{-13}, from which it follows that in a molar solution (1 grm.-mol. per litre), acid sodium cyanamide would be hydrolytically dissociated to the extent of 3 per cent. and the acid ammonium salt to the extent of 79—89 per cent. For the preparation of dicyandiamide from commercial calcium cyanamide, these results show that the addition of a foreign base is unnecessary. From the solution of the commercial product so much lime should be precipitated that the concentrations of undissociated cyanamide and of cyanamide ions in the solution are equal, and this condition should be maintained, as far as possible, during the process by periodical precipitation of further quantities of lime. (See also Morrell and Burgen, this J., 1913. 1155.)—A. S.

Nitrogen ; Active ——. E. Tiede and E. Domcke. Ber., 1913, **46**, 4095—4103.

Further experiments have confirmed the view expressed previously (this J., 1913, 232) that the yellow after-glow considered by Strutt (this J., 1911, 683; 1912, 70) to mark the re-formation of ordinary nitrogen from an active modification produced by the action of electric discharges, is due to the presence of a small quantity of oxygen and indeed forms an extraordinarily sensitive test for the presence of traces of oxygen in nitrogen. An apparatus is described in which pure nitrogen can be generated by heating barium azide in a vacuum and then subjected to the electric discharge. If the apparatus be rinsed with the nitrogen several times to remove all traces of foreign gases, then the yellow after-glow does not appear when the electric discharge is subsequently produced, but makes its appearance immediately a little oxygen is generated by heating a small quantity of silver oxide enclosed in the apparatus.—A. S.

Sodium nitrate. Shipments and consumption from 1911 *to* 1913. W. Montgomery and Co. Dec. 31, 1913. [T.R.]

12 months ending Dec. 31st.	1911.	1912.	1913.
	Tons.	Tons.	Tons.
Shipments from South American Ports to all parts	2,412,000	2,452,000	2,660,000
Consumption in U.K.	132,000	130,000	124,000
Do. in Continent	1,564,000	1,778,000	1,700,000*
Do. in United States	556,000	485,000	608,000
Do. in other Countries	103,000	115,000	88,000*
Do. in the World ...	2,355,000	2,508,000	2,520,000

* Egypt, which has hitherto been included in "other Countries," is now included in the figures for the "Continent."

Nitrate industry of Chile. Oil, Paint, and Drug Rep., Dec. 8. 1913. [T.R.]

According to the annual report of the Nitrate Propaganda Association, the total production of nitrate of soda in Chile in 1912 was 2,885,959 short tons, as compared with 2,784,361 tons in 1911. Exports from the whole district in 1912 were 2,753,500 tons, as compared with 2,705,382 tons in 1911, 2,579,945 tons in 1910 and 2,357,968 tons in 1909. The United States during last year received about 500,000 tons of the product. Germany received about 600,000 tons, and the United Kingdom 1,000,000 tons out of the total listed exports. Of iodine the United States took 183 tons, as against 264 tons to European countries and 65 tons to the United Kingdom.

Considerable progress is being made in the use of oil as fuel for boilers in the oficinas; its use is stated to effect a saving of about 40 per cent. It is proposed to carry out extensive experiments on a large scale, with a view to discover a method of treating low-grade caliche.

Incandescence mantles, rare earths, and their radioactive by-products. Stern. *See* IIb.

Thermal analysis of clays, bauxites, and some related substances. Wohlin. *See* VIII.

Gravimetric determination of nitrites. Busvold. *See* XXIII.

Patents.

Sulphuric acid ; Process and apparatus for concentrating and distilling ——. C. Stoffmehl. Fr. Pat. 460,627, July 10, 1913.

A masonry tower, provided with an acid-proof and dust-proof lining, contains internally a helical system of flue chambers, arranged stepwise one below the other. Each flue chamber is sealed at the top by means of a silica plate, which is surmounted by a silica evaporating basin, the lip of each basin protruding well over the edge of the next lower vessel. Outside the tower, above and close to the highest, internal flue chamber, an external flue chamber is covered by a silica plate and series of basins, in which preliminary heating takes place; the lowermost external basin communicates by way of a silica funnel and tube with the highest internal evaporating basin, the furnace gases passing upwards through all the internal heating chambers in turn, then to the external chambers, and finally through flues in the masonry of the tower into the chimney. The flues are so constructed that the masonry reaches a uniformly high temperature, and the sulphuric acid vapours, which are formed in the process of concentration, are aspirated through an opening in the top of the tower and condensed.—O. R.

Ammonia from its elements ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 460,859, July 29, 1913. Under Int. Conv., Aug. 5, 1912.

An increased yield of ammonia is obtained from nitrogen and hydrogen, heated under pressure in the presence of a catalyst, if the compressed gases are allowed to expand as they leave the reaction chamber.—O. R.

Hydrosulphites from aqueous hydrosulphite solutions ; Direct preparation of anhydrous ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 460,610, June 23, 1913.

Aqueous hydrosulphite solutions are evaporated *in vacuo* with thorough and continuous agitation, so as to prevent the formation of lumps ; an organic base, such as aniline, may be added to the solution in such quantity that free aniline remains after the evaporation of the water, further heating being then required for the removal of the base.—O. R.

Tin oxides ; Process for the preparation of ——. E. P. Wetzig. Fr. Pat. 460,857, July 29, 1913.

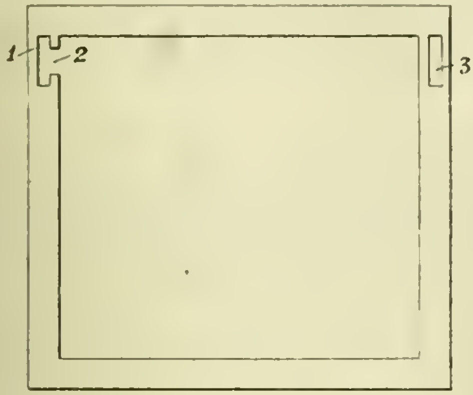
Tin is melted in a furnace, and air and the flames from the furnace are simultaneously directed on to the surface of the molten metal.—O. R.

Hydrogen peroxide ; Process of stabilising caustic alkaline solutions of —— *and utilisation of the stabilised solutions for bleaching.* Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Fr. Pat. 460,959, July 11, 1913.

Aqueous solutions of sodium peroxide are stabilised by the addition of a small quantity of an "anticatalyst," such as a magnesium compound, preferably freshly precipitated, colloidal magnesium silicate, the resulting mixture being ready for immediate use for bleaching; the "anticatalyst" is claimed to protect cellulose fibres, especially cotton, from the action of caustic alkali. Thus, separate solutions containing 0·15 kilo. of sodium silicate, 0·12 kilo. of magnesium chloride, and 0·4 kilo. of soap respectively, are added to a solution of 1·6 kilos. of sodium peroxide in 400 litres of water; 100 kilos. of cotton, impregnated with 200 kilos. of water, are then added to the bath, which is heated to 65°—67° C. during one hour, maintained at that temperature for a second hour, and finally heated to 87° C. until the bath is exhausted.—O. R.

Hydrogen and oxygen by electrolysis of water ; Production of ——. Soc. Anon. L'Oxhydrique Française. First Addition, dated June 25, 1913. to Fr. Pat. 459,967, Sept. 21, 1912 (this J., 1913, 1156).

Each frame, constructed of wood, ebonite, etc., is provided with an opening 3, and a similar opening, 1, the latter communicating with the interior of the frame by a side opening, 2. The frames are placed together so that the openings 1, and 3, in adjacent frames are in contact, and are separated by diaphragms, thus forming the anode and cathode compartments. The anode compartments will thus discharge oxygen into the channel formed on one side of the cell, and the alternate compartments will discharge hydrogen into the channel on the opposite side. The frame may be of wood, with ebonite or rubber pieces forming the openings.—B. N.



Acetic acid ; Manufacture of ——. N. Grünstein, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,081,959, Dec. 23, 1913.

See Eng. Pat. 8076 of 1912 ; this J., 1913, 141.—T. F. B.

Phosphate of lime ; Process for the treatment of ——. J. Ciselet, Forest-lez-Bruxelles, and P. Noblet, Ixelles, Belgium. Eng. Pat. 8608 of 1912, date of appl., Jan. 27, 1913.

See Fr. Pat. 436,551 of 1911 ; this J., 1912, 448. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 1790 of 1865, 686 of 1875, and 2981 of 1882.—T. F. B.

Sulphur from iron pyrites : Process for the extraction of ——. W. A. Hall, New York. Eng. Pat. 20,758, Sept. 11, 1912. Under Int. Conv., July 26, 1912.

See Fr. Pat. 458,028 of 1912 ; this J., 1913, 1156.—T. F. B.

Sulphur and sulphates from sulphites ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,820, Dec. 14, 1912.

See Ger. Pats. 264,920 and 265,167 of 1912 ; this J., 1913, 1068.—T. F. B.

Silicate rocks ; Treating —— *and recovery of alkalies therefrom.* A. Hambloch, Andernach, Germany, and S. Gelleri, Budapest, Hungary. Eng. Pat. 4842, Feb. 25, 1913.

See Ger. Pat. 258,702 of 1912 ; this J., 1913, 602.—T. F. B.

Carbide ; Process for coating —— *with calcium cyanamide.* V. Imperatori, Assignor to Soc. Italiana per il Carburo di Calcio, Rome. U.S. Pat. 1,081,938, Dec. 16, 1913.

See Fr. Pat. 448,078 of 1912 ; this J., 1913, 425.—T. F. B.

Evaporating pans or surfaces for brine and the like. Eng. Pat. 9570. *See* I.

VIII.—GLASS ; CERAMICS.

Fluorspar in glass, with calculations for its use. L. Springer. Sprechsaal, 1914, 47, 4—5, 20—21.

The use of fluorspar in glass is deprecated except for special cases and under favourable circumstances. It attacks the hearth and walls of the furnace and makes the exit-gases more injurious. By formation and decomposition of silicon fluoride it causes a scum of silica on the surface of the glass, and also alters the constitution of the glass in respect of the proportion of acid to base. On the other hand it is said to impart brilliancy to bottle-glass, and to increase its resistance under pressure. The method of calculating raw materials and costs from molecular formulæ is explained.—H. H. S.

Glass ; Requirements of —— *for bottling purposes.* R. L. Frink. Trans. Amer. Ceram. Soc., 1913, **15**, 706—727.

Bottle glass requires to withstand the corrosive action of carbonated liquids contained in it under a fairly high pressure, and also the severe changes of temperature due to the washing and steaming process which the bottles undergo in cleaning. Bottles filled with beverage were purchased and the liquid was compared with unbottled liquid of the same manufacture. Green glass was more soluble in beer than amber glass. Of a dozen bottles the lime content of the glass was found to range from 3·3 to 12·5 per cent. Owing to the presence of magnesia and an uncertain amount of hydration and carbonation, lime is the most unreliable constituent of glass and is responsible for three-fourths of loss in manufacture. The soda content of the bottles tested ranged from 13·5 to 26 per cent. ; the alumina from 1 to 8 per cent. ; magnesia from 0·5 to 4 ; silica from 66 to 74 per cent. With a constant proportion of alumina, solubility increased with increase of soda and decrease of lime, whilst with a constant proportion of lime, solubility decreased with increase of alumina. A composition of least solubility contained 12 per cent. of soda and of lime and 5—6 per cent. of alumina. A series of microphotographs illustrates the lack of homogeneity found in bottle glasses. To meet all requirements of bottling, the author recommends the composition : Na_2O 13—14, CaO 12, Al_2O_3 3—5, SiO_2 70—71 per cent.—H. H. S.

Plate glass chemist ; Some chemical reactions of interest to the ——. F. Gelstharp. Trans. Amer. Ceram. Soc., 1913, **15**, 585—590.

The chief point investigated was the behaviour of arsenic trioxide in glass manufacture. Its oxidising power by formation, and subsequent volatilisation, of metallic arsenic is disputed, and instead it is shown to be a reducing agent. Soda ash and arsenic trioxide react according to the equation : $As_2O_3+3Na_2CO_3+O_2=2Na_3AsO_4+3CO_2$. With saltcake (sodium sulphate) white arsenic forms first sulphides and sulpharsenate of sodium, and ultimately sodium arsenate ; the formation of sodium sulphite is not regarded as possible. With limestone and with lime, calcium arsenate is formed. In all cases an appreciable proportion of the arsenic introduced remains in the melt.

Another problem was the interaction of sand, soda ash and limestone. Only in certain proportions, when the ratio Na_2O : CaO was not less than 2 : 1, was the product a uniform glass.—H. H. S.

Glasses ; Investigation of surface devitrification of —— *under thermal after-treatment.* C. J. Brockbank. Trans. Amer. Ceram. Soc., 1913, 15, 600—605.

The physical and chemical changes which may take place in the surface layers of glass on reheating from the solid to the plastic state are due to volatilisation of alkalis with consequent production of silicates of higher silica content. If maintained at the critical temperature for several days, the change will proceed throughout the solid glass. Soda-lime silicates, as most liable to the defect, were investigated with regard to influence of chemical composition on devitrification. The softening point was determined by the distorted reflection of a pointed steel rod poised vertically on the heated glass, and the dimming point was indicated by the disappearance of these reflections, the muffle being provided with a thermo-couple. The results show that magnesia, and still more alumina, are beneficial constituents of glass. The use of dolomite is of decided advantage. In addition to its influence against devitrification, alumina in amounts above 3 per cent. greatly increases the viscosity of glass.—H. H. S.

Clays, bauxites, and some related substances; Thermal analysis of ——. R. Wohlin. Silikat-Zeits., 1913, **1**, 225—229.

The heating curves obtained by gradually raising the temperature of finely divided clays to 1300° C. (reached in 75 minutes) exhibit a more or less pronounced heat absorption at 560°—580° C., corresponding to the loss of water of constitution, and an emission of heat at 960° C., due, in the author's opinion, to physical change (probably a rise in specific gravity). Both of these disturbances are characteristic of the clay substance, the evolution of heat being most marked in those cases in which pronounced absorption has been observed. Bauxites of the formula, Al_2O_3,H_2O, are characterised by an absorption of heat at about 540° C. and those of the formula, $Al_2O_3,3H_2O$, by an absorption at about 310° C.; dehydration is complete at these temperatures, so the monohydrated oxide is evidently not formed as an intermediate product in dehydrating the trihydrate, and, similarly, artificial aluminium hydroxide is completely dehydrated at a low temperature. With both types, there is also often observed an evolution of heat at 1060° C., owing probably to increase of specific gravity. Bauxites of the supposed type, $Al_2O_3.2H_2O$, are mixtures of the above, for they exhibit absorption of heat both at 310° and 540° C., and at those temperatures only. The above characteristic behaviour of clay, $Al_2O_3,2SiO_2.2H_2O$, and of the two types of bauxite has been applied to the detection of these in minerals, and this method of thermal analysis is claimed to give more reliable results than are deduced from ultimate chemical analysis, besides being more rapid. —F. Sodn.

Clays and clay suspensions; Electrical conductivity of ——. [*Determination of soluble salts.*] A. V. Bleininger and C. S. Kinnison. Trans. Amer. Ceram. Soc., 1913, **15**, 523—531.

Soluble salts in clays may be rapidly estimated by determining the electrical conductivity, which is approximately proportional to the concentration of the salts within certain limits. For unknown clays qualitative analysis should first be conducted, but the method is recommended chiefly for the control of slips to which sodium carbonate or silicate has been added for the casting process.—H. H. S.

Clays: Effect of overburning upon the structure of ——. A. V. Bleininger and E. T. Montgomery. Trans. Amer. Ceram. Soc., 1913, **15**, 71—88.

The formation of vesicular structure in clays during burning leads to the presence of pore space into which water cannot penetrate, and which therefore finds no expression in absorption tests as commonly practised. The magnitude of these "blebs" is of considerable and unfavourable influence on the properties of the burned material. Conditions of burning, such as incomplete oxidation and too rapid firing, affect the phenomenon, but when all precautions are taken, a certain amount of gaseous matter is given off by every clay, resulting in more or less permanently enclosed pore space. The inherent structure of the clay and that imparted to it in moulding are important factors. Some clays, on burning, develop vesicular structure long before their porosity as measured in absorption tests approaches zero; others reach the stage of non-absorption and then form blebs rapidly. The authors investigated the effect of overburning rather than of normal conditions in order to ascertain the readiness with which different clays became spongy and to determine how important a factor the enclosed pore space is in bringing about swelling. A definite rate of firing, a rise of 20° C. per hour, was maintained during all the tests. Pore space was calculated from the dry and wet weights of specimen briquettes, and their true and apparent specific gravity. The results show that molecular changes still proceed after vitrification and that equilibrium is only reached when complete fusion has been brought about.—H. H. S.

Clays; Function of time in vitrification of ——. G. H. Brown and G. A. Murray. Trans. Amer. Ceram. Soc., 1913, **15**, 193—216.

Following the work of Bleininger and Boys (this J. 1911, 1384) clays were heated to their maturing temperatures at definite rates and the effect compared by means of porosity and shrinkage determinations. Before testing, the sample discs were fired in a gas kiln to 850° C. until the clays were fully oxidised. The effect of time in the firing of clay products is of great importance. A rapid rate of firing requires a higher finishing temperature than a slower one. The higher the content of fluxes the more marked will be the influence of the time factor. General rules governing time-temperature relations are not possible, owing to the fact that certain properties of clays, such as their viscosity at kiln temperatures, vary widely according to composition and physical structure. Vesicular structure (see preceding abstract) is produced by excessive temperature and also by longer burning at lower temperatures. The rate of burning must depend on the character of the clay and the size of the product to be fired. For most purposes rates of firing of from 10° to 35° C. per hour are suitable. Firing at constant rate cannot be applied to practical work. Within 40° of the minimum maturing temperature, the rate should be lowered to 10° C. per hour until the burn is finished. When uniformity of temperature cannot be obtained in a kiln, the minimum maturing point should be maintained until the clay has reached the desired degree of density. The greater the tendency of a clay to produce vesicular structure, the lower should be the burning temperature with a corresponding increase in time. For this purpose it is necessary to know the temperature limits within which the time factor becomes effective. Every clay should be studied by means of pyrometers, cones, and shrinkage and porosity determinations.—H. H. S.

Felspar; A commercial method of testing ——. J. Minneman. Trans. Amer. Ceram. Soc., 1913, **15**, 101—111.

The common practice of making cones of samples of new consignments of material and firing them in comparison with a cone of standard felspar is not justified by its results. The variation in deformation temperatures is not so great as is indicated by chemical analysis with regard to the content of the quartz impurity. If quartz be added to pure felspar, very little change in deformation is noticed until 15 per cent. is reached, after which deformation is decreased with increase of quartz. The author suggests that flint to the extent of 15 or 20 per cent. be added to the samples of felspar when making the trial cones. The fired cones should be examined for colour and the presence of black specks.—H. H. S.

Felspar and a deformation study of some felspar and felspar-quartz mixtures. A. S. Watts. Trans. Amer. Ceram. Soc., 1913, **15**, 144—166.

The potash spar of commerce, usually regarded as orthoclase, is really microcline. Deposits of pure albite (soda-felspar) do not exist on a commercial scale, and the material on the market always contains small quantities of potash and lime. The relative influence of potash and soda bases in causing cones of felspar to deform was tested by various mixtures of microcline and albite. Pure potash spar deforms at cone 10; the most fusible member of the series consists of a mixture of 7 of albite to 3 of microcline, which goes down before cone 6; mixtures containing 44—77 per cent. of albite to 53—21 of microcline are all completely deformed before cone 6, but the rate of deformation decreases as the microcline content increases. High soda content hence does not indicate low deformation temperature, and the proportion of soda spar cannot be determined in this manner except by careful observation of the rate of deformation. Potash spars are very slightly affected by additions of quartz or flint; substitution of quartz for felspar up to 20 per cent. may be made without materially affecting the temperature at which deformation begins or is completed; substitution up to 35 per cent. does not affect it more than half a cone. Mixtures of soda spar and quartz have in all cases more rapid rates of deformation than any mixture of potash spar and quartz. This property might be convenient in glazes where fluidity is desired, but would tend to cause warping in porcelain bodies. Soda spar-quartz mixtures do not deform at a lower temperature than pure soda spar. Ware made from soda spar gives a dead woody ring. In manufacture there is no advantage in introducing more than half the fluxes as soda spar.—H. H. S.

Kaolin-felspar mixtures: Deformation study of ——. H. Wilson. Trans. Amer. Ceram. Soc., 1913, **15**, 217—232.

The deformation of mixtures of pure microcline felspar and pure kaolin was studied. With pure felspar deformation occurred at cone 9. With 2 and 3 per cent. of kaolin, deformation began later, but proceeded more rapidly, the end being reached earlier than with pure felspar. With 5 and 6 per cent. the rate declined to that of pure felspar, but deformation began and finished later than with the latter. At 9—11 per cent. of kaolin, deformation proceeded at a more rapid rate than with any other mixing, though it began late. Beyond 10 per cent., deformation began and finished at higher temperatures as the quantity of kaolin was increased. The results indicated two eutectics, one in the region of 2—3 of kaolin and 98—97 per cent. of felspar, the other with 9—11 of kaolin to 91—89 per cent. of felspar. When kaolin was added to a 1 : 9 mixture of quartz and felspar, there was most rapid deformation with 8 per cent., and next with 10 and with 0 per cent. of kaolin. Hence felspar with both quartz and kaolin as impurities may deform either with or before pure felspar.—H. H. S.

Talc as a [pottery] body material. C. W. Parmelee and G. H. Baldwin. Trans. Amer. Ceram. Soc., 1913. **15**. 532—546.

Commercial talc may be either talc or steatite. It can be substituted for clay in bodies in considerable quantities without affecting the working properties. It has a decided influence, even in small quantities, in promoting translucency and whiteness of ware. Talc promotes vitrification, which proceeds slowly and without the sudden fusion caused by lime, and it also increases the toughness of the body as measured by abrasion loss.—H. H. S.

Porcelain bodies; Viscosity of ——. A. V. Bleininger and P. Teetor. Trans. Amer. Ceram. Soc., 1913, **15**, 328—337.

The vitrification of ceramic bodies requires for its explanation two assumptions, the existence of surface tension tending to contract the mass, and a lowered viscosity or softening, which will permit the displacement and rearrangement of the molecules. As a measure of viscosity the deformation under tensile strain was used. Specimens of porcelain bodies were made up of such shape that they could be hung from a fireclay grid and a weight attached to the bottom. The specimens possessed a cross-section of approximately 1 sq. in. after burning them to vitrification; their length was 4½ ins., their width 1½ ins., mould measurement. The load was applied to each bar after firing to cone 10, by means of a fireclay piece provided with a groove into which fitted the bottom of the porcelain, and was maintained at 5 lb. per sq. in. Porcelains tested embraced compositions of 35—50 per cent. of clay and 10—25 per cent. of felspar. Complete vitrification, as indicated by the ink test, was not possible with less than 19 per cent. of felspar. Excess of felspar proved undesirable, the viscosity being reduced. The higher the clay content, the less marked was the effect of felspar. A sharp line of demarcation appeared between bodies containing less and more than 45 per cent. of clay. The former possessed a very much higher temperature coefficient of decrease of viscosity and hence were more subject to deformation, and accordingly undesirable. Under tensile stress at kiln temperatures, the strength of porcelain bodies was found to be low, about 5 lb. per sq. in. with maximum elongation, and to be but a small fraction of the tensile strength at ordinary temperatures. The permissible elongation under a load of 5 lb. per sq. in. appeared to be about 5 or 6 per cent.—H. H. S.

Sanitary ware; A process of making [engobes for] ——. J. B. Shaw. Trans. Amer. Ceram. Soc., 1913. **15**, 467—481.

A description of the manufacture of sanitary ware with some experiments on the composition of the intermediate engobe or slip. All slips were fired at cone 9. A clay content of more than 40 per cent. required a felspar content of more than 15 per cent. to get sufficient vitrification at cone 9 unless more than 1 per cent. of lime was present. Lime could be introduced up to 10 per cent. in slips containing 40 per cent. of clay without attacking the overglaze or destroying opacity. The presence of lime assisted the start of vitrification but was not essential to good slips. More than 45 per cent. of felspar made a slip too vitreous and likely to craze, and similar results were obtained with less than 40 per cent. of clay and more than 15 per cent. of felspar. The following limits are assigned for satisfactory slips: felspar 20—45, flint 10—40, china clay 30—60, calcium carbonate 0—10 per cent.—H. H. S.

Refractory bodies; Development of special ——. E. T. Montgomery. Trans. Amer. Ceram. Soc., 1913, **15**, 606—619.

Refractory bodies are of two classes; those which have high thermal conductivity and low coefficient of expansion inherent in their constituents, and those which have an open porous structure of just the proper density to conduct heat with the least detriment to the body. The former class, which includes fused magnesite, fused alumina and fused quartz, is the safer. The latter class may be made from combinations of alumina, kaolins and ball clays. The Marquart pyrometer tubes, inner and outer, have the approximate composition: 30 per cent. of calcined alumina, 30 of raw ball clay, and 40 of calcined clay for the inner, and 40 per cent. of calcined alumina, 30 of raw ball clay, and 30 of burnt clay for the outer tube. The body is glazed with a refractory glaze to make it impervious, and has an absorption of 13·7 per cent. Various bodies were made up with fused magnesia, burnt alumina and kaolin respectively as refractory elements, and with a percentage of ball clay to render them plastic enough to be formed into tubes by means of a die. The magnesia trials gave the best results, followed by those of alumina and then of kaolin. A mixing particularly recommended is: ball clay 30, kaolin 55, fused magnesia 15 parts by weight. Fired at cone 12 it is impervious to gases without a glaze, does not absorb liquids and withstands sudden cooling.—H. H. S.

Tile; Production of a pink vitrified floor ——. R. Heidingsfeld. Trans. Amer. Ceram. Soc., 1913. **15**, 140—143.

The tile body was vitrified at cone 11, and the best pink was obtained from a mixture of Fe_2O_3 1, Al_2O_3 90, and Cr_2O_3 9 per cent., mixed as a stain with 10 times its weight of the body-mixing: 64 per cent. of spar, 5 of flint and 31 of kaolin. The pink thus obtained could be darkened to ruby by substituting 5 per cent. of calcium phosphate for 5 per cent. of alumina in the stain composition. The calcium phosphate probably acted as a flux, bringing out at cone 11 a dark pink which would have been produced without its use at a higher temperature. —H. H. S.

Hydrous silicates formed under steam pressure. L. E. Barringer. Trans. Amer. Ceram. Soc., 1913, **15**, 125—139.

For insulating ware similar to that described in Eng. Pat. 19,035 of 1905 (this J., 1906, 700), it was found that a high percentage of silica was desirable and also that an inert fibrous material like asbestos was necessary to impart mechanical strength. A suitable mixture consists of 30 parts of slaked lime, 45 of flint and 25 of asbestos. It is shaped by presses, dried, subjected to steam pressure of not less than 135 lb. per sq. in., and again dried, when the pieces are ready for use. A pressure of 150 lb. per sq. in. for about four hours gives the best results. Other oxides and hydroxides than those of calcium gave varying results. Zinc, magnesium and lead oxides gave good results, as also did manganite. Of these hydrous silicates of calcium, magnesium, zinc and lead, that of calcium had the highest disruptive and mechanical strength and the highest absorption. The formulæ for the substances were: $CaO,SiO_2,0{\cdot}54\ H_2O$; $MgO,SiO_2,\ 0{\cdot}45\ H_2O$; $ZnO,SiO_2.\ 0{\cdot}05\ H_2O$; the lead compound giving a doubtful result, —H. H. S.

Crazing of white ware; Method of testing [delayed] ——. H. Harkort. Trans. Amer. Ceram. Soc., 1913, **15**, 368—372.

Ware crazed on coming from the kiln is not so serious an item of loss in manufacture as ware which crazes after an interval during which it may have been despatched and put into use. For this delayed crazing the author suggests the quenching test. A drying oven was heated by electric current with the greatest possible uniformity by means of wire winding. Heating was accomplished gradually in order that the piece should acquire the temperature indicated by the thermometer. The piece was then quenched in cold water. If crazing did not result, the test was repeated at a temperature 10° C. higher. Ware which had a quenching temperature limit of 120° C. crazed in a few days; of 150°, in three or four months; of 160°, in 15 months; over 170° C., crazing seldom resulted in the period of observation, 2½ years. Variations up to 20° C. were observed from different thicknesses of glaze, the thicker glaze rupturing the more easily. Another method of conducting the quenching test consisted in repeating it at a fixed temperature, say 120° C., until crazing occurred. The results agreed with those of the previous method. Ware which failed at 190° was not crazed after 15 repetitions at 120° C.—H. H. S.

Underglaze colours containing chromium; Effect of zinc in ——. F. K. Pence. Trans. Amer. Ceram. Soc., 1913, **15**, 118—124.

An inference by Heubach (this J., 1912, 1129) that the green developed by chromium is not destroyed by the presence of zinc in the stain, as it is by zinc in the glaze, is not confirmed by the author. Whether a mixture of zinc oxide and chromium trioxide be fired alone or with the normal constituents of glaze-stains, such as silica, alumina, and boric oxide, the green is destroyed in the stain as actively as in a glaze. The tint obtained is determined by the composition of the stain, and varies from brown to grayish pink.—H. H. S.

Matt glazes. F. K. Pence. Trans. Amer. Ceram. Soc., 1913, **15**, 413—419.

The theory advanced previously (this J., 1912, 1128) that mattness is due to crystallisation from a glass matrix, was confirmed by microscopic examinations at different stages of development of the glaze. The evidence indicated that in true matts the glaze behaved in every way analogous to a bright glaze, except that all of the components did not always enter into solution and that on cooling segregation of crystals took place. The best way of obtaining a matt glaze was found to consist in facilitating most effectively the process of solution and subsequent crystallisation. Special types of matt glaze might be produced by different phenomena, such as vesicular structure, but a causal relation was found to exist between crystallisation and the production of true matt glazes. In the case of calcium-alumina and barium matt glazes the crystals were very tiny and in some cases did not amount to more than 20 per cent. of the mass, whilst presenting a smooth matt texture. Zinc matt glazes exhibited relatively large crystals and correspondingly coarse texture. Barium matt glazes have hitherto been regarded as due to immaturity, but the author succeeded in obtaining a true matt from the formula: $0{\cdot}15\ K_2O$, $0{\cdot}05\ ZnO$, $0{\cdot}15\ PbO$, $0{\cdot}30\ CaO$, $0{\cdot}35\ BaO$, $0{\cdot}25\ Al_2O_3$, $1{\cdot}88\ SiO_2$, the glaze being fired at cone 02.—H. H. S.

Leadless enamels [on cast iron]. H. F. Staley and G. P. Fisher. Trans. Amer. Ceram. Soc., 1913, **15**, 620—627.

Experiments were made by eliminating lead from a commercial cast iron enamel, and by converting a leadless sheet steel enamel into one for cast iron. The latter method was unsatisfactory, enamels for sheet steel being too refractory and too high in fluorides; crazing resulted if the fusibility was brought to the desired pitch. It was not possible in all cases to stop crazing by decreasing fusibility. The following four recipes are recommended for leadless enamels, the figures applying to the raw mixings:—

	1	2	3	4
Felspar	422·0	430·0	410	410
Fluorspar	122·5	154·5	—	—
Borax	151·0	151·0	241	241
Na_2CO_3	80·8	107·0	—	—
$NaNO_3$	27·4	27·4	27	27
$BaCO_3$	90·3	90·3	—	—
$CaCO_3$	26·9	—	—	—
ZnO	150·0	110·0	—	125
SnO_2	83·0	83·0	80	80
Cryolite	—	—	120	120
Boric acid	—	—	443	222

The felspar used contained 10·8 per cent. K_2O and 4·44 Na_2O. All fluxing oxides in common use except lead oxide and boric oxide gave a matt finish in enamels when used in excesive amounts. Crazing was liable to occur if the fluorides exceeded 15 per cent. of the weight of the melted glass.—H. H. S.

Lead in the ceramic industry; Problem of ——. L. Petrik. Sprechsaal, 1914, **47**, 1—3.

The solubility of lead glazes is tested by official methods which vary somewhat in different countries. The German method is to heat for half an hour with a 4 per cent. solution of acetic acid. In the English method, solubility is tested at ordinary temperatures in 0·25 per cent. hydrochloric acid. The method proposed by the author consists in digesting 5 grms. of the finely ground substance for one hour in an Erlenmeyer flask with 150—200 c.c. of 0·33 per cent. hydrochloric acid at 37°—40° C. Sodium acetate is then added to promote settling, and to dissolve lead chloride. The residue after filtration is also washed with sodium acetate solution. Lead is then estimated as sulphate. In a comparison of these methods, a glaze which had a solubility of 0·17 per cent. PbO by the English method, yielded 0·25 by the German and 0·56 by the author's method. As low solubility can only be obtained in glazes containing a high percentage of lead by fritting some of the constituents, a series of frits was tested. The frits contained a constant molecular proportion of $0{\cdot}75\ PbO$, $0{\cdot}12\ Al_2O_3$, and $2{\cdot}4\ SiO_2$ and varying amounts of lime, potash, and boric anhydride. With $0{\cdot}20\ CaO$, $0{\cdot}05\ K_2O$, the solubility was 0·57 per cent. (Petrik); addition of $0{\cdot}125\ B_2O_3$ to the frit gave 0·79; of $0{\cdot}25\ B_2O_3$, 2·54; of $0{\cdot}375\ B_2O_3$, 7·02 per cent. When the lime and potash proportions were reversed, *i.e.*, with $0{\cdot}05\ CaO$ and $0{\cdot}20\ K_2O$, solubility was 3·42 per cent.; addition of $0{\cdot}25\ B_2O_3$ gave 5·95; of $0{\cdot}375\ B_2O_3$, 12·88 per cent. PbO. The first frit of the series was accordingly the best, viz., that of the formula $0{\cdot}75\ PbO$, $0{\cdot}20\ CaO$, $0{\cdot}05\ K_2O$, $0{\cdot}12\ Al_2O_3$, $2{\cdot}4\ SiO_2$.—H. H. S.

Patents.

Mica sheets; Process and apparatus for making ——. Meirowski und Co. Akt.-Ges., Porz on Rhine, Germany. Eng. Pat. 15,568, July 5, 1913. Under Int. Conv., July 22, 1912.

To overcome the adhesion of lumps of split mica and to separate them into single flakes which can be applied to an adhesive backing, the split mica lumps are introduced into a rotating sieve drum. When sufficiently separated the flakes pass individually through the meshes of the sieve drum on to the adhesive backing, or on to a wire-gauze or finely perforated carrier band.—W. C. H.

Kilns or apparatus for drying china clay and other materials. The Oil-Flame Furnace Co., Ltd., London, and E. Buchholtz, Harrow. Eng. Pat. 29,065, Dec. 17, 1912.

To obtain more uniform heating of the floors of drying kilns, a central flue extends from each of the furnaces located at the front of the kiln to the rear of the kiln under the floor. The flue is closed at its rear end and is provided with openings in its side walls adapted to conduct heating gases from the furnace to flues extending laterally and communicating at their outer ends with collecting flues arranged parallel to the central flue and connected with a main outlet flue. The openings in the flues may increase in size as their distance from the furnace increases. H. H. S.

Crucible. G. N. Jeppson, Assignor to Norton Co., Worcester, Mass. U.S. Pat. 1,081,535, Dec. 16, 1913.

A porous crucible or container has glazed and unglazed portions which are isolated from each other by a septum of glazing composition.—H. H. S.

Refractory composition. G. N. Jeppson, Assignor to Norton Co., Worcester, Mass. U.S. Pat. 1,081,536, Dec. 16, 1913.

Previously fused alumina is mixed in a loose, dry state with a small quantity of a refractory binding material. The mixture forms with water a plastic mass which is capable at high temperatures of binding previously burned portions of like composition without fluxing them. —H. H. S.

Glazed refractory article [crucible]. A. T. Malm, Assignor to Norton Co., Worcester, Mass. U.S. Pat. 1,081,542, Dec. 16, 1913.

A crucible or other article comprised of alumina and a ceramic binding material is covered with a porcelain glaze having a coefficient of expansion closely approximating to that of the body. H. H. S.

Enamel; Process for dulling ——. A. J. Schüler, Hamburg, Germany. Eng. Pat. 28,679, Dec. 12, 1912.

An enamel coating of ordinary composition is first fired upon the article, and then a second coating of enamel is fired on, which is prepared by intimately mixing together ordinary enamel ingredients comprising about equal proportions of alkali and silica, fusing them to form a vitreous mass, which is ground and mixed with an almost equal quantity of raw silicious materials. To give surfaces suitable for writing with pencil, graphite or chalk, magnesium carbonate, borax or soda is mixed with the materials of the second coating.—W. C. H.

Porous article. U.S. Pat. 1,081,573. *See* XXIII.

IX.—BUILDING MATERIALS.

Portland cement; Properties of —— as affected by different burning temperatures. P. H. Bates. Trans. Amer. Ceram. Soc., 1913, 15, 420—443.

Increase of lime in the raw mixing caused increase of tricalcium silicate and aluminate, accompanied by decrease of calcium orthosilicate and disappearance of the compound, $5CaO,3Al_2O_3$, but to burn the material containing higher lime required a higher temperature. Investigation of various mixtures fired to the temperatures 1100°, 1200°, 1300°, 1350°, 1400°, 1450°, and 1500° C., was carried out with regard to changes in constitution of the resulting clinker and also concerning physical properties of the cement. With increase of temperature there was an increase in the amount of $3CaO,SiO_2$; alumina tended to pass into $3CaO,Al_2O_3$, and iron oxide entered into the orthosilicate, colouring it brown and apparently preventing inversion of the β- to the γ-form on cooling. There was but slight change in strength beyond the temperature at which satisfactory material was first obtained. —H. H. S.

Ultramarine; Behaviour of —— in cement ware. K. Haerting. Z. angew. Chem., 1913, 26, 800.

Ultramarine used for colouring cement ware is gradually decolourised in the interior of the mass, although the exterior remains apparently unaltered. This takes place more rapidly in tropical regions. In a six-year old building the surface of some coloured cement plates became covered with a deposit which proved to be almost pure sodium sulphate. Under the deposit the plate appeared unaltered, but the coloured layer was found to extend to a depth of only 0·2 mm., the remaining 2·5 cm. having been completely decolourised.—A. S.

Cast-iron; Concrete-covered ——, a new structural material. F. von Emperger. Stahl u. Eisen, 1913, 33, 1803—1808, 1972—1979.

An account is given of the use of beams of cast-iron with a covering of reinforced concrete in bridge- and building-construction. The total diameter of the beams is twice that of the iron cores. It is claimed that with such beams the great strength under pressure of cast-iron can be utilised, without the disadvantage of its brittleness. —T. St.

Gypsum; Calcining of ——. L. C. Snider. Eng. and Min. J., 1913, 96, 1220.

In the continuous Cummer process, a rotary kiln is used through which gypsum crushed to nut size passes in about ten minutes. When discharged it has a temperature of 260° C., and it is stored in brick bins in which it acquires a uniform temperature to produce plaster of the right quality. This is pulverised and sifted. The continuous process requires less fuel and power than the older process. —W. R. S.

Slags; Study of some calcareous and magnesian ——. A. V. Bleininger, G. H. Brown, C. S. Kinnison and A. A. Klein. Trans. Amer. Ceram. Soc., 1913, 15, 547—569.

The production of slags for building purposes where better materials are not available is suggested as an independent industry. Suitable compositions should not contain less lime than is represented by 56 per cent. of limestone to 44 of shale or 52 of dolomite to 48 of shale per cent. The dolomitic slags show greater fluidity, crystallise more readily and are superior in hardness and toughness. Impure stones, rejected for lime making, are suitable for this industrial application. The basic slags of the limestone series are coarser in grain than the corresponding dolomitic slags, and have higher indices of refraction.—H. H. S.

The Dunn pulverised coal burner. Roush. *See* IIa.

Patents.

Portland cement; Manufacture of ——. G. T. Hill, Norwood, Transvaal, and C. G. Stone, Johannesburg. Eng. Pat. 5908, March 10, 1913.

From 1 to 10 per cent. of magnesium silicate (as soapstone, steatite, etc.), is incorporated with Portland cement preferably by grinding with the clinker. Mortar made with the product is said to be stronger and more waterproof than that made with ordinary cement.—F. Sodn.

Waterproof cement and method of making. R. Schuler, New York, Assignor to The Gibraltar Stone Co. U.S. Pat. 1,081,155, Dec. 9, 1913.

A mixture of Portland cement, alum, a soluble soap, puzzuolana cement, and slaked lime. The Portland cement (200 parts) is preferably mixed in separate portions with the alum (3 parts), potash soap (3 parts), puzzuolana cement (28 parts), and lime (24 parts), and the portions are then mixed together.—F. Sodn.

Artificial stones ; Method of and means for manufacturing ——. G. Hidoux and J. Bernheim, Paris. Eng. Pat. 7002, March 22, 1913.

The incombustible waste from house refuse, or the slag from destructors, or a mixture of both, is ground "as finely as normal commercial conditions permit," mixed with green calcareous or other clay, previously dried and sifted, the mixture moistened with a jet of water or of air charged with atomised water, or of steam, moulded under pressure and finally baked at 950° to 1000° C. Suitable proportions are 65 to 75 per cent. by volume of incombustible waste, 35 to 25 of clay, and 8 to 10 per cent. of water. The plant used comprises a millstone grinder, a sieve, and a hopper provided with a distributor for dealing with the incombustible matter, a disintegrator, a dryer, a millstone grinder, a sieve, and a hopper provided with a distributor for the clay, a mixer provided with spiral wings for mixing the incombustible waste with the clay, a grinder, a sieve, a hopper and a moulding press. —W. C. H.

Lithographic stone ; Manufacture of artificial ——. V. Hereng, Brussels. Eng. Pat. 12,640, May 30, 1913. Under Int. Conv., May 30, 1912.

Equal weights of two or three kinds of Portland cements (obtained from different manufacturers), trass, and oolitic limestone (such as French stone or Euville stone), are mixed and sifted before being introduced into a perforated mould where the mixture is first compressed in the dry state and then immersed in water in which it is maintained under a high pressure, about 135,000 kilos. per sq. m., until completely impregnated. As the volume of the mass cannot increase, air is expelled, and the stone so formed is hardened from the centre to the periphery by remaining in water for at least three months, after which it is dried very slowly in a damp room protected from currents of air.—H. H. S.

Fireproofing composition. W. A. Hall, New York, Assignor to William A. Hall Lumber and Fibre Co. U.S. Pat. 1,080,966, Dec. 9, 1913.

An alkaline mixture made from approximately equal proportions of a salt having fireproofing properties and an acid reaction and a salt having an alkaline reaction, especially from ammonium sulphate and trisodium phosphate.—F. Sodn.

Wood ; Apparatus for preserving ——. G. B. Shipley, Milwaukee, Wis. U.S. Pat. 1,081,158, Dec. 9, 1913.

A measuring tank, which may be supported on a weighing machine, is connected, on the one hand, with a retort for the wood and, on the other, with a source of preservative fluid. Means are provided for conveying fluid to the tank for weighing; for producing uniform pressures (above atmospheric) in the tank and retort; for conveying the weighed fluid to the retort, and additional fluid at a pressure above that obtaining in the retort; and for allowing the excess fluid from the retort to return to the tank for re-weighing, and thence to the source.—F. Sodn.

Refractory materials ; Treatment of —— and apparatus therefor. G. Weintraub and H. Rush, Lynn, Mass., U.S.A. Eng. Pat. 20,348, Sept. 6, 1912. Under Int. Conv., May 28, 1912.

See U.S. Pat. 1,071,488 of 1913; this J., 1913, 944.—T.F.B.

Refractory materials. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 29,389, Dec. 20, 1912.

See U.S. Pat. 1,072,413 of 1913; this J., 1913, 1070.—T.F.B.

Hydraulic cement ; Process for the manufacture of a ——. C. L. Carlson, Stockholm. Eng. Pat. 2239, Jan. 28, 1913. Under Int. Conv., Aug. 19, 1912.

See Fr. Pat. 452,399 of 1912 ; this J., 1913, 659.—T. F. B.

Mortar ; Process of manufacturing a waterproof ——. A. Markus, Assignor to A. Prée, Dresden, Germany. U.S. Pat. 1,082,035, Dec. 23, 1913.

See Fr. Pat. 446,375 of 1912 ; this J., 1913, 144.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Dry blast ; Economy of ——. J. von Ehrenwerth. Iron and Steel Inst., May, 1913.

Calculations showed that the percentage economy of fuel due to reduction of the moisture of the blast from 15 to 5 grms. per kilo., without considering the consequent reduction of temperature of the waste-gases, ran between 6 and 11 ; and that due to the lowering of temperature of the waste-gases between 3 and 15. The total economy was from 9 to 25 per cent. The economy of drying the blast is greater the lower the temperature of the blast and the higher the original temperature of the waste gases. There being less fuel charged, the total volume of material, and hence the volume of blast, per unit of production, is less ; thus the blowing engine and stoves can cope with a larger production, and the furnace yield is increased. The temperature in the melting-zone is raised, and not only is the melting accelerated but the silicon is increased and the sulphur lowered. The advantages are, however, dependent on local conditions, being greatest in the case of furnaces working with high temperatures both of blast and waste-gas, as in making ferromanganese, ferrosilicon, or ferrochrome, and in places where the atmosphere is moist.—J. T. D.

Cast iron ; The magnetic properties of ——. E. Gumlich. Stahl u. Eisen, 1913, **33**, 2133—2136. (See also this J., 1912, 539.)

Manganese and combined or dissolved carbon all reduce the permeability of iron. For dynamo-iron, therefore, these elements should be kept as low as possible, and silicon should be present only in sufficient amount to bring about separation of carbon as graphite. It is desirable, after casting, to anneal and cool slowly. For permanent magnets, in which high coercive strength is desired, carbon in solution is most advantageous, the best results being obtained with C 1·2—1·5, Mn 1—2 per cent. with little or no silicon, and a hardening temperature of 850° to 900° C.—T. St.

Steel ; Studies in the cold flow of ——. P. Longmuir. Iron and Steel Inst., May, 1913.

Three annealed steel rods, 0·201 in., 0·214 in. and 0·212 in. in diameter, and containing respectively C 0·10, 0·48 and 0·89 per cent. ; Mn 0·89, 0·87 and 0·78 ; Si 0·06, 0·058 and 0·07 ; S 0·103, 0·039 and 0·035 ; P 0·307, 0·050 and 0·046, were drawn down by successive reductions of 0·001 in. until they would not admit of further cold flow. The maximum stress values of the steels, originally 35·98, 43·48 and 50·87 tons per sq. in. in the rod, were increased to 75·63, 90·0 and 104·0 tons, respectively, by reduction to a thickness of 0·072 in.; after further reduction to 0·024 in. in the first and 0·056 in. in the second sample, the values were 112·0 and 100·0 tons per sq.in respectively. In the case of a steel containing C 0·25, Mn 0·35, Si 2·50, S 0·025, P 0·020 and Al 0·75 per cent., which was drawn down from 4- to 20-gauge under commercial conditions

(the reduction per pass varying from 0·04 in. to 0·006 in.), the original maximum stress of 50·26 was increased to 74·5 tons per sq. in. A series of six crucible steels—containing C 0·10 to 1·47 per cent., and normal amounts of Mn, Si, S and P—were reduced to 25-gauge wire by means of light draughts and frequent annealings. Up to 0·26 per cent. C the maximum stress values of the wires (about 46 tons per sq. in.) were about double those of the annealed rods; from 0·75 per cent. C onwards the maximum stress values of the wires (52—60 tons per sq. in.) although not differing materially from those of the rods as rolled, were about 50 per cent. greater than those of the annealed rods. In the higher carbon ranges the resistance to torsion of the finished wire as compared with that of the rolled or annealed rod was very marked. From a study of the evidences of polishing action exhibited by the outer surfaces of drawn wires, the author is of opinion that Beilby's theory (analogy with the mobility of a liquid) cannot be sustained, since the vitreous or non-crystalline form is not attained by cold drawing or rolling. As regards the readjustment of structure by annealing after cold working, it is pointed out that the crystals do not regain their original size but become permanently smaller as the diameter of the wire diminishes. The causes of cracking and cupping during drawing are discussed in some detail; and, in connection with the latter phenomenon as caused by segregation, an account is given of experiments made with a number of composite bars each of which contained a core of steel having a different composition from that of the surrounding metal.
—W. E. F. P.

[*Iron and steel.*] *So-called "crystallisation through fatigue."* F. Rogers. Iron and Steel Inst., Sept., 1913.

The crystalline structure frequently exhibited by wrought iron or steel which has failed in service by reason of repeated stress does not appear to be the result of fatigue, since in every case of such failure coming under the author's notice a fracture of similar appearance could be obtained in an unfatigued part of the metal. Examples of the failure of wrought iron are given in which such crystalline structures, in both the new and the fatigued metal, were due to the presence of low-grade iron or steel scrap.—W. E. F. P.

Iron and steels; Transformations of —— at high temperatures. K. Honda and H. Takagi. Rev. Mét., 1913, **10**, 1326—1336.

Pure iron, tungsten steel (W 5 and C 0·6, per cent.) and leven carbon steels (C 0·14—1·50, Si 0·05—0·34, Mn 0·27—67, P 0·010—0·051, S 0·014—0·044, Cu 0·05—0·13, per ent.) were heated and allowed to cool under conditions ermitting observation by magnetometric methods of the hanges occurring more particularly between the temperaures of 700° and 800° C. With pure iron, the transormation β→α was found to correspond to a small temerature interval, which, like that of γ→α, increased with he carbon content of the material. No sensible evolution f heat occurred during either of these transformations in he case of the steels; but during the eutectic separation f α-iron and the iron-cementite solid solution (which curred at a temperature 30°—40° C. higher when heating han when cooling) the magnetism of the samples increased nd heat was evolved. Recalescence in steels thus ppears to be due to the separation of the solid solution nd not to the polymorphous transformation β→α or γ→α.
—W. E. F. P.

on; Rusting of —— in water. W. A. Bradbury. Chem. News, 1913, **108**, 307—308.

xperiments are described in support of the view that e rusting of iron in water is due to dissolved oxygen d carbonic acid. Boiled water to which 5 per cent. of turated solution of magnesium chloride had been added owed no action on iron, either at the ordinary temrature or boiling.—J. T. D.

Cyanidation; Slimes agitation for ——. H. A. Megraw. Eng. and Min. J., 1913, **96**, 1161—1164.

The more important agitation processes are reviewed. Agitation was originally performed by means of compressed air injected through portable or fixed pipes. Mechanical stirrers were next introduced, the best device being a central vertical shaft provided with arms halfway down the tank and swinging rods weighted with iron suspended from the lowest arms. Centrifugal pumps taking away pulp from the bottom and throwing it back at the top of the tank insure thorough mixing. In another form of stirrer the central shaft and horizontal arms are hollow and serve to force air through the liquid. In the Hendryx agitator the central tube is rather large and contains a turbine which forces material upwards and discharges it at the top. Mechanical stirring is dispensed with in air agitators such as the Pachuca tank, the principle of which is similar to the Hendryx, but the flow of pulp is accomplished by compressed air. The working cost is rather high, and there is a tendency for sandy material to settle. In the Parral tank the air discharges are set tangentially, causing a rotary motion. The Trent agitator has hollow arms through which the pulp is forced out into the tank, thus causing the arms to rotate. The Dorr machine has a central hollow shaft carrying two inclined arms which move the pulp toward the lower end of the shaft, through which it is taken up and discharged at the top. The addition of oxidising agents has been abandoned almost everywhere: the essential thing being to keep slime pulps agitated.—W. R. S.

Magnetite in mattes and slags. J. W. Bennie. Eng. and Min. J., 1913, **96**, 1213.

The reaction $FeS+10Fe_2O_3=7Fe_3O_4+SO_2$ is stated to occur in the roasting of sulphide ores and probably also in blast and reverberatory furnaces (this J., 1913, 1111), while the reaction $3FeS+5O_2=Fe_3O_4+3SO_2$ takes place in pyritic and partial pyritic smelting. Ferrous sulphide reduces both ferric and magnetic oxides to the lowest oxide if the temperature is sufficiently high; a fall in the temperature of the furnace therefore causes an increase in the quantity of magnetite, and this has been observed repeatedly in practice. Only a small amount of magnetite is formed through oxidation of ferrous silicate in the blast furnace; most of it is derived from the oxidation of ferrous sulphide below the temperature of formation of ferrous silicate. (See also this J., 1913, 738.)—W. R. S.

Zinc smelting; By-products in electric ——. W. M. Johnson. Eng. and Min. J., 1913, **96**, 1157—1159.

Experimental smelting has been in progress for some years past at Hartford, Conn., U.S.A. The results so far obtained indicate that electric smelting is advantageous where the retort process fails, *i.e.*, with complex sulphide ores. The cost of roasting is reduced, as the object is to leave enough sulphur in the ore to combine with the copper and iron. Besides spelter the process yields copper matte and lead bullion containing the gold and silver. The slag produced is extremely poor in values.
—W. R. S.

Pulverised coal; Use of ——, in metallurgical furnaces. J. Lord. Proc. Engineers' Soc. of W. Pennsylvania, 1913, **29**, 363—417.

The coal (slack) employed for puddling-, heating-, and other furnaces at the works of the American Iron and Steel Manufacturing Co., Lebanon, Pa., contains 1·1 per cent. of moisture, 33·2 of volatile matter and 9·6 of ash. After being dried, it is ground in horizontal (tube) or upright mills until 95 per cent. will pass through a sieve of 100 meshes per sq. in. (over 80 per cent. of the product will pass through a sieve of 200 meshes per sq. in.) and conveyed through pipes to the storage tanks of the respective furnaces, to which it is subsequently delivered at a uniform rate, and under an air-pressure of about 1/16 lb. per sq. in. at the furnace mouth, by means of an adjustable "burner" of the screw-conveyer type; a low air-pressure is employed to minimise the destructive effects of the projected fuel upon the interior of the furnace. The coal should contain at least 30 per cent. of volatile matter and not more than 0·5 of moisture or 1 of sulphur; the bulk of the ash is either deposited at the bases of the stacks or collected in the latter by means of suction-fans; the furnace charges are not adversely affected by the small amounts of ash which settle upon them. The average cost of preparing and delivering the fuel to the furnaces did not exceed 50 cents (2s. 1d.) per ton of pulverised coal produced in 1912. In four furnaces employed for the production of high-grade puddled bar from grey forge pig iron, the maximum and minimum consumptions of pulverised coal per ton of puddled bar were respectively 1472 and 1169 lb. over a period of two months; during the same period, the maximum and minimum amounts of fuel required for heating iron piles for rolling were 570 and 516 lb., respectively, per gross ton of rolled bars. In discussion W. A. Evans stated that danger arising from explosion or spontaneous combustion of dry, powdered coal, could be avoided by keeping the material in motion and not allowing it to remain in the storage-bins for longer than a week. Owing to the volume of flame produced, furnaces for pulverised coal require about 4 times as much combustion-space as ordinary grate furnaces, and this should be entirely free from metallic cooling surfaces. Ash trouble may be minimised by the use of high-grade coal, by employing a bed of cinders in the combustion chamber, and by regulating the temperature of the flues to prevent deposition of slag; chequer-work is considered unsuitable for this method of firing. The use of powdered coal is stated to be more economical than that of producer-gas or oil to the extent of about 25 per cent. in the former, and probably much more in the latter, case.—W. E. F. P.

Sodium amalgam and water; Interaction of ——. H. B. Baker and L. H. Parker. *Action of variously treated waters on sodium amalgam.* L. H. Parker. Chem. Soc. Trans., 1913, **103**, 2060—2073.

Water condensed from steam which had been passed through a red-hot tube was found to act with a strikingly slower velocity on sodium amalgam than did ordinary distilled water. The activity of ordinary water was probably due to the presence of traces of hydrogen peroxide, which passed over during distillation but were destroyed by superheating the steam. Water which had been exposed in sealed Jena-glass flasks to the action of metals (copper, silver, platinum, mercury, and aluminium) exhibited increased activity towards sodium amalgam, especially in the case of aluminium. It is suggested that during the prolonged contact of the metals with water and dissolved oxygen a small amount of hydrogen peroxide was formed, although not detectable by the ordinary colour tests. The activity of water which had been exposed to radium bromide (a treatment known to transform the water partially into hydrogen peroxide) was in every case greater than that of the same water untreated.

—F. Sodn.

Mineral production of the United Kingdom in 1912. Board of Trade J., Jan. 8, 1914. [T.R.]

The following table, showing the quantity and value (definitive figures) of the minerals produced in the United Kingdom in 1912, as compared with 1911, is taken from the General Report with Statistics on Mines and Quarries, 1912, Part III.

Description of Mineral.	1911.		1912.	
	Quantity.	Value at the Mines and Quarries.	Quantity.	Value at the Mines and Quarries.
	Tons.	£	Tons.	£
Alum shale	10,516	1,051	11,258	1,155
Arsenical pyrites	1,170	1,290	2,450	2,049
Arsenic	2,144	14,413	2,194	17,901
Barium (compounds)	44,118	40,386	45,377	39,430
Bauxite	6,007	1,294	5,790	1,414
Bog ore	2,700	540	3,340	835
Chalk	4,884,020	199,573	4,285,412	190,799
Chert, flint, etc.	71,577	14,074	74,718	13,426
Clay and shale	13,835,038	1,758,466	12,808,950	1,633,736
Coal	271,891,899	110,783,682	260,416,338	117,921,123
Copper ore	3,135	14,620	1,787	12,985
Copper precipitate	127	3,548	146	6,404
Diatomite	—	—	62	62
Fluorspar	55,231	18,941	47,246	17,263
Gold ore	2,752	992	170	4,784
Gravel and sand	2,275,177	172,214	2,191,451	167,640
Gypsum	276,684	104,221	285,291	110,591
Igneous rocks	6,524,696	1,241,967	6,638,215	1,210,418
Iron ore	15,519,424*	4,035,893	13,790,391*	3,763,837
Iron pyrites	10,114	4,237	10,522	4,324
Lead ore	23,910	219,314	25,409	295,614
Lignite	120	60	62	31
Limestone (other than chalk)	12,183,355	1,268,853	11,500,660	1,206,022
Manganese ore	4,987	3,997	4,170	3,371
Mica	25,335	8,748	29,962	11,317
Natural gas cubic feet	221,400	Not stated	161,200	Not stated
Ochre, umber, etc.	14,585	13,732	13,947	13,661
Oil shale	3,116,803	857,120	3,184,826	765,730
Salt	2,082,688	601,324	2,122,250	577,473
Sandstone	4,044,907	1,194,420	3,839,567	1,132,391
Slate	425,125	1,050,667	383,422	972,022
Soapstone	—	—	8	2
Sulphate of strontia	5,869	4,400	19,370	15,020
Tin ore (dressed)	7,746	837,957	8,166	1,012,29
Uranium ore	67	Not stated	42	Not stated
Wolfram ore	266	24,629†	193	16,87
Zinc ore	17,652	82,690	17,704	87,86
Total value	—	124,579,313	—	131,220,85

*Exclusive of 372 tons in 1911 and 431 tons in 1912 of micaceous iron ore used for paint, and placed under the heading "Ochre, umber, et

† Value of 251 tons only for 1911 and of about 192½ tons only for 1912.

The increase in the total value of the minerals raised during the year is mainly accounted for by the increased value of coal, the average price of coal being 9s. 0·68d. per ton in 1912, as compared with 8s. 1·79d. in 1911.

The quantity of coal exported, exclusive of coke and manufactured fuel and of coal shipped for the use of steamers engaged in foreign trade, was 64,444,395 tons. France received over 10 million tons, Italy over 9 million tons, Germany over 8 million tons, Russia and Sweden each over 4 million tons, Spain nearly 3½ million, Argentina over 3¼ million, Egypt nearly 3 million, Denmark over 2¾ million, and Norway and the Netherlands each over 2 million. Adding the 3,107,140 tons exported in the form of coke and manufactured fuel, and the 18,291,370 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 85,842,905 tons, as against 87,081,382 tons in 1911. The amount of coal remaining for home consumption was 174,573,433 tons, or 3·823 tons per head of the population; 35,322,147 tons were used in the manufacture of coke and briquettes, and 17,997,854 tons in the blast furnaces for the manufacture of pig iron, as against 36,096,857 tons and 19,218,491 tons, respectively, in the previous year.

The iron ore raised in the United Kingdom yielded 4,451,636 tons of iron, or more than one-half of the total quantity of pig iron made in this country.

Mercury imports and exports; British ——. A. S. Pickering. Jan., 1914. [T.R.]

	Imports.	Exports.
	Bottles.	Bottles.
1913	45,348	26,815
1912	47,261	32,240
1911	46,547	31,438
1910	44,595	24,748
1909	43,163	22,050
1907	39,448	29,465
1905	34,031	21,330

The estimated consumption in the United Kingdom is 14,000 bottles per annum.

Metals; New apparatus for the pulverisation (atomisation) of ——. *(Schoop process.)* V. Bernard. Rev. Mét., 1913, **10**, 1377—1382.

A PORTABLE apparatus ("pistol-syringe") for simultaneously producing a fine spray of fused metal, alloy, lass or enamel and projecting the same continuously pon any suitable surface. The metal, etc., in the form f wire, is automatically fed—at a rate depending upon its sibility—into an oxy-coal-gas or similar flame, and, s melted, is atomised and projected by means of compressed air. It is stated that 1 kilo. of copper (or brass), inc, aluminium or lead may be atomised and redeposited y this means at a total cost, including metal, of 7·75, 80, 9·50 or 1·40 fr. (6s. 2d., 3s., 7s. 6½d., or 1s. 1½d.), spectively, the time occupied being about 30 mins. r copper or brass and about 20 for zinc.—W. E. F. P.

erium: Alloys of —— with silicon and bismuth. R. Vogel. Z. anorg. Chem., 1913, **84**, 323—339.

UCH heat is evolved in the production of the alloys of rium with both silicon and bismuth, and the reactive ture of the fused products has rendered thermal investition difficult. Cerium and silicon form at least one mpound, probably of the formula CeSi, and an eutectic ntaining 47 per cent. Si (m.pt. 1240° C.). The alloys are rd and brittle, and stable in the air. At very high mperatures cerium, like magnesium, attacks silica and rcelain. Cerium forms with bismuth the compounds, Ce$_3$, Bi$_3$Ce$_4$, BiCe, and Bi$_2$Ce, the melting points of which, e those of cerium-aluminium compounds (this J., 1912, 5), are remarkably high, that of the compound, Bi$_3$Ce$_4$, ing approximately 1630° C. The bismuth alloys slowly ell up and disintegrate in air, the moisture accelerating dation, especially with those containing 25—75 per cent. Bi, which may become heated to visible combustion; dilute acids attack the alloys readily. Hardness reaches a maximum with the compound, Bi$_3$Ce$_4$, for which it is between 5 and 6 on Mohs' scale.—F. SODN.

Concrete-covered cast iron, a new structural material. Von Emperger. *See* IX.

Fractionation of alloys and minerals in the electric microfurnace. Fletcher. *See* XXIII.

PATENTS.

Iron: Purification or extraction of ——. G. H. Benjamin, New York. Eng. Pat. 27,968, Dec. 4, 1912.

SEE U.S. Pat. 1,051,065 of 1913; this J., 1913, 198. The iron may be refined in one electric furnace and then transferred to another electric furnace, heated to a lower temperature, in which the necessary ingredients are added. Magnesia may be added to combine with the nitrogen in the charge, and compounds may also be used to facilitate the combination or uniform mixing of the iron with the added materials.—T. F. B.

Cast-iron: Method for removing sulphur from ——. W. F. Prince, Elizabeth, N.J. U.S. Pat. 1,081,403, Dec. 16, 1913.

MANGANESE is added to the cast iron in the ladle and the metal is then treated with an oxidising agent, *e.g.*, air, to oxidise part of the manganese, and agitated to accelerate the combination of manganese and manganese oxide with the sulphur and the separation of manganese sulphide and oxide from the charge.—A. S.

Iron blast-furnace flue-dust; Method of utilising ——. R. Baggaley, Pittsburgh, Pa. U.S. Pat. 1,081,921, Dec. 16, 1913.

MOLTEN iron or steel is run into a receiving vessel, and at the same time flue-dust and fines from iron blast-furnaces are introduced in such manner as to cause them to be enveloped by, and thoroughly mingled with, the molten metal.—T. ST.

Iron ores and blast-furnace dust; Agglomeration of —— into briquettes. W. Mathesius. Fr. Pat. 460,954, July 10, 1913. Under Int. Conv., July 10, 1912.

A MIXTURE of very basic alumino-silicates (3 mols.) and ferrous hydroxide (1 mol.) is moistened with hot water, mixed with the ores or dust, and formed into briquettes. Setting takes place in a few hours, 1 to 2 per cent. of the alumino-silicates being required. Powdered lime may be used in place of the alumino-silicates, but it must be pulverised in the moist state with the proper amount of ferrous hydroxide at a high temperature. The agglutinant formed as described melts above 1500° C., but by the addition of relatively small quantities of magnesium oxide, strontium oxide, barium oxide, titanic oxide, etc., the melting point may be reduced to 1000° to 1100° C.—T. ST.

Steel; Melt or compound for use in the hardening or tempering of ——. S. N. and E. R. Brayshaw, Manchester. Eng. Pat. 22,167, Oct. 2, 1913.

THE substance, which is stated to be very fluid at 130°—140° C. and practically unaffected by heating to 700° C., is composed of the nitrates and nitrites of sodium and potassium in equimolecular proportions, and may also contain similar compounds of lithium or alkaline-earth metals.—W. E. F. P.

Steel; Art of manufacturing ——. G. H. Benjamin, New York. U.S. Pat. 1,080,807, Dec. 9, 1913.

MOLTEN bessemerised iron from which carbon, phosphorus, and silicon have been partially removed, is fed on to a heated hearth, a basic flux added, and the charge heated by gas and air. The slag is separated, and the hearth, together with the iron, is removed from the first atmosphere, lime is added, and the charge is heated electrically to a temperature sufficiently high to bring about combination of the remaining carbon, phosphorus, and silicon, with the lime. After the slag has been removed, the hearth and iron are again moved into a reducing heating atmosphere, the necessary carbon added, and the resulting steel tapped.—T. St.

Steel ; Purifying ——. E. Humbert, South Chicago, Ill. U.S. Pat. 1,081,532, Dec. 16, 1913.

A mixture of silica sand, 10 to 30 per cent., and lime, 70 to 90 per cent., is melted, and carbon is added to the extent of 10 to 30 per cent. of the total lime and sand. The molten steel is poured into a finishing vessel upon the melted mixture, so as to convert silicates of manganese and iron into a readily fusible calcium silicate.—B. N.

Zinc ores ; Reduction of —— in the electric furnace. W. McA. Johnson, Hartford, Conn. U.S.A. Eng. Pat. 27,881, Dec. 3, 1912. Under Int. Conv., Oct. 17, 1912.

Complex zinc ores are roasted at a temperature not exceeding 1000° C., then intimately mixed with 15 to 20 per cent. of soft coal and the necessary fluxes, and subjected to a preheating, with stirring, at a temperature of 800° to 950° C. All remaining sulphates are thus reduced to sulphides, and iron and copper oxides are reduced to metal. While still hot, the charge is transferred to an electric furnace, where a matte of iron and copper sulphides is formed, and sinks to the bottom of the charge, taking with it all the sulphur. On their way to the condenser the zinc vapours pass through a deoxidising body of carbon. The zinc, being thus freed from sulphur and oxygen, condenses to a liquid and the formation of "blue powder" is avoided. The temperature of the charge in the electric furnace must be kept sufficiently low to prevent the liberation of sulphur from the matte, or the formation of carbon bisulphide, and the charge should be so proportioned that the amount of iron and copper is from 5 to 7 times that of the sulphur.—T. St.

Smelting volatile metals ; Electrically ——. W. McA. Johnson, Hartford, Conn. U.S. Pat. 1,080,912, Dec. 9, 1913.

The charge, which contains a reducing agent, and is proportioned to yield a fusible slag which forms a molten electrode, is progressively heated in the absence of air, by passing an electric current through the charge, the evolved metallic vapours and the electrode. The volatile reaction products are conducted through the charge, thereby progressively cooling it, and also into contact with carbon at a temperature which gives maximum reduction, the carbon being continuously replaced. The volatile metal is condensed apart from the charge.—B. N.

Zinc-furnace with integral condenser ; Electric ——. J. Thomson, New York, U.S. Pats. 1,080,862 to 1,080,866, Dec. 9, 1913.

(1) The furnace comprises a reaction chamber, with walls provided with a number of side openings extending outwards, and leading into a condenser composed of vertical spaces or galleries, and the products of the reaction pass through these in a downward, or a downward and then upward direction to side openings in the outer walls leading to the atmosphere. An underlying receptacle receives the products of the reaction from the condenser. The furnace is provided with a horizontal carbon resister in contact with the inner ends of a number of carbon terminal members, the outer ends of which are located in the furnace walls, in contact with two sets of metallic strips extending through the walls of the furnace. (2) A rod resister, resting on side supports, is used, the lower surface being exposed to an underlying trough or sump; the upper and side surfaces are encased within the charging material. The furnace is provided with outer walls, forming a gallery or galleries extending along the outer side or sides, with ports in the walls in axial alignment with corresponding ports in the resister support or supports. (3) The carbon resister bed is supported on spaced grate bars arranged above a sump, and the resister is retained in place by walls provided with openings leading the gases to the condensers on opposite sides of the resister. The top portion of the openings are below the top of the adjacent resister, and the lower portion of the openings communicate with the space between the grate bars, so that any fumes passing through the resister to the space between the grate bars can flow directly through the openings to the condensers. (4) The carbon resister, in the form of a reaction bed, is supported on a grate formed of rods, with an underlying carbon filter bed, and the grate is of lesser electrical conductivity than the carbon above and below. (5) The lower surface of the carbon resister rests on a grate, and the side surfaces are retained by spaced rods. The resister and rods are embedded in a charge of the reacting material, and the reaction occurs primarily along the vertical sides of the resister by means of conducted or radiated heat or by both.—B. N.

Zinc ; Method and furnace for the extraction in a vacuum of metallic —— from zinc ores. E. Herter. Fr. Pat. 460,404, July 15, 1913. Under Int. Conv., July 15, 1912.

Zinc oxide is reduced at about 1500° C. with carbon in a vacuum furnace heated internally by an electric current. The vapours may be allowed to condense in the furnace or may be drawn into a condensing chamber maintained at 500° C. The zinc vapours thus condense almost completely into molten zinc.—T. St.

Zinc ; Method of extracting ——, from ores, especially those containing lead. Minerals Products Ltd., and H. C. Woltereck. Fr. Pat. 460,233, July 10, 1913. Under Int. Conv., July 11, 1912.

The crushed, roasted ore is treated, at atmospheric pressure, with a boiling solution of ferrous sulphate by which, it is claimed, zinc oxide is converted into sulphate according to the equation: $ZnO+FeSO_4+H_2O=ZnSO_4+Fe(OH)_2$.—W. E. F. P.

Metal colloids ; Production of ——. H. Crookes and L. Stroud, London. Eng. Pat. 28,776, Dec. 13, 1912.

Metal colloids are obtained, it is claimed, without the use of sodium chloride, by the addition of a very dilute solution of the metal salt (about 1 part of metal in 1000 of solution) to a solution of peptone; and are rendered permanent by adding about 0·1 per cent. of phenol to the mixture. For the preparation of silver and iron colloids, the solutions of peptone employed contain about 300 and 150 grains per quart, respectively.—W. E. F. P.

Solder. J. and E. Wilkins, and J. G. Morris, London. Eng. Pat. 29,239, Dec. 19, 1912.

A solder, for aluminium, composed of Zn 5—5½ and Sn 8, parts by weight.—W. E. F. P.

Soldering composition. M. and E. Richardson, London. Eng. Pat. 23,077, Oct. 13, 1913.

The solder (for aluminium, etc.), consists of Sn 58·6, Zn 23·4 and Pb 17·6, parts by weight.—W. E. F. P.

Metals or metallic alloys ; Salicylate electrolytes for use in the electrolytic deposition of ——. P. Marino, London. Eng. Pat. 28,953, Dec. 16, 1912.

The metal or metals to be deposited may be present in the electrolyte either as the salicylate or other salt. The other ingredients are ammonium, potassium or sodium salicylate, equal in amount to the weight of the metallic salt, and from 5 to 10 grms. of sulphosalicylic acid for each litre of water. The bath is rendered alkaline by addition of ammonia. A current density of 0·3 to 0·4 ampère per sq. dcm. of area of the article to be covered is used, and the electrolyte is agitated continuously o heated. Cyanide or thiocyanate of potassium may b added to the electrolyte, the precipitate which is forme being dissolved and added to the bath.—T. St.

[Copper-nickel] Alloy ; New metal ——. C. E. Monkhouse, London, and M. H. Denton, Sheffield. Eng. Pat. 1819, Jan. 22, 1913.

A "WHITE metal" composed of Cu 40, Ni 8½, Zn 5, Pb 1 and Sn 2½, parts by weight. The alloy—which is stated to resemble silver in appearance—is prepared by melting the nickel under a flux of white glass, adding half the copper gradually and the remainder in bulk, then the zinc and finally the tin and lead together.—W. E. F. P.

Nickel-copper alloys. P. J. A. Douglass, Halifax, Nova Scotia. Eng. Pat. 8331, April 9, 1913.

CLAIM is made for alloys composed of Ni 67, Cu 33, ferromanganese 2—8, Al 5 and Sn 6—10, parts by weight; and Ni 67, Cu 33, ferro-silicon (55 per cent. Si) 5—15 and Cr 1—8, parts by weight; to either of which 3—5 per cent. W may be added. The alloys are stated to be hard, tough, incorrodible and suitable for the manufacture of cutting tools.—W. E. F. P.

[Tungsten.] Wire drawing [; Lubricant for ——]. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 2001, Jan. 24, 1913.

FOR use more particularly in the hot drawing of tungsten wire, claim is made for a lubricant composed of an aqueous suspension of finely divided graphite (*e.g.* "aquadag") containing sufficient organic binding material (*e.g.* glucose) to cause the graphite to adhere firmly to the wire on heating.—W. E. F. P.

Tungsten ores ; Process of treating ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., New York. U.S. Pats. 1,081,566 and 1,081,571, Dec. 16, 1913.

(1) ORES of the iron tungstate type are heated and then treated with an acid reagent, *e.g.*, sulphuric acid, under such conditions that the ratio of tungsten to phosphorus in the ore is increased. (2) A low-phosphorus manganese-bearing ore of the iron tungstate type, after being partially reduced, is treated so as to increase the ratio of tungsten to manganese in the product, and then the reduction is completed.—A. S.

Tungsten and alloys thereof ; Method of preparing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., New York. U.S. Pats. 1,081,567, 1,081,568, and 1,081,570, Dec. 16, 1913.

(1) CRUDE ferrotungsten is subjected to an oxidising roast and the product is treated so as to remove phosphorus and increase the tungsten-content, and then reduced. (2) Crude ferrotungsten is subjected to an oxidising roast, the resulting oxide reduced without substantial fusion of the reduced product, and the latter treated with acid to remove phosphorus or iron and phosphorus, and increase the tungsten-content. (3) Phosphorus-bearing ores of the iron tungstate type are partially reduced, treated so as to increase the ratio of tungsten to phosphorus in the product, and then the reduction completed.—A. S.

Ferrotungsten ; Method of dephosphorising——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., New York. U.S. Pat. 1,081,569, Dec. 16, 1913.

SUBDIVIDED solid ferrotungsten is fed to the surface of a molten basic oxidising bath, containing an oxygen compound of tungsten, and kept at a temperature near to or above the fusing point of the ferrotungsten.—A. S.

Ores and other material ; Lixiviating apparatus for ——. C. Robinson, Mount Vernon, N.Y., U.S.A. Eng. Pat. 2805, Feb. 3, 1913.

LONG rectangular tanks are divided by partitions into series of receptacles with pyramidal hopper-like bottoms. In each receptacle is a central vertical tube open at both ends and provided at the top with a deflecting hood. Secured to the bottom of each receptacle is a nozzle connected by a pipe with an air manifold which is common to all the receptacles in one tank. Each nozzle is provided with an inclined valve seat, and a conoidal valve closure. A guided vertical rod secured to the valve closure serves to hold the latter in a vertical position, and tends by its weight to keep the valve closed. Ore pulp with solvent liquid is fed continuously into the first receptacle of a series, and by means of air driven under pressure through the nozzles, is agitated and conveyed up the central pipes, at the top of which it becomes deflected towards, and passes along shelves by gravity to the next receptacle, in each case. Particles of pulp are thus continuously brought into contact with fresh portions of the solvent liquid.
—T. ST.

Magnetic separator. H. J. H. Nathorst, Gellivare Malmfält, Sweden. Eng. Pat. 12,368, May 27, 1913. Under Int. Conv., June 4, 1912.

A CYLINDRICAL drum rotates about stationary magnetic poles, which are consecutively of different polarity, the core of each of the two outermost poles having a lesser cross-section than the core of the nearest inner pole. There may be four poles, the two inner poles being similarly magnetised, and their combined cross-section greater than that of either of the cores of the outer poles. The flux of lines of force thus formed gives the separator a good power of separation.—T. ST.

Furnace ; Electrical reduction ——. R. E. Frickey, Heroult, Cal., Assignor to Noble Electric Steel Co., San Francisco, Cal. U.S. Pat. 1,080,824, Dec. 9, 1913.

THE furnace is of the long and narrow type, and comprises a crucible with a number of feed stacks through which charges of ore are fed. A pair of end electrodes, and a number of middle electrodes, spaced apart and arranged in a row, extend in a downward direction through the conducting charge into the crucible. The electrodes are connected with a number of transformers, the primary circuits of which are connected with a three-phase system in such a manner that the phase angle is 60° between voltages supplied to adjacent pairs of electrodes, and so that a concentrated zone of energy is produced under the central electrodes.—B. N.

Reducing compounds ; Apparatus for ——. H Niewerth, Berlin, Germany. U.S. Pat. 1,081,287, Dec. 9, 1913.

THE material is contained in a closed vertical shaft, connected with two inclined auxiliary shafts containing carbon, one near the top and the other near the bottom. The upper outer ends of the two auxiliary shafts are in communication, and means are provided to admit air to the shafts, and to cause a circulation through the shafts in either direction of the air and products of combustion.—T. ST.

[Cyanide] Solutions ; Method of aerating ——. W. E. Darrow, Amador City, Cal. U.S. Pat. 1,081,436, Dec. 16, 1913.

CYANIDE solution is formed into a film by allowing it to descend a tower filled with solid fragments, and air is admitted under pressure, with the solution, at the top of the tower.—T. ST.

Ores ; Process of treating —— for separating precious metals. D. C. Reinohl, Washington, D.C. U.S. Pat. 1,081,514, Dec. 16, 1913.

PULVERISED ore is saturated with a cyanide solution, and the pulp is heated and agitated in the presence of the atmosphere, and the strength of the solution augmented progressively.—T. ST.

Settling-tank and filter [for ore pulp] ; Combined ——. D. C. Reinohl, Washington, D.C. U.S. Pat. 1,081,515, Dec. 16, 1913.

A CYLINDRICAL tank with a converging bottom contains an inner similarly shaped filtering vessel, for the separation of solution from treated ore pulp. The filtered liquid is run off, and a central discharge pipe, controlled by a valve, allows of the removal of the tailings by gravity. Discharge pipes at different levels allow of clarified liquid being drawn off progressively from above the tailings. —T. St.

Ores; Apparatus for treating ——. D. C. Reinohl, Washington, D.C. U.S. Pat. 1,081,516, Dec. 16, 1913.

Ore is fed into an inclined cylindrical conduit open to the atmosphere, and is supplied with solvent in continuously greater quantity, as it passes along, so that its fluidity constantly increases, and the strength of the solvent is maintained. The pulp is agitated and aerated by arms fitted to an axial revolving shaft, and means are provided for heating the pulp.—T. St.

Ores: Furnace for treating ——. J. W. Frey, Silver Spring, Md. U.S. Pat. 1,081,732, Dec. 16, 1913.

Ore is treated in a cylindrical roasting chamber which rotates within a furnace casing. This consists of a base portion, provided with bearings for the roasting chamber, and an upper portion made up of two separable quarter-cylindrical members. An inverted U-shaped frame, secured to the base, forms a support for the upper members, and for a stack through which the furnace gases escape. The roasting chamber rotates on hollow shafts journaled on the bearings in the casing. Steam is admitted into the chamber through one hollow shaft, and gaseous products escape through the other, over the end of which is disposed a deflector.—T. St.

Ores; Process and opparatus for the perfect roasting of —— in furnaces of all systems. E. Bracq. Second Addition, dated May 13, 1913, to Fr. Pat. 434,494, Sept. 22, 1911 (this J., 1912, 343, and 1913, 609).

The mechanism governing the division, propulsion and rabbling of the charge is disposed outside the heating chamber or chambers of the furnace and is independent of the central shaft; the latter is counterpoised and grooved externally, so that when raised or lowered, the shaft rotates and the attached rabble arms move in a helical path along the hearth.—W. E. F. P.

Roasting furnace; Mechanical ——, with helical hearth. P. Banette. Fr. Pat. 460,728, Oct. 11, 1912.

The hearth is supported at the centre by a hollow, helical, metal tube which surrounds the central shaft of the furnace and through which air is circulated. The central shaft, upon which the rabble arms are supported so that they remain in position by their own weight, is counterpoised and provided at the base with a guide engaging with a helical groove having the same pitch as the hearth. The admission of the charge to the furnace is regulated by the vertical movement of the central shaft.—W. E. F. P.

Antifriction alloy of aluminium suitable for parts of machinery. R. Esnault-Pelterie. First Addition, dated July 5, 1913, to Fr. Pat. 405,157, July 16, 1909 (this J., 1910, 284).

The metal of the iron group, used according to the chief patent, may be replaced by one of the metals Mo, W, V, Ti, Ta, Nb, etc.—T. St.

Nickeling of aluminium; Direct ——. M. Canac née Quentin. First Addition, dated Sept. 16, 1912, to Fr. Pat. 446,949, Oct. 14, 1911 (this J., 1912, 394).

The articles are first cleansed with potash and milk of lime, then immersed in a bath of potassium cyanide, and afterwards passed through a bath containing metallic iron and hydrochloric acid. They are finally introduced into the plating bath containing nickel chloride and boric acid, the successive operations being in each case separated by a prolonged washing with cold water.—B. N.

Gold; Extraction of —— contained in auriferous mispickel and other arsenical ores. A. Grandjean. Fr. Pat. 460,439, June 20, 1913.

The finely ground ore is mixed with permanganate of potassium or sodium, and sufficient water to dissolve the permanganate and form a thin paste. After several hours an excess of hydrochloric acid is added, and when no more gas is evolved, the mass is stirred vigorously with water, and filtered. Gold and other metals are precipitated from the solution by means of zinc, and the gold recovered by cupellation.—T. St.

[*Gold.*] *Precious metals; Process for recovering —— from very dilute solutions, particularly from sea-water.* E. Baur and O. Nagel. Fr. Pat. 460,680, July 23, 1913. Under Int. Conv., July 29, 1912.

The solution (sea-water) is filtered through powdered charcoal, textile material, infusorial earth or colloidal hydroxide of iron, by which and similar substances—it is stated—the salts of precious metals are absorbed until a certain concentration is attained; *e.g.*, when a solution containing 10 mgrms. of gold (as gold-sodium chloride) per cub. m. is brought into contact with pulverised wood charcoal, the gold salt is absorbed by the charcoal until the latter contains 0·05 per cent. Au. —W. E. F. P.

Converter-bottoms; Manufacture of ——. L. Thomas. Fr. Pat. 460,519, July 18, 1913.

To produce smooth, straight blowing-holes, the pegs around which the material forming the converter-bottom is moulded are provided with loose sheaths of thin sheet iron which are allowed to remain in the structure when the pegs are withdrawn.—W. E. F. P.

Nickel; Extraction of metallic —— from nickel ores. Mineral Products, Limited, and H. C. Wolterеck. Fr. Pat. 460,575, July 21, 1913.

The ore, crushed to walnut size, is treated in externally heated retorts, with a mixture of superheated steam and air (nickel sulphide ores), or superheated steam alone (magnesium nickel silicate ores known as *garniérite*), at a temperature of 400° to 750° C., to oxidise the nickel. The mass may be treated, in the retorts, with reducing gases at about 500° C., and the resulting finely divided nickel separated by means of carbon monoxide, or in magnetic separators; or it may be extracted with hot dilute sulphuric acid, and the nickel recovered electrolytically. The whole of the nickel in some magnesium-nickel silicate ores may be dissolved out by treating directly with hot dilute sulphuric acid.—T. St.

[*Copper.*] *Ores; Process of chloridising* ——. A. D. Ledoux. Fr. Pat. 460,579, July 21, 1913. Under Int. Conv., Aug. 13, 1912.

A mixture of the roasted ore (or residue) with sodium chloride is introduced continuously into a heated furnace of the superposed chamber type, the heat developed by the reactions occurring in the first portion of the charge being sufficient, it is claimed, to promote reaction in the succeeding portion, and so on.—W. E. F. P.

Cupola furnace; Gas-fired ——. G. Gautier and L. Esselin. Fr. Pat. 460,967, July 22, 1913. Under Int. Conv., July 22, 1912.

A cupola for use more particularly with gases containing both hydrogen and oxygen, has an annular gas-chamber between the outer casing and the furnace proper; the walls of the latter are constructed of blocks spaced apart to form several series of superposed openings inclined downwards, into each of which a burner extends from the gas-chamber. The return of flame to the latter is prevented by metal grids.—W. E. F. P.

Metallic layer; Process for obtaining a —— by the projection of a fused metal melted by means of an electric current which traverses it. Soc. de Métallisation. Fr. Pat. 461,028, Oct. 19, 1912.

The metal is heated by the resistance which it offers to the passage of an electric current, or is melted by employing it as electrodes for the production of an electric arc, and the molten metal is projected on to the material to be coated by means of a current of gas.—B. N.

Ores and metals ; Method and apparatus for treating ——. L. Petit Devaucelle. Fr. Pat. 461,029, Oct. 19, 1912.

Ore is agitated with a liquid which will dissolve a particular constituent, and is at the same time reduced to a fine state of division, by subjecting it to a rapid stream of a fluid containing small particles of the ore. The ore and liquid are contained in a cylindrical vessel, the bottom having the form of an inverted cone, at the apex of which is a conical nozzle for introducing the fluid under pressure. Inside the vessel and directly above and in line with the nozzle is a hollow truncated cone, which serves to direct the circulation of the liquid and powdered ore. The contents of the vessel may be heated by means of a jacket, or by a coil placed inside.—T. St.

Iron ; Protecting —— from rust. A. Lang, Karlsruhe, Assignor to H. F. von Seldeneck, Frankfort, Germany. U.S. Pat. 1,082,161, Dec. 23, 1913.

See Eng. Pat. 21,638 of 1909 ; this J., 1910, 1255.—T. F. B.

Steel ; Process of making ——. P. P. Reese and S. S. Wales, Munhall, Assignors to Carnegie Steel Co., Pittsburgh, Pa. U.S. Pat. 1,082,359, Dec. 23, 1913.

See Fr. Pat. 441,352 of 1912 ; this J., 1912, 821.—T. F. B.

Furnaces for roasting ores. X. de Spirlet, Brussels. Eng. Pat. 1849, Jan. 22, 1913. Addition to Eng. Pat. 10,782 of 1910, dated May 5, 1909.

See Addition of Jan. 22, 1913, to Fr. Pat. 415,338 of 1910 ; this J., 1913, 794.—T. F. B.

Ores ; Concentration of ——. H. H. Greenway, Clare, South Australia, and A. H. P. Lowry, Prahran, Victoria. Eng. Pat. 11,471, May 16, 1913. Under Int. Conv., May 24, 1912.

See Fr. Pat. 458,051 of 1913 ; this J., 1913, 1018.—T. F. B.

Method and instrument for the separation, detection, and estimation of elements in alloys and other chemical substances. Eng. Pats. 29,537 and 29,538. *See* XXIII.

XI.—ELECTRO-CHEMISTRY.

lectrolysis of chloride solutions with a mercury cathode. Le Sueur. *See* VII.

ractionation of alloys and minerals in the electric micro-furnace. Fletcher. *See* XXIII.

Patents.

attery ; Primary galvanic ——. S. Yai, Tokyo, Japan. Eng. Pat. 15,909, July 10, 1913.

N air-tight amalgamated zinc casing encloses a hydrogen-bsorbing material, such as a mixture of graphite and anganese peroxide, the air being extracted from the sing and replaced by a solution of ammonium chloride. —B. N.

tteries ; Preparation of absorbents to be used in the cells of electric dry ——. P. Rabbidge, Neutral Bay, New South Wales. Eng. Pat. 19,783, Sept. 1, 1913. Under Int. Conv., Sept. 27, 1912.

E absorbents are prepared from suitable vegetable re, treated with a water solution containing sulphuric d and potassium or sodium permanganate until bleached. —B. N.

Electrodes ; Storage-battery ——. H. C. Hubbell, Newark, N.J. U.S. Pat. 1,081,531, Dec. 16, 1913.

A "thread-like material" formed from a mixture of powdered metallic nickel or cobalt or both, is mixed intimately with nickel or cobalt hydroxide, dried, and a metallic nickel or cobalt coating is deposited on the exposed surface of the thread-like material. The material is then formed into a "matted cake," and enclosed in a suitable conducting envelope or container.—B. N.

Furnaces ; Electric ——. E. Stassano, Turin, Italy. Eng. Pats. 22,723 [Addition to Eng. Pat. 8901, April 10, 1911] and 22,724, Oct. 8, 1913. (See this J., 1911, 1067).

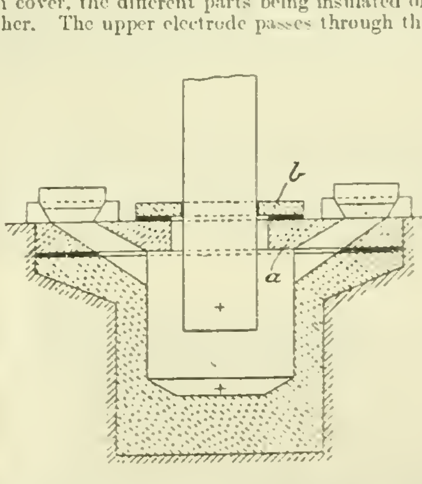
(1) The furnace chamber is oscillated by means of a motor, the wheel connected with the motor being combined with a hand control, and the latter put in gear through a pinion made to slide on a shaft by means of a pedal control. This allows of small displacements being imparted to the chamber, in order to regulate a casting operation. (2) The rod, to which the electrode is fixed, carries in front an insulated stirrup, provided with insulated wheels adapted to travel on two insulated rails mounted on the bottom of the electrode chamber, and the rear end of the carriage, connected with the controlling piston actuating the electrode, rests on guides fixed to the wall of the chamber. Water is circulated through the front and rear walls of the electrode chamber. Two insulated tubes are arranged within the rod, the inner tube discharging water into the outer one at the end where connection is made with the electrode, so that a tight joint may be made where the electrode passes through the wall of the furnace chamber.—B. N.

Furnace ; Electric ——. F. M. Chaplet and La Néo-Métallurgie. First Addition, dated July 2, 1913, to Fr. Pat. 370,005, Sept. 25, 1906 (this J., 1907, 210).

The conductor bringing the current to the base of the furnace has the same cross-section throughout its length, and may debouch from the furnace through the upper part or the side wall, but at such a height that escape of the product from the furnace is impossible. The external portion of the conductor may be cooled in any convenient manner.—B. N.

Furnaces ; Arrangement for closing electric arc ——. I. Hole and O. R. Olsen. Fr. Pat. 460,236, July 10, 1913. Under Int. Conv., July 10, 1912.

The furnace is covered by a single, double or multiple carbon cover, the different parts being insulated one from the other. The upper electrode passes through the upper cover, *b*, which may be adjusted so as to prevent contact of the cover and electrode, and the latter is provided with guides so as to avoid lateral oscillation. Two or



more inclined charging openings, which may be hermetically sealed, are arranged in the lower cover, *a*, along the sides of the furnace, and the walls of the latter are insulated from the base.—B. N.

Furnace ; Reheating with the electric ——. F. Fischer. Fr. Pat. 460,526, July 19, 1913. Under Int. Conv., Nov. 5, 1912.

The furnace is supplied with hydrogen, or gases containing hydrogen, in order to rapidly transmit the heat to the objects to be heated.—B. N.

Ionisation of gases ; Apparatus for measuring ——. Siemens Bros. and Co., Ltd., London. From Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 18,827, Aug. 19, 1913.

See Fr. Pat. 458,078 of 1913 ; this J., 1913, 1019.—T.F.B.

Furnace ; Electric ——. A. Helfenstein, Vienna. U.S. Pat. 1,082,195, Dec. 23, 1913.

See Fr. Pat. 454,195 of 1913 ; this J., 1913, 873.—T. F. B.

Furnace ; Electric ——. A. Helfenstein, Vienna. U.S. Pat. 1,082,196, Dec. 23, 1913.

See Fr. Pat. 456,926 of 1913 ; this J., 1913, 1076.—T.F.B.

Production of hydrogen and oxygen by electrolysis of water. Addition to Fr. Pat. 459,967. *See* VII.

XII.—FATS ; OILS ; WAXES.

Phytosterol ; Detection of —— in animal fats. M. Fritzsche. Z. Unters. Nahr. Genussm., 1913, 26, 644—648.

The following shortened modification of the method of Marcusson and Schilling (Chem.-Zeit., 1913, 37, 1001) is recommended :—Fifty grms. of the melted fat are treated with 20 c.c. of a 1 per cent. alcoholic solution of digitonin, and the mixture mechanically stirred for 5 minutes at 60° to 70° C. In the case of fluid and semi-solid fats, the mass is at once filtered with the aid of suction in a Buchner's funnel, and the residue washed six times with ether (5 c.c.), whilst in the case of solid fats an addition of 20 c.c. of chloroform is made to the hot liquid, and the residue washed with 2 portions (5 c.c.) of hot chloroform and then with six portions of ether to remove all fat. The residue (digitonide) is dried for about 5 minutes at 30° to 40° C. and dissolved in 2 c.c. of hot acetic acid, and the solution boiled for about 5 minutes in a test tube with a vertical tube to act as condenser, and then filtered through cottonwool. The tube and filter are twice washed with 0·5 c.c. of hot absolute alcohol and the combined filtrate and washings evaporated on the water bath in a current of air. The residual phytosteryl or cholesteryl acetate is dissolved in 1 c.c. (or less) of absolute alcohol, and the crystals drained on porous porcelain and examined in the usual way.—C. A. M.

Catalysts ; Influence of impurities on the activity of ——. III. Experiments with platinum as a hydrogen-carrier. C. Paal and E. Windisch. Ber., 1913, 46, 4010—4016. (See also this J., 1911, 715 ; 1913, 1089.)

Metal powders purified with alcohol and ether were platinised by shaking with a solution of chloroplatinic acid, and metallic oxides and carbonates were platinised by the action of sodium carbonate and hydrazine hydrate on a solution of chloroplatinic acid containing the oxide or carbonate in suspension. Experiments with these products as catalysts in the hydrogenation of cottonseed oil showed that of the metals only magnesium and nickel had no influence on the activity of the platinum ; the platinum was much less active in presence of aluminium, cobalt, and bismuth, and rendered completely inactive by iron, copper, zinc, silver, tin, and lead. Of the oxides and carbonates examined, only the magnesium compounds were without influence. (See also Fr. Pats. 425,729 and 434,927 of 1911; this J., 1911, 1022 ; 1912, 346.)—A. S.

Indian, Japanese and Chinese beeswax. H. Fischer. Z. öffentl. Chem., 1913, 19, 473—476.

Further details are given of the adulteration of E. Indian beeswax, which includes Indian, Japanese and Chinese waxes (this J., 1913, 665, 982). All these waxes show the same characteristic of low acid value. The Chinese and Japanese waxes are harder, cleaner and of better quality than the Indian wax. The latter, although showing the same m.pt. as ordinary beeswax, is softer to the touch, and, unlike the Chinese and Japanese wax, is not readily bleached by the sun. "Rosin wax," consisting of 40 to 80 per cent. of American rosin and paraffin wax, is largely imported into India, and appears to be occasionally, though not commonly, used as an adulterant of beeswax. Persistent emulsions sometimes obtained in treating Indian beeswax are due to the borax used in the purification and to oil present as adulterant. Chinese and Japanese beeswax is not adulterated with oil, but frequently contains paraffin wax. Trigona wax, fragments of which are present in almost every consignment of Indian beeswax, is described as humble beeswax in Germany. It is unbleachable and is only suitable for special technical purposes. During the last ten years the price of humble beeswax (Germany) has risen from M. 40 to M. 100—120 per 100 kilos. (from £11 19s. to £29 17s.—£35 16s. per cwt.). In India humble beeswax is not known as a separate commercial product.—C. A. M.

Detection of a yellow dye in edible fats. W. Arnold. Z. Unters. Nahr. Genussm., Dec. 1, 1913, 654.

A yellow dye which has long been in use for artificially colouring fats may be detected by the following test :—One vol. of the melted fat is dissolved in 2 vols. of petroleum ether and well shaken with 0·5 vol. of hydrochloric acid of sp. gr. 1·19. After separating, the acid layer will be found coloured yellow to orange, and this colour may be discharged by the addition of 1 drop of stannous chloride solution. Fats containing none of the dye may give more or less colour to the acid, but the distinguishing test is the decolourisation with stannous chloride. This property indicates that the dye is probably one of the easily reduced nitro-dyes. Its presence in a fat may interfere with Baudouin's test for sesame oil if carried out in the usual way, but this can be obviated by using a solution of 0·1 part of stannous chloride in hydrochloric acid instead of the pure acid.

Naphthenic acids and sodium naphthenate. Davidsohn *See* IIa.

Patents.

Oils and greases ; Machines for testing the lubricatin properties of ——. R. C. Hislop, London. Eng. Pa 29,086, Dec. 17, 1912.

The oil or grease is subjected to friction between a bod rotating on a horizontal spindle and one or more movab bodies to which pressure may be applied by means of spring mounted upon a second spindle in the same a as the main shaft. The motions of the movable bodi and hence the degree of friction of the oil, may be record upon cylinders which are simultaneously rotated fro the main shaft.—C. A. M.

Grease ; Process of manufacturing a consistent — Chem. Fabrik. Troisdorf Dr. Hülsberg und Seil Fr. Pat. 460,418, July 16, 1913. Under Int. Con May 26, 1913.

A lubricating grease is prepared by heating the vari constituents (mineral oil, oleine, lime or equival materials) under pressure. For example, a mixture of mineral oils, compounds of alkaline-earths with oleic or other fatty acid, or magnesium or aluminium salts of fatty acids, is heated at about 150° C. (by means of superheated steam) under a pressure of about 5 atmos.—C. A. M.

Oil from fish ; Process of extracting —— W. E. Overton, Solomons, Md. U.S. Pat. 1,080,294, Dec. 2, 1913.

As much as possible of the oil and watery fluids is extracted from a quantity of fish by pressure, and the watery portion is separated from the oil, heated, and returned to the pressed mass, with which it is well mixed. Subsequent application of pressure to the wet mass results in the removal of a further quantity of oil, together with the watery fluids, from which the oil is afterwards separated.—E. W. L.

Oils and fats ; Method of obtaining sulphonated ——. R. Russ, Assignor to Stolle and Kopke, Rumburg, Austria-Hungary. U.S. Pat. 1,081,775, Dec. 16, 1913.

The oils, etc., are treated with sulphuric acid, the excess of acid removed by the addition of water or a washing liquid, and the sulphonated product separated by centrifugal action.—C. A. M.

Alkaline oils [for protecting ordnance from the effects of smokeless powder] ; Process for the preparation of ——. J. T. Westermann. Fr. Pat. 460,419, July 16, 1913.

Linseed, or other vegetable oil, is mixed with an alcoholic solution of caustic alkali or ammonia in such proportion that the free alkali in the mixture shall not exceed 2 to 3 per cent. Petroleum oil (preferably 10 to 50 per cent.) may also be added to the mixture. The resulting products will form emulsions with water, and are particularly useful for protecting ordnance from the effects of smokeless powder.—C. A. M.

Solvents for fats ; Process and apparatus for separating the vapours of ——. E. Bodin, H. Dupont, and M. Riom. Fr. Pat. 460,746, July 25, 1913. Under Int. Conv., Mar. 31, 1913.

The solvent is brought into contact tangentially with the heated wall of an extraction vessel so that a rotatory movement is communicated to the vapours and the liquid.
—C. A. M.

Solutions of organic compounds producing emulsions with water ; Liquid or solid ——. R. Vidal, Paris. Eng. Pat. 28,832, Dec. 14, 1912. Addition to Eng. Pat. 15,827, July 6, 1912.

See Addition of Dec. 11, 1911, to Fr. Pat, 445,053 of 1911 ; this J., 1913, 498.—T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Egyptian blue. A. P. Laurie, W. F. P. McLintock, and F. D. Miles. Roy. Soc. Proc., 1914, A 89, 418—429.

Experiments with a mixture of fine sand 36 grms., fusion mixture 4 grms., copper carbonate 8·6 grms., and calcium carbonate 7·2 grms., showed that at 800° and at 905° C. none of the true Egyptian blue was formed, the product consisting of uncombined quartz, copper oxide, and an olive-green glass, but at 830° C. considerable quantities of the blue pigment were formed, and on re-grinding and re-heating several times at this temperature, the green glass and copper oxide practically disappeared, leaving a mixture of the blue pigment and uncombined quartz, corresponding to lump samples of frit discovered in Egypt but much richer in the blue. Samples of typical Egyptian blue and of the products prepared as above all proved to consist essentially of a definite crystalline copper silicate as described by Fouqué (this J., 1889, 290). One of the authors' samples contained : SiO_2 63·4, CaO 14·4, CuO 19·5, K_2O 1·19, Na_2O 0·93 per cent. The blue crystals could be obtained without fusion mixture, but it was necessary to heat to a higher temperature (*e.g.* 1050° C.) and then re-grind and reheat at 850° C. When fusion mixture or other alkali salts were used, some of the copper or calcium in the blue crystalline silicate (CaO, CuO, $4SiO_2$) was replaced by alkali metals. The crystalline blue silicate was formed at a temperature far below the fusing point of the whole mixture, the mass merely becoming pasty. At temperatures above 900° C. the blue crystals were converted into a green glass, but the Egyptian blue crystallised out again on re-heating at 850° C.—A. S.

Shellac ; Examination of bleached ——. H. Wolff. Chem. Rev. Fett Ind., 1914, 21, 4—5.

Bleached shellac of diverse origin (65 samples) yielded an ethereal extract ranging from 11·5 to 14·5 per cent. A further test of purity is to determine the amount of benzene extract after previous extractions with petroleum spirit and with ether. The powdered shellac, preferably air-dried or dried at 40° C., is best extracted in a linen bag suspended in the extraction apparatus. Before each extraction it is rapidly ground up with a little of the solvent and sufficient sand to give a dry powder. The extraction with each of the solvents is continued for 3 to 6 hours. In this way a final benzene extract varying between 4 and 5 per cent. was obtained (45 samples gave 4·3 to 4·6 per cent.). The method is not suitable for the quantitative examination of mixtures.—C. A. M.

Japan lac ; The chief constituent of ——. *IV. Derivatives of hydro-urushiol.* R. Majima and J. Nakamura. Ber., 1913, **46**, 4080—4088.

Hydro-urushiol, the crystalline reduction product of urushiol from Japan lac (this J., 1912, 998), yielded a lead salt and various benzoyl derivatives. Its dimethyl ether was converted into a mono-nitro derivative (m. pt. 72°—73° C.), and the latter (by nitration with fuming nitric acid) into a di-nitro compound (m. pt. 83° C.). Both compounds crystallise in needles, and they afford the best means of identifying the dimethyl ether of hydro-urushiol. The behaviour of this ether on nitration was analogous to that of dihydrosafrol. Oxidation of hydro-urushiol in acetone solution by means of permanganate yielded palmitic acid—thus confirming the presence of an alkyl group in the side chain and showing that the latter must contain $C_{15}H_{31}$ instead of $C_{14}H_{29}$ as previously assumed. The constitutional formulæ of all the derivatives of hydro-urushiol must be correspondingly modified. The reactions showed that hydro-urushiol is a higher phenol (see also this J., 1907, 1245 ; 1909, 532, 1212).—C. A. M.

Phenols ; New synthesis of higher ——. [*Isomerides of hydro-urushiol dimethyl ether.*] R. Majima and J. Nakamura. Ber., 1913, **46**, 4089—4095.

Phenols with the constitution of a 3·4-dimethoxy-1-tetradecyl-benzene and a 3.4-dimethoxy-1-pentadecyl-benzene were synthesised as follows :—Myristyl chloride and veratrol were condensed by means of aluminium chloride (yield under 25 per cent.) and the resulting tridecyl-veratryl ketone, $(CH_3O)_2C_6H_3.CO.C_{13}H_{27}$ reduced to a phenol by the following stages. It was first converted into the oxime, and this was reduced by means of ammonium amalgam to the amine, $(CH_3O)_2C_6H_3.CH(NH_2).C_{13}H_{27}$. The phosphoric acid salt of this amine yielded, on dry distillation, tetradecenyl-veratrol, $(CH_3O)_2C_6H_3.CH : CH.C_{12}H_{25}$, and this, when reduced with hydrogen and platinum, was converted into tetra-decyl-veratrol, $(CH_3O)_2C_6H_3.C_{14}H_{29}$. Pentadecyl-veratrol was obtained by a similar series of reactions from tetra-decyl-veratryl-ketone, the latter being prepared by converting myristic acid into pentadecanic acid and condensing the chloride of this acid with veratrol, as described. Hexadecyl-veratrol was also prepared. None of these higher phenols was identical with hydro-urushiol dimethyl ether, although they showed similar reactions and were apparently isomeric therewith (see preceding abstract).—C. A. M.

Rosin size; Examination of ——. J. Marcusson. Chem. Rev. Fett Ind., 1914, 21, 1—3.

In addition to determinations of the alkali, rosin (free and combined) water and impurities, special tests are now required for the numerous substances added to commercial sizes. The older type of rosin size was completely soluble in alcohol, but the modern additions (glue, starch, dextrin, casein, gum, etc.) are insoluble. The insoluble residue should be tested for weighting materials (clay, barium sulphate, etc.), and the ash and nitrogen determined. If no nitrogen is present glue, albumin and casein are absent. Starch may be detected by the iodine reaction and separated almost quantitatively from dextrin and gum arabic by treatment with cold water. Lead acetate precipitates gum arabic from an aqueous solution, whilst dextrin remains in solution. They may also be distinguished by their different optical rotations. Viscose may be identified by being decomposed by dilute acid, with the liberation of hydrogen sulphide and separation of cellulose hydrate. Occasionally vegetable gum ("Pflanzen-schleim") is added to rosin size. In such cases the alcoholic precipitate is flocculent or in threads but is always transparent. The aqueous solution of this precipitate gives a gelatinous precipitate with lead acetate. The principal vegetable gums, including linseed gum and gum tragasol, also give insoluble precipitates with 5 per cent. tannin solution—in which respect they differ from gum arabic, which is also precipitated by lead acetate. If the alcoholic precipitate contains nitrogen, its behaviour towards water and acetic acid is ascertained. Animal glue is completely soluble in water, and the solution does not give a precipitate with acetic acid either in the cold or on heating—in contradistinction to the other nitrogenous products (casein, albumin). Ordinary animal glue contains about 18 per cent. of nitrogen, and about 0·2 to 0·25 per cent. of sulphur. When heated with alkaline lead oxide solution it does not yield a precipitate of lead sulphide, as is given by vegetable glue ("Pflanzenleim"), albumin and casein. With tannin it forms a sparingly soluble compound. Albumin (egg-albumin) is soluble in cold water, but is precipitated on heating or on the addition of acetic acid. Vegetable glue and casein are soluble as alkali compounds. These are decomposed by acetic acid with the precipitation of the protein. Casein is distinguished from the other proteins by containing about 0·8 per cent. of phosphorus and by being precipitated by rennet. For the detection of dextrin and gum arabic (which may be precipitated by alcohol with nitrogenous compounds) an excess of tannin is added to the aqueous solution and the liquid filtered. The filtrate is evaporated to dryness, and the residue taken up with a little water and again filtered. The new filtrate is treated with alcohol in excess, which keeps the tannin in solution and precipitates dextrin and gum arabic. This precipitate is dissolved in water and examined as described.
—C. A. M.

Behaviour of ultramarine in cement ware. Haerting. *See* IX.

Patents.

Oil paints; Process of manufacturing ——. H. Steinherz and F. von Schaller. Fr. Pat. 460,296, April 19, 1913.

Materials of colloidal structure (*e.g.* talc, asbestos, kaolin, etc.) are ground under pressure with driers and liquid "bakelites" until absorption and emulsification is complete. Coloured organic or inorganic pigments may be added to the mixture, and owing to the pressure obtaining in the mill or kneading machine, are perfectly incorporated.—C. A. M.

Turpentine and rosin; Process for extracting —— *from wood.* B. F. A. Saylor, Rome, Ga., Assignor to Standard Turpentine and Wood Pulp Co., Atlanta, Ga. U.S. Pat. 1,081,276, Dec. 9, 1913.

Finely divided resinous wood is placed in a closed cylinder which is then heated externally to about 212° F. (100° C.), the pressure in the cylinder being at the same time reduced to about 4 ins. of mercury. Dry caustic soda is then injected into the cylinder, and steam admitted under pressure. The steam is allowed to escape and carry off some of the turpentine and practically all air, until the pressure is reduced to about 20 lb. per sq. in., when the cylinder is closed. The cylinder is again heated externally, and steam is admitted from the bottom until 100 lb. pressure is attained; this pressure is maintained, by the further injection of steam, while steam is also allowed to escape, carrying with it more turpentine, until all the latter is recovered from the wood. The steam supply is now cut off, and the pressure allowed to fall. The turpentine product is ejected from the cylinder, on opening the latter, by the residual steam pressure, and the wood-pulp is finally removed from the cylinder.—E. W. L.

Resinous and wax-like condensation products and process of making same. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 24,254, Oct. 23, 1912.

Resinous or wax-like substances are produced in two stages consisting in the interaction of a polyhydric alcohol —*e.g.* glycerol—with an amount of a polybasic acid or anhydride—such as phthalic anhydride, succinic, tartaric, glutaric, malic or camphoric acid—insufficient for complete esterification, and the subsequent interaction of the intermediate products with another acid such as those mentioned above, or propionic, stearic, palmitic, oleic, benzoic, lactic, salicylic, glycollic, chloroacetic, chlorobenzoic, or chloropropionic acid, or with a substance having certain acid properties *e.g.*, colophony. For example, 184 parts of glycerol and 296 parts of phthalic anhydride (equimolecular proportions) are heated at 200°—210° C. until gas bubbles cease to rise. To the somewhat thickened mass 118 parts of succinic acid are added and the mixture is heated at 210°—225° C. until it forms a jelly, or nearly so. The transparent mass becomes hard and brittle and free from bubbles on cooling; it is not fusible but becomes plastic on heating. It is apparently not identical with the product of the simultaneous action of phthalic anhydride and succinic acid on glycerol. When solid it may be powdered and moulded under pressure either with or without fillers. The moulded product may be rendered hard, tough and non-plastic under heat by heating for half-an-hour at 200°—210° C. The product obtained when succinic acid (236 parts) is employed in the first stage, and phthalic anhydride (148 parts) in the second, is slightly elastic when cold, but on heating, loses its flexibility and becomes a strong, tough, clear, solid mass, free from bubbles, infusible and insoluble. The product obtained when colophony (279 parts) is used in the second stage is a hard, reddish-brown resin, which is not the equivalent of a simple mixture of the phthalic resin and colophony. When stearic acid is used in the second stage the product is a soft waxy substance with good insulating properties, soluble in some heavy hydrocarbon oils. Lactic acid gives a very plastic product with a relatively low flow-point. The product from glycerol, phthalic anhydride, and monochloroacetic acid in equimolecular proportions has a flow-point of 64·5° C., is pliable and sticky. By increasing the anhydride to 1$\frac{3}{8}$ mol. and reducing the chloroacetic acid to $\frac{1}{4}$ mol. the flow-point is raised to 88° C. and the product is hard and brittle, becoming infusible when heated to 160° C. for 8 hours.—E. W. L.

Phenol and formaldehyde; Process for making an anhydrous reaction product of ——. F. G. Wiechmann, New York, Assignor to Fenoform Corporation, Hastings-upon-Hudson, N.Y. U.S. Pat. 1,080,188, Dec. 2, 1913.

A condensation product which is viscous and syrupy at ordinary temperatures, non-hygroscopic, insoluble in water, and showing no trace of water when tested with anhydrous copper sulphate, is obtained when 100 parts of crystallised carbolic acid are heated with from 10—35 parts of paraformaldehyde (or with formaldehyde), in the presence of a catalytic agent (*e.g.* dry ammonia).—E. W. L.

Condensation product of phenol and formaldehyde; Process of obtaining a ——. Stockhausen Kautschukwerke Ges. m. b. H. Fr. Pat. 460,675, July 23, 1913. Under Int. Conv., Jan. 7, and April 19, 1913.

Condensation products of phenol and formaldehyde are converted into plastic (and finally insoluble) masses by heating for a short time, while in a fluid or still fusible condition, with (say 50 to 100 per cent.) of a compound of a trivalent metal, such as iron chloride or aluminium chloride; sulphur, rubber, filling materials, etc., may be added before or after the addition of the iron chloride. The initial condensation product may be prepared by heating the phenol and formaldehyde in the presence of alkali until the liquid becomes turbid, when the mass is rapidly cooled. Products obtained as described may be used for the impregnation of paper, wood, cork, asbestos, wool, etc.—C. A. M.

Varnish. A. Kuegel, Jersey City, N.J. U.S. Pat. 1,080,461, Dec. 2, 1913.

A solution of a resinous substance in alcoholic ammonia. —E. W. L.

Cellulose nitrates; Process of manufacturing non-inflammable solutions of —— *preferably utilisable as lacquers.* Akt. Ges. für Anilin-Fabrikation. Fr. Pat. 461,034, Aug. 1, 1913. Under Int. Conv., Nov. 15, 1912.

A chloro-derivative of ethane or of ethylene (di-, tri-, or tetrachloroethylene or tetrachloroethane) is added in large proportion to a concentrated solution of cellulose nitrate in a suitable solvent.—C. A. M.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Vulcanisation of rubber. F. Ahrens. Gummi-Zeit., 1913, **28**, 490—491.

The author examined old and new samples of a mixing of a low quality rubber. The old sample contained 9 per cent. of free sulphur (by acetone extraction), 13·6 per cent. of total sulphur, and 2·83 per cent. of combined sulphur. The new sample contained 7 per cent. of free, 15·8 per cent. of total, and 5·03 per cent. of combined sulphur. (The sulphur was estimated by a slight modification of the usual nitric acid method, in which the acid mixture, after oxidation, was diluted with water, neutralised by dilute caustic soda solution, then evaporated down and fused as usual.) Hence the combined sulphur in the old sample had actually diminished. This is not the case with samples of good quality, *e.g.*, Para rubber. The author remarks that vulcanisation must depend essentially on the colloidal structure of the rubber; he considers that coagulation from the latex is intimately connected with oxidation, and that further experiments are necessary on the parallelism between vulcanisation and oxidation.—H. E. P.

Patents.

Caoutchouc; Synthetic products resembling or related to ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 975, Jan. 13, 1913.

The synthetic products from butadiene and its homologues may be improved in quality by heating them alone under reduced pressure in an inert atmosphere, provision being made for the removal of volatile products. In some cases the simultaneous employment of nitrogen compounds, such as ammonia, methylamine, aniline, amino-acids, glue, and albumin, is very advantageous. —E. W. L.

Rubber; Process for preparing a product similar to soft ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 267,945, Dec. 25, 1912. Addition to Ger. Pat. 266,618.

To produce a product resembling soft rubber, the process described in the principal patent (see Eng. Pat. 11,530 of 1913; this J., 1913, 1078) is carried out at a lower temperature, or for a shorter period.—T. F. B.

India rubber; Coagulation and curing of ——. F. A. Byrne, Birmingham. Eng. Pat. 18,061, of 1913, date of appl., Oct. 30, 1912. (See this J., 1913, 98, 1163.)

The vapours obtained by heating formic acid may be employed for the coagulation and or curing of rubber. —E. W. L.

Raw rubber; Preparation of ——. F. Ripeau. Fr. Pat. 460,689, July 23, 1913.

Latex is distributed in successive layers over the surface of a horizontal revolving drum, which has been previously smoked, each layer of latex being smoked to induce coagulation before applying the next layer. The sheet of rubber is removed from the drum by a longitudinal cut. No pressure is applied to the sheet of rubber during the process.—E. W. L.

Gums [rubber, etc.]; Process and apparatus for extracting —— *from vegetable tissues containing them.* F. Kempler. Fr. Pat. 461,093, Aug. 4, 1913.

The bark, etc., containing rubber or allied gums is coarsely crushed by some method which does not overwork the particles of rubber, and is then fed into an apparatus consisting of a horizontal cylindrical casing, of which the lower half is perforated and acts as a screen, and in which revolves a friction roller. The whole is immersed in a tank in which water can be maintained at the desired level to enable the fine particles of crushed bark, etc., to be carried away through the screen, whilst the agglomerated rubber remains behind.—E. W. L.

Rubber and analogous substances; Vulcanisation of articles made of ——. V. Thomas. Fr. Pat. 460,780, July 26, 1913. Under Int. Conv., July 26, 1912.

Vulcanisation may be effected by the action of the chemically active light rays (*e.g.*, violet and ultra-violet rays from mercury vapour lamps) upon thin films of rubber mixings containing sulphur, or upon solutions of such mixings. The process may be used in combination with the ordinary process of hot vulcanisation, and may be carried out in an inert atmosphere in order to avoid the formation of ozone. A very thin film of Hevea plantation rubber mixed with 6 per cent. of sulphur, prepared by evaporating a 3 per cent. solution in benzine on a transparent quartz plate, was exposed on both sides to the rays from a Heraeus lamp run at 110 volts and 3·5 ampères and distant 13 cm. The rubber was covered with a layer of water to shield it from the heat of the lamp. 2·56 per cent. of combined sulphur was found in the exposed sample. A 3 per cent. solution of plantation rubber and sulphur in benzine exposed in thin layers to the rays from a quartz lamp run at 220 volts and 3 ampères, at a distance of 3—4 cm., vulcanised very rapidly, a rapid passage before the lamp, with a stream of water interposed to cut off heat, being sufficient to bring about the combination of sulphur to the extent of 1·5 to 2·5 per cent. The solution left on evaporation a residue of vulcanised rubber, insoluble in the ordinary rubber solvents.—E. W. L.

Rubber; Process for regenerating ——. C. Harries. Ger. Pat. 267,277, Nov. 28, 1912.

Solutions of rubber waste are treated with gaseous hydrogen chloride, bromide, or iodide, and the products, of the type, $C_{10}H_{16},2HCl$, are heated with bases, such as alkalis, ammonia, or amines; it is stated that rubber of good quality is regenerated by this process, whether from the waste of natural or artificial rubber goods.—T. F. B.

Vulcanisation of natural or artificial caoutchouc substances; Process for accelerating the ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 266,619, Dec. 25, 1912. Addition to Ger. Pat. 265,221.

In place of using piperidine or its homologues as described in the principal patent (see Eng. Pat. 11,530 of 1913; this J., 1913, 1078), derivatives of these bases may be used —T. F. B.

Plastic compositions. A. Oetker, Altona-Ottensen, Germany. Eng. Pat. 4663, Feb. 24, 1913.

A plastic composition for elastic padding, floor coverings, etc., consists of waste vulcanised rubber, in the form of small pieces or powder, agglomerated by a binding agent of gutta-percha and fatty matter or paraffin, to which caoutchouc or resin may be added.—H. E. P.

Rubber compositions. J. W. Aylsworth, East Orange, N.J., U.S.A. Eng. Pat. 8757, April 14, 1913. Under Int. Conv., April 18, 1912.

Rubber compositions, soft or hard, are made by vulcanising a mixture of rubber, chloronaphthalene (*e.g.*, liquid monochloronaphthalene or a solid chloronaphthalene) and vulcanising agent, which is preferably added after the previous ingredients have been mixed. Fillers may be added. Metal articles or fibrous materials may be coated with a film by covering them with a varnish made by using liquid monochloronaphthalene or a solvent such as acetylene tetrachloride with the ingredients mentioned above and then baking.—H. E. P.

Rubber; Manufacture of reinforced hard ——. J. T. Szek. Fr. Pat. 460,243, July 11, 1913. Under Int. Conv., Sept. 20, 1912.

In order to protect the fabric used in the production of ebonite "insertion" from the destructive action of moisture and high temperature in the presence of sulphur during vulcanisation, it is first impregnated with a solution of vulcanised asphaltum in carbon tetrachloride, benzene, etc., then dusted with finely divided quartzite, keiselguhr, glass powder, talc, or other similar substance before the rubber mixing is applied to it.—E. W. L.

Caoutchouc; Manufacture of compounds resembling or related to ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,980, June 4, 1913. Addition to Eng. Pat. 26,550, Nov. 19, 1912.

See Addition of June 7, 1913, to Fr. Pat. 459,005 of 1913; this J., 1913, 1164.—T. F. B.

Caoutchouc: Vulcanised —— *and process of making same.* F. Hofmann and K. Delbrück, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,081,613, Dec. 16, 1913.

See Eng. Pat. 2312 of 1912; this J., 1912, 651.—T. F. B.

Caoutchouc substance and process of making same. F. Hofmann and K. Delbrück, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,081,614, Dec. 16, 1913.

See Eng. Pat. 2313 of 1912; this J., 1912, 547.—T. F. B.

Vulcanised glycerol resin. W. C. Arsem, Schenectady. Assignor to General Electric Co., New York. U.S. Pat. 1,082,106, Dec. 23, 1913.

See Eng. Pat. 9985 of 1913; this J., 1913, 1023.—T. F. B.

Obtaining erythrene and other unsaturated compounds. Ger. Pats. 267,079 and 267,080. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Tans; Distinction of bark —— *from fruit and wood tans.* B. Kohnstein. Collegium, 1913, 645—648.

Aqueous or alcoholic extracts of the bark of the pine and other conifers and of willow bark when boiled with hydrochloric acid, cooled and shaken with ether give a green colouration when the ether solution is removed and shaken with ammonia. The reaction is not confined to these barks, but in most cases is masked by the production of phlobaphenes by the action of the hydrochloric acid. The test may also be carried out by placing a drop of the esterified tannin solution on a piece of solid caustic potash on a white tile. In both cases extracts of leaves and bark give a green colour while those of fruits and wood give a brown colour. A green colour is produced by galls, and young valonia gives an olive green colouration.—D. J. L.

Tanning materials; [Apparatus for] Determination of the ethyl acetate figure of ——. J. R. Blockey. Collegium, 1913, 634.

The apparatus consists of a modification of the Soxhlet extractor with an overflow tube at the side instead of the usual siphon tube. The extractor will hold 30 c.c. of liquid up to the level of the overflow tube and contains, inside, a small glass funnel the stem of which reaches to the bottom and is there bent round, or the end of the stem may be in the shape of a small bulb pierced with small holes. 25 c.c. of clear filtered liquor are placed in the extractor and extraction carried out in the usual manner with ethyl or amyl acetate. The condensed solvent flows down through the funnel, then rises through the liquor in small drops and returns to the distilling flask through the overflow tube. Extraction is complete in 3—4 hours. —D. J. L.

Tannin from Turkish and Chinese galls; Constitution of ——. K. Feist and H. Haun. Arch. Pharm., 1913, 251, 468—526.

The crystalline glucogallic acid obtained by Feist (see this J., 1912, 652) from Turkish galls was methylated by means of diazomethane. The methylated product was very resistant to boiling $N/1$ sulphuric acid, but readily hydrolysed by alkali, yielding trimethylgallic acid. As glucogallic acid contains no aldehyde group, the carboxyl group of the gallic acid residue must be combined with the glucose aldehyde group, the substance being thus a mono-galloylglucose. Tannins obtained from Turkish and Chinese galls were methylated by Herzig's method (see this J., 1909, 1051) and the methylated products shown not to be homogeneous, fractions of varying methoxyl content being obtained by treatment with absolute ether and absolute alcohol. The fractions obtained from methylated Turkish tannin showed a higher methoxyl content than the corresponding fractions from methylated Chinese tannin. The fraction insoluble in cold absolute alcohol, obtained from methylated Chinese tannin was found to be identical with Herzig's "methylotannin" (*loc. cit.*). The methoxyl content of this substance agreed with a compound of 1 mol. of glucose with 11 or 12 mols. of gallic acid, whilst the corresponding fraction from methylated Turkish tannin had a methoxyl content agreeing with 1 mol. of glucose to 1 to 3 mols. of gallic acid. The fraction soluble in cold absolute alcohol obtained from methylated Turkish tannin was not homogeneous but a mixture of mono-, di-, and tri-galloylglucose. Molecular weight determinations by the ebullioscopic method, using acetone as solvent, gave lower values for Turkish than for Chinese tannin. (See also this J., 1912, 1044; 1913, 36.)—T. C.

Pistachia atlantica, Desf., from Libia as a tanning material. F. Vignolo-Lutati. L'Ind. Chim., 1913, 13, 355—356.

The air-dried leaves of *Pistachia atlantica*, when examined by Procter's filter-bell method, gave 40·86 per cent. of soluble matter, of which 19·74 per cent. was absorbed by hide-powder, *i.e.*, a considerably greater proportion than that yielded by *P. lentiscus*, a common adulterant of sumach. The extract of *P. atlantica* was light-coloured and the tannin present gave the reactions of a pyrogallol-tannin, whereas that of *P. lentiscus* is a catechol-tannin. Having regard to the low cost of transport from Libya, it is suggested that it would be advantageous to try *P. atlantica* as a tanning material on a commercial scale in Italy.—A. S.

Water; Natural —— and the catalytic action of some colloidal substances at great dilution [in tanning and dyeing]. E. O. Sommerhoff. Collegium, 1913, 635—638.

If the calculated quantity of lime or soda be added to a natural water the precipitation of calcium carbonate is not nearly quantitative and the result will vary greatly according to the scale on which the experiment is performed. In a softened natural water of 3° of hardness, magnesium salts were still present and could not be quantitatively precipitated by sodium phosphate. The calcium and magnesium salts in natural water are probably present partly in a colloidal complex polymerised form, and thus do not take part in the usual ionic reactions. The presence of inorganic colloidal alkaline earth compounds in water used for silk dyeing and leather manufacture may produce good or bad results. Their influence is favourable in quickly coagulating the colloidal tanning matter in the hide and silk fibre during washing and results are obtained with natural water which can never be imitated by the addition of crystalline magnesium salts to soft water. The formation of colloidal calcium and magnesium salts is favoured by the presence of protective organic colloids such as humic acid. The catalytic action of these salts as oxygen carriers may become, under certain conditions, so strong as to result in local destruction or staining of the silk or hide so that some metallic salts which are quite harmless when present in crystalloidal form may have a very harmful effect when in the colloidal polymerised form. An instance is given of the occurrence of red stains in silk dyeing which were explained as due to a catalytic oxidation effect causing local decomposition of albumin. The colloidal metallic salts are very similar in their effects to bacteria. The author regards it as doubtful that salt stains are due entirely to bacteria. Investigation of the stains should be carried out on a practical scale as it is impossible to produce similar conditions in the laboratory.
—D. J. L.

Leather; Free sulphuric acid in ——. J. Paessler. Collegium, 1913, 648—649.

Leather tanned with the synthetic tanning material Neradol D gives erroneous results when tested for free sulphuric acid by the usual tests. The tanning material itself contains sulphur compounds which are taken up by the hide during tanning. Any method of estimating the free sulphuric acid involving the determination of the total sulphur in the leather must give too high results.
—D. J. L.

Leather; Free sulphuric acid in ——. W. Moeller. Collegium, 1913, 649—650.

Besides Neradol many other substances, when present in leather, give rise to erroneous results in the determination of free sulphuric acid by any of the methods previously proposed. Sody (Gerber Courier, 1913, No. 37) has shown that, in most cases, the high percentage of free sulphuric acid found in many samples of leather by the usual methods is not really present but is formed during the course of the analysis from sulphur present in the leather in other forms. The varying amount of the sulphur in the raw skin, the selenium in the water, sulphur-containing salts in the raw skin, sodium sulphide in the limes, sulphites, sulphates and bisulphites in the tanning extracts, sulphonated oils, sulphur dyestuffs, sulphite-cellulose extract, etc., may all contribute to the total sulphur in the leather.—D. J. L.

Patents.

Quebracho; Method of treating ——. J. M. Fiske, New York. U.S. Pat. 1,081,730, Dec. 16, 1913.

Solid extract of quebracho is immersed in water in a closed vessel, and the water is caused to circulate at a temperature not higher than 175° F. (79° C.). The water may be heated by steam. The solution and insoluble matter are drawn off separately.—H. E. P.

Tanning in one operation with mineral and vegetable products. W. A. Klipstein. Fr. Pat. 460,870, July 30, 1913.

Skins are tanned in a mixture of vegetable tanning agents, caustic soda and normal chromium sulphate or other alkalis and chromium salts. For example 70 parts by weight of solid quebracho extract, 8 parts of caustic soda, 75 parts of chromium sulphate and 15 parts of chromium oxide may be used.—D. J. L.

Leather; Treatment of —— for waterproofing and rendering it non-slipping. A. McLennan, Ross, Hereford. Eng. Pat. 21,081, Sept. 16, 1912.

The resistance to water of leather is increased by drumming, for 20 hides of average weight, with a solution of 6 oz. of celluloid dissolved in 5—6 pints of acetone, adding later, at suitable intervals, 10 oz. of gum juniper, 30 oz. of ether, 6 oz. of amber resin and 15 oz. of benzol. The treated leather has a much better grip on a damp or greasy surface than untreated leather. The process is preferably combined with a treatment with rubber solution.—D. J. L.

Leather; Drying japanned or varnished ——. A. Genthe, Worms a/R., Germany. Eng. Pat. 20,795, Sept. 15, 1913.

The ozone produced by mercury vapour lamps when used for the production of ultra-violet rays in the drying of japanned or varnished leather acts injuriously on the varnished surface. The method of removing ozone from the chamber by ventilation (see Eng. Pat. 10,971 of 1912; this J., 1912, 694) fails on moist summer days, but even in such cases, the injurious action of the ozone may be prevented by removing the aqueous vapour as far as possible from the air entering the chamber by suitable chilling.—D. J. L.

Bones; Preliminary treatment of —— for gelatin manufacture. H. Bunzel. Fr. Pat. 460,611, June 26, 1913. Under Int. Conv., Oct. 28, 1912.

The bones, after treatment with hydrochloric or other acids, are treated with a solution of peroxide or percarbonate of sodium or other alkali or alkaline-earth persalts. The process is much quicker than the usual treatment with lime water and a product of better colour is obtained.—D. J. L.

Leather and leather products; Manufacture of ——. W. Spalteholz, Leipzig, and K. Haring, Hersfeld, Germany. Eng. Pat. 28,392, Dec. 9, 1912.

See Ger. Pats. 258,992 and 258,993 of 1911; this J., 1913, 668.—T. F. B.

XVI.—SOILS; FERTILISERS.

Sodium sulphate; Effect of —— on the growth of plants. E. Haselhoff. Landw. Jahrb., 1913, 44, 641. Biedermann's Zentr., 1913, 42, 824—826.

The presence of sodium sulphate in the effluents from soda works, and in atmospheric dust in the neighbourhood of potash and other chemical works, has led the author to try its effect on plants when present in the soil and when dusted on to the leaves. The dust had an undoubted retarding effect on grasses, and soil cultures and water cultures showed in many cases a retarding effect on other plants with 0·5 grm. per litre. The results fluctuated considerably and the individuality of the plant had undoubtedly some effect.—W. H. P.

Nitrogenous fertilisers in U.S.A. J. W. Turrentine, U.S. Dept. of Agriculture. Bureau of Soils, Dec., 1913. [T.R.]

Of the 250,000,000 tons of sodium nitrate exported from Chile in 1911, the United States took 500,000 tons, of which some 70,000 tons were used in agriculture. Surveys of those parts of the U.S.A., the climate of which would permit of nitrate formation, has failed to reveal their presence in workable quantities. For the last five years the annual U.S. production of ammonium sulphate has ranged from 83,400 tons in 1908 to 155,000 tons in 1912. The world's production in 1911 was 1,187,000 tons. The only feasible development lies in the by-product oven. An oil shale from Montana is reported which yields 41·5 lb. ammonium sulphate and six gallons crude oil per short ton. During 1910, 13,531 tons of calcium nitrate were exported from Norway, and the total production was about 22,000 tons. In 1911, 2302 tons were imported into the U.S.A. In 1912 about 12,000 tons of cyanamide were produced at Niagara, 4000 at Nashville, and from 15,000 to 18,000 tons in Europe. Owing to recent additions, the Niagara Works of the American Cyanamid Co. should be able to put out at the rate of some 50,000 tons a year by the end of 1913. Tankage and dried blood contains from 5 to 8 per cent. of nitrogen and from 5 to 12 per cent. of phosphoric acid. Pure dried blood contains 14 per cent. of nitrogen, but as obtained on the market the content varies from 9 to 13 per cent. An ox in good condition yields 12 lb. of tankage and 7 lb. of dried blood; each calf, 2·4 lb. tankage and 0·75 lb. blood; each hog, 4·8 lb. tankage and 1·2 lb. blood; and each sheep, 1·2 lb. tankage and 0·5 blood. These figures do not include bone or concentrated tank water. Had all the materials derived from cattle of all kinds slaughtered in U.S.A. in 1912 been rendered available they would have produced 222,535 tons of tankage and 79,794 tons of dried blood. The present supply depends largely on the output of the large packing houses, for the work from the smaller ones is not so available, and there is little likelihood of much increase. Of the fertilisers used in U.S.A., 215,000 tons are ammonium sulphate, 70,000 tons sodium nitrate, 11,000 tons calcium cyanide, from 100,000 to 150,000 tons tankage, and 70,000 tons fish scrap.

XVII.—SUGARS; STARCHES; GUMS.

[Beetroot] Juice; Purification of —— [by alumina]. M. Lindner. Deutsch. Zuckerind., 1913, 38, 1136—1138.

On digesting beetroot pulp with a suspension of colloidal alumina at 45°—50° C., the juice obtained was only slightly turbid when cold and filtered quite clear. Experiments made on a larger scale with a glass diffusion apparatus gave equally favourable results, the alumina separating easily from the beetroot chips as a black mass. The alumina must be free from salts and ammonium compounds. 50 kilos. of chips required 1 kilo. of colloidal alumina, containing 12 per cent. Al_2O_3. Sugar boiled from the juice thus prepared, without the use of lime, gave the following results:—Polarisation, 98·00, ash, 0·33, water, 0·68, organic non-sugar, 0·99 per cent. The sugar dried easily in the centrifugal machine and, with slight steaming, yielded a product fit for direct consumption: polarisation, 99·80, ash, 0·003, water, 0·180, organic non-sugar, 0·017 per cent. The alumina did not produce the same purification with diffusion juice as when applied direct to the beetroot chips, the reason adduced being that the non-sugars of the beetroot have a labile structure which no longer exists when they are freed in the diffusion juice.

—L. J. de W.

Sucrose; Constants for use in the double polarisation method of determining ——. L. G. L. Steuerwald. Archief Suikerind. Nederl.-Indië, 1913, 21, 1383—1392.

Several investigators have observed when using the double polarisation (Clerget-Herzfeld) method of determining sucrose that the Herzfeld constants are not strictly accurate, a result higher than the truth being given, so that in the examination of raw beet sugars the presence of raffinose may be indicated, when the trisaccharide is absent (International Commission for Uniform Methods of Sugar Analysis, New York, 1912). The author has found the Herzfeld constant to give 0·2—0·3 per cent. more sucrose in the case of high-grade cane sugars than a constant specially determined by him. A new series of constants, the average of values determined at 28°—29° C. and at 20° C., and calculated to 0° C., has now been constructed by him (Table 1).

Table 1.

Concentration, grms. of sucrose per 100 c.c.	Constant for 0° C.	Concentration, grms. of sucrose per 100 c.c.	Constant for 0° C.
1	142·19	11	142·91
2	142·26	12	142·98
3	142·34	13	143·05
4	142·41	14	143·12
5	142·48	15	143·20
6	142·55	16	143·27
7	142·62	17	143·34
8	142·69	18	143·41
9	142·77	19	143·48
10	142·84	20	143·55

A table in which the change of rotation due to concentration as well as that caused by temperature has also been worked out, following the procedure of Geerligs (Archief Suikerind. Nederl.-Indië, 1913, 21, 33).

Table 2.

	Temperature of reading.					
	20° C.	22° C.	24° C.	26° C.	28° C.	30° C.
—25	143·51	—	—	—	—	—
—24	143·45	143·43	—	—	—	—
—23	143·39	143·38	143·36	—	—	—
—22	143·34	143·32	143·30	143·29	—	—
—21	143·28	143·26	143·24	143·23	143·21	143·20
—20	143·23	143·20	143·18	143·16	143·15	143·14
—19	143·17	143·15	143·12	143·10	143·09	143·07
—18	143·12	143·09	143·06	143·04	143·02	143·01
—17	143·06	143·03	143·00	142·98	142·96	142·94
—16	143·01	142·98	142·95	142·92	142·90	142·88
—15	142·95	142·92	142·89	142·86	142·83	142·81
—14	142·90	142·86	142·83	142·80	142·77	142·74
—13	142·84	142·80	142·77	142·74	142·71	142·68
—12	142·79	142·75	142·71	142·68	142·64	142·61
—11	142·73	142·69	142·65	142·61	142·58	142·55
—10	142·68	142·64	142·59	142·55	142·52	142·48
— 9	142·62	142·58	142·53	142·49	142·45	142·42
— 8	142·57	142·52	142·47	142·43	142·39	142·35
— 7	142·51	142·46	142·41	142·37	142·33	142·29
— 6	142·46	142·41	142·36	142·31	142·26	142·22
— 5	142·40	142·35	142·30	142·25	142·20	142·15
— 4	142·35	142·29	142·24	142·19	142·14	142·09
— 3	142·29	142·24	142·18	142·13	142·07	142·02
— 2	142·24	142·18	142·12	142·06	142·01	141·96
— 1	142·18	142·12	142·06	142·00	141·94	141·88

—J. P. O

Dextrose; Action of alkali and alkaline-earth cyanides on ——. E. Rupp and A. Hölzle. Arch. Pharm., 1913, 251, 553—556.

A mixture of dextrose and potassium cyanide (or barium cyanide) liberated ammonia even without the addition of caustic alkali. The potassium compound of the nitrile of heptagluconic acid was first formed as an additive compound and was converted first into the ammonium salt of heptagluconic acid, and then into the corresponding potassium salt with evolution of ammonia. The mechanism of the reaction was elucidated by determining quantitatively the amount of ammonia formed and the potassium content of the product and the isolation and identification of the anhydride of heptagluconic acid.—T. C.

Betaine hydrochloride from molasses residues ; Preparation of ——. H. Stoltzenberg. Zentralbl. Zuckerind., 1913, **22**, Nos. 4 and 5. Chem. Zentr., 1914, **1**, 22.

In the preparation of betaine from molasses residues (this J., 1912, 788 ; 1913, 301), the ethyl alcohol used need not be pure ; alcohol denatured with methyl alcohol is quite suitable. The method of Urban (this J., 1913, 440) is criticised, especially in regard to the quantity of hydrochloric acid, the use of animal charcoal, and omission of alcohol. The solubilities of betaine hydrochloride, glutamic acid hydrochloride, and potassium chloride in water are nearly equal, and only a mixture can be obtained by evaporation of an aqueous solution of these substances. —A. S.

Patent.

Starch ; Process for treating —— for the production of an adhesive particularly suitable for use as a size. W. J. Mellersh-Jackson, London. From Casein Co. of America, New York. Eng. Pat. 4203, Feb. 18, 1913.

See U.S. Pat. 1,053,719 of 1913 ; this J., 1913, 302.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Brewing barleys ; Direct determination of extract, as a factor in the valuation of ——. R. Seibriger. Woch. Brau., 1913, **30**, 649—650.

The protein-content of barley, valuable as a means of judging how the grain will behave on the malting floor, does not by itself constitute a trustworthy basis for the calculation of extract yield. Barleys of the same protein-content may differ by as much as 4·8 per cent. in their yield of extract. For the valuation of brewing barleys the author therefore recommends the direct determination of extract (see this J., 1910, 893 ; Woch. Brau., 1912, **29**, 297) besides that of moisture, proteins and germinative capacity. When malting is conducted under ordinary conditions there is a fairly constant difference (1—1·5) between the percentage extract of the barley (determined as above) and that of the malt (determined in fine grist by the Congress method) the latter value being the lower. Greater differences than this indicate unsatisfactory methods of malting, and the direct determination of extract in barley serves not only as a basis for the valuation of the grain itself, but, together with the determination of extract in the malt, as a control on the malting operations. Barleys containing less than 77 per cent. of extract (calculated on the dried substance) are as a rule not well suited for brewing.—J. H. L.

Malt ; Influence of dilution of the mash on the yield of extract found in the examination of —— by the Congress method. W. Windisch and W. Glaubitz. Woch. Brau., 1914, **31**, 1—4.

In the determination of extract in malt by the Congress method in use on the Continent, the extract-content of the filtered wort (about 8·5 per cent.) is found from its density by reference to Balling's table. The results obtained vary slightly according to the dilution of the mash, and these discrepancies depend to some extent on the character of the malt, but are smaller and more constant when instead of Balling's table, that of K. Windisch is used (cp. O. Saare, this J., 1902, 557). For example, if the mash is so diluted as to give a 12 per cent. instead of an 8·5 per cent. wort, the values found for the yield of extract in the malt are higher by 0·75—0·8 per cent. or 0·4 per cent., according as Balling's or K. Windisch's table is used. These differences are due mainly to the state of dilution of the wort and not to the amount of matter extracted from the malt. Similar discrepancies are encountered when a wort (or a pure sucrose solution) is diluted to different extents, and the extract-contents calculated from the degree of dilution are compared with those deduced from the actual densities by reference to Balling's table ; but if K. Windisch's table is used the discrepancies almost if not quite vanish. The authors recommend that in order to approach technical conditions as closely as possible, the Congress method of mashing should be so modified as to yield a wort of 11—12 per cent. extract, and also that Balling's table should be replaced either by that of K. Windisch (15° C.) or by that of Mohr (17·5° C.).—J. H. L.

Pyruvic acid, a product of the vital activity of yeast. A. Fernbach and M. Schoen. Comptes rend., 1913, **157**, 1478—1480.

The quantity of acid produced in yeast fermentations was considerably increased by adding calcium carbonate to the medium. Using a Champagne yeast in a sugar solution containing mineral salts and 1·5 grm. of peptone per litre, a quantity of calcium salts insoluble in alcohol (*i.e.* free from acetate) equivalent to 5·5 per cent. of the sugar fermented was obtained, whilst with the myco-yeast of Duclaux the yield rose to 25 per cent. Among the acids produced pyruvic acid was identified.—A. S.

Invertase ; Formation of ——. H. Euler and H. Cramér. Z. physiol. Chem., 1913, **88**, 430—444. (See also this J., 1912, 245, 654.)

The marked production of invertase which occurs when yeast is kept for some days in sugar solutions (see *loc. cit.*, and Meisenheimer and others, this J., 1913, 838) is not a consequence of increased general vitality of the cells, for it is sometimes accompanied by diminished fermentative activity. It takes place in solutions of sucrose, dextrose or mannose, but not in those of mannitol, sodium formate or sodium lactate ; yet the effect of sugar is somewhat increased by the presence of sodium lactate and diminished by sodium formate. The authors conclude that the formation of invertase requires conditions favourable to the production of protoplasm, and the energy required for both processes must be supplied by fermentation.—J. H. L.

Emulsin free from proteins ; Production of ——. K. Ohta. Biochem. Zeits., 1913, **58**, 329—338.

Commercial emulsin (Kahlbaum's) was digested with 1/10 of its weight of pancreatin and 100 parts of water rendered slightly ammoniacal, for 5—16 days at 37° C. in presence of toluene. The clear filtered solution was dialysed against water for 5—10 days and afterwards concentrated at a low temperature and mixed with several times its volume of alcohol. The precipitated enzyme, washed with alcohol and ether, and dried, amounted to only 2 per cent. of the original material. It still contained nitrogen but was free from proteins (biuret and triketohydrindene tests negative). It gave a positive pentose reaction, contained organically combined phosphorus, reduced Fehling's solution strongly after boiling with mineral acids but not at all before, and on incineration yielded an ash containing calcium and magnesium but no sulphates or chlorides. It hydrolysed amygdalin and salicin, the former more readily than did the commercial emulsin, and its activity remained unimpaired after six months.—J. H. L.

Lactic acid ; Determination of free and combined —— in wines. T. Roettgen. Z. Unters. Nahr. Genussm., 1913, **26**, 648—650.

For the determination of free lactic acid 50 c.c. of the wine (grape or fruit) are freed from volatile acids by distillation (200 c.c. of distillate), and the residue extracted for 24 hours with ether. The ethereal extract is mixed with 30 c.c. of water, the ether evaporated, and the aqueous residue treated with barium hydroxide solution in slight excess, and heated for 15 minutes on the water-bath. A current of carbon dioxide is now passed through the still alkaline liquid and the heating continued until the residue is concentrated to 10 c.c. It is then made up to 150 c.c.

by the addition of 40 c.c. of water and 100 c.c. of 95 per cent. alcohol, filtered, and 100 c.c. of the filtrate titrated with $N/4$ hydrochloric acid. Results thus obtained are in close agreement with those given by the more tedious methods of Kunz and Möslinger, which may however be used for the determination of the total lactic acid.
—C. A. M.

Spirits; Regulations of Dominion of New Zealand regarding methylation of ——. Board of Trade J., Jan. 8, 1914. [T.R.]

A Ministers' Order (No. 1058), dated 28th October last, prescribes regulations to be observed under Section 35 (10) of the Customs Law Act of 1908, for the manufacture, use, and sale of methylated spirits in the Dominion. The regulations provide, *inter alia*, that no spirits shall be methylated which are of a lower strength than 50 per cent. overproof, and that no wood naphtha or pyridine shall be used for the purpose of methylation which has not been approved by the Secretary of Customs. No wood naphtha will be approved which is of a less strength than 60 o.p. by Sikes' hydrometer, whilst pyridine must comply with certain prescribed tests. The regulations further specify the kinds of methylated spirit which may be manufactured for sale and used in certain industries.

Patents.

Wines and spirits, Ageing or maturing ——. J. Da V. Vianna, Lourenço Marques, Africa. Eng. Pat. 23,548, Oct. 17, 1913.

The wine, or spirit, is stored in closed casks and subjected to a continual rocking movement for some months at a temperature of about 110° F. (43° C.).—W. P. S.

Wine; Process of clarifying ——. A. Ornstein, Vienna. U.S. Pat. 1,081,623, Dec. 16, 1913.

See Eng. Pat. 4597 of 1913; this J., 1913, 548.—T. F. B.

XIXa.—FOODS.

Carabao's milk; Composition of ——. E. R. Dovey. Philippine J. Sci., 1913, **8**, 151—157.

Analyses of the milk from 19 different carabaos (a kind of buffalo) yielded the following results :—

	Minimum.	Maximum.	Average.
Sp. gr. at 17·5° C.	1·0307	1·0418	1·0364
	per cent.	per cent.	per cent.
Total solids	17·61	27·85	21·55
Fat	5·62	15·93	10·35
Solids-not-fat	9·92	14·22	11·20
Proteins (N × 6·25)	4·86	9·79	5·88
Lactose	3·50	5·32	4·32
Ash	0·71	0·95	0·84

The composition of the ash, etc., is also recorded. Determinations of the total solids and fat in the milk from a further 105 animals showed that the fat averaged 10·44 per cent. and the total solids 21·42 per cent. It is suggested that 8·5 per cent. of solids-not-fat and 8·0 per cent. of fat be adopted as minimum standards for the milk.—W. P. S.

Rennet; Conditions of activity of the enzyme of ——. L. Michaelis and A. Mendelssohn. Biochem. Zeits., 1913, **58**, 315—328.

The optimum concentration of hydrogen ions for the precipitation of casein by acids in pure solutions or in milk is $2{\cdot}5\times10^{-5}$. The presence of calcium salts displaces this optimum in the direction of greater acidity (*e.g.*, to 3×10^{-4} in $M/10$ solutions of calcium chloride) and renders it less definite. The optimum concentration of hydrogen ions for the precipitation of casein by rennet in presence of calcium salts lies between the values 4×10^{-7} and 1×10^{-6}. There is thus a zone of relative inactivity (10^{-6}—10^{-5}) between the optimum concentration of hydrogen ions for acid precipitation and that for precipitation by rennet. The action of rennet is therefore specific, and not simply a particular case of acid precipitation. The calcium ions necessary for the action of rennet cannot be replaced by hydrogen ions.—J. H. L.

Butter; Adulteration of —— by addition of cocoanut oil. [Presence of cocoanut oil in genuine butter.] R. Ledent. Bull. Soc. Chim. Belg., 1913, **27**, 325—330.

Certain of the constants of samples of butter, undoubtedly genuine and obtained from the milk of cows which had been fed on cocoanut oil cake, appear to indicate definitely the presence of cocoanut oil.—T. F. B.

Patents.

Flour; Milling of ——. H. Leetham and Sons, Ltd., and S. Leetham, York. Eng. Pats. 28,375, Dec. 9, 1912, and 6043, March 11, 1913.

Flour, at any point of the milling process, is subjected to the action of a spray of water charged with ozonised air. Ammonium carbonate or lime may be added to the water.—W. P. S.

Cattle foods; Manufacture of ——. J. J. Eastick and J. J. A. de Whalley, London. Eng. Pat. 29,648, Dec. 24, 1912.

Peat moss, either alone or mixed with from 0·5 to 5 per cent. of its weight of sulphurous acid, is heated in an autoclave to 160° C. for 30 minutes; the excess of acid is then removed or neutralised, and the product is dried, if desired. It may be used as a fodder directly, or may be ground to a meal, pressed into cakes, or mixed with other foodstuffs.—W. P. S.

Milk; Process of sterilising ——. C. E. Bonine, Philadelphia, Pa. U.S. Pat. 1,081,483, Dec. 16, 1913.

Milk is heated in a closed vessel under pressure to about 130° C.; the volume of the milk should be such as will occupy about 90 per cent. of the capacity of the vessel, and it is continually agitated while being heated and subsequently cooled.—W. P. S.

Butter suitable for long storage; Process of obtaining ——. G. Zmeskall. Fr. Pat. 460,525, July 19, 1913.

Fresh milk is heated to boiling and the "cream" which rises to the surface in the form of a skin is separated and churned into butter.—W. P. S.

Margarine suitable for cooking purposes; Process of manufacturing ——. P. A. Schmitt. Fr. Pat. 460,614, June 28, 1913. Under Int. Conv., June 28, 1912.

Ten parts of a mixture of alkali-casein solution (100), and egg albumin (20 parts) are incorporated with 90 parts of a mixture of vegetable fats and milk or water.
—W. P. S.

Alimentary substances; Process of preserving and sterilising ——. Ges. fur Sterilisation m. b. H. Fr. Pat. 460,912, July 31, 1913.

The substances are treated with an organic or mineral acid and a halogen. For instance, meat is treated with

0·3 per cent. of its weight of hydrochloric acid and 0·05 per cent. of bromine dissolved in alcohol; vinegar may be preserved by the addition (per 100 litres) of 6 grms. of bromine dissolved in 6 grms. of potassium bromide and 60 grms. of water. After 24 hours, the excess of the halogen is destroyed by the addition of a sulphite or thiosulphate, and the acid may be neutralised by means of an alkali carbonate or bicarbonate.—W. P. S.

Baking powder. C. H. Boehringer Sohn. Ger. Pat. 266,377, April 4, 1912.

An aluminium salt of lactic acid is mixed with an alkali or alkaline-earth carbonate or bicarbonate, particularly sodium bicarbonate. Baking powders prepared with normal or basic aluminium lactate are said to be stable. —T. F. B.

Flour; Processes and machines for treating ——. C. Herendeen, Chicago. Eng. Pat. 17,330, July 28, 1913.

See U.S. Pats. 1,073,985 and 1,073,986 of 1913; this J., 1913, 987.—T. F. B.

Condensation or concentration of milk and other liquids by filtration; Process for the ——. E. W. Kuhn, Brussels. Eng. Pat. 19,420 of 1913, date of appl., Sept. 9, 1912.

See Fr. Pat. 448,160 of 1912; this J., 1913, 445.—T. F. B.

Milk-separating machine; Centrifugal ——. S. C. Hauberg, Copenhagen. U.S. Pat. 1,081,304, Dec. 16, 1913.

See Eng. Pat. 19,154 of 1912; this J., 1913, 503.—T. F. B.

Alimentary products from soy-beans; Process of manufacturing ——. F. Gössel, Stockheim, Germany. U.S. Pat. 1,082,118, Dec. 23, 1913.

See Fr. Pat. 451,447 of 1912; this J., 1913, 621.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Plumbo-solvent-water, Treatment of —— by means of mechanical filters. F. J. Dixon. Inst. of Water Engineers. Engineering, 1914, **97**, 55—56.

A description of the plant installed for the Ashton-under Lyne, Stalybridge, and Dukinfield (District) Water Works Joint Committee. The water comes mainly from peaty moorland gathering grounds; it is generally acid, discoloured, and contains low forms of animal and vegetable matter in suspension. It is purified by treatment with whiting (basic calcium carbonate) and aluminium sulphate and passage through mechanical filters. The latter consist of closed cylinders having a false bottom of steel which is riveted to the outer shell and pierced by holes into which phosphor-bronze nozzles are fixed from the underside. On the false bottom rests the filtering bed, 3·5 feet deep, of graded quartz crystals. A central vertical tube, extending nearly to the false bottom, contains a spindle to which propeller blades and two water-jets are attached for cleansing purposes. At the outlet end of the filter-house is a tintometer consisting of two glass tubes connected respectively with the raw water inlet pipe and the filtrate outlet pipe. According to an appendix to the paper, prepared by S. Delépine, the plumbo-solvent power of the water (grains of lead dissolved per gallon by the water in contact with new lead for 24 hours) has been reduced from 0·7 to 0·07 or less. Since Jan., 1913, there have been used 0·385 grain of lime and 0·320 grain of aluminium sulphate per gallon of water, the cost of chemicals per million gallons of water being, on the average, 1s. 11d., and the total cost of treatment 7s. 10d.—A. S.

Carbon monoxide; Laws of absorption of —— by blood in vitro. M. Nicloux. Comptes rend., 1913, **157** 1425—1428.

The displacement of oxygen from blood by carbon monoxide and inversely of carbon monoxide by oxygen may be expressed by the reversible equation:

$$HbO_2+CO\rightleftarrows HbCO+O_2,$$

where Hb represents hæmoglobin. Hence if blood be placed in contact with a mixture of the two gases, an equilibrium between the oxygen and carbon monoxide compounds, respectively of hæmoglobin should be established, depending upon the relative concentrations of the two gases in the plasma surrounding the blood corpuscles, which concentrations in turn would depend upon the partial pressures of the two gases in the gaseous mixture. Experiments with hog's blood saturated with carbon monoxide and with oxygen respectively and exposed to mixtures of carbon monoxide and oxygen or air showed that these views are correct. (In the case of air the partial pressures of the carbon monoxide and oxygen are calculated for a mixture of carbon monoxide and oxygen alone in the proportions present.) If the concentration of the carbon monoxide compound of hæmoglobin be termed y, and the percentage of carbon monoxide in the gas, x, then the concentration of the oxygen compound of hæmoglobin will be $100-y$ and of oxygen $100-x$, and the reaction constant

$$K=\frac{(100-y)\times x}{y\times(100-x)}$$

The mean value found experimentally for K was 0·0045. —A. S.

Lime, sulphur and salt wash; Composition of the ——. J. K. Haywood. J. Amer. Chem. Soc., 1905, **27**, 244—255.

Methods are suggested for the determination of sulphur in various states of combination when present in the same solution. Sulphide sulphur is determined by treating the solution with ammoniacal zinc chloride, heating, filtering, treating the precipitate with potassium hydroxide solution and hydrogen peroxide, and precipitating the sulphate by means of barium chloride. The first filtrate is neutralised with hydrochloric acid and titrated with sodium iodide, this furnishing a figure for sulphur as sulphite and thiosulphate. The residual liquid is now acidified and barium chloride added; this gives a measure of the sulphate and sulphite. Finally the sulphite-sulphur is determined from the acidity to sodium hydroxide of the solution remaining after the sodium iodide titration.—T. F. B.

Natural water and the catalytic action of some colloidal substances at great dilution [in tanning and dyeing]. Sommerhoff. *See* XV.

Gravimetric determination of nitrites. Busvold. *See* XXIII.

Patents.

Water, sewage and the like; Means [floating filter] for filtering ——. A. Mitchell, Longside, Aberdeenshire. Eng. Pat. 3751, May 21, 1913.

A floating vessel or pontoon is divided into three compartments by longitudinal partitions: the two outer compartments are enclosed and act as floats whilst the middle compartment contains the filtering material which is supported on a perforated false-bottom. The bottom of the pontoon under the middle compartment is provided with a number of openings for the admission of the liquid, and these openings are covered by transverse strips or bands of fabric which pass under the pontoon and are attached to drums on the upper parts of the latter. When the fabric over the openings becomes clogged, a fresh portion may be brought over the openings by rotating the drums. A rubber band, operated in the same manner may be employed for closing the openings when it is desired to cleanse the filter. The filter compartment is also divided into sections by transverse partitions, so that any section may be put out of use without interfering with the others, and each section is fitted with a separate outlet connected with a common discharge pipe.—W. P. S.

Sewage; Method of treating ——. A. Priestman, Philadelphia, Pa. U.S. Pat. 1,080,926, Dec. 9, 1913.

The sewage is delivered into a settling tank, the denser portion being discharged in small quantities at intervals from the bottom of the tank into a second tank and thence, subsequently, into a third tank. The discharge is controlled by the overflow of the liquid sewage from the first tank.—W. P. S.

Liquids; Purification of ——. R. H. McKee, Orono, Maine, U.S.A. Eng. Pat. 4139, Feb. 18, 1913. Under Int. Conv., March 27, 1912.

See Fr. Pat. 455,408 of 1913; this J., 1913, 954.—T. F. B.

Sewage and the like; Apparatus for purifying ——. P. Bunzel, Coethen, Germany. Eng. Pat. 17,304, July 28, 1913.

See U.S. Pat. 1,079,391 of 1913; this J., 1914, 39.—T. F. B

Water; Process for clarifying —— *and purifying it from germs.* R. Gans, Pankow, Assignor to J. D. Riedel A.-G., Berlin. U.S. Pat. 1,082,315, Dec. 23, 1913.

See Fr. Pat. 423,388 of 1910; this J., 1911, 645.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloids of the morphine group and phenanthrene; Absorption of ultra-violet rays by ——. M. Gompel and V. Henri. Comptes rend., 1913, **157**, 1422—1425.

A comparison of the absorption of ultra-violet rays by morphine, codeine, and apomorphine and by phenanthrene gave results in agreement with the view that these alkaloids are derivatives of phenanthrene. The absorption of the rays by apomorphine was much more intense than by morphine and more nearly approached that by phenanthrene. Morphine and codeine gave almost identical results, there being a single marked absorption band at $\lambda = 2850$; it is possible to determine spectrographically 0·1 mgrm. of either of these alkaloids in 1 c.c. to within 5 per cent. In the case of apomorphine there are three small absorption bands at $\lambda = 3200$, 3078 and 3026 respectively and a large absorption band at $\lambda = 2785$; 0·01 mgrm. of the alkaloid can be determined spectrographically. (See also this J., 1913, 671.)—A. S.

Brucine; Some new oxidation products of ——. H. Leuchs and H. Rauch. Ber., 1913, **46**, 3917—3922.

On oxidising brucine with an acetone solution of permanganate (see this J., 1914, 40) small quantities of certain non-acidic substances were formed in addition to dihydrobrucinone and brucinonic acid. The first substance had the composition, $C_{23}H_{24}O_7N_2$, and when dissolved in glacial acetic acid, it was optically inactive, but in hydrochloric acid it had $[\alpha]_D = +87{\cdot}4°$. It was insoluble in benzene and ether and sparingly soluble in chloroform, acetone, alcohol and ether. It melted at 336° C. with decomposition. The composition of the second substance was $C_{23}H_{26}O_7N_2$ It had $[\alpha]_D = +5{\cdot}66°$ in glacial acetic acid. It could be crystallised from water and melted at 240° C. Glacial acetic acid and chloroform dissolved the substance readily. The third substance had the composition, $C_{21}H_{22}O_6N_2$, and had $[\alpha]_D = +72{\cdot}8°$ in glacial acetic acid. After crystallising from water, it melted at 290° C. with decomposition. All these substances gave the brucine reaction with nitric acid.—F. Shdn.

Genisteine, a new volatile alkaloid. Valeur. J. Pharm. Chim., 1913, **8**, 573.

Genisteine, $C_{16}H_{28}N_2$, m.pt. 60·5° C., b.pt. 177°—178° C. (uncorr.) at 22 mm., was isolated from the mother-liquor from the crystallisation of commercial sparteine sulphate. It forms a hydrate, $C_{16}H_{28}N_2,H_2O$, which melts with loss of water at 117° C. The hydrate has the rotatory power $[\alpha]_D = -52{\cdot}34°$ in absolute alcohol (4 per cent. solution). The alkaloid is a saturated base, not reducing permanganate in acid solution, it does not contain a methoxyl group attached to a nitrogen atom. It is a di-acid base (mono-acid to phenolphthalein), yielding a picrate, $C_{16}H_{28}N_2$, $2C_6H_2(OH)(NO_2)_3$, m.pt. 215° C., with decomposition, and a platinichloride, $C_{16}H_{28}N_2.2HCl.PtCl_4 + 2{\cdot}5H_2O$, which loses its water at 110° C. and decomposes at 235° C. without melting. —A. S.

"Rhein cryst."; Commercial ——. O. A. Oesterle and E. R. Haugseth. Arch. Pharm., 1913, **251**, 550—552.

In commerce "*Rhein cryst.*" is regarded as synonymous with "*Acid. chrysophanic. ver.*" Three samples obtained from different sources were found to be identical in composition. They consisted of almost pure chrysophanic acid and contained no rhein (1.8-dihydroxyanthraquinone-3-carboxylic acid) and no emodin monomethylether. It is recommended that the name rhein should be reserved for 1.8-dihydroxyanthraquinone-3-carboxylic acid.—T. C.

Perfumes of lichens. E. M. Holmes. Perfum. and Essent. Oil Record, 1913, **4**, 408—409.

Attention is drawn to the need of investigation of the odorous principles of lichens, with a view to using them in perfumery. As a basis for retaining odours in *pot pourri* and sachets, the common reindeer lichens, *Cladonia rangiferin* and *C. sylvatica*, appear very suitable. The tree lichen, *Evernia prunastri*, known in France as *Mousse de chêne* (oak moss), has been used for some years as a basis for perfumes. It is generally found admixed with other less fragrant lichens, but may be readily distinguished by the frond being grey on the outside and white on the under or channelled side. According to Gattefossé the odorous principle is a phenol, *lichenol*, isomeric with carvacrol, and soluble in a 3 per cent. solution of sodium carbonate; and a suitable basis for perfumes is obtained by extracting the lichen with a volatile solvent, and distilling the extract *in vacuo*. Other fragrant lichens mentioned are *Lobaria pulmonaria* ("oaklungs." *mousse de la base du chêne*), *Conocephalu-conicus* (having a bergamot odour), *Hygrophorus agathosmu* and *Clitocybeodora* (having an odour of aniseed).—A. S.

Mosses in perfumery; Use of ——. H. Mann. Amer Perfumer and Essent. Oil Rev., 1913, **8**, 248—249.

At the present time oak moss (*Lichen Quercius viridis* known in France as "Mousse de chêne" is almost univer sally used in perfumery. It is usually extracted wit light petroleum, and the residue obtained is dilute with about 200 times its weight of alcohol. In some case an alcoholic infusion of the dry moss is made. This ca be used as a base for fine perfumes and for toilet soap The moss residues are sometimes incorporated with th latter where special mechanical cleansing properties a desired.—F. Shdn.

Essential oils; Constituents of ——. The sesquiterpene fraction of Java citronella oil. F. W. Semmler and K. E. Spornitz. Ber., 1913, **46**, 4025—4029.

A fraction of Java citronella oil containing sesquiterpene was washed repeatedly with 60 and 70 per cent. alcohol. It then boiled at 153°—156° C. at 15 mm., had the sp. gr. 0·8659 at 20° C. and n_D = 1·50386. The fraction consisted of a mixture of sesquiterpene and sesquiterpene alcohol. After distilling over sodium, and again fractionating, sesquicitronellene, $C_{15}H_{24}$, was separated. The characters were, b. pt. 138°—140° C. at 9 mm., sp. gr. 0·8489 at 20° C., n_D = 1·53252, $\alpha_D = +0° 36'$. This substance was reduced by means of sodium and alcohol to dihydrosesquicitronellene, $C_{15}H_{26}$, b. pt. 131°—133° C. at 12 mm., sp. gr. 0·8316 at 20° C., n_D = 1·4800 and $\alpha_D = \pm 0°$. Reduction in ethereal solution with platinum and hydrogen led to the formation of octohydrosesquicitronellene, b. pt. 115°—117° C. at 9 mm., sp. gr. 0·7789 at 20° C., n_D = 1·43518, $\alpha_D = \pm 0°$. The sesquiterpene was inverted to *cyclo*-sesquicitronellene by means of concentrated formic acid. The substance then boiled at 129°—132° C. at 15 mm., had the sp. gr. 0·8892 at 20° C., n_D = 1·5069, $\alpha_D = +56°$ and could not be reduced by means of sodium and alcohol. The original oil contained a small quantity of a paraffin boiling at 165°—167° C. at 15 mm.—F. Shdn.

Patchouli oil. M. Lehmann. Chem.-Zeit., 1913, **37**, 1589.

Oils distilled during the last six months have shown a much lower sp. gr. (0·95 to 0·96), optical rotation (—42° to —59° C.), and solubility in alcohol (6 vols. of 90 per cent. alcohol for clear solution) than the oils of previous years. The aroma of the recent oils is superior, and the alteration in the properties is to be attributed to climatic conditions during the growth of the plants. The following limits are suggested for the constants of this year's patchouli oil:—Sp. gr. 0·95 to 0·97: optical rotation, —40° to —59°; refractive index, 1·504 to 1·515; saponification value, 4 to 18; saponif. value of acetylated oil, 35 to 80; soluble at first in equal vol. of 90 per cent. alcohol. After the addition of 2 to 5 vols. the solution becomes turbid, but should become permanently clear again after the addition of 6 vols.—C. A. M.

Calamus oil; Constituents of ——. H. Thoms and R. Beckstroem. Ber., 1913, **46**, 3946—3948.

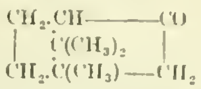
A fraction of terpene-free calamus oil of Japanese origin gave results different from those of Semmler and Spornitz (this J., 1914, 40). The oil contained a little calameone and about 66 per cent. of asarone. A fraction of the composition, $C_{15}H_{24}O$, was treated with cold concentrated arsenious acid solution and washed. The residue consisted of a hydrocarbon, $C_{15}H_{22}$, which had the characters, b. pt. 146° C. at 19 mm., sp. gr. 0·9330 at 18° C., α_D = +6·5° at 18° C. in a 2 cm. tube. The hydrocarbon was present as such in the original oil, and was not produced by the dehydration of an alcohol.—F. Shdn.

Mastiche [Pistachia lentiscus] leaf oil. Vimard, Dhumez and Monschein. Perfum. and Essent. Oil Rec., 1913, 4, 403.

The oil had the sp. gr. 0·887, optical rotation +3°, esters 5·8 per cent., total acetylisable constituents 13·5 per cent. It did not distil below 160° C., but yielded 20 per cent. below 170° C., 50 below 180° C., 58 below 190° C., 66 below 200° C., 74 below 210° C., and 78 per cent. below 220° C. When distilled under reduced pressure and collected in four fractions of 20 per cent. and then one of 15 per cent., the sp. gr. of the fractions increased from 0·855 to 0·925 and the refractive index from 1·4680 to ·4795, whilst the optical rotation fell from +11° to nil. The first two fractions contained pinene. The oil had a eculiar odour somewhat resembling that of rue and savin ils.—A. S.

l-Epicamphor (l-β-camphor). J. Bredt and W. H. Perkin, jun. Chem. Soc. Trans., 1913, **103**, 2182—2225.

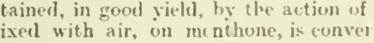
Epicamphor,



was prepared independently by Lankshear and W. H. Perkin (Chem. Soc. Proc., 1911, **27**, 167) and by Bredt and his co-workers (Chem.-Zeit., 1911, **35**, 765). The product obtained by Wagner (Chem.-Zeit., 1903, **27**, 271; Ber., 1903, **36**, 4602) and described as epicamphor was apparently a mixture consisting largely of impure camphor. A better method for the preparation of epicamphor than those referred to above consists in treating methyl-*d*-bornylene-3-carboxylic acid with hydroxylamine in the presence of sodium methoxide, whereby *d*-bornylene-3-hydroxamic acid, $C_8H_{14}<\genfrac{}{}{0pt}{}{C.C(OH):N.OH}{\ddot{C}H}$ is produced almost quantitatively and this acid readily yields epicamphor under a variety of conditions. Preferably the reaction mixture, without isolating the acid, is shaken continuously for 12 hours with *p*-toluene sulphonyl chloride, whereby molecular rearrangement takes place with formation of bornylene-3-isocyanate, and the latter is extracted with ether and converted into epicamphor by distillation with steam in presence of hydrochloric acid. Epicamphor has an odour very similar to, but distinct from, that of ordinary camphor; it melts at 182° and distils at 213° C. and its optical rotation (in benzene solution at a concentration of 13·1205) is $\alpha_D^{18} = -58·21°$: its oxime (α_D = +100·5° for a benzene solution containing 0·6293 grm. per 10 c.c.) melts at 103°—104° C. and its semicarbazone at 237°—238° C. On oxidation it yields *d*-camphoric acid, whilst when reduced with sodium in boiling alcoholic solution it yields *l*-epiborneol, m. pt. 181°—182·5° C. Physiological experiments carried out by Van der Velden and Leyden showed that epicamphor has a much less pronounced and less persistent action than camphor on the beat of the heart: the action of camphor is toxic at the concentration necessary for favourable action in the case of epicamphor.—A. S.

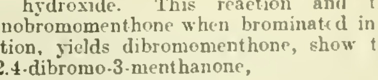
Dibromomenthone; Structure of ——, and a new synthesis of buchu camphor [diosphenol]. G. Cusmano. Atti R. Accad. dei Lincei, Roma, 1913, **22**, II., 569—575.

Dibromomenthone, m. pt. 78°—80° C., which can be readily obtained, in good yield, by the action of bromine vapour mixed with air, on menthone, is converted into buchu camphor (diosphenol),



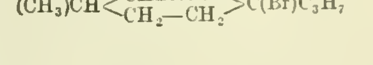
$$(CH_3)CH<\genfrac{}{}{0pt}{}{CH(OH).CO}{CH_2—CH_2}>CH.C_3H_7$$

when treated with a 2·5 per cent. aqueous solution of potassium hydroxide. This reaction and the fact that 4-monobromomenthone when brominated in chloroform solution, yields dibromomenthone, show that the latter is 2.4-dibromo-3-menthanone,



$$(CH_3)CH<\genfrac{}{}{0pt}{}{CHBr.CO}{CH_2—CH_2}>C(Br)C_3H_7$$

and not



$$CH_3(Br)C<\genfrac{}{}{0pt}{}{CH_2.CO}{CH_2.CH_2}>C(Br)C_3H_7$$

as stated by Beckmann and Eickelberg (this J., 1896, 470). The semicarbazone of buchu camphor melts, with decomposition, at 219°—220° C.—A. S.

Sylvestrene; Synthesis of d- and l- ——. W. N. Haworth and W. H. Perkin, jun. Chem. Soc. Trans., 1913, **103**, 2225—2237.

The acid obtained by the elimination of hydrogen bromide from 1-bromo-1-methylcyclohexane-3-carboxylic acid in the course of the synthesis of carvestrene (*dl*-sylvestrene), and supposed to be 1-methyl-Δ^1-cyclohexene-3-carboxylic acid, is now shown to consist of a mixture of this acid with the isomeric 1-methyl-Δ^6-cyclohexene-3-carboxylic acid. By the resolution of this *dl*-mixture of acids by means of brucine and *l*-menthylamine, there were obtained finally the dextro Δ^6-acid ($\alpha_D = +108°$) and the lævo-Δ^1-acid ($\alpha_D = -49{\cdot}7°$), and from these, by methods similar to those used in the synthesis of carvestrene (*loc. cit.*), *d*-sylvestrene (the terpene of Swedish oil of turpentine), b. pt. 174°—176° C., sp. gr. 0·8485 at 18° C., $n_D = 1{\cdot}4752$, $\alpha_D = +67{\cdot}5°$, and *l*-sylvestrene, b. pt. 175°—178° C., $\alpha_D = -66{\cdot}5°$, were prepared. *l*-Sylvestrene was also synthesised from *l*-1-methyl-Δ^9-cyclohexene-3-carboxylic acid obtained by the resolution of *dl*-acid (see Fisher and Perkin, Chem. Soc. Trans., 1908, **93**, 1878): the specimen thus obtained had the b. pt. 176°—178° C., sp. gr. 0·848 at 19° C., $n_D = 1{\cdot}4761$, $\alpha_D = -68{\cdot}2°$. A mixture of equal quantities of *d*- and *l*-sylvestrene dihydrochlorides when recrystallised from methyl alcohol yielded carvestrene dihydrochloride. (See also this J., 1913, 766.)—A. S.

Geranyl chloride. M. O. Forster and D. Cardwell. Chem. Soc. Trans., 1913, **103**, 1338—1346.

GERANYL chloride, $C_{10}H_{17}Cl$, prepared by the action of thionyl chloride on a mixture of geraniol and pyridine, was a colourless liquid with a marked odour of hops, b. pt. 103° C. at 14 mm., sp. gr. 0·918 at 25° C., $n_D = 1{\cdot}4741$. The same product was obtained in a similar manner from linalool, and it is probably identical with the linalyl chloride of Dupont and Labaune (this J., 1910, 716, 1132). The chloride gave a nitrosate, $C_{10}H_{17}O_4N_2Cl$, m.pt. 101° C., which proved a convenient means of identifying it. On treatment with ethyl sodioacetoacetate, it yielded ethyl geranylacetoacetate, identical with the ester prepared by Dupont and Labaune from linalyl bromide. This ester when boiled with alcoholic baryta and the product treated with hydrochloric acid, yielded geranylacetone (dihydro-ψ-ionone), identical with the ketone prepared by Kerschbaum (this J., 1913, 711) from the nitrile of farnesinic acid, and proved by the work of Harries and Haarmann (this J., 1913, 711) on farnesol, to have the constitution, $CH_3.C(CH_3):CH.(CH_2)_2.C(CH_3):CH.(CH_2)_2.CO.CH_3$. The production of this ketone proves that the compounds prepared by the authors contain the geranyl and not the linalyl radical, and hence that when linalool is converted into a chloride, the latter contains the geranyl radical. Besides the compounds mentioned, ethyl geranyl ether, geranylamine, ethyl geranyl malonate, geranylacetic acid, and a hydrocarbon, $C_{10}H_{18}$ (b. pt. 161° C. at 763 mm., 65° C. at 20 mm., sp. gr. 0·768 at 25° C., $n_D = 1{\cdot}4458$, were also prepared, the last-named by the action of zinc dust and acetic acid on geranyl chloride.—A. S.

Oleanol; Derivatives of ——. F. Tutin and W. J. S. Naunton. Chem. Soc. Trans., 1913, **103**, 2050—2060.

OXIDATION of the crystalline compound oleanol, $C_{31}H_{50}O_3$, from olive leaves (this J., 1908, 641) by means of potassium permanganate yielded a dihydroxy compound, $C_{29}H_{46}O_4$, which contained a carbonyl group, and was termed *oleanone*. It yielded mono- and diacetyl derivatives. On heating oleanone with glacial acetic acid and diluting the mixture with water, a pink colouration changing to green and then to fugitive violet was obtained, the changes of colour closely resembling those given by a phytosterol when treated with sulphuric acid and acetic anhydride. In this reaction of oleanone an acetyl derivative was formed, and this on hydrolysis gave the corresponding alcohol, $C_{50}H_{76}O_5(OH)_2$. An analogous reaction occurred when diacetyloleanone was heated with acetic acid containing hydrochloric acid, the mono-acetyl derivative, $C_{50}H_{76}O_7(CO.CH_3)_2$, being formed. Oxidation of oleanone with chromic acid gave a compound, $C_{29}H_{42}O_4$ (m. p. 275° C.), which yielded only a mono-acetyl derivative. A mixture of carboxylic acids was also produced in the chromic acid oxidation.—C. A. M.

Yatrene. O. Anselmino. Apoth.-Zeit., 1914, **29**, 10—11.

YATRENE was found to be a mixture of 8-hydroxy-7-iodoquinoline-5-sulphonic acid with aboot 20 per cent. of sodium bicarbonate.—F. SHDN.

Acetylation of organic compounds. E. Knoevenagel. Annalen, 1914, **402**, 111—148.

THE acetylation of hydroxyl groups with acetic anhydride can be accelerated and often carried out almost quantitatively at ordinary temperatures by the addition of 1 to 5 per cent. of certain substances (ferric, zinc and stannous chlorides, phosphorus trichloride, sulphuric acid, copper sulphate, ammonium sulphate, etc.) which behave, not as dehydrating agents, but in some unexplained way as catalysts. Substances containing carbonyl oxygen, and ethereal or anhydride-like bodies such as ethers, polysaccharides, celluloses and starches, and oxygen ring compounds as epichlorhydrin, cineol, etc., can also by the breaking of an oxygen linkage be similarly converted into diacetates (called "acetolysis" in contradistinction to hydrolysis). The catalysts appear to be specific in their action, so that by using a suitably selected catalyst with, for example, cellulose it may be possible either to acetylate hydroxyl groups, or split the molecule by acetolysis at specific positions favourable for attack by the catalyst employed. The acetylation of a number of different types of substances has been studied in detail using the catalysts mentioned above. All except ammonium sulphate convert aldehydes into diacetates. Quinone and unsaturated ketones react best in presence of ferric chloride. Diethyl ether and three-membered oxygen carbon rings react only with ferric chloride, the former at 100° C., the latter at the ordinary temperature. In contrast to this, six-membered rings, such as cineol, readily yield acetates, in presence of nearly all the catalysts, by the splitting of the ring at the oxygen atom. Salicylic aldehyde with acetic anhydride and phosphorus trichloride, copper sulphate or zinc sulphate, was converted into disalicylic aldehyde, whilst the other catalysts yielded mainly the triacetate.—G. F. M.

Hydroxy-acids; Decomposition of —— *with soda-lime.* L. Carpenter. Chem. News, 1914, **109**, 5.

MIXTURES of sodium lactate and sodium citrate respectively with soda-lime when destructively distilled under reduced pressure in an iron tube heated to just below redness, yielded mainly acetone and mesityl oxide, $(CH_3)_2.C:CH.CO.CH_3$.—A. S.

PATENTS.

Diaryl ethers; Process for the formation of ——. F. Fritzsche und Co., Hamburg, Germany. Eng. Pat. 9797, April 25, 1913. Under Int. Conv., June 29, 1912.

A SOLUTION of dry alkali phenolate (phenoxide) in excess of the corresponding phenol is heated to about 200° C. under pressure with monohalogen substitution products of aromatic hydrocarbons. Phenyl ether can be prepared in this way from potassium phenoxide and chlorobenzene. —F. SHDN.

Emetine; Manufacture of ——. H. S. Wellcome, London, F. H. Carr and F. L. Pyman, Dartford. Eng. Pat. 14,677, June 25, 1913.

EMETINE can be prepared by suitably methylating cephaeline, for instance, by boiling the latter with sodium methylate (methoxide) and methyl sulphate in methyl alcoholic solution.—F. SHDN.

Arsenic antimony compounds; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 19,778, Sept. 1, 1913 Under Int. Conv., Oct. 4, 1912.

THE method of manufacture of aromatic arseno-compound described in Eng. Pat. 11,709 of 1911 (this J., 1912, 256

can be modified by using an antimony compound in place of one of the arsinic acids or one of the arsenoxides. In this way, arsenic-antimony compounds are produced.
—F. Shdn.

Chemical process [preparation of diacetone-alcohol]. A. Hoffman, Brooklyn, Assignor to Alco Deo Co. U.S. Pat. 1,082,424, Dec. 23, 1913.

A liquid containing a "comparatively large percentage" of acetone is heated to a temperature below 150° C. but sufficiently high to evolve acetone vapour; the vapours are condensed and allowed to pass through a granular mass of calcium hydroxide or other sparingly soluble catalyst heated to a high temperature, whereby a small percentage of the acetone is converted into diacetone-alcohol. The liquid thus obtained is added to a quantity of previously distilled liquid, the mixture is distilled to remove some of the acetone and to produce a more concentrated solution of the alcohol, and the acetone evolved is again submitted to the action of the catalyst.—T. F. B.

Erythrene and other unsaturated compounds; Process for obtaining ——. A. Gerlach and R. Koetschau. Ger. Pats. 267,079 and 267,080, Sept. 24 and 26, 1912.

(1) Oleic acid, or oils, fats, or waxes containing acids of the oleic series or compounds thereof, are heated by means of electrically heated wires, etc., in an apparatus, the walls of which are kept at a temperature about the boiling-point of the mass. An agent which facilitates decompostion may be added. The erythrene and other unsaturated compounds are separated from the products of the reaction by physical or chemical methods. (2) In the above process, the oleic acid may be replaced by wool-grease or other substances containing cholesterol. It is advisable that the wool grease be free from water. By this process it is possible to obtain a yield of 50 per cent. of product boiling below 200° C. Free cholesterol, or analogous substances such as phytosterol, are said to give similar results.—T. F. B.

2-Phenylquinoline-4-carboxylic acid and its homologues; Process for preparing esters of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 267,209, Nov. 3, 1912.

The acetol esters of 2-phenylquinoline-4-carboxylic acid or its homologues are obtained by treating the acids with halogen derivatives of acetone. The physiological effects of the esters resemble those of the free acids, but the esters are tasteless.—T. F. B.

Amino- and diaminoketones; Process for preparing aliphatic ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 267,347, Nov. 8, 1912. Addition to Ger. Pat. 254,714 (see this J., 1913, 380).

The reactions described in the principal patent and also in Eng. Pat. 14,231 of 1913 (see this J., 1913, 1128) can be carried out in presence of solvents not miscible with water, and also of inorganic or organic salts, preferably under pressure. It is said that by appyling this modification to the condensation of acetone or its homologues with ialkylamino-oxymethanes or with tetra-alkyldiaminomethanes, the formation of by-products is prevented to a large extent, and the reaction is very complete.—T. F. B.

arbohydrate phosphoric acid esters; Process for forming ——. S. Carlson, Nadhammar, Sweden. Eng. Pat. 11,653, May 19, 1913. Under Int. Conv., May 20, 1912.

ee Fr. Pat. 458,096 of 1913; this J., 1913, 1031.—T. F. B.

zonides; Gaseous —— and their production. W. J. Knox, New York, Assignor to Knox Terpezone Co. of America. U.S. Pat. 1,081,617, Dec. 16, 1913.

e Eng. Pat. 27,371 of 1912; this J., 1913, 924.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Colour-screens [for colour photography], Process for the manufacture of ——. C. Späth, Steglitz, Germany, Assignor to Eastman Kodak Co., Rochester, N.Y. U.S. Pat. 1,081,341, Dec. 16, 1913.

See Eng. Pat. 23,138 of 1910; this J., 1911, 109.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Composition of newly permitted ——. Chem. Trade J., Dec. 27, 1913. [T.R.]

An Order, No. 1217, of November 25, 1913, authorising additions to the permitted list of explosives to be used in coal mines, has been made by the Home Secretary under Section 61 of the Coal Mines Act. The composition of these new explosives as given in the Order is as follows:—

Ingredients.	Parts by weight.	
	Not more than	Not less than
Ammonite No. 3 (Miners' Safety Explosive Company, Ltd.)—		
Nitrate of ammonium	72	68
Nitrate of sodium	23	21
Tri-nitro-naphthalene	4	3
Chloride of ammonium	4·5	3·5
Moisture	1	—
Expedite (Explosives and Chemical Products, Ltd.)—		
Nitrate of ammonium	36	33
Nitrate of potassium	34	32
Chloride of ammonium	21	19
Tri-nitro-toluol	13	11
Moisture	1·5	—
Negro Powder No. 2 (Roburite and Ammonal, Ltd.)—		
Nitrate of ammonium	58	55
Chloride of sodium	29	26
Tri-nitro-toluol	16	14
Graphite	1	0·5
Colouring matter	0·1	—
Moisture	1	—
New Fortex (Explosives and Chemical Products, Ltd.)—		
Nitrate of ammonium	36	33
Nitrate of potassium	34	32
Amido compound	13	11
Chloride of ammonium	21	19
Moisture	1·5	—
Permon Powder (Carbonite Syndicate, Ltd.)—		
Nitro-glycerine	13	11
Collodion cotton	0·5	0·2
Glycerine	5	3
Flour of potatoes (dried at 100° C.)	10·5	8·5
Nitrate of ammonium	57	54
Nitrate of sodium	1·5	0·5
Chloride of sodium	18	16
Moisture	3	—
Pitsea Powder, No. 2 (British Explosives Syndicate, Ltd.)—		
Nitro-glycerine	7	6
Nitrate of ammonium	56·5	53·5
Nitrate of potassium	11	9
Woodmeal (dried at 100° C.)	10	8
Oxalate of ammonium	19·5	17·5
Moisture	2	—
Sheppey Powder (Cotton Powder Company, Ltd.)—		
Nitro-glycerine	28	26
Nitrate of potassium	32	30
Woodmeal (dried at 100° C.)	33	30
Oxalate of ammonium	7	5
Moisture	6	3
Sunderite (Nobel's Explosives Company, Ltd.)—		
Nitro-glycerine	10	8
Nitrate of ammonium	54·5	50·5
Perchlorate of potassium	10	8
Woodmeal (dried at 100° C.)	9	7
Oxalate of ammonium	21	19
Moisture	2	—

The usual stipulations are made in each case as to markings, quality, etc.

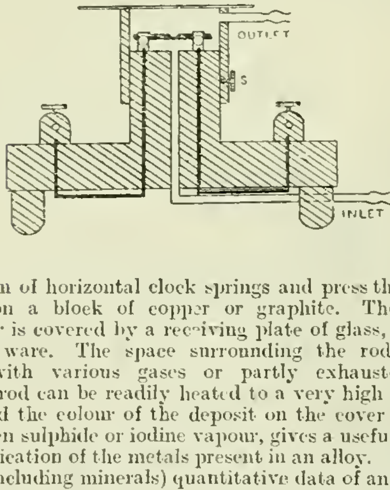
PATENT.

Preparation of alkaline oils [for protecting ordnance from the effects of smokeless powder]. Fr. Pat. 460,419. *See* XII.

XXIII.—ANALYTICAL PROCESSES.

Electric micro-furnace; Fractionation of alloys and minerals in the ——. A. L. Fletcher. Chem. Soc. Trans., 1913, **103**, 2097—2108.

THE furnace (see fig.) consists of a brass drum sliding on a solid slate cylinder of 5—8 cm. diameter which bears a pair of terminals for a carbon rod. The terminals take the form of horizontal clock springs and press the carbon down on a block of copper or graphite. The sliding cylinder is covered by a receiving plate of glass, silica, or biscuit ware. The space surrounding the rod can be filled with various gases or partly exhausted. The carbon rod can be readily heated to a very high temperature and the colour of the deposit on the cover in air or hydrogen sulphide or iodine vapour, gives a useful qualitative indication of the metals present in an alloy. In many cases (including minerals) quantitative data of an approximate nature may be obtained from very small specimens by weighing the deposit and the residue.—W. H. P.



High temperatures; Methods of research at —— and the high temperature microscope. E. Kittl. Oesterr. Zeits. Berg- u. Huttenw., 1913, **61**, 745—748.

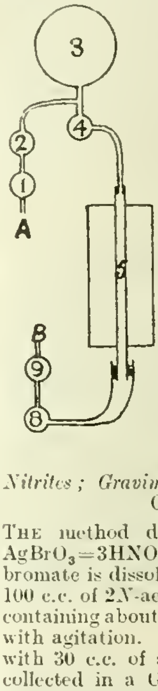
CHIEFLY a description, with drawings, of Doelter's high temperature microscope, an ordinary mineralogical polarising microscope the stage of which is fitted with a small electrical resistance furnace, 5½ cm. or 10 cm. high, giving internal temperatures up to 1300° C. and 1600° C. respectively. A small quartz or platinum capsule contains the substance to be examined, and is lowered to the centre of the furnace; and a plate of glass or other transparent substance covers the top of the central tube, thus protecting the objective, and allowing the use of indifferent gases other than air in the furnace. The lower part of the microscope tube and the objective are water-cooled, and the magnification possible is from 13 to 15 diameters.—J. T. D.

Chromium; Determination of —— by alkaline oxidation. F. Bourion and A. Sénéchal. Comptes rend., 1913, **157**, 1528—1531.

THE method depending upon the oxidation of a chromic salt to chromate by means of hydrogen peroxide in alkaline solution and subsequent estimation of the chromate has been carefully examined. The presence of iron does not affect the process; but small amounts of nickel, cobalt, or manganese vitiate the results owing to rapid catalytic action on the peroxide. The addition of a small amount of sodium sulphate (1/100 grm.-mol.) after oxidation has been effected greatly facilitates the decomposition of the excess of peroxide.—J. R.

Iron and aluminium; Separation of ——. H. Borck. Chem.-Zeit., 1914, **38**, 7.

AN apparatus for the separation of iron and aluminium by heating the ignited oxides in hydrochloric acid gas (this J., 1912, 460) comprises a series of washing flasks, 1, 2, 4, 8 and 9, and a Kipp's apparatus, 3, for the production of the hydrochloric acid gas from ammonium chloride and sulphuric acid. The flask, 1, is left empty, 2 is charged with concentrated sulphuric acid or with mercury, 4 with about 30 c.c. of concentrated hydrochloric acid, 8 with 50 c.c. of water, and 9 with 50 c.c. of 30 to 40 per cent. potassium hydroxide solution. The oxides are heated in a quartz boat, in the tube, 5, whilst a mixture of hydrochloric acid gas and air (drawn through A by means of a pump at B) is passed through the tube. After the ignition any traces of chlorine absorbed by the quartz boat are expelled by continuing the ignition for a short time in a current of air alone. The same apparatus may be used for the rapid separation of tungsten, molybdenum and uranium from silica and thoria.—C. A. M.

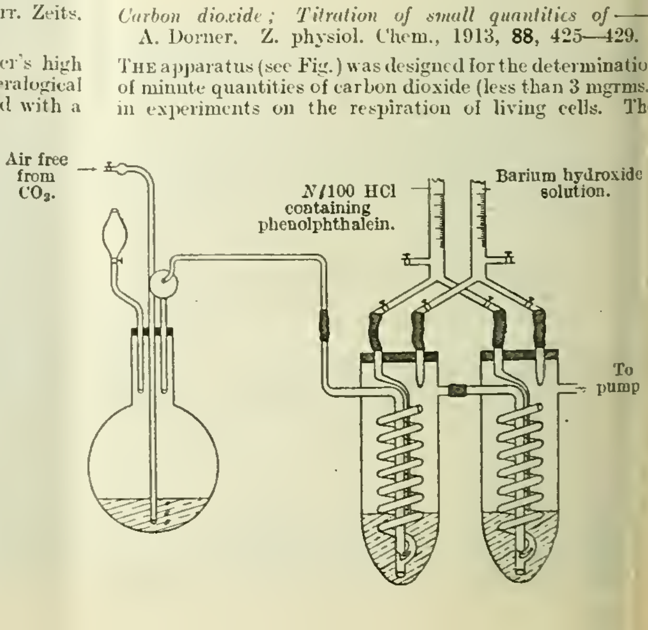


Nitrites; Gravimetric determination of ——. N. Busvold. Chem.-Zeit., 1914, **38**, 28.

THE method depends upon the reaction: $3HNO_2+AgBrO_3=3HNO_3+AgBr$. About 1·4—1·5 grm. of silver bromate is dissolved by warming in 100 c.c. of water and 100 c.c. of 2*N*-acetic acid and the nitrite solution (200 c.c. containing about 1 grm. of sodium nitrite) added gradually, with agitation. The mixture is heated to 85° C., treated with 30 c.c. of sulphuric acid (1 : 4), the silver bromide collected in a Gooch crucible, washed, dried at 130° C. and weighed: 0·907 grm. AgBr is equivalent to 1 grm. $NaNO_2$. The method is accurate to within ±0·1 per cent.; in presence of chloride the quantity of silver chloride in the precipitate must be determined and a correction applied.—A.S.

Carbon dioxide; Titration of small quantities of —— A. Dorner. Z. physiol. Chem., 1913, **88**, 425—429.

THE apparatus (see Fig.) was designed for the determinatio of minute quantities of carbon dioxide (less than 3 mgrms. in experiments on the respiration of living cells. Th


Air free from CO_2.
N/100 HCl containing phenolphthalein.
Barium hydroxide solution.
To pump

absorption vessels, which are constructed on the principle of the Walter's apparatus for washing gases, are of ordinary glass and are not heated during absorption (cp. Warburg, this J., 1912, 1049). At the commencement of a determination they are swept out by air free from carbon dioxide, and then about 30 c.c. of barium hydroxide solution are run into each. During absorption the gas is drawn through at the rate of 150 c.c. per min. The current of air is continued during the subsequent titration with acid.—J. H. L.

Organic matter; Destruction of large quantities of —— in the Kjeldahl process. E. Carpiaux. Bull. Soc. Chim. Belg., 1913, **27**, 333—334.

The following method has been found to give satisfactory results in the determination of nitrogen in samples weighing from 20 to 30 grms.:—The sample (say 30 grms.) is introduced into a 500 c.c. flask, 30 c.c. of sulphuric acid is added, and the whole is well shaken and allowed to stand for an hour; the mass becomes hot and forms a spongy carbonaceous product. Carbonisation may be accelerated by moderate heat. When the mass appears to be dry, mercury and sulphuric acid are added and the oxidation is proceeded with as usual. To remove any undesirable excess of sulphuric acid after the oxidation, pure sugar may be added to the boiling liquid. Nitrogen, phosphoric acid, and calcium may be determined in the resulting liquid. It is stated that this method obviates the difficulties due to excessive frothing which occur in the usual process.—T. F. B.

Boron; Determination of extremely small quantities of —— in organic substances. G. Bertrand and H. Agulhon. Comptes rend., 1913, **157**, 1433—1436. (See this J., 1910, 375.)

For very small quantities of boron, strips of turmeric paper of definite size are partly immersed under standardised conditions in the solutions containing boron as sodium borate and rendered acid with hydrochloric acid and in standard solutions of known boron content and of the same degree of acidity. The solution rises in the paper by capillarity and after a certain time (1—2 hours at 35° C., 10—24 hours at the ordinary temperature), the upper portions of the papers, exposed to the air, will have become coloured to a length depending upon the quantity of boron present. For quantities of boron between 0·0005 and 0·1 mgrm., the quantity of boron may be estimated accurately from the length of the coloured portion of the paper. Even in pure water a brown colouration may appear on the paper, but this is not changed to blue by ammonia as are the colourations due to boron.—A. S.

Analysis of petroleum oil and mineral wax. Kantorowicz. *See* IIa.

Rapid determination of arsenic in sulphuric and hydrochloric acids. Koelsch. *See* VII.

Thermal analysis of clays, bauxites, and some related substances. Wohlin. *See* VIII.

Electrical conductivity of clays and clay suspensions. [*Determination of soluble salts.*] Bleininger and Kinnison. *See* VIII.

Detection of phytosterol in animal fats. Fritzsche. *See* XII.

Examination of bleached shellac. Wolff. *See* XIII.

Examination of rosin size. Marcusson. *See* XIII.

Distinction of bark tans from fruit and wood tans. Kohnstein. *See* XV.

[*Apparatus for*] *determination of the ethyl acetate figure of tanning materials.* Blockey. *See* XV.

Constants for use in the double polarisation method of determining sucrose. Steuerwald. *See* XVII.

Direct determination of extract as a factor in the valuation of brewing barleys. Seibriger. *See* XVIII.

Influence of dilution of the mash on the yield of extract found in the examination of malt by the Congress method. Windisch and Glaubitz. *See* XVIII.

Determination of free and combined lactic acid in wines. Roettgen. *See* XVIII.

Composition of the lime, sulphur, and salt wash. Haywood. *See* XIXb.

Absorption of ultra-violet rays by alkaloids of the morphine group and phenanthrene. Gompel and Henri. *See* XX.

Patents.

Alloys and other chemical substances; Method and instrument for the separation, detection, and estimation of elements in ——. A. L. Fletcher, Dublin. Eng. Pats. 29,537 and 29,538, Dec. 23, 1912.

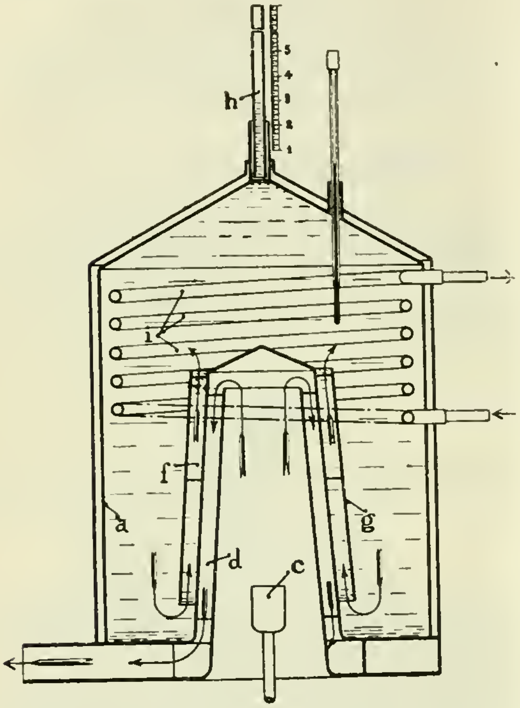
The material is heated electrically near a moving surface, such as the surface of a revolving drum. As the drum revolves, resistances are cut out of the electrical circuit so that the material is heated continuously to higher temperatures. Substances volatilised at different temperatures are thus received on different portions of the moving surface.—T. St.

Heating bodies; Process and apparatus for determining the calories given off from ——. M. Arndt. Fr. Pat. 460,248, July 11, 1913. Under Int. Conv., July 13, 1912.

A volume of air measured at atmospheric pressure is forced by a body of mercury moved by the action of a water pressure tube and intermittent siphon into a hollow vessel in contact with the heating body. The air expands and causes the mercury contained in a second vessel to rise to a corresponding degree. A float in the mercury also rises and by means of a cord passing over a pulley actuates the recording mechanism which indicates the number of calories given off and also closes an electric circuit which causes a bell to ring or some other signal to be shown. —W. H. C.

Heating value of fuels; Method and device [*calorimeter*] *for measuring the ——.* H. Junkers, Aachen, Germany, Eng. Pat. 22,514, Oct. 6, 1913. Under Int. Conv., Oct. 16, 1912.

The heat liberated by the combustion of solid, liquid, or gaseous fuels is transmitted by known heat-exchanging devices to a stationary liquid having a coefficient of expansion which is as nearly as possible constant at the temperatures under consideration, and the heating value calculated from the increased volume of the liquid. The effect of a uniform coefficient of expansion is that the increase in volume of the liquid is the same whether the temperature is uniform throughout or not, so that no stirring is necessary. Petroleum satisfies the necessary conditions but water is unsuitable. In the form of apparatus shown, the heat is transmitted from a burner, *c*, to petroleum in the vessel, *o*, by means of gills, *d*, in the flue and gills, *f*, in a liquid circulating passage, *g*. The top of the apparatus is made conical to avoid presence of air bubbles, and a heating or cooling coil, *i*, is provided to enable the calorimeter to be brought quickly to the temperature of the room to avoid radiation corrections. The increase of volume of the liquid is measured by means of a tube, *h*, and the heating value obtained by multiplying by a factor and dividing by the amount of fuel used. In another form of apparatus the tube, *h*, is replaced by an expansible chamber operating a pointer.—H. H.



Porous article. Filtering apparatus for laboratory use. P. A. Boeck, Assignor to Norton Co., Worcester, Mass. U.S. Pats. 1,081,573 and 1,081,574, Dec. 16, 1913.

(1) A THIN-WALLED porous article, for use as a filter, composed essentially of grains of a highly refractory material, especially alumina, with a small proportion of a ceramic bond. (2) An elastic band covers the rim of a funnel and extends into the same, and a porous cone disposed within the funnel is supported by the elastic band.—A. S.

Analysis of gaseous mixtures ; Means for use in the quantitative —— and for automatically regulating the state of gaseous mixtures. Siemens Bros. and Co., Ltd., London. From Siemens und Halske A.-G., Berlin. Eng. Pat. 28,943, Dec. 16, 1912.

SEE Fr. Pat. 458,916 of 1913 ; this J., 1913, 1171.—T.F.B.

Crucible. Glazed refractory article [*crucible*]. U.S. Pats. 1,081,535 and 1,081,542. *See* VIII.

Machines for testing the lubricating properties of oils and greases. Eng. Pat. 29,086. *See* XII.

XXIV.—MISCELLANEOUS ABSTRACTS.

Sublimation ; The temperature of ——. J. Joly. Phil. Mag., 1914, 27, 1—14.

BY means of the apophorometer (see this J., 1913, 509) the temperature of sublimation and the nature of the sublimate have been investigated for a large number of minerals containing Sb, As, S, Te, Bi, Se and Pb. Quantitative experiments upon several of these minerals are also described.—J. R.

Books Received.

MINES AND QUARRIES : GENERAL REPORT, WITH STATISTICS, FOR 1912. By THE CHIEF INSPECTOR OF MINES. Part III. Output. [Cd. 7197.] Price 1s. 5d. Wyman and Sons, Fetter Lane, E.C.

THIS return, which is prepared annually by the Home Office, contains statistics of the quantity and value of various minerals raised in the United Kingdom. The value of the mineral output of the United Kingdom in 1912 was £131,220,853, an increase of £6,641,540 as compared with 1911 ; the increase is mainly accounted for by the increased value of coal. (See page 84.)

MINES AND QUARRIES. GENERAL REPORT WITH STATISTICS FOR 1911. Part IV. Colonial and Foreign Statistics. [Cd. 7217.] Messrs. Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 8d.

THIS report, which completes the statistics for 1911, contains details of the persons employed, output, and accidents at mines and quarries in the British Colonies and in foreign countries. A corrected sheet of certain coal statistics in the 1912, Part III., report (pages 255 and 256) is also included.

RECHERCHES SUR LES ORGANISMES DE FERMENTATION. Vol. X. Alb. Klocker, II. RECHERCHES SUR 17 FORMES DU "SACCHAROMYCES APICULATUS." [Copenhagen. En commission chez H. Hagerup, Imp. De Thiele, 1913.]

THIS work fills a small pamphlet volume of 59 pages ($9\frac{5}{8}$ by $5\frac{1}{8}$ in.), followed by $3\frac{1}{4}$ pages of bibliographic references, and then by 8 plates with microscopic figures of the organisms described in the text and further 3 pages of descriptive notes. Then follow two photographs representing the monuments erected to the respective memories of Joh. Kjeldahl and Emil. Chr. Hansen, and 5 pages of memoirs. Finally, a Table of Contents to Vol. X. Price 2 Kr. 65 Ore.

CHEMICAL TECHNOLOGY AND ANALYSIS OF OILS, FATS, AND WAXES. By the late Dr. J. LEWKOWITSCH, M.A. F.I.C. Fifth Edition, entirely rewritten and enlarged In three volumes. Vol. I. Macmillan & Co., Ltd., St Martin's St., London. 1913. Price 25s.

PRESENTED to the Society's Library by his widow.

THE LILLY SCIENTIFIC BULLETIN. Series 1, No. 4 Jan. 5, 1914. Messrs. Eli Lilly and Co., Indianapolis Ind., U.S.A.

PAMPHLET consisting of 46 pages, $8\frac{7}{8} \times 5\frac{7}{8}$ ins., containin the following papers :—The improvement of medicin plants (F. A. Miller). A convenient method f estimating albumin in urine (F. R. Eldred and C. M Pence). The influence of alcohol on the toxicity of dig talis for guinea pigs (C. C. Haskell). Breeding medicin plants (F. A. Miller). The comparative value of vario sugars in the feeding of infants (C. C. Haskell). Th deterioration of pharmaceutical preparations (F. Eldred). The assay of individual plants of *Datura Str monium*, L., and *Datura Tatula*, L., and other species an varieties (F. A. Miller and J. W. Meader).

TRANSACTIONS OF THE AUSTRALASIAN INSTITUTE MINING ENGINEERS. Vols. XIV., XV. (Parts 1 and and XVI. Published by the Institute at the He Office, 57–59, Swanston Street, Melbourne.

Journal of the Society of Chemical Industry.

No. 3, Vol. XXXIII. FEBRUARY 16, 1914. No. 3, Vol. XXXIII.

Canadian Section.

Meeting held at Montreal, on Friday, March 28th, 1913.

DR. R. F. RUTTAN IN THE CHAIR.

THE RUBBER AND RESIN CONTENT OF THE DESERT RUBBER-PLANT "GUAYULE," IN RELATION TO RAINFALL.

BY FRANCIS E. LLOYD, M.A.

In an earlier paper* the view has been advanced that the amount of rubber secreted by the guayule, *Parthenium argentatum* Gray, varies within wide limits, inversely with the amount of soil water available. It was shown, however, that the amount of rubber which may ultimately occur within the secreting cells (which are chiefly those of the parenchyma) may be quite as great in those cultivated plants which receive a maximum water supply, as in feral plants, while the amount calculated to the total dry weight of the plant remains small. This is explained by the great changes in the character and especially in the volume relations undergone by the various tissues when the plant accommodates itself to the change from xerophytic to mesophytic conditions. The most obvious of these changes is seen in the thickness of the cortex (" bark "), which is relatively much less in well-watered plants, this constituting an important factor in determining the amount of rubber relative to total dry weight.

Correlated with the soil water supply is also the rate of secretion within the cell, which is much slower in well-watered plants. Thus a feral plant will show a much larger amount of rubber within the cells at the close of the normal wet season, say three months after the earliest effective rainfall of summer (in Chihuahua), than will an irrigated plant after six months of rapid growth, while the latter, during a subsequent period of enforced drought, will make marked advance toward attaining a full complement of rubber.

From the study of plants grown under such extreme conditions as regards water supply, it was to be inferred that variations in rainfall, either from season to season in the same locality, or as correlated with geographical conditions, would be accompanied by variations in structure and rate of rubber secretion in the same directions in plants in their normal habitats. Indeed, one striking example was afforded and has been described elsewhere† as well as in the publications above cited, but, at the time, no analyses were available, so that the divergencies of structure and rubber content had to be described in histological terms only.

Since then, the writer has received samples of plants in three lots from as many separate localities which bear out in a striking way the inference made, both in regard to the general habit of the plant and as to the rubber content in terms of total dry weight. These were very kindly furnished me by Sr. Ramon Muñoz, accompanied by the following data. The material was collected in December, 1912. During that year and during the latter half of 1911 the rainfall had been " very abundant," and in consequence an " abundant and rapid reproduction and growth " in all he guayule fields was reported. It is not possible to say n exact terms what "abundant" means, but we may uppose that, in a country where 12 to 15 inches is not considered meagre, 20 inches would fall somewhere near he mark. However this may be, it is more to the present purpose to point out that the region where the plants of Lot 3 grew is recognised as having a distinctly more abundant rainfall than those lands lying farther to the west. It lies on the eastern border of the guayule area, partly in the states of Nuevo Leon and partly in San Luis Potosi. These plants have a very different appearance from those of the other lots, namely, Lot 1 and Lot 2, both from guayule fields situated well within the area of distribution, and, indeed, markedly different from that of any guayule which I have seen growing in the field. Rather do they resemble irrigated plants in their slender twigs, yellowish bark, and greater shrinkage upon drying, the last-named character becoming evident in deep longitudinal folds. The plants of Lot 1 were four small seedlings, of which one was three years old and the remainder two, and except for a growth rate (viz., about 6 cm. yearly) somewhat greater than usual (about 3·5 cm. yearly) presented nothing unusual. The plants of Lot 2, also four in number, were of a type of guayule generally recognised as the " best." They were stocky plants, with fewer and thicker branches and twigs, grey in colour and generally conforming to the popular conception of " macho " (male) guayule, while the plants of Lot 3 are regarded as " hembra " (female). This distinction I have discussed elsewhere (*l.c.*), but briefly the alternative views are that we are dealing either with distinct races (elementary species) or with merely environment types. The latter view is strongly indicated by the evidence, which is not of the kind to be pertinent to this paper, but whichever of the interpretations is true, the present record will have its value. The great difference between the two samples (Lots 2 and 3) of plants which we are discussing is indicated by the weights. The plants of Lot 2 were 5 to 7 years old and had an average weight of 45·7 grms.; while of those of Lot 3 four, which were of a similar range of ages, had an average weight of only 29·2 grms. The average heights above soil were 22 and 19 cm. respectively, from which it appears that their growth rates were not connected with their transverse measurements. This is the one discrepancy which makes itself evident in a comparison of the plants of Lot 3 with irrigated ones, which may, however, be due to temperature effects, if we may assume, as seems proper, that the soil conditions need not be called into the question. That, however, a greater rainfall for 1911–1912 made itself felt more especially where it occurred, in probably greater abundance, appears to be indicated by a more rapid average growth rate for the plants of Lot 3.

The number of measurements (11 to 13) is admittedly rather too small to justify much reliance upon them, but they are given for their probable worth.

Average growth in height.

Lot No.	1911.	1912.
	cm.	cm.
2	3·6	4·4
3	4·8	5·3

All these measurements are somewhat in excess of the average growth rate of 3·5 cm. per annum, as established by numerous measurements by myself (*l.c.*). Nevertheless, they are not excessive nor greater than observed by me for particular localities. The seedlings comprised in Lot 1, however, also show a greater amount of growth in length than is usual during years of less rainfall than occurred in 1911-12, being, for the two years, about 10 cm. against a normal of about 6 cm. (*loc. cit.*). The samples, the analysis of which is given below, indicate therefore a rainfall of more favourable quantity, in harmony with the testimony of Sr. Muñoz, while those of Lot 3 conform to a type of guayule which resembles the irrigated plant.

The analyses were carried out by Mr. E. H. Pound in this laboratory in the following manner. The finely ground material was dried for 24 hours at 105° F. It was then extracted with acetone (6 hours) followed by petroleum ether of 60° (2 hours). The extracts were dried for one hour at 105° F. Parallel series were run. The plants of Lot 1 were entirely incorporated with the samples extracted; those of Lots 2 and 3 were divided into tops (the growth of the last two years) and stocks (the remaining basal portion). The following are the results and their averages:—

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* F. E. Lloyd. The guayule—a rubber plant of the Chihuahuan Desert. Carn. Inst., Wash., Publ., 139, 1911.

† F. E. Lloyd. Guayule—a desert rubber plant. Pop Sci. Mo., **81**, 313—330, Oct., 1912. The Acclimatization of Guayule; adia Rubber World, 1913, **47**, 183, 563.

Lot 1.

Rubber.	Resin.
per cent.	per cent.
1·30	12·73
1·75	11·04
Average 1·52	Average 11·88

Lot No.	Tops.		Stocks.	
	Rubber.	Resin.	Rubber.	Resin.
	per cent.	per cent.	per cent.	per cent.
	3·47	18·76	1·20	18·59
	4·29	16·35	1·08	14·71
2	—	—	1·77	19·63
	—	—	2·40	18·84
Average	3·88	17·55	1·61	17·94
	2·68	12·96	1·46	13·05
3	2·15	12·26	1·40	12·60
Average	2·41	12 61	1·43	12·82

NOTE.—For analyses of mature plants, see Whittelsey, J. Ind. Eng. Chem., April, 1909.

From these figures it appears that the plants of Lot 2 have about 62 per cent. more rubber in the tops and 13 per cent. in the stocks than those of Lot 3. The amount in the latter is about the same as I observed for field seedlings (exclusive of leaves) which had grown rapidly in response to a rather favourable season. In the seedlings of Lot 1 the amount is less than would be expected (namely, 1·52 per cent. against 1·80, leaves included) (Lloyd, *l.c.*), in view of the alleged considerable rainfall. But, as rain is usually local in the desert, especially on "bajadas" or footslopes, one has to admit the absence of exact information. The resin content, on the other hand, is little variable, and this fact is cited in support of a view earlier expressed that there is no connection between the occurrence of rubber and that of resin, for which view histological evidence had been given. That rubber may break down into resins is of little value as evidence that the resin in guayule is used in the building up of the rubber.

Concerning the anatomical structure of the plants in question, the same differences as between field and irrigated plants, such as I have heretofore described (*l.c.*) occur, but in smaller measure. These need not be mentioned here in detail, it sufficing to mention merely the greater development of cork, mechanical elements (stereome) and of the tracheids, together with a reduction of medulla and medullary rays, in the plants of Lot 3, those, namely, which received the greater rainfall. Microscopical examination does not discover any discrepancy in the amount of rubber in the individual cells, except to some extent in the smallest twigs, so that we must therefore conclude that the differences in the total amount of rubber produced must be referred chiefly to the differences in the volumes of tissues which secrete rubber as compared with those which do not. That, in the case of field plants, these differences may account for a considerable difference in favour of plants of the type of Lot 2 is seen in the ratios presented by the squares on the radial dimensions of the "wood" (that is, the whole cylinder of tissue bounded by the cambium layer) and the "bark" (those tissues on the outside). This, for stems of the same sizes are:—

	Ratio $\frac{\text{Bark}}{\text{Wood}}$.	
Total diameter:—	2·82	1·95
Lot 1	1·02	0·98
Lot 3	0·76	0·76

That is, in the better watered plants, the "bark" is considerably thinner.*

These ratios, however, indicate only a difference of 34 per cent. (for larger twigs) and 29 per cent. (for smaller twigs) in favour of the field plants, while the analyses show a 60 per cent. difference of rubber content for tops (which would include all the twigs of the sizes measured here together with somewhat larger ones). It is evident that an error of large size has been introduced, due as a matter of fact to ignoring the amount of cork, which is barren of rubber, and of pith, which is rich equally with the living cortex. The relative volumes of these tissues in twigs of the same diameter (about 5—6 mm.) are indicated by the following numbers, representing areas in transverse sections:—

Lot.	Pith.	Wood.	Cortex.	Cork.
2	95	394	984	236
	19	522	788	380

from which is it seen that the pith is smaller and the cortex thinner, while the wood and cork are thicker. By eliminating the cork and introducing the pith into the calculation, the ratios of volume of rubber producing tissue (still ignoring the medullary rays) to "wood" turns out to be for Lot 2, 2·74 and for Lot 3, 1·55, showing a difference of 76 per cent. in favour of the plants of Lot 3. This difference would not be realised in the extractions, since, aside from the imperfections of the method, the tissues of the smaller twigs of the two lots were not, as microscopic examination revealed, equally loaded with rubber, while larger twigs were included under the heading "tops" than the size chosen for measurement, two conditions which would disturb the relative amount of rubber recoverable.

Aside from the rate of secretion, there are two ways in which the amount of rubber produced by plants is affected by water supply, namely, by altering the volumes of rubber-bearing tissues, and by affecting the total amount of secretion within them. The evidence is clear that, in speaking of the effect of soil water, this difference must be recognised. Records show that both conditions occur, either in combination, as in the plant here under discussion, or severally. The latter only has been observed in the case of latex-plants. Olson-Seffer,† and Collins and Pittier‡ have noticed that *Castilloa* produced less rubber when it had been subjected to larger amounts of water by irrigation, and Fox, quoted by Neish,§ observed that milkweed (*Asclepias syriaca* and *incarnata*) gives a higher yield of rubber when it has grown in dry soils. It is obvious that the question is one of very great practical as well as theoretical importance, quite aside from the guayule problem, the importance of which is, at present, on the wane. The rubber planter will be compelled to study this relation whenever the problems of irrigation and drainage present themselves.

Conclusion.—The determinations of rubber for tw samples of feral guayule plants grown in their natura habitats under diverse conditions of soil-water, show tha a relatively abundant amount of rainfall results in a plan which simulates in many ways one grown under irrigatio the likeness extending to the amount of rubber produce and the relative volumes of bearing and non-bearin tissues. The departure from the normal, as indicated by typical desert plant producing a maximum yield of rubbe is such as to result in a plant which yields a distinctly less amount of rubber. Within the normal habitat of the guayule plant, therefore, the amount of rubber varies in an amount at least as great as that above indicated, namely, 62 per cent.

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* The different values of this ratio for larger stems are illustrat by tables in Publ. 139, Carn. Inst. Wash., above cited.

† Year Book, 1908. Rubber Planters' Assoc., Mexico.

‡ In O. F. Cook. Bull. U.S. Dept. Agric., No. 49, Oct., 1903

§ This Journal, 1913, **32**, 72.

The amount of resin secreted appears not to be affected by the amount of soil-water, and evidence is yet lacking that rubber and resin secretion are causally related in the plant.

Such differences, which are attributable to physiological causes are of great theoretical and practical importance.

London Section.

Meeting held at Burlington House on Monday, January 5th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE VISCOSITY OF OILS.

BY J. L. STREVENS.

(Taranaki Oil Fields, New Zealand.)

Considerable work in connection with viscosity and lubrication has been carried out during the past few years chiefly with a view to determine true (or absolute) viscosity through a large range of temperature in a simple and convenient manner (Dunstan and Strevens, this J., November 30th, 1912) and more recently (Higgins, this J., June 16th, 1913) on behalf of the International Commission for the Unification of Tests on Petroleum Products.

This communication, which may be regarded as a continuation of the first paper mentioned above, does not deal with the connection between lubrication and viscosity to any further extent beyond the statement that the lubricating capacity of any oil from a purely mechanical point of view depends entirely on the viscosity. Where special circumstances attend the use of a lubricant such as in a steam cylinder, air compressor, or gas engine, the rôle played by the extraneous bodies with which it comes in contact and the affecting conditions must be taken into account, as also its chemical characteristics. Under similar circumstances oils of equal viscosity at the working temperature of a bearing, even when there are constitutional and other physical differences, possess the same coefficient of friction in the bearing (Ubbelohde, "Theory of Lubrication"). Hence the necessity for absolute viscosity temperature curves in the study of lubrication.

The first determinations made by the author in collaboration with Dr. Dunstan contained certain errors which arose unavoidably from an interpolation of Scarpa's viscosity figures for phenol, at that time the only source available from which to calculate the viscometer constant. Later figures by Dunstan and Thole (this J., Nov. 30th, 1912) resulted in a different phenol viscosity curve from which the oil-viscometer constant curve was replotted. The result was a comparatively small variation through a large range of temperature as the following logarithmic values show :—

Before correction.		After correction.	
Temp.	log. Kt.	Temp.	log. Kt.
15·5° C.	$\bar{3}$·175	15·5° C.	$\bar{3}$·030
100° C.	$\bar{4}$·965	100° C.	$\bar{4}$·990
200° C.	$\bar{4}$·715	200° C.	$\bar{4}$·950

Consequently previous figures for all viscosities below [illegible]° C. (the temperature corresponding to the junction of the uncorrected and corrected "constant" curves) are too high and those above too low.

As a check on the result a similar viscometer was recalibrated showing a corresponding curve and both instruments were used in the investigations.

Many new oils have been investigated which, with the exception of some of vegetable and animal origin, are all lubricants well known to the oil trade.

The previous viscosity curves are materially altered, especially in the high temperature region, which for some oils approximates to their actual working temperatures.

Until more is known of the actual constitution of the various lubricating oils of commerce, to what extent the viscosity is affected cannot be stated, but from analogous work on bodies of known constitution it may be generally inferred that (1) Increase of mol. wt. favours increase of Zt., *e.g.*, rape oil (trierucin) $>$ olive (triolein). (2) Hydroxyl formation favours increased Zt., *e.g.*, castor oil and the blown oils. (3) Polymerisation (see 1), *e.g.*, "Elektrion" oils. (4) Solution of solid bodies in oils (*e.g.*, "soaping") tends to a high viscosity-temperature coefficient. (5) Unsaturation tends to lower the viscosity and, broadly, the $>$ iodine value $<$ Zt., *e.g.*, linseed and perilla oils less than nut or olive oil. (6) Combined high mol. wt. and conjugated doubled bonds mean a high Zt., *e.g.*, tung oil.

Some of the figures obtained are lower than those obtained by Higgins, *e.g.* :—

	Strevens.	Higgins.	Temp.
Russian engine ……	1·9	2·05	25° C.
Olive ……………	0·95	1·07	15° C.

This must be attributed to several causes, including difference in method of investigation and probable difference in origin of oil—long period of flow—as well as a substance of considerably lower viscosity than oils being the calibrating agent. On the other hand, the percentage rate of change of Zt. per 1° C. in the neighbourhood of 25° C—50° C. for Russian engine oil is 5·7 against 5·6 (Higgins).

The author, in conclusion, would like to draw the attention of the International Commission for the Unification of Tests on Petroleum Products to the possibility of standardising the viscosity of an oil (or oils) by Higgins' method and using the same as calibrating liquid for the determination of the viscometer constant detailed in the above investigations. Moreover, the oil trade could use with perfect reliability and uniformity instruments thus calibrated and similar to the simple type detailed in the previous paper (this J., Nov. 30th, 1912) with all confidence in their exactitude under a guarantee certificate and constant-curve drawn up by a responsible scientific authority such as the National Physical Laboratory.

Experimental Results.

Temp. ° C.	Zt.	Origin and Redwood range for commercial product.
Medium spindle oil.		
64	0·098	Pennsylvania (Anglo-American). 250—280 secs. 70° F.
100°	0·0368	
150°	0·0164	
Heavy engine oil.		
70°	0·167	Texas, 1460 secs 70° F : 213 secs. 120° F.
110	0·050	
150°	0·0233	
Light gas engine oil. (Dynamo oil.)		
75	0·085	Pennsylvania (Anglo-American). 450—500 secs. 70° F.; 80—85 secs. 140° F.
111°	0·037	
163	0·0145	
207°	0·0086	
Medium gas engine oil. (Crank chamber oil.)		
70°	0·136	Pennsylvania (Anglo-American). 700—750 secs. 70° F.
100°	0·058	
Medium gas engine oil.		
133°	0·0285	
150°	0·021	

Temp. C.	Zt.	Origin and Redwood range for commercial products.
Heavy gas engine oil.		
75°	0·172	A blend of Russian and American.
116°	0·044	
159°	0·016	
*211°	0·007	
(* decomposition).		
Ravison rape oil.		
70°	0·1347	Benzine-extracted from Continental seed. S.G. 0·919 at 60° F.; 350—380 secs. 70° F.
100°	0·0718	
130°	0·0398	
150°	0·0293	
Engine oil.		
25°	1·9	Russian. About 1300 secs. 70° F.; 240 secs. 120° F.
50°	0·398	
75°	0·140	
80°	0·121	
100°	0·059	
125°	0·036	
150°	0·022	
Engine oil.		
25°	1·96	
50°	0·439	Galician. About 1400 secs. 70° F.
75°	0·191	
100°	0·0698	
125°	0·0388	
Marine engine oil.		
70°	0·212	A blend of Russian and Lardine (10 per cent.). 270 secs. 120° F.
100°	0·0826	
140°	0·0312	
150°	0·0262	
Heavy engine oil.		
76°	0·245	Artificially soaped oil. 5400 secs. 70° F. 540 secs. 120° F.
100°	0·100	
120°	0·0585	
112°	0·036	
Cold test motor oil.		
110°	0·126	American. 500—800 secs. 120° F., 100—115 secs. 200° F.
160°	0·0413	
180°	0·0308	
200°	0·0223	
XX Century motor oil.		
110°	0·157	
150°	0·066	American. 115—120 secs. 200° F.
198°	0·0294	
Monogram motor oil.		
75°	0·171	A blended American oil.
103°	0·068	
127°	0·0395	
160°	0·023	
Standard cylinder oil.		
70°	0·8857	A blended cylinder oil with 5 per cent. tallow.
100°	0·280	
109°	0·203	
160°	0·0632	
190°	0·0342	
198°	0·0318	
Locomotive cylinder oil.		
80°	0·635	American. 1300—1680 secs. 120° F.; 210—240 secs. 200° F.
100°	0·2955	
150°	0·0767	
180°	0·041	
Castor oil.		
108°	0·127	
130°	0·073	First pressings. S.G.=0·962 60° F.
*155°	0·042	
*198°	0·022	
(* decomposition)		
Thickened rape oil.		
75°	0·792	East Indian pressed. S.G. 0·916 (originally) at 60° F. blown to 0·965; 540 secs. 140° F.
105°	0·306	
135°	0·156	
200°	0·0176	
Elektrion rape oil.		
120°	0·807	An electrically polymerised mixture of mineral oil and rape oil. 2,990 secs. 140° F.
150°	0·3676	
160°	0·316	
190°	0·179	
200°	0·146	

China wood oil. S.G. 0·942 60° F. Genuine.

Viscometer A.		Viscometer B.	
39°	0·988	25°	2·115
65°	0·324	50°	0·594
95°	0·131	70°	0·269
120°	0·0718	85°	0·167
140°	0·0485		

The Redwood figures given above show the range usually met with in the commercial oils. The numbers are those obtained by the author from examination of some hundreds of such products during the past few years.

It is possible to obtain the ratio of the times of flow on a standard technical viscometer to the actual absolute viscosity by the formula :—

$$Zt = (aT - \frac{b}{t})t$$

where a and b are constants differing slightly at various temperatures, and T=time of outflow in seconds.

The adoption of certain "standard temperatures" at which to ascertain the viscosity of an oil for comparison purposes is not satisfactory owing to the difference in the ratios of the viscosity of oils over a wide range of temperature. The only really satisfactory method is by means of viscosity-temperature curves over a range depending on the kind of oil and its proposed use. Thus for light oils, engine oils, and lubricants which are not likely to be subjected to high temperatures in their ordinary practice, a range from 15° C.—100° C. would be ample, whilst valuable information should be obtainable for cylinder oils and gas engine oils, from a viscosity curve over a much higher range.

Vegetable and Animal Oils.

Oil.	Zt. at 15·5° C.	Redwood secs. at 15·5° C.	Sp. gr. at 60° F.
Arctic sperm	0·441	210	0·881
Pale olein	0·462	212·2	0·898
Linseed (Dutch)	0·550	266	0·933
Hempseed	0·600	284·5	0·931
Pale dog-fish liver	0·605	289	0·9275
Nigerseed	0·697	326	0·925
Pale whale	0·711	—	0·922
White seal	0·724	—	0·926
Sunflower seed	0·776	352·2	0·924
Poppy seed	0·789	354·5	0·924
Sesamé oil	0·797	358	0·924
Soya bean oil	0·797	358	0·924
Apricot kernel	0·857	—	0·919
Sweet almond	0·860	—	0·917
Peach kernel	0·869	—	0·917
Ravison oil	0·935	452·4	0·919
Arachis oil	0·942	464	0·9165
Aragon olive oil	0·950	—	0·916
Neatsfoot oil	0·987	—	0·9164
Pale cotton seed	0·994	485	0·925
Refined colza (old sample)	1·085	511·4	0·919
Japanese rape	1·123	533·6	0·919
Kerosene	0·0194	31·2	0·811
Mineral colza	0·0626	48	0·823
Half-white mineral oil ..	0·297	154·4	0·869

Solid fats and waxes.	Zt. 50° C.	Density. 50° C.	Free fatty acids.
			° C.
Semi-refined petroleum jelly .	0·610	0·825	—
Cocoanut oil	0·154	0·901	6·0
Palm kernel oil	0·171	0·900	5·3
Cacao butter	0·171	0·900	Trace
Illipé butter	0·175	0·881	64·8
Palm oil	0·198	0·877	75·0
Bone fat	0·256	0·891	15·0
Lard	0·258	0·890	Trace
Premier tallow	0·267	0·888	,,
Chinese vegetable tallow ...	0·274	0·880	3·8
Skin grease	0·293	0·892	8·6

Waxes.	65° C.	65° C.
Paraffin (American 120/2) ..	0·0375	0·771
,, (Burmah 138/40) ...	0·0522	0·779
Ceresin .... 74° C.	0·057	0·770 at 74° C.

DISCUSSION.

Mr. ARNOLD PHILIP said he thought Dr. Beilby ha shown some years ago that the solution of paraffin wa under certain circumstances in mineral oils actually lowere their viscosity, whilst in experiments carried out Portsmouth he had found that the solution of naphthale in ordinary mineral oils usually very remarkably lower their viscosity.

Mr. J. H. Coste emphasised the great need for standardisation of viscosity tests. They knew the reading of the Redwood viscometer did vary, and it was very desirable that any viscometer used should be definitely standardised.

ON THE OXYGEN CONTENT OF THE GASES FROM ROASTING PYRITES.

BY LEWIS T. WRIGHT.

About 40 years ago, Scheurer-Kestner (Bull. Soc. Chim., 1875, 23, 437) called attention to the fact that the gases from roasting pyrites did not contain nearly enough oxygen to justify satisfactorily what I may term the normal reaction, $2FeS_2+11O=Fe_2O_3+4SO_2$. Friedr. Bode (Dingl. 218, 322) then called attention to the existence of ¾ to 1½ per cent. of sulphur as sulphate of iron in the cinder as helping to explain this observed shortage of oxygen, and pointing out that Winkler and others had shown how SO_3 was formed by the action of incandescent ferric oxide on SO_2 and oxygen. Scheurer-Kestner (Dingl., 219, 512), in reply to Bode, entered into further detail, and showed that the quantity of oxygen in the cinder as sulphate was in any case trifling, but that even if all the sulphur in the cinder existed as sulphate, and all the missing oxygen were disposed of as SO_3 either in the cinder as sulphate, or as SO_3, then the sulphur in a case he cites would have been thus disposed of: 65·5 per cent. sulphur as SO_2 in the burner gas; 32·5 per cent. as SO_3, and 2 per cent. as sulphate in the cinder.

This was followed by Lunge and Salathe's work on the action of red hot ferric oxide on 1 vol. SO_2 and 2 vols. air (Ber., 10, 1824). They were able to get experimentally as high as, for 100 parts by weight of sulphur as SO_2, 22 parts of sulphur as SO_3. This is less than would be inferred by Scheurer-Kestner's reasoning for the case from practice he had presented. The matter was apparently left to rest there with an observation by Lunge that perhaps an error in the estimation of oxygen by pyrogallate had influenced the result.

If the matter has no further interest, so far as the sulphuric acid industry is concerned, I believe it may have in connection with the increasing attention now being given to the efficiency of air used in copper smelting processes, and I venture to revive it.

If the whole of the pyrites were burned according to the "normal" reaction, $2FeS_2+11O=Fe_2O_3+4SO_2$, and if 100 vols. of the air furnishing the oxygen supply contained 20·90 vols. of oxygen and 79·10 vols. nitrogen, and further the reaction could proceed to the exhaustion of the oxygen of the air employed, then there would be for 100 vols. of air used, 15·2 vols. SO_2, 5·7 vols. of oxygen disappearing from the gas and forming Fe_2O_3, and 79·10 vols. of nitrogen, and the furnace gas would have this composition: SO_2, 16·1 per cent., N, 83·9 per cent.

I had frequently tried to ascertain how much SO_2 I could "soak" into the burner gas by closing up pyrites oasting furnaces against the admission of further air at a time when they were running well and hot, and then aking a series of gas analyses for SO_2. This would ise till about 11·5 to 12·5 per cent. SO_2 appeared, and hen cease. The average maximum of rather less than 2 per cent. SO_2 which was found on these tests I regarded s a working maximum, and attributed the deficiency rom the 16·1 per cent. which would obtain if all the yrites were burned by the above reaction with 100 per ent. air efficiency, partly to the SO_2 forming an "extincive" atmosphere. It did not occur to me then that the ee oxygen might have been entirely used up. I was ware that a deficiency of oxygen had been generally oted, but it did not occur to me that this was more han relatively unimportant, and I now regret that I did ot on those occasions also have the burner gas examined r free oxygen.

I was satisfied that about 12 per cent. of SO_2 was a actical maximum. On examining a number of analyses wing both SO_2 and oxygen in burner gas from works under my control, and afterwards other analyses published at various times by different observers, I noticed certain peculiarities to which I would like to call attention.

The analyses are dealt with in the following manner. The difference between the total of the SO_2 and oxygen is treated as nitrogen. From this nitrogen the original oxygen is calculated on the basis of 20·90 oxygen to 79·10 nitrogen (by multiplying the nitrogen by the factor 0·264). The difference between the original oxygen and that in the SO_2 and the oxygen found in the gas is the oxygen which has disappeared from the gas. This I call "oxygen absorbed." According to the "normal" reaction it combined with the iron to form Fe_2O_3. For instance, if the reaction had been exclusively the "normal" one, then as said before, for an original 20·90 vols. oxygen, 15·2 vols. of oxygen would remain in the gas, and 5·7 vols. would be absorbed by the iron, and the ratio, oxygen absorbed to SO_2 would equal 0·375.

In the accompanying table are given analyses of burner gas so discussed as well as the "normal gas" of Lunge, which has a ratio of oxygen absorbed to $SO_2=0·37$. It may be convenient to call this the "normal" ratio.

It will be noticed (1) that in no case is the "normal" ratio approached; (2) that the results of each observer are not only generally concordant in themselves, but also with those of other observers, and (3) that the highest SO_2 results have the lowest ratios and the lowest SO_2 the highest ratios, and generally as the percentage of SO_2 increases the oxygen absorbed to SO_2 ratio decreases.

If there were any constant error in these analyses that made, for instance, the absorbed oxygen 1 too high, the "normal" ratio would be increased by 0·5 in the case of gas with 2 per cent. SO_2 and 0·125 with gas of 8 per cent. SO_2. Also if 80 per cent. of the pyrites were burned by the "normal" reaction, and the balance by secondary reactions, the average effect of which could be expressed by the equation $FeS_2+7O=FeSO_4+SO_3$, then the ratio, oxygen absorbed to SO_2 would be 0·81.

I am not prepared to say how much of the defect from the "normal" reaction is caused by the undoubted occurrence of other reactions by which metallic sulphates and SO_3 are formed, or by some constant error in the method of analysis, but I do want to point out that if the remaining oxygen in ordinary burner gas were used up in the combustion of pyrites, we could never reach a "normal" gas containing so much as 16·1 per cent. of SO_2, and the maximum must be 12 per cent. SO_2 when the free oxygen is all exhausted.

If we consider the burner gas, SO_2 found, 8·6; O found, 5·5; N by diff., 85·9; O original, 22·7; O absorbed, 8·6; ratio, 1; and the remaining oxygen could be disposed of in the same ratio, then the SO_2 would increase by one-half of the remaining oxygen and the other half of the oxygen would be "absorbed"—the final result would be, SO_2 found 11·35, O found none, N by diff. 85·9, O. absorbed 11·35, ratio 1, or correcting for shrinkage of volume, 11·67 per cent. of SO_2.

In the case of the burner gas containing 8·4 per cent. SO_2 and the "ratio" 0·9, SO_2 found 8·4, O found 6·5, N by diff. 85·1, O absorbed 7·6, ratio 0·9; and of the remaining free oxygen, viz., 6·5 were disposed of at the same ratio of 0·9, the resulting gas would be: SO_2 found 11·8, O found none, N by diff. 85·1, O absorbed 10·7, ratio 0·9 and correcting for shrinkage of volume the resulting gas would contain 12·2 per cent. of SO_2 as a possible maximum

The gas with a percentage content of 16·1 per cent. SO_2 is therefore, so far as our experience goes, not attainable in pyrites roasting furnaces.

In closing this paper I would like to offer a tribute to William Crowder, whose "Observations made on the Working of Vitriol Chambers" is the most complete account of the progressive change in the composition of the gases in the chamber sulphuric acid process with which I am acquainted. His expressed wish that the information he then gave to the world might prove to be useful memoranda will already, I believe, have been amply fulfilled.

	SO_2.	O	N by difference.	Original O calculated from N.	O "Absorbed."	O Absorbed / SO_2.
Crowder. This J., 1891, 303	4·86	10·68				
	5·12	10·17				
	5·21	10·44				
	5·42	10·01				
Average	5·15	10·33	84·52	22·31	6·83	·33
	6·34	8·82				
	6·43	8·53				
	6·54	8·82				
	6·57	8·47				
,, ...	6·47	8·66	84·87	22·40	7·27	1·12
	7·03	8·9				
	6·83	8·98				
	6·21	9·43				
....	6·69	9·10	84·21	22·23	6·14	0·91
	7·43	7·96				
	7·31	8·06				
	7·06	8·32				
	7·03	8·32				
,, ...	7·21	8·16	84·63	22·34	6·97	0·97
Fischer. Ding. J., **258**, 2:	0·96	18·4	80·64	21·29	1·93	2·01
	1·52	16·6	81·88	21·61	3·49	2·30
	3·81	12·5	83·69	22·07	5·76	1·51
	8·26	5·9	85·84	22·66	8·50	1·03
	7·53	7·5	84·97	22·42	7·39	0·98
	2·48	14·8	82·72	21·84	4·56	1·84
	2·62	16·0	81·38	21·49	2·87	1·1
	8·43	3·9	87·67	23·30	10·81	1·28
	4·92	10·7	84·38	22·28	6·66	1·35
	5·80	10·6	83·60	22·08	5·68	0·98
	9·3	5·0	85·70	22·62	8·12	0·87
Scheurer-Kestner. Bull. Soc. Chem., **23**, 437	6·33	8·66	85·01	22·44	7·45	1·16
	8·57	6·77	84·66	22·29	7·01	0·82
L. T. Wright. Private memoranda	6·6	8	85·4	22·54	7·97	1·20
	7·2	6·7	86·1	22·73	8·8	1 22
	7·2	7·7	85·1	22·47	7·57	1·05
	7·6	6·9	85·5	22·57	8·07	1·06
	8·4	6·5	85·1	22·47	7·57	0·90
	8·6	5·5	85·9	22·68	8·58	0·99
Lunge's "Normal" gas	8·59	9·87	——	——	——	0·37

Discussion.

Sir **William Ramsay** asked whether it was certain that the formula of the oxide of iron produced was Fe_2O_3. The main argument seemed to be conceived on a difference of oxygen, an error in the estimation of which would make that difference greater or smaller.

Mr. J. H. **Coste** said that sulphur trioxide was always produced when coal gas was burned without chilling the products.

Sir **William Ramsay** asked whether it was allowed for.

Mr. J. H. **Coste** said that the gases from a calorimeter, like Boys' or Junker's, always showed sulphur dioxide, apparently because the product had been chilled; but if gas were burned in the Referees' apparatus for determining sulphur practically the whole of the sulphur came off as sulphur trioxide. Sulphur dioxide was not usually found.

The **Chairman** said that that might account for the expected discrepancy in the analyses in the second column.

Mr. D. M. **MacKechnie** said, with regard to Sir William Ramsay's remarks on the degree of oxidation of the iron present, ferrous oxide was admittedly present and might be there in quantity.

Mr. **Lewis Wright**, in reply, said in regard to the matter raised by Sir William Ramsay, the amount of sulphur trioxide formed under these circumstances, would hardly, in his opinion, account for the ratios shown. Of course some magnetic oxide was formed and tha affected the ratio. He did not know if anyone had determined that; but there were other well-known secondar reactions taking place. Some of the claims which ha been made to the production of a burner gas containin nearly 18 per cent. of SO_2 in special types of furnace could hardly be explained in the face of the analys which came from all kinds of practices, not only from h own but that of many other chemists engaged in th manufacture of sulphuric acid. On the question of tl possible analytical error in the absorption of oxyg which was suggested by Dr. Lunge, when they we dealing with gases of such extreme dilution, it was obvio any of the many possible errors in technical gas analys might happen and would then affect the ratio. If aft a burner gas was taken away through various channe air was allowed to enter, that was to say, if there was mixture of burner gas and false air, or if a dilute g was taken off directly from roasting pyrites, the sa high ratio was found in each case.

THE HEAT TEST OF EXPLOSIVES.

BY A. C. EGERTON.

It is satisfactory to find that interest has been tak in the paper on the heat test published in this Journ. 1913, 331, Robertson and Smart having criticised seve of the deductions therein (see this J., 1913, 967).

The results of certain experiments, described in the fore-mentioned paper, were only explicable, in the opinion of the writer, by considering that an explosive can attain a state of equilibrium within a closed heat test tube. In fact, it was suggested that the dissociation pressure of the explosive compound was measurable, and would act as a good guide to its stability. Such a statement has been considered untenable, because decomposition of an explosive can proceed to completion—it is not a reversible process.

Explosives to which the heat test is applicable, on heating at a constant temperature for a long time, gradually deteriorate and eventually decompose; in fact on heating they are all liable to ignite of their own accord. This could not be so if the products of decomposition were in equilibrium with the explosive; indeed the products of decomposition tend to accelerate the rate of decomposition. What then is the evidence for the assertion made in the author's last paper?

It was found that the heat test time was little altered by the presence of two test papers, or even two drops, although calculation from the formula derived from the assumption of a regular rate of increase of the concentration of the nitrogen peroxide and its removal by absorption in the drop or paper, would require that the heat test time should be considerably greater: the continuous tests show that for quite a long period the heat test times remain practically constant.

These two facts appear only to be explicable on the hypothesis that equilibrium establishes itself within the tube. For how otherwise would the results of a continuous test not give decreasing times, or the presence of two drops instead of a single one not cause an increase in the time of the first test?

It will be well to consider other possible reasons. Firstly the concentration of "reacting" gas may be greater than expected and the absorption by the drops or paper less; an upper limit for the value Tc=K for the drops and papers was found (for the drops $K = 156 \times 10^{-6}$), but even this is not great enough to account for the similar results obtained when two drops are exposed; the value for the absorption by the papers was confirmed, and that for the drops was found to be nearly four times as great. This, then, will not account for the facts. Secondly, during a continuous test the drops or papers may absorb the reacting gases as fast as they were formed, or leakage and dilution of the atmosphere within the tube may occur when the drops are changed; this, however, is also disproved, because, if a continuous test is run alongside a similar sample which is kept in a closed tube and only tested at long intervals, after the same period of time has elapsed from the commencement, nearly the same heat test times are obtained. There remains Dr. Robertson's suggestion that during a continuous test the nitrogen peroxide is reduced to nitrogen, this action increasing as time goes on much in the same proportion as the nitrogen peroxide is evolved. If this were so, two tubes treated similarly and heated for a certain time, should contain the same amount of nitrogen peroxide; if they were then tested the one with one drop or paper and the other with two, the results should be very different; they are, however, nearly the same. There is also direct evidence that this is not a plausible explanation, as will be shown later: indeed, from the results of the Will test it would be exceedingly unlikely that the reduction would be sufficient to account for the constant heat test results, especially as the temperature at which a heat test is carried out is so much lower than that for the Will test.

Smart has pointed out that oxygen, nitrous and nitric acids, nitrogen trioxide and peroxide, and nitric oxide are all reacting gases so far as the heat test is concerned: if constant continuous test results were only obtained for the potassium iodide paper, it would be easy to understand, for the reaction on the paper is an oxidising action and that on the drop is due to nitrous acid. It appears conceivable that the nitric oxide found by reduction of nitrogen peroxide might act as a carrier of oxygen, being alternately reduced and oxidised, and this might account for the constant results; but as the nitrogen peroxide increased, one would expect the nitric oxide to increase, and the test times to decrease. It does not seem that such considerations throw any light on the matter.

As none of these explanations suffices to explain the experimental results which had been obtained, it was thought advisable to confirm them, and the following table gives the results of some of the further experiments.

TABLE I.

Guncotton "Conditioned."

KI paper. 70° C.				Naphthylamine drop. 75° C.			
1. Single paper 10′ interval.	2. Two papers 10′ interval.	3. Single papers 30′ interval.	Time.	1. Drops exposed successively.	2. Two drops (in cases marked*).	3. Single drops 30′ interval.	Time.
24′	22½′	21½′		23′	24′	24′	
4′	8′	2′	30′	10′	10′		
3½′	4½′			9½′	10′	8½	60′
3½′	7½′	3½′	60′	8½′	10½′*		
3½′	7′			9½′	9½′		
3′	7′	1½′	90′	10½′	11′	8½′	90′
4′	8′			14′			
3½′	8′	2′	120′	18′	17′*	15′	140′
3½′	6′			17′			
4′	5′	3′	150′	27′	31′	21′	200′
5′	10½′						
3½′	6′	2½′	180′				
4½′							
5′	15′	3′	210′				
5′							
5′	15′	4′	240′				
8½′							
9′	11′		270′				

Thus after two hours in the case of the paper indicator.

When 14 papers have been exposed, heat test time is ..	8′
8 " " " " " " " " " ..	3½′
4 " " " " " " " " " ..	3′

while with the drops after 1½ hours

When 8 drops have been exposed, heat test time is ..	11′
6 " " " " " " " " " ..	10½′
2 " " " " " " " " " ..	8½′

It has been shown in the other papers that the presence of two papers or two drops during the first test should alter the time of the test considerably; but in fact, experiments show that the time of the first test does not alter.

On the other hand, a simple calculation shows that if the rate of evolution of nitrogen peroxide is about 1·0 ×

10^{-6} mgrm. NO_2 per minute per c.c., the amount of nitrogen peroxide in a heat test tube after two hours should be about $1{\cdot}6 \times 10^{-3}$ mgrm., a number which would give a very quick heat test time, and which would not be affected appreciably by the exposure of several papers within the tube.

If the amount remained about 5×10^{-4} mgrm., as the continuous tests seem to show, the difference in tests on exposing different numbers of papers should be about that observed; one can quite realise that the approximate equilibrium would hardly establish itself quickly enough to prevent this effect being observed. The drops absorb much more nitrogen peroxide in colouring up to tint, and if it were not that results after the exposure of very few drops are not greatly different from those where many drops have been exposed during the continuous tests, it would be possible to explain the constant results obtained by absorption in the drop, but that possibility is excluded.

One point to be noticed is that the heat test rises after a certain time, and that this rise occurs sooner, the greater the number of drops or papers introduced. The suggestion of Smart that at the commencement of the continuous test the nitrogen peroxide is reduced by foreign substance, more nitrous acid being thereby obtained, might possibly explain this fact; but it is more probable the result of a slower rate of evolution of nitrogen peroxide after the explosive has been heated some time.

Other experiments were made which confirmed the above results. One experiment was carried out with a sample of dry guncotton at 70° C. for 36 hours (using a drop of *α*-naphthylamine as indicator). The drops were exposed at intervals of an hour. The test times obtained were practically constant, and no gradual increase in concentration in nitrogen peroxide was detectable.

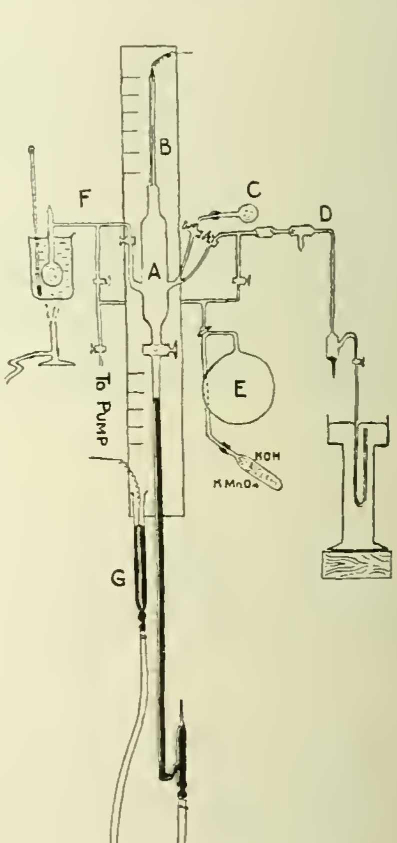
These results confirm those described in another paper, and show that the reacting gases do not increase regularly as time goes on, but that their concentration remains practically constant. Excluding the idea that reduction to NO and nitrogen might account for these constant results, it does not seem possible to explain them otherwise than by assuming that the explosive is behaving like an ordinary dissociable substance in an enclosed space.

How, then, can the two views be brought into line, and how does an explosive behave when kept at a temperature about 70 to 80° C.?

The explosive, if it were an ordinary substance at a constant temperature (*e.g.*, copper nitroxyl), would get into equilibrium with the products of decomposition. There is little doubt that this is the main condition of affairs; at the same time, in order to account for the instability of an explosive and its liability to decompose rapidly, there must be a second process going on. Certain few molecules (especially in the case of explosives of non-homogeneous structure) are decomposed more completely than those which are merely dissociating, and these are decomposed irreversibly with evolution of considerable heat; at certain centres, then, within the explosive this action begins and may spread rapidly and cause spontaneous ignition. The two actions may be looked on as separate; and the results of heating an explosive, as in a continuous test, are those of the two supposed actions. When the explosive is first heated, the explosive may be somewhat more disturbed than after a considerable heating. The explosive would show sudden increases in the concentration of the "reacting" gases; but no marked increase should occur until the explosive has practically reached a condition in which it is likely to explode. These remarks are borne out by the results of continuous tests.

Leakage or absorption by the reagent have been shown not to account for the approximately constant results of a continuous test. As it is not apparently impossible to prove satisfactorily by means of experiments, such as have been described, whether or not reduction of nitrogen peroxide is sufficient to account for the constant results obtained in continuous tests, another method has been devised for this purpose. The method is based on Ramsay's apparatus for measuring small quantitica of gases.

The gas burette, A, ends in a fine capillary tube, B. The side tubes communicate through taps with a bulb containing potash, C, a tube of phosphorus with a mercury inlet, D, and a tube, F, containing the guncotton which can be heated at a constant temperature. The upright tube communicating with the mercury reservoir can be closed by a tap so that the mercury can be shut off from the inside space. The bulb, E, contains pure oxygen. The guncotton in F is heated for some definite time in pure oxygen, and in the meantime the burette, etc., are completely evacuated. The tap to the burette is then opened so that the gas passes chiefly into A (the bulb, F, being small); after closing this tap, that to D is opened and the oxygen burnt up by the phosphorus, and the oxides of nitrogen are decomposed giving nitrogen. The result would be a mixture of CO_2, CO, hydrogen, and nitrogen.



The CO_2 can be partially got rid of by opening to the potash bulb. To get rid of hydrogen a little oxygen is let into the burette, A pumped out and sparked. Then it is let back into the apparatus through the inlet to the phosphorus tube, the nitrogen and CO_2 remaining pass into the burette on opening the tap thereto. The CO_2 can be cooled out by a cup of liquid air over the capillary tube and the residue examined by passing the electric discharge through, by connecting to the mercury reservoir and the small platinum wire at the top of the capillary tube. Its volume can also be measured in the capillary tube.

After two hours' heating, if the rate of evolution of N, NO, and NO_2 from the explosive is constant, the volume of nitrogen obtained should be greater than two cubic millimetres for an ordinary guncotton according to the calculation from the formula giving the rate of evolution of nitrogen peroxides. It is possible, however, to detect a very much smaller quantity of nitrogen by this method.

The results of preliminary experiments have shown that a very much smaller quantity (about $\frac{1}{50}$ cubic mm.) than this is obtained and that this quantity does not seem to increase on prolonged heating for several hours. In fact the results so far obtained support the contention that the explosive substance behaves, in part, like an ordinary dissociable substance.

The method is somewhat difficult to work, but if it can be perfected it should be valuable as an absolute method of measuring the stability of an explosive by the analysis of the gases evolved on heating for different periods of time at different temperatures.

Another experiment was made, in which the bulb, E, was filled with pure CO_2, instead of oxygen: the guncotton being heated in an atmosphere of CO_2, as in the Will test. The gas is then passed into the burette, the CO_2 and NO_2 absorbed in the potash bulb, C, and the hydrogen got rid of by washing out with oxygen and sparking as before. If the nitrogen oxides had been reduced by the guncotton the nitrogen (or nitric oxide which would give nitrogen after this process) should be detectable; but the result obtained was quite negligible even after 4 hours' heating. These experiments seem to prove that for several hours, with temperatures as low as 80° C., a normal nitro-compound explosive does not decompose to any great extent but behaves like a dissociable substance, which gets its equilibrium with the products of dissociation. This process, however, is not alone taking place, but there is also the tendency to decompose irreversibly, which tendency is increased by rise or change of temperature, by the presence of impurities or by the production of acids. At the temperature of the Will test, where even the nitrogen peroxide is itself partially decomposed owing to the high temperature, the latter process is much more prominent. The two processes are independent: the apparent equilibrium is only an approximately constant state of affairs. Other points in the last paper have been called to notice, but these do not require so much discussion.

The reaction on the indicators.—In the above remarks, the expression "reacting gases" has been used, because it was immaterial to the argument what gas was in equilibrium with the explosive. But when interpreting the differences shown by the test paper (which is coloured by oxidation) and the drop (which detects only nitrous acid), it is important to take these differences into account. This difference was recognised, and it was considered to be an argument in favour of a "nitrous acid detecting" reagent, over the ordinary heat test paper, as with the former it becomes possible to interpret the results in a reliable manner. At the same time, Smart quite rightly points out that the starch iodide paper by reason of the back reaction ($2\ KOH + I_2 = KI + KOI + H_2O$) gives a great range between good and bad, and an apparently greater sensitiveness.

Relation between concentration (*C*) *and time* (*T*).—In the determination of the value of K (when TC = K) the higher value obtained by the writer can hardly be due to depletion owing to the size of the vessel. One drop introduced into an atmosphere containing 0·017 mgrm. of nitrogen peroxide would hardly deplete it sufficiently to account for the different value of K obtained, for one drop absorbs only 4×10^{-4} mgrm. of N_2O_4, but for times of 50′ or longer, no doubt the effect is appreciable. Local depletion of NO_2 in the neighbourhood of the drop might have accounted for the difference, but it was found that stirring the gas during the absorption by the drop made little difference to the time. However the results were not satisfactory and the errors were no doubt due to condensation on the side of the vessel; this effect appeared to be more prominent than that of absorption by alkalinity of the glass, as a silica globe gave much the same results.

The other method employed was the measurement of the vapour pressure of nitrogen peroxide. The vapour pressure of nitrogen peroxide at 90° is about 0·009 m.m., the time of colouring of a drop in an atmosphere exhausted with NO_2 from nitrogen peroxide at this temperature is 11′. The value for TC K would consequently be about 140×10^{-6}; measurements at other temperatures below 80°, agree approximately with this value for K, which is not very different from that obtained by the other method.

Heat tests on guncotton.—A long series of experiments, which will be published in full, have all led to the idea that nitric acid, or at any rate H ions, formed in the moisture in the guncotton has an accelerating influence on the decomposition, and that as the water is removed, the rate of evolution of gases becomes slower. It does not seem possible to explain otherwise the results of continuous tests, tests done after drying or evacuation, and tests done in the presence of other substances. The evolution of moisture follows a similar curve to the evolution of other gases. In looking through all the evidence for the view which has been held about the nitric acid, there does not appear to be any better hypothesis, for it fits in well with all the facts.

Continuous tests.—The suggestion made by Smart about the curious difference in the behaviour of iodide paper and of the α-naphthylamine drop at the beginning of continuous tests on cordite offers a possible explanation; but owing to change of temperature, the rate of evolution of gases is probably greater at first, when the unstable portions of the substance are broken up: the drop which absorbs more, may therefore deplete the atmosphere of gases too quickly and give rise to the anomalous maximum in the curve obtained with the drop reagent. This seems to the writer a more probable explanation, but further work would be needed to clear up this point.

Absorption of NO_2 *by guncotton.*—The writer pointed out that there seemed to be contradiction in the results of experiments with guncotton and nitroglycerin respectively which had been described by Robertson and Smart. The contradiction is due, in Smart's opinion, to the physical difference of the guncotton and the nitroglycerin comminuted on silica fibres. No doubt this physical difference exists, but it should tend to give an effect in the opposite direction. In the writer's opinion, the contradiction is due rather to the fact that the nitrogen peroxide is absorbed differently in the two cases; in the guncotton it is absorbed chiefly, not wholly, by the moisture in the guncotton, and in the nitroglycerin it is dissolved in that substance itself. Therein is the physical difference.

There is no doubt, however, that physical difference in the nature of explosives is a very important matter from the practical point of view. A single heat test, for this reason, often gives an unreliable result; a continuous test, on the other hand, might overcome such difficulties.

The practical use of the heat test.—In the discussion of these details, the main problem must not be lost sight of, that is, so to improve the heat test that it may become a thoroughly reliable stability test.

The vagaries of the test are due to differences in the moisture content of the explosives, the presence of foreign substances (like acetone), the physical condition of the explosive and the unreliability of the reaction on the starch iodide paper. None of these would matter, if the differences caused by each effect could be ascertained. It is the writer's opinion that the suggestion made in the last paper would attain this object, namely that a continuous test on the sample of the explosive should be carried out alongside that on a standard sample, and a comparison made of the results obtained. The continuous tests need not last more than 2 or 3 hours, and tests need only be made every ½ hour. It is suggested, also, that the tests should be done with a nitrous acid indicator in the drop form, as well as with the iodide indicator on paper: in this way a reliable knowledge of the stability of the explosive could be established, for the effect of the various disturbing factors could be ascertained.

The values of the first test are important, because if it is short the explosive contains oxides of nitrogen from previous decomposition, or it shows its instability owing to the change of temperature to which it has been submitted; subsequent tests should make it possible to distinguish between these two sources. A single Abel heat test is doubtless a valuable indication of the stability of the explosive, and it has the advantage of being carried out under conditions very similar to those to which the explosive is normally exposed, and it is easy to carry out; its unreliability however, owing to various influences, is its chief drawback. The writer hopes that this drawback will be removed by his suggestion.

Discussion.

Dr. R. Robertson understood Mr. Egerton to hold that while at some higher temperature (say at that of the Will test) the dominant action was that of decomposition, it was possible at the lower temperature of 80° C. for an equilibrium to be set up between the explosive and its products of decomposition. Apart from the known catalytic effect of these on the explosive heated under dry conditions, it might be recalled that even down to a temperature of 40° C. Vieille had found guncotton to decompose in a continuous and regular manner (Mém. Poudres et Salpêtres, **15**). He gathered that in the apparatus illustrated on the board, less nitrogen had been obtained than might have been expected. That might possibly be due to absorption of nitric peroxide by traces of liquid water in the small space in which the products of decomposition were evolved, for he had found in experiments on the decomposition of guncotton *in vacuo* (J. Chem. Soc., **91**, 772) that this space must always be sufficiently large to prevent the deposition of liquid water, proceeding either from decomposition of the guncotton or constitutionally combined, or possibly oxides of phosphorus may have absorbed some of the oxides of nitrogen. In contact with heated guncotton the oxides of nitrogen were reduced to nitrogen, and the more readily the greater the opportunity for reaction between them and the heated explosive. This reduction, noticeable in the Will test, where the products were carried off in a stream of CO_2, became much more pronounced in a closed space, and might have more bearing on the results obtained in the continuous test with guncotton, than the conception of an equilibrium in an instance where the products were found to exercise a catalytic influence on decomposition and where the decomposition had been followed down to a fairly low temperature.

Mr. W. Macnab said that up to a point the heat test was an extremely useful means of testing explosives, but when it was pushed too far and asked to do too much, he thought one got into an unknown land. On the other hand, work like that of Mr. Egerton and Dr. Robertson was all to the good, and ultimately they would get a clear idea of what the heat test could do.

Mr. Egerton in reply said that, with regard to Dr. Robertson's remarks as to the Will test, he thought those results were not very different in a way from what he (Mr. Egerton) had got. Will in his experiments had mentioned the other irreversible effect, and as Dr. Robertson had said those experiments lasted several years. He had noticed especially with cordites that the results of his continuous tests remained constant for a time and then dropped, then remained constant a bit and dropped. He, the speaker, had never gone on for more than 36 hours even with guncotton; but if one went on long enough he had no doubt the same effect would be observed with guncotton. The apparatus he had shown was evacuated with a pump. The guncotton was admitted and the pump had a phosphorus pentoxide tube in connection with it so that the guncotton was fairly dry. After long heating the guncotton gave off the water of constitution; but he had not seen a sufficient quantity in the tube so he did not think nitrous acid could account for these results. On the other hand, he criticised the apparatus himself and he could improve it for the purpose. The mercury was bound to get left in the burette to a small extent, and of course the mercury would absorb the nitrogen oxide at once. Besides that, there was a small amount of grease in the taps which would take some nitrogen oxide, but he did not think that could account for it all disappearing. Finally, he thanked Sir William Ramsay for allowing him to use the apparatus, which was one of Sir William's masterpieces.

Manchester Section.

Meeting held at the Grand Hotel on Friday, December 5th, 1913.

MR. JULIUS HÜBNER IN THE CHAIR.

THE ACTION OF STRONG NITRIC ACID ON COTTON CELLULOSE.*

BY EDMUND KNECHT AND ADOLF LIPSCHITZ.

The remarkable action of strong nitric acid (68 per cent.) on cellulose appears to have been first noticed by Francis (Chem. Soc. Trans. 1885, 183), who proposed to utilise this action for the toughening of filter papers intended for use in filtering under diminished pressure. In 1893, Horace Koechlin pointed out that cotton on being steeped in strong nitric acid did not undergo any diminution in strength, but that it acquired an affinity for basic colours (rhodamine). He also found that after washing the fibre retained a certain amount of fixed nitrogen. In 1896, one of the present authors showed (Soc. Dyers and Col., **12**, 89) that when bleached cotton is treated with nitric acid of 82° Tw. it contracts considerably, becomes much stronger and evinces a greatly increased affinity for direct cotton colours; no increase in its affinity for methylene blue could, however, be observed. On the other hand it was noticed that the treated cotton showed a marked affinity for some acid colours (*e.g.*, Brilliant Scarlet 2 R. Berlin). It was further shown in 1904 by the same author (Ber., **37**, 549) that the mercerising action of nitric acid on cotton only began at ordinary temperatures at 76° Tw. and that the most suitable strength of the acid for the purpose was 83° Tw. Acid of 62°, 42°, and 22° Tw. was found to exert a tendering action on the fibre. These results were partly corroborated by the researches of Hübner and Pope (this Journal, 1904, **23**, 406), who showed that the amount of benzopurpurin taken up by cotton which had been treated with acid of 65° Tw. was very small as compared with that taken up by cotton which had been treated with acid of 83° Tw.

It was further shown by one of the present authors (l.c.) that the mercerising action was preceded or accompanied by the formation of a labile cellulose nitrate which approximated to the composition $C_6H_{10}O_5.HNO_3$ and which was instantly decomposed by contact with water into nitric acid and cellulose, showing in this respect an analogous behaviour to the phenanthrenequinone nitrate of Kehrmann and Mattisson (Ber., 1902, **35**, 343).

It has been shown by Vieille (Compt. rend., 1882, **95**, 132) and by Häussermann (Z. ges. Schiess- u. Sprengst.-Wesen, 1908, **3**, 121) that by the action of nitric acid of sp. gr. 1·52 on cellulose, actual nitration takes place, with the formation of a nitrate containing as much as 12·65 per cent. of nitrogen, *i.e.*, an amount approximating to that of a fully nitrated product (guncotton).

According to C. Hoitsema (Z. angew. Chem., 1898, 173) it is not possible to obtain a more highly nitrated product than that corresponding to the formula $C_{12}H_{14}O_4(NO_3)_6$, which demands 14·14 per cent. of nitrogen.

According to H. Koechlin, cotton treated with ordinary concentrated nitric acid forms a cellulose dinitrate, and this was corroborated by Knecht (l.c.). It has however, since been ascertained that the amount of fixed nitric acid in the treated cotton is considerably less than that demanded by a dinitrocellulose. The former conclusions of one of the authors were based mainly on the results of nitrogen estimations by the Dumas method, and it is probable that the copper spiral employed was not long enough, for subsequent experiments showed that it is necessary, in the estimation of nitrogen in nitrocelluloses to use a spiral at least three times as long as in ordinary nitrogen estimations, in order to avoid the formation of NO. In all the new experiments, the estimation of the nitrogen was made in the Lunge nitrometer.

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* Excerpt from the dissertation of A. Lipschitz, presented fo the degree of Doctor of Technical Sciences at the Federal Technica High School, Zürich.

In any case the action of strong nitric acid on cotton cellulose is found to take place in two stages. The first and almost instantaneous reaction probably consists in the formation of the labile nitrate. The secondary reaction, which is comparatively slow, consists in the formation of stable nitrates, the nitrogen content of which increases up to a certain maximum and then, by continued contact with the acid, decreases down to a negligible quantity. In this connection it should be mentioned that Chardonnet proposed the use of nitric acid of sp. gr. 1·32 for the denitration of artificial silk (Germ. Pats. Nos. 46, 125, 1888, and 56,655, 1890).

The extent of the action of nitric acid on cellulose depends upon three factors, viz., concentration of the acid, time, and temperature. If the concentration is kept constant, it is found that by increasing the temperature the time required to produce a given result is shortened. Thus, whereas in using an acid of 83° Tw. the maximum of firmly combined nitric acid was obtained after three hours' steeping at a temperature of 31° C., the raising of the temperature in another experiment to 61° resulted in the expulsion of the whole of the nitrogen and the formation of oxycellulose. The properties of this beta oxycellulose are described below.

One of the most characteristic properties of cotton that has undergone treatment with strong nitric acid is its increased affinity for all classes of colouring matters. Of these, methylene blue forms a remarkable exception, and it is for this reason that one of the authors did not find himself in agreement with H. Koechlin, who appears to have used rhodamine as a typical basic dyestuff. In many cases, *e.g.* the direct cotton colours, the mercerising action of the nitric acid is sufficient to account for the increase in the affinity for dyestuffs. In the case of the basic colours, the presence in the fibre substance of the stable nitrate may account for this property, while in other cases again (*e.g.* certain vat dyes and sulphide colours) the oxidising action of the combined nitric acid on the reduced dyestuff is at least a contributory cause to the increased affinity of the fibre for such dyestuffs. Only in the case of acid dyes, such as naphthol yellow, have we been unable to afford any satisfactory explanation from the chemical point of view as to why there should be increased affinity of the mercerised and nitrated cotton.

In connection with the behaviour of mercerised cotton in dyeing a point arises which has never yet received a satisfactory explanation. It is well known that cotton mercerised with caustic soda shows an increased affinity for most colouring matters, and Justin-Müller (Z. Farben-Ind., 1904, **3**, 251), as well as Dreaper (Chem. News, 1904, **90**, 179), have sought to explain this by the assumption that the swelled fibre substance approaches the colloidal condition. If this were the only cause for the increased affinity shown by mercerised cotton for direct colours, mercerisation with caustic soda should give a fibre with a much greater affinity for these colours than mercerising with nitric acid, for the contraction, increase in strength and increase in weight of the air-dried material are much greater in the case of the former reagent. Experience has shown however that exactly the opposite is the case (see also J. Soc. Dyers and Col., 1908, 69) and some other explanation will consequently have to be found for the increased affinity of mercerised cotton for such colouring matters.

In connection with the marked affinity shown by Chardonnet silk for basic colours, it is still a moot point as to what this is due to. It might be caused by the presence in the fibre substance of small quantities of combined nitric or sulphuric acid. On the other hand, Häussermann (Z. ges. Schiess- u. Sprengst.-Wesen, 1906, **1**, 39, 305), maintains that on denitrating the nitrate obtained from cellulose and nitric acid of 1·47 sp. gr., the acid-cellulose of Bumcke and Wolffenstein is formed. Denitrated collodion silk would therefore appear to be of the nature of an acid-cellulose, and this would at least in part account for its affinity for basic colours.

Experimental.

The substance used in the following experiments was a well-bleached two-fold cotton yarn containing only 0·073 per cent. of ash. Mr. C. F. Cross kindly determined the alpha-cellulose in a sample of the material and found this to be 96·6 per cent. The nitric acid employed in all cases was of 83° Tw. strength (sp. gr., 1·415) and the proportion of acid to cotton taken was 100 c.c. of acid to about 5·5 grms. of cotton. After steeping for the required length of time in the acid, the cotton was taken out, well washed in running water until free from acid and was then further examined.

The influence of time was tried at two different temperatures, and the results are given in the following tables:—

TABLE I.

Showing the amount of nitric acid (expressed in terms of nitrogen) which combines with cotton cellulose at –5° C.

No. of exp.	Time.	Per cent. N	No. of exp.	Time.	Per cent. N
1	1 min.	0·0	7	1½ hrs.	0·099
2	5 ,,	0·005	8	2 ,,	0·148
3	12 ,,	0·007	9	2½ ,,	0·244
4	20 ,,	0·018	10	3 ,,	0·314
5	30 ,,	0·012	11	4 ,,	0·416
6	1 hr.	0·084			

TABLE II.

Showing the amount of nitric acid (expressed in terms of nitrogen) which combines with cellulose at 16°—17° C.

No. of exp.	Time.	Per cent. N	No. of exp.	Time.	Per cent. N
1	30 sec.	0·0	13	12 hrs.	2·63
2	5 min.	0·03	14	16 ,,	2·85
3	15 ,,	0·16	15	24 ,,	2·94
4	30 ,,	0·31	16	32 ,,	3·05
5	45 ,,	0·48	17	4 days	2·34
6	1 hr.	0·67	18	7 ,,	0·63
7	1½ ,,	1·19	19	14 ,,	0·543
8	2 ,,	1·46	20	1 month	0·13
9	3 ,,	1·90	21	2 ,,	0·071
10	4 ,,	2·26	22	3 ,,	0·033
11	6 ,,	2·81	23	5 ,,	0·046
12	9 ,,	2·90	24	8 ,,	0·035

The results are also shown in the curves in Figs. 1 and 2. The main line A in Fig. 1 shows the results obtained at the ordinary temperature, while the dotted line B shows those obtained at –5° C. Fig. 2 gives a graphic representation of curve A in Fig. 1, in which a day is taken as unit of time.

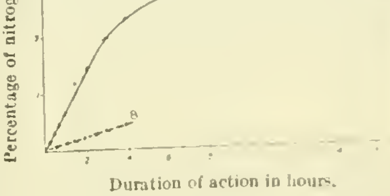


FIG. 1.

The formation of oxycellulose which begins at the same time as the decomposition of the nitrate (denitration) must be accompanied by a corresponding formation of nitrous acid. This was tested for by means of the Griess-Illosvay-Lunge reagent (sulphanilic acid and alpha-naphthylamine, dissolved in acetic acid). After 30 hrs. no trace of nitrous acid could be found, but after 35 hrs. it was found to be present, while after 4 days the amount found was 0·04 grm. (the weight of cotton used in this experiment was 11 grms.). Substances other than oxycellulose are however simultaneously formed, and these are evidently soluble in water, for there is a loss after 7 days' steeping, of 35 per cent. in the weight of the cotton immersed.

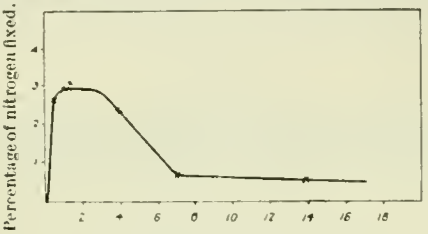


Fig. 2.

The influence of temperature in the nitrating process is as important as that of time and is shown in the following tables, of which Table III. gives the amounts of nitric acid (expressed in terms of nitrogen) taken up at different temperatures during an immersion of 30 seconds' duration.

Table III.

No. of exp.	Temp.	Per cent. N.
1	25·5° C.	0·0
2	33	0·05
3	39	0·11
4	45	0·18
5	60	0·70

Table IV.

Showing the amounts of nitric acid taken up at different temperatures after an immersion of 5 minutes' duration.

No. of exp.	Temp.	Per cent. N.	No. of exp.	Temp.	Per cent. N.
1	15° C.	0·03	5	45° C.	0·39
2	24	0·10	6	60	1·73
3	27	0·19			
4	33	0·32			

Table V.

Showing the amounts of nitric acid taken up at different temperatures after an immersion of 3 hours' duration.

No. of exp.	Temp.	Per cent. N.
1	0·7	0·09
2	4·5	0·48
3	15	1·90
4	19	2·24
5	20	2·30
6	31	2·57
7	34	2·38
8	44	1·48
9	52	0·82
10	61	0·0

The results are shown graphically in Fig. 3.

In relation to the results shown in Table V. it is interesting to note that the highest percentage of combined nitric acid is obtained at 31° C., and that at this point the formation of oxycellulose commences. The first indication of the presence of nitrous acid was obtained after 2 hrs. 30 mins. immersion. In its appearance the fibre had however lost the characteristics of mercerised cotton and had lost much in tensile strength. At 44°, the presence of nitrous acid was evident after 80 mins. immersion and after 2 hrs. 30 mins. the nitric acid showed a yellowish colouration, while the cotton was disintegrated into small fibres. At 61° the formation of oxycellulose was indicated by the appearance after 1 hr. 30 mins. of brown fumes and the resulting oxycellulose, which constituted not more than one-fifth by weight of the original cotton showed the same properties as the product obtained by the action of nitric acid after two months' steeping at the ordinary temperature.

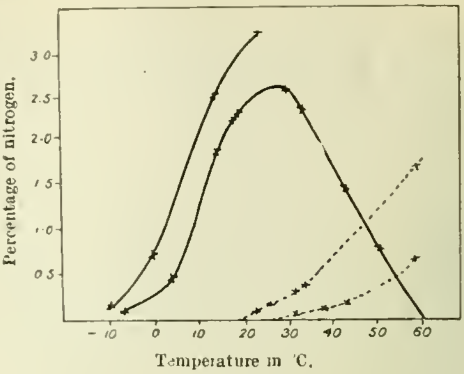


Fig. 3.

Physical properties of the treated cotton.

It has already been shown by one of the authors that cotton yarn after being steeped in nitric acid of 83° Tw. shrinks some 13 per cent. As in the case of caustic soda, the action is very rapid, most of the shrinkage taking place in the first 20 seconds. Generally speaking, the shrinking action is also more marked at low than at more elevated temperatures.

Previous work has shown that the strength of cotton yarn is influenced by steeping in nitric acid of 83° Tw. In the new experiments it is now shown that time and temperature are important factors. Thus, a considerable increase in strength is obtained by steeping for periods up to 15 minutes at the ordinary temperature, but this is not maintained after 30 minutes, and after 32 hours the tensile strength of the treated yarn is less than one third of that of the original. The other results are shown

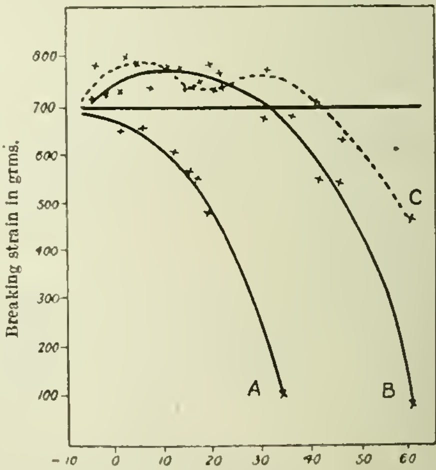


Fig. 4.

in Fig. 4, in which curve A shows the effect of a 3 hours' treatment at different temperatures, curve B the effect of 5 minutes' and curve C that of 30 seconds' treatment.

Cotton yarn which had been steeped in nitric acid for 30 seconds and 3 hours respectively was examined under the microscope in the ordinary way and in section and was compared in this way with the untreated yarn. The result of this examination showed that the effect of nitric acid on the structure of the fibres was very similar to that of strong caustic soda (mercerising).

Chemical properties of the treated cotton.

The ultimate analysis of the product formed by steeping cotton for three hours at the ordinary temperature in nitric acid of 83° Tw. gave the following figures :—

	Per cent.
C	40·23
H	5·91
N	2·14
O	51·72
	100·00

Its behaviour towards acetic, sulphuric and hydrochloric acids does not appear to differ from that of ordinary cotton. In 20 per cent. caustic soda it readily dissolves at the temperature of the water-bath. This reaction is evidently accompanied by a considerable amount of oxidation as about one-third. of the nitric acid originally present in combination with the cellulose was found as nitrous acid in the decomposition products.

It is interesting to note that the product after being denitrated by ammonium sulphide differs from that obtained by the denitration of gun cotton (with 13 per cent. N) in that it is neither soluble in weak nor in concentrated caustic soda.

Treated with N/50 solution of iodine in potassium iodide, the following behaviour was noticed :—

Bleached cotton	Very faint brownish colouration.
Witz's oxycellulose	,, ,, ,, ,,
Hydrocellulose	Slightly more pronounced.
Cotton steeped 40″ in HNO_3	Strong brown colouration.
,, ,, 5′ ,,	Very strong brown colouration.
,, ,, 3 h. ,,	Brown-black
,, ,, 16 h. ,,	Brown-black, but deeper.
Cotton steeped 5′ and denitrated	Strong brown colouration.
,, ,, 3 h. ,,	Very strong brown colouration.
Chardonnet silk	Blue black.
Nitrocellulose (13 per cent. N)	Faint yellow.
Mercerised cotton.	Slightly darker than bleached.

The behaviour of these various products was also studied towards ammoniacal silver nitrate. The reagent was made up as follows :—50 c.c. of a 2 per cent. solution of silver nitrate, 10 c.c. conc. ammonia and 0·5 c.c. of a 5 per cent. solution of caustic soda.

1. Bleached cotton	——
2. Witz's oxycellulose	Yellow.
3. Hydrocellulose	Faintly yellow.
4. Cotton steeped 40″	Turns slowly yellow, then yellowish brown.
5. ,, ,, 5′	
6. ,, ,, 3 h.	Turns slowly yellow, then yellowish brown. Sol. light yellow.
7. ,, ,, 16 h.	
8. Steeped 5′ and denitrated	Brownish colouration.
9. ,, 3 h. ,,	As No. 8, but stronger.
10. Chardonnet silk	,, ,, ,,
11. Nitrocellulose (13 per cent. N)	As No. 5.
12. Mercerised cotton	As No. 3.
13. Sol. of cotton steeped 8 months.	Black.

The product of the action of nitric acid of 83° Tw. on cellulose when tested by Schwalbe's process (Z. angew. Chem., 1910, 23, 924 ; this J., 1910, 688) was found to give a high copper number (31—33 at 20° C.).

Schiff's reagent (Magenta solution decolourised with sulphurous acid) gives a strong red colour with samples of cotton which had been steeped for 40 seconds, 3 hours and 16 hours, and the same behaviour was shown by cotton which had been steeped for 5 minutes and had been subsequently denitrated. From this behaviour, coupled with the fact that cotton steeped for 4 hours gives (with paranitro phenyl hydrazine a yellow colouration ten times deeper that that obtained with ordinary cotton would appear to indicate that treatment with nitric acid imparts to the cellulose the character of an aldehyde. This is all the more remarkable as Lunge and Bébié (Z. angew. Chem., 1901, **14**, 511) state that nitrocellulose prepared by the action of mixed acids is indifferent towards Schiff's reagent. It may be that in the nitrocelluloses formed in the two ways there are constitutional differences.

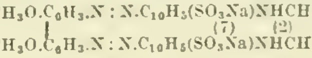
Behaviour towards colouring matters. It was known already to Kuhlmann (Comptes rend. 1856, **42**, 711, and **43**, 900) that a preliminary treatment of cotton with nitric acid increased its affinity for mordant colours. The best results obtained by this author were obtained by steeping the cotton for 20 minutes in nitric acid of 62° Tw. (sp. gr., 1·31). Later, one of the present authors showed that cotton treated with nitric acid of 83° Tw. showed a greatly increased affinity for the direct and for certain acid colours. The behaviour of cotton treated with nitric acid towards benzopurpurin has also been studied and reported upon by Hübner (this Journ., 1907, **91**, 1064), while Grandmougin (Z. Farbenind., 1907, **36**) maintains that by using an acid of 67° Tw. at higher temperatures the affinity for direct colours decreases (possibly through formation of oxycellulose).

Direct colours. The following points are of interest in connection with the increased affinity of the treated cottons towards these colours :—

Benzopurpurin 4B. The affinity for this colour is very strong and gradually increases up to a certain point with the duration of the period of steeping. When this point is reached the amount of colouring matter taken up diminishes, so that after 16 hours' steeping the shade obtained is lighter than that obtained after 3 hours' steeping. This result is probably due to oxidation of the dyestuff by the combined nitric acid. The denitrated product takes up less colouring matter than the nitrated but nevertheless much more than untreated cotton.

Chrysophenin behaves similarly to benzopurpurin, likewise diamine sky blue, though in the latter case there is a material difference in its behaviour towards cotton which has been steeped for 16 hours. The depth of shade obtained in dyeing under this condition is only about half of that obtained on ordinary cotton. This is possibly due to the fact that diamine sky blue is easily destroyed by oxidising agents. In the case of Erika which represents another class of direct cotton colour, the maximum depth was obtained on cotton which had been steeped for 3 hours. The comparative behaviour of this dyestuff towards cotton which had been steeped for 3 hours and had then been denitrated and towards Chardonnet silk is noteworthy in that the latter is only dyed a faint shade while the former dyes about twice as deep as untreated cotton.

In the case of Heliotrope BB, with the formula :—



$$\begin{array}{l} CH_3O.C_6H_3.N : N.C_{10}H_5(SO_3Na)NHCH_3 \\ \quad\;\; | \qquad\qquad\qquad\qquad\qquad (7) \qquad\; (2) \\ CH_3O.C_6H_3.N : N.C_{10}H_5(SO_3Na)NHCH_3 \end{array}$$

there is about the same increase in affinity up to 3 hours' steeping as with other direct colours, but it is noticeable that as nitration proceeds, the shade becomes redder, and this is very pronounced after 16 hours' steeping. This behaviour is analogous to the effect of light on Crystal Violet and may be due to the oxidation of the methyl groups, which are the cause of the blue shade of the original dyestuff.

In the table, it has been attempted to give a rough summary of the results obtained with six typical direct colours. The amounts of colouring matter were not estimated accurately, but were judged by the depth of shade of the dyed patterns. In each case the shade obtained on ordinary cotton is taken as standard or unit, 2 for instance indicating twice the depth of that obtained on ordinary cotton.

Table showing the relative amounts of direct cotton colour taken up in dyeing :—

	Benzopurpurin 4 B.	Chrysophenin.	Diamine Sky Blue.	Erika BN.	Heliotrop BB.	Oxamine Green MN.
Ordinary cotton	1	1	1	1	1	1
Hydrocellulose (HCl)	1·25	1·25	1·25	1·25	1·25	1·25
Oxycellulose (Witz)	0·75	0·5	0·5	0·5	0·5	0·75
Mercerised Cotton	1·5	1·25	1·25	1·25	2	2
Cotton treated for 30 at 15°	3	3	3	3	3	3
,, ,, ,, 5' .. 15°	3	3	3	3	3	3
,, ,, ,, 3h. ,, 15°	3	4	4	4	4	4
,, ,, ,, 3h. ,, 34°	4	4·25	4·25	—	—	—
,, ,, ,, 16h. ,, 15°	2	1·25	0·5	0·75	1	0·75
,, ,, .. 5h. and denitrated.	2	2	2·5	—	—	—
,, ,, ,, 3h. and denitrated.	2	2	2	2	3	3
Chardonnet silk	2	1·25	1	0·5	0·1	1·25

Basic colours. In comparing the behaviour of these colours towards the treated cotton, the dye trials were carried out at the boil for one hour.

Auramine II. is not taken up by cotton steeped for 3 hours and then denitrated in larger amount than by ordinary cotton. This finding is in conformity with that of Hübner and Pope (this Journ., 1903, **22**, 70), in regard to the behaviour of all basic colours towards cotton mercerised with caustic soda. It is remarkable that the amount of Auramine taken up by cotton which has been steeped 21 hours is comparatively greater than with any other basic colour tried ; nevertheless it is not as pronounced as the affinity of Chardonnet silk for this dyestuff. Rhodamine B does not dye Witz's oxycellulose any deeper than it does ordinary cotton ; in other respects it resembles Auramine. It is noteworthy that the steeped and denitrated cotton has even less affinity for Rhodamine than ordinary cotton. Brilliant Green resembles Rhodamine except in its extraordinary affinity for Chardonnet silk. With Safranine and Bismarck Brown the shades become brighter in the presence of combined nitric acid. In both cases, Chardonnet silk is dyed very deep shades. In the case of Methylene Blue. it is characteristic that very little increase in the affinity is shown after steeping even for 3 hours.

The results obtained are shown in the following table :—

	Auramine II.	Safranine FF extra.	Rhodamine B	Bismarck Brown extra.	Brilliant Green extra.	Methylene Blue B.	Spirit Blue.
Untreated cotton	1	1	1	1	1	1	1
Witz's oxycellulose	2	5	1	5	2	5	1·5
Treated 40"	1·5	1·5	1	2	1	1	0·75
,, 5'	1·5	1·5	1	2	1	1	—
,, 3 hrs.	4	2	4	3	4	1·5	3
,, 21 ,,	5	2	4·5	3	4	2	—
,, 5' and denitrated	1	1	0·75	1	0·75	1	—
,, 3 hrs. ,, ,,	1	1	0·75	1	0·75	1	0·5
Chardonnet silk	8	8	3	8 >	10 >	10	—

Acid colours. Kuhlmann observed, as far back as 1856 (Comptes rend., **42**, 711) that by nitrating or by the moderated action of nitric acid, the cotton fibre acquired an affinity for picric acid. We find that by simply steeping for a short time in nitric acid of 83° Tw., no affinity has been produced for this dyestuff. After steeping for at least one hour, the fibre begins to take up picric acid and the amount taken up increases with the time of steeping which was prolonged to 21 hours. It is evident that the presence of the combined nitric acid is the cause of this remarkable behaviour, for denitrated cotton no longer shows any affinity for the dyestuff. Acid Violet 3 BN showed a similar behaviour, but in the other cases, the denitrated cotton still dyed deeper shades with acid dyes than ordinary cotton.

The results are shown in the following table :—

	Picric acid.	Naphthol Yellow S.	Crystal Scarlet 6 R.	Eosin A.	Naphthylamine Black 4 BN.	Acid Violet 3 BN.	Lanacyl Blue R.
Ordinary cotton	1	1	1	1	1	1	1
Witz's oxycellulose	1	1	0·1	1	0·2	0·5	0·1
Cotton steeped 40"	1	2	1	2	2	1	2
,, ,, 5'	1	2	1·5	2	2·5	1	2·5
,, ,, 3 hrs.	5	10	4	4	4	6	3
,, ,, 21 ,,	8	9	3	4	grey-black	6	1
,, ,, 5" denitrated..	1	2	1·5	2	2	1	2
,, ,, 3 hrs. ,, ..	1	2	1·5	2	2·5	1	2·5
Chardonnet silk	1	1	0·1	1	0·5	2	0·0

Sulphide colours. In their behaviour towards ordinary and treated cotton, these dyestuffs behave like the direct colours, and according to the researches of Biltz (Ber., 1905, **38**, 2973) and of Minajeff (Z. Farbenind., 1907, **6**, 313) on the laws of adsorption should be classified as such.

	Katigen-Brilliant Green G.	Thion Yellow G.	Sulphur Brown G.	Immedial Sky Blue.
Ordinary cotton	1	1	1	1
Steeped 40"	2	2	2	2
,, 5'	3	2·5	2	2
,, 3 h.	3	3	2	1·5
,, 16 h.	1·5	2·5	1·5	1·25
,, 3 h. and denitrated	2·5	1·5	1·5	1·75

Saposchnikoff and Minajeff (*ibid.*, 1905, **4**, 81) showed by quantitative experiments that the affinity of cotton mercerised by caustic soda was one and a half times as great as that of ordinary cotton. It is now found that by mercerising with nitric acid, the affinity of cotton for these colours is somewhat more than doubled. Prolonged steeping has, like in many other cases, the effect of diminishing the affinity, and this was found to be especially marked in the case of Immedial Sky Blue, which began to show a decreased affinity even after 3 hours' steeping.

Some typical results are given in the preceding table.

Feydion blue which constitutes, as it were, a link between the sulphide and vat dyes, behaves in a similar manner.

Vat dyes. According to Saposchnikoff and Minajeff (l.c., 1903, 2, 257) mercerised cotton dyed against ordinary cotton in the vat takes up one and a half times as much indigo as the latter. By mercerising with nitric acid and then dyeing in vat dyes, it is found that still larger amounts of colouring matter are taken up than by mercerising with caustic soda. This increase in affinity is evidently due to two causes, one of which is the mercerising *per se*, while the second contributory cause is to be found in the oxidising action of the combined nitric acid in the fibre. (See also Knecht, Journ. Soc. Dyers and Col.)

It is seen, namely, that in dyeing in the vat, especially with indigo and thioindigo red, the dyestuff and not its leuco compound is fixed *in the vat*. Algol Red B forms an exception to the general behaviour of the vat dyes tried, in that it falls off considerably in intensity on cotton which has been steeped for 3 hours. The results are shown in the following table :—

	Ciba Scarlet G.	Algol Red B.	Helindone Red B.	Helindone Blue BB.	Indanthrene S.	Indigo.	Thioindigo Red B.
Ordinary cotton	1	1	1	1	1	1	1
Witz's oxycellulose	0·75	0·75	0·75	0·75	1	1	1
Cotton steeped 40″	2	2·5	2·5	2·5	2	3	2·5
,, ,, 5′	2·5	2·5	2·5	2·5	2·2	3·5	3
,, ,, 3 hrs.	3	0·9	3	3·5	1·8	6	4
,, ,, 16 ,,	3	0·9	3	3	1·7	10	5
,, ,, 3 hrs. and denitrated	2	2	2	2	2	1·5	1·5

Some further experiments were done in the case of indigo with a view to ascertain the strength of acid which would give the best results. To this end bleached calico was spotted with nitric acid of different strengths, washed and then dyed in the vat. It was thus found that the action only began with acid of 80° Tw. (sp. gr. 1·4) and increased up to 86° Tw. (sp. gr. 1·43) beyond which strength the experiments were not continued. This mode of experimenting may, however, be open to an objection in that the amount of acid being limited, it is diluted by the natural moisture in the cotton.

The colours obtained on cotton treated with nitric acid show the same fastness to light, rubbing and washing as those obtained on untreated cotton.

Aniline Black. A copper black dyed in a full shade on cotton which had been steeped in nitric acid for 3 hours showed a red shade, but by previously denitrating the cotton, this did not occur. If, however, the Aniline Black liquor was used more dilute, so as to yield only a thin black on ordinary cotton after ageing and chroming, it was found that the nitric acid treated cotton yielded only a dirty grey and this is probably due to excessive oxidation of the aniline by the chlorate present in the liquor on the one hand and the combined nitric acid in the fibre on the other.

Tannic acid. Previous experiments have shown (Knecht and Kershaw, this Journ., 1892, **11**, 129, and Saposchnikoff and Minajeff, Z. Farbenind., 1904, **3**, 164) that cotton mercerised with caustic soda takes up one and a half times as much tannic acid as ordinary cotton. It is now found that towards cotton mercerised with nitric acid (steeping 40 seconds) tannic acid shows at least twice the affinity as towards ordinary cotton. With cotton steeped for 3 hours there is a decrease in the amount of tannic acid fixed, but this is evidently due to destruction by oxidation as denitration of the cotton caused it to take up more tannin again.

DISCUSSION.

Mr. **William Thomson** asked whether, in denitrating cotton, the nitro-compound went into solution, as he understood the author to state that nitrated cotton lost considerably in weight by the process. What was the nature of the solution of the partially nitrated cotton in caustic soda? He had treated filter paper with sulphuric acid, and afterwards exhausted the paper thoroughly with water, and determined the amount of acid remaining in the paper. He found on each occasion he did not get the quantity of acid from the paper which was originally put into it, the presumption being that the acid remained in combination with the cellulose.

Dr. **G. J. Fowler** inquired whether Professor Knecht had made special experiments as to the degree of nitration best adapted for fixing acid dyes on cotton, whether he had any theory as to the action which took place; further, if he had tried any other reducing agents than ammonium sulphide, and if there was any likelihood of other reagents being effective. It was known to be possible to decompose cellulose by organisms, both in the presence and in the absence of nitrates, and it was a matter for enquiry as to whether nitrated cellulose could be fermented by itself and what the action would be. He was aware Professor Knecht had experimented on the action of enzymes on cellulose, and would like to learn whether he had incidentally tried the action of enyzmes or of bacterial ferments on nitrated products.

Dr. **H. Levinstein** asked whether the dye tests were made cold or hot. He would imagine from the appearance of the direct dyestuffs they were dyed cold. Had Professor Knecht made a comparative washing test of the Acid Violet on what he called "animalised cellulose" and on ordinary animal fibre. It would be interesting to know whether Acid Violet was fixed on the nitrated cellulose with the same tenacity it was fixed on wool.

Dr. **M. Wyler** asked what was the special lightfastness of treated and untreated cotton dyes.

Mr. **Hübner** enquired as to the relationship of the fastness of an acid colour and eosine, as in the case of an eosine some light would be thrown upon the problem of dyeing. He also asked whether any experiments had been made by viewing the fibres in polarised light. He believed the late Mr. Guttmann had first drawn attention to the difference between guncotton and ordinary cotton when examined in polarised light.

Mr. **L. E. Vlies** asked whether Professor Knecht had observed any increased resistance to weak mineral acids of cotton treated with nitric acid, and if so what was the best strength of nitric acid and temperature to use. This information would be valuable in connection with the treatment of cotton filter cloths with mixed acids, or nitric acid alone, to give resistance to the action of weak, hot, mineral acids.

Mr. **R. des F. Shepherd** enquired whether the nitrated cellulose was inflammable.

Dr. **T. J. I. Craig** asked whether nitrated cotton behaved differently to unnitrated cotton with regard to stripping agents; also had Professor Knecht any information regarding the action of nitric acid on artificial silk, and had it the same effect upon the strength of the silk as it had upon that of the cotton.

Professor **E. Knecht**, in reply, stated he was not in a position to say what became of the nitro-compound when it went into solution. He did not think a certain amount of the fibre dissolved in water as a nitrate. The question had been partly studied by Berl, who, in the course of his investigations on the action of caustic soda on guncotton obtained a most complicated mixture of acids, some nitrogenous and some not nitrogenous, but nearly all belonging to the fatty series. The whole molecular complex was broken up when this treatment was carried out hot: but if guncotton was treated with cold caustic soda, then some soluble nitro acids were obtained, which were precipitated by acids from the solution. He was very much interested in Mr. Thomson's experiment with filter paper treated by sulphuric acid. The point had recently been investigated by Heermann, who sought to show that Chardonnet silk contained combined sulphuric acid. He, personally, did not feel quite satisfied upon the point, that esters did actually exist in a fibre like Chardonnet silk. He had not put forward the processes described in the paper as actually of commercial value. He had not gone systematically into the question of the best temperature for fixing acid dyes on cotton. In the majority of cases there was a considerably increased affinity for colouring matter, the main cause being the mercerisation. Naphthol Yellow, which could be taken as a typical acid dye, gave a very strong shade. Cotton mercerised with nitric acid showed a much stronger affinity for colouring matters than cotton mercerised with caustic soda. As yet there was no explanation for the increased affinity of ordinary mercerised cotton, and he was equally unable to offer an explanation for the behaviour of cotton mercerised with nitric acid. There was no doubt that combined nitric acid in many cases was a contributory factor to the absorption of colouring matter. This was evidently the case with the basic and the sulphide colours, and particularly with the vat dyes, where the oxidising action of the combined nitric acid made itself evident in fixing the larger proportion. He took it, it was similar to the increased affinity shown by cotton dyed Manganese Bronze for vat dyes. It was known that if cotton were dyed Manganese Bronze, and then dyed with indigo or other vat dyes, it took up a very much larger percentage of colouring matter. He had gone into the question of reducing agents referred to by Dr. Fowler, and had tried all sorts of reducing agents to reduce the nitric acid in cellulose, but had not found anything which would take the place of ammonium sulphide, though perhaps sodium sulphide would act in the same way. He had tried hydrosulphite of soda, both in the presence of a little caustic soda or in the presence of ammonia, with the result that in either case it rotted the fibre and did not denitrate it. This was remarkable as hydrosulphite was known to possess in other respects a far more powerful reducing action than ammonium sulphide. Stannite of soda was without action. He had not gone into the question, but he thought that it would be very interesting to ascertain whether either the nitrated or the denitrated product was capable of undergoing any process of fermentation. The specimen cotton hanks exhibited were treated quite roughly at a boiling temperature, except the vat dyes, which were treated cold. He was somewhat afraid the experiments rather complicated the theory of dyeing for he was quite at a loss to explain certain of the phenomena observed. With regard to comparative washing tests of Acid Violet on nitrated cotton and on wool, it had been shown that the colour was not so fast as in the case of wool. He had not made any test with regard to the fastness to light of the colours, not having thought the process of any technical value. He was, however, very glad the suggestion had been made and would make some trials. He had not made any experiment with regard to eosine and Acid Violet, nor with regard to polarised light, although the latter test was apparently quicker and more reliable than a determination of the nitrogen in the nitrometer. They had made some general tests as to the effect of weak mineral acids on the product, and there was not much difference between the nitrated product and ordinary cotton. He was of opinion that in order to obtain an acid-proof fibre it would be necessary to nitrate very much higher than he had done. The inflammability of the material was not greater than that of ordinary cotton. In reply to Mr. Craig, he had not tried the action of stripping agents on colours dyed on the nitrated cotton, but he imagined it would require a larger amount of stripping agent to strip colours from nitrated cotton than from ordinary cotton.

Scottish Section.

Meeting held at Glasgow on Tuesday, November 25th, 1913.

DR. THOMAS EWAN IN THE CHAIR.

THE COMPOSITION AND AGRICULTURAL VALUE OF CARBONATE OF LIME FROM CAUSTICISING PLANT.

BY JAMES HENDRICK, B.SC., F.I.C.

In the aggregate enormous quantities of carbonate of lime from causticising plant are produced and allowed to go to waste. There are, I understand, about 58 paper mills in Scotland alone, most of which have causticising plant. The production by these of waste carbonate of lime, dry, is probably not less than 20,000 tons per annum. In the case of works known to the writer there are dump heaps containing thousands of tons of this substance, while in other cases expense is incurred in carting it to hollows which are filled up with it and other waste of the works. Occasionally it is got rid of by running it into a river or other watercourse.

Much burnt lime and carbonate of lime are used for agricultural purposes, and much more ought to be used. Formerly lime, both in the form of burnt lime and carbonate of lime, was used to a far greater extent than at present. For a variety of reasons the use of lime began to fall off about 40 years ago, and between 1870 and 1900 the practice of liming became almost non-existent over a great part of Scotland. Since 1900 liming has been increasing again, but only to a limited and partial extent, and one may say that over large parts of Scotland farmers have been living, so far as lime is concerned, on the capital laid up in the soil by their predecessors. With the gradual exhaustion of the store of available lime the soil is becoming sour, and various evils, such as weeds which are favoured by sour, lime-deficient soils, and the disease of finger and toe in turnips, are becoming more prevalent.

It has been shown by drainage experiments that every cultivated soil is constantly losing lime. Hall and Miller * have estimated that the loss of lime in the drainage of unmanured plots at the Rothamsted Experiment Station is equal to 1000 lb. of carbonate of lime per acre per annum. The loss is greater from manured plots. Similar results have been obtained on the Continent, where Creydt † and his co-workers estimated from drainage experiments on a cultivated and manured field that the loss of lime in the drainage was 630 kilos. of CaO per hectare, which is almost exactly 1000 lb. of carbonate of lime per acre.

It is estimated that the average loss per acre per annum throughout England and Wales is not less than 500 lb. of carbonate of lime. If we take it at this figure for Scotland also, and for cultivated and manured land, it is probable that this is an under-estimate: at least 500 lb. of carbonate of lime, or 280 lb. of quicklime, per acre per annum should be applied to all cultivated land. In other words, at least 1 ton of commercial burnt lime of good quality or 1¾ tons of good quality chalk or ground limestone, should be applied once in seven years merely to maintain the lime of the soil. Only a fraction of this amount is used at present.

For many purposes at any rate it is safer and better to use carbonate of lime than to use burnt lime. Formerly great quantities of soft chalks, marls, shell sands, and other easily friable forms of carbonate of lime were applied to the soil, and in recent years a considerable amount of hard limestone rock has been ground for application to the soil as "ground limestone." While expense is thus being incurred in grinding limestone to a comparatively coarse powder, the very fine precipitated carbonate of lime of causticising plant, which is specially valuable on account of its very great fineness of division, is being thrown away.

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* "The Effects of Plant Growth and of Manures upon the Retention of Bases by the Soil." Proc. Roy. Soc., 1905, **77**, B 1—32. (This J., 1906, 34.)

† Creydt, C. v. Seelhorst and Wilms, Jour. Landw., 1901, **49**, 251.

Samples of the waste carbonate of lime as it comes from the dump heaps of different paper works were obtained, and analyses of a number of these are shown in Table I.

TABLE I.

Analyses of Wet Waste Carbonate of Lime.

	I.	II.	III.	IV.	V.
	Inverurie.	Inverurie.	Culter.	Culter.	Stoney-wood.
	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture ...	49·64	47·84	38·29	47·97	43·78
Carbonate of lime	37·31	44·04	51·93	45·64	49·91
Lime in other forms	9·35	3·30	0·87	0·32	6·80
Alkalinity (as NaOH) ..	8·25	2·89	2·24	1·61	3·65
Silica	0·64	2·15	2·86	2·78	1·70

Nos. I., II. and V.: The alkalinity was due to free lime.
Nos. III. and IV.: The alkalinity was due to carbonate of oda and caustic soda. There was no free alkaline lime.

The amount of moisture in, and the composition of these samples, vary somewhat according to the nature of the process used, and the methods used in removing the carbonate of lime from the caustic lye. In some works the process is comparatively crude and rough, while in others it is carried out with greater precision and with more perfect appliances. In crude samples the moisture is nearly 50 per cent., but in samples which have been well drained or treated in a vacuum filtering apparatus, it is considerably less than 50 per cent.

Several paper works known to the writer have for years offered this substance free of charge to farmers who will take it away, but in no case has any substantial quantity been taken. The objection seems to be that it is sticky and difficult to spread when wet. Further, farmers are unfamiliar with it, and are very doubtful if it is of any value at all. It is quite possible to use it in the undried state, and much of it might be used in this way by farmers in the neighbourhood of paper works, for if it is scattered about in lumps and left exposed for a short time to dry weather or to frost, it readily falls to powder and can then be spread. Where it has to be carried any considerable distance before use it will probably be found better to dry it.

It is easily dried by artificial means, and at the suggestion of the writer some paper works have experimented on drying it, and one at least is now drying it on a large scale and is selling it to farmers in this state at a price sufficient to cover the costs of drying and marketing. Even if nothing more is obtained, this is a saving as compared with incurring expense merely to dispose of it as a waste product. When dried, it is more easily disposed of to farmers, and the firm in question has got rid of hundreds of tons during the past few years.

Table II. gives analyses of a number of dried samples obtained from different sources.

TABLE II.

Analyses of Dried Waste Limes.

	I.	II.	III.	IV.	V.
	per cent.	per cent.	per cent.	per cent.	per cent.
oisture	4·02	1·23	12·27	9·51	13·48
arbonate of lime	66·50	88·33	68·08	60·84	74·20
me in other forms	13·89	3·48	3·74	11·60	1·45
kalinity (as NaOH)	16·08	0·63	4·37	6·76	0·92
ica	2·40	1·65	3·48	2·48	4·97

No. I. contained alkaline lime equal to 11·26 per cent. CaO; ual to 14·87 per cent. $Ca(OH)_2$, and practically no soda.
No. II. contained no free alkaline lime, and very little soda.
Nos. III. and V.: The alkalinity was due to soda and carbonate soda.
No. IV.: Like No. I., contained much alkaline lime.

In addition to carbonate of lime, which is the chief substance present, and which may constitute upwards of 90 per cent. of a well-dried sample, there are smaller quantities of other substances present. The material is sometimes very alkaline, in other cases very little alkalinity is exhibited (Nos. II. and V., Table II.). In some cases the alkalinity is due to alkaline lime (Nos. I., II., and V., Table I.; and Nos. I and IV., Table II.), which shows that considerable excess of lime had been added in the causticising tanks. In other cases the alkalinity is due to the presence of sodium hydroxide and sodium carbonate (Nos. III. and IV., Table I.; and No. III., Table II.), which indicates that the soda lye had not been efficiently drained from the precipitated lime. There is always a small quantity of silica present, chiefly as silicate of lime, and some organic matter. On the whole, however, the dried samples contain as much available lime, as carbonate of lime and hydrate of lime, as is contained in ordinary commercial ground limestone, and they contain more than half as much available lime as is contained in ordinary commercial burnt lime. By "available lime" is meant lime available to neutralise acids, and therefore in a form which will be of use for the purposes for which lime is needed in the soil.

Field Experiments.—The field experiments carried out by the writer with paper works waste lime were not undertaken primarily to determine the value of this substance for field use. Their main object was to demonstrate the value of lime as a remedial agent in combating the disease of finger and toe in turnips. At the outset the writer was inclined to the common view that burnt lime is far more effective for the object in view than carbonate of lime. The paper works carbonate of lime was included among the different kinds of lime used, as it was a waste product extensively produced locally, the value of which it was thought it might be worth while to test in comparison with other forms of lime more generally used by farmers. Further study of the subject has shown that one of the principal reasons which led to the general use of burnt lime in agriculture was that such lime can readily be brought into a fine state of division by slaking and can thus be thoroughly incorporated with the soil. Another important reason for the use of burnt lime was that carriage was saved by its use. In former days, before means of transport were developed to the present extent, this was a consideration of even more importance than at present. In course of time it has been forgotten that these were the main reasons for the adoption of the use of burnt lime in agriculture and not any essential superiority for most agricultural purposes of calcium oxide or calcium hydrate over calcium carbonate. If we look back to the agricultural records of the first half of the nineteenth century we find that wherever soft chalks, marls, or shell sands could be obtained, they were used extensively in the surrounding districts without being burnt to quicklime, but on the other hand, where only hard limestone rock could be obtained or where lime had to be carried from a distance, burnt lime was used. There is little doubt that for nearly all purposes carbonate of lime is, weight for weight of lime, as valuable as burnt lime, and that on certain soils and under certain conditions carbonate of lime is a safer and better substance to apply to the soil than quicklime. The results of the four experiments described below are in favour of this view.

These experiments are only part of a series which is at present in progress, and they are very incomplete. Such experiments should be carried out not for one or two years only but over a considerable period of years, so as to cover more than one rotation of crops on the same land. But it is very difficult to arrange this except on an experimental farm, and till now this has not been available to the writer. When carried out on the lands of private persons, and especially of tenant farmers, for obvious reasons it is generally impossible to have the experiment continued for more than a short period.

In some of the experiments mentioned below the lime was applied only a few months before the turnips were drilled. It would have been better had it been possible to commence the liming at least a year or two before the land came into turnips. Also had one had complete control of the land and been able to keep in view merely the experiment without considering the natural wish of the farmer not to risk the loss of a crop, much larger quantities of lime would have been applied to some of the plots than were applied. Experiments covering all these points are at present in progress; meantime the results already obtained are quoted because they illustrate the value of paper works waste lime.

Field experiments suffer from the disadvantage that the probable error of a single experiment is very great. In measuring differences, therefore, which are not very great it is necessary to repeat the experiment over and over again on a large number of plots in order to obtain significant figures. In the experiments here described the differences found in the incidence of disease and also in the weight of crop obtained are so great that the figures may safely be regarded as significant.

The experiments were carried out on soils which were known to be badly infected with finger and toe, and on which the turnip crop had been seriously injured by the ravages of the disease the last time the land was under turnips. In all four cases samples of the soil were taken for analysis, and in every case it was found that the soil was distinctly acid in its reaction to litmus paper. Analyses of the soils were made, and among other things the percentages of lime were determined which could be extracted from each by digestion with strong hydrochloric acid, and by treatment with cold 1 per cent. citric acid, according to Dyer's method, respectively. The results are shown in the table below.

TABLE III.

Amount of Lime (CaO) found in the Soils.

	Kinmundy.	Greenhowe.	Barra.	Blackhills.
Extraction with hydrochloric acid	0·70	0·61	1·72	0·62
Extraction with 1 per cent. citric acid	0·163	0·225	0·125	0·246

Although all these soils were found to contain an appreciable quantity of lime soluble even in weak citric acid, it does not follow that they contained any carbonate of lime. As they were all found to be acid in reaction the presumption is that they contained little, if any, carbonate of lime. They were therefore tested by a modification of the method of Amos and Marr.* In this modification the soil is not heated with acid, but air freed from carbon dioxide is drawn through it for several hours after addition of an excess of hydrochloric acid and the carbon dioxide estimated by Brown and Escombe's double titration method after absorption in a Reiset Tower. This method when used with suitable precautions is capable of estimating carbonate equal to less than 0·05 per cent. stated as carbonate of lime in 20 grams of soil. It does not of course follow that if carbonate is found it is necessarily present as carbonate of lime, but it is usual to estimate it as such.

In the case of all four soils no appreciable amount of carbonate could be detected. The titration never differed from the blank, which was always carried on alongside, by more than 0·1 c.c. of the $N/10$ HCl used. This is well within the probable error of experiment for the method.

The first experiment was carried out at Kinmundy where the soil is a good rich loam and carries heavy crops, but when previously in turnips the crop was almost completely destroyed by disease. Two varieties of turnips were grown on the plots; Challenger Green Top Yellow, and a Purple Top Yellow. The purple top variety was known to be very liable to disease.

Waste carbonate of lime from two different paper works, marked I. and II. in the table, was used. It was applied at the rate of 4 tons per acre. To another plot "shell lime" was applied at the rate of 2 tons per acre. All the lime was applied in January about 5 months before the turnips were sown. Four tons of paper works lime was taken as a standard dressing in these experiments, while 2 tons of shell lime of good quality, which contains about the same amount of available CaO as 4 tons of paper works lime, was taken as the standard dressing of this substance for purposes of comparison.

The weights of turnips per acre obtained on the different plots are shown in Table IV.

TABLE IV.

Finger and Toe Experiment: Kinmundy.

Variety (A) Challenger Green Top Yellow. Variety (B) Purple Top Yellow.

		No lime.		Waste carbonate of lime. 4 tons per acre.				Shell lime. 2 tons per acre.	
				I.		II.			
		tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Weight of turnips per acre	(A)	20	10	22	10	22	16	21	19
	(B)	10	11	13	1	13	1	13	1
Increase over no lime	(A)	—		2	0	2	6	1	9
	(B)	—		2	10	2	10	2	10

As the table shows considerable increases of crop were obtained from the use of each kind of lime and on each variety of turnips.

It was found that in spite of the liming the purple top turnips were very badly diseased on all the plots, while the green tops were affected to only a comparatively slight extent. This accounts for the great differences in weight between the two varieties. Up to a certain point they seemed to be equally vigorous. Had they been weighed early in the season instead of in December, it is probable that the purple tops would have given weights quite as great as the green tops, but after a certain point they went down rapidly with disease, and at the time of weighing there was hardly a turnip of this variety on any of the plots which was not more or less attacked. At the same time there was a great difference between the disease on the limed and on the unlimed plots. There were far more turnips which were only slightly diseased on the limec than on the unlimed plots.

An attempt was made to estimate the incidence of th disease, but the methods adopted were too crude to giv results of value except in so far as they taught us tha better but more laborious methods would have to b adopted in succeeding experiments. In the experiment which follow the incidence of disease was estimated by th extremely laborious method of lifting individually and a once examining on the field a large number of bulbs fror each plot, and dividing these into three classes:—

(A) *Badly diseased*, or those in which the bulb was cithe completely or badly rotted by the disease;

(B) *Slightly diseased*, where either the bulb was nc touched by the disease which was confined to the root or where the bulb, if attacked, was not rotted by tl disease;

(C) *Sound*, where no disease was noticed.

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* Jour. of Agr. Science, 1905, I., 322, and 1909 III., 155.

It does not follow that bulbs classed as "sound" were quite free from disease. In pulling the bulbs many of the roots were left in the ground, and if the disease was confined to these it would not be noticed. The number of bulbs examined on each plot always amounted to several hundreds. These were taken up in lots of one hundred each along one drill, and the lots were systematically distributed over the plot so as to give as fair an average as possible.

In this method the disease is estimated not by weighing but by counting. Many of the bulbs in the badly diseased class were so far gone with disease that they were not fit to be weighed at all in estimating the crop by weight.

The result of this first experiment showed that the amount of lime applied was not sufficient on this soil to control the disease in the case of a susceptible variety like the purple tops, though in the case of both varieties it certainly diminished disease and increased the weight of crop.

The second experiment was carried out at Greenhowe on a poor, shallow, mossy loam, with pan beneath. The soil was distinctly acid, and infested with such weeds as are found on sour soils. The crop suffered considerably from drought as well as from the bad condition of the land. Gas lime at the rate of 2 tons per acre was used in this experiment as well as paper works carbonate of lime and shell lime. The lime was not applied directly to the turnip crop but early in the previous year before a crop of oats. Table V. shows the weight of crop per acre, and the incidence of disease on the different plots.

In every case the liming greatly increased the weight of crop, and in the case of paper works lime and shell lime, greatly diminished the amount of disease. The plot which was dressed with paper works lime was almost free from badly diseased roots, while that which received shell lime had the badly diseased reduced from over 20 per cent. to under 5 per cent. This plot was perhaps hardly fairly treated with regard to weight of crop per acre. The crop on it suffered most from drought and probably it was the thinnest soil. The dressing of gas lime, though it increased the weight of crop considerably, did not diminish the disease very much.

The third experiment was carried out on a good, fairly deep loam at Barra. This soil yields good crops, but was rotten with disease when previously in turnips. The lime was applied in February, only three months before the turnips were sown. Waste lime from two different paper works was used as well as shell lime and gas lime. The results, both as to weight per acre and incidence of disease, are shown in Table V.

As in the last experiment any form of lime increases he crop and diminishes the disease, but, just as at Greenowe, waste lime from paper works does better than either shell lime or gas lime, especially in diminishing disease. One sample of waste lime gave a better result both as to weight of crop and as to diminution of disease than the other. While the differences are not great enough to be treated as significant in the case of single plots, it is interesting to notice that the plot which gave the better result was treated with a waste lime containing a distinct amount of soda (Analysis III., Table II.). This indicates, at least, that the presence of soda was not injurious in the quantity here used. There was at first some hesitation in using this lime as it was feared that the soda might be injurious to the crop.

The fourth experiment was carried out on a somewhat peaty loam at Blackhills. The soil was considered a fairly good one, but was not in very good condition, and the previous turnip crop had been very badly diseased. The soil was quite acid in reaction and badly infested with such weeds as rejoice in a sour soil. Paper works waste lime, lime shells, and gas lime were all used as before. All these forms of lime were applied only two months before the turnip seed was sown. The results in this case were very curious, as none of the dressings of lime had any distinct effect in diminishing the disease or increasing the crop. The results tabulated in the usual form are shown in Table VI.

The differences in weight of crop and in amount of disease shown in this table from the use of lime, are of a quite different order from those shown in Tables V. and VI. In order to find the reason for this anomalous result, the soil from the limed plots was examined, and it was found that on this peaty soil the amount of lime used was not sufficient to neutralise the acidity. The limed soils were still acid to litmus paper. A representative sample taken from the plot which had been dressed with paper works lime was analysed. It yielded to extraction by strong hydrochloric acid 0·78 per cent. of CaO, and to extraction by 1 per cent. citric acid 0·34 per cent. of CaO. As might be expected, these figures are both somewhat greater than those given by the untreated soil (Table III.), but the lime was not present as carbonate of lime. When tested by the method described above no carbonate of lime was found: 20 grams of soil yielded the same result as the blank determination.

The soil sample was taken to a depth of 9 inches. There are roughly speaking about 1000 tons of soil on an acre to a depth of 9 inches. The paper works lime used contained 74·2 per cent. of calcium carbonate (V., Table II.), therefore about 0·3 per cent. of calcium carbonate had been added to the soil. As none was found the whole of this had been neutralised by the soil acids, and the soil still remained sour to litmus paper. It is evident that on this soil much more lime was needed to produce a result. It is proposed to make further investigations on this soil.

TABLE V.

Finger and Toe Experiment: Greenhowe and Barra.

	No lime.	Waste carbonate of lime.		Shell lime.		Gas lime.	
		4 tons per acre. I.	4 tons per acre. II.	1 ton per acre.	2 tons per acre.	2 tons per acre.	4 tons per acre.
GREENHOWE:—	tons cwt.	tons cwt.	tons cwt.	tons cwt.	tons cwt.	tons cwt.	tons cwt.
Weight of bulbs .... per acre	7 5	12 16	—	9 2	—	11 19	—
Increase over no lime	—	5 11	—	1 17	—	4 14	—
Sound turnips .... per cent.	42·5	70·0	—	61·5	—	47·0	—
Slightly diseased .... per cent.	37·0	29·0	—	34·0	—	39·8	—
Badly diseased .... per cent.	20·5	1·0	—	4·5	—	13·2	—
BARRA:—	tons cwt.	tons cwt.	tons cwt.	tons cwt.	tons cwt.	tons cwt.	tons cwt.
Weight of bulbs .... per acre	12 8	15 5	17 5	—	13 6	15 15	16 10
ncrease over no lime	—	2 17	4 17	—	0 18	3 7	4 2
ound turnips .... per cent.	41·8	72·2	82·6	—	60·6	59·1	58·6
lightly diseased .... per cent.	36·0	18·5	14·4	—	24·6	28·0	24·0
adly diseased .... per cent.	22·2	9·3	3·0	—	14·8	12·9	17·4

TABLE VI.

Finger and Toe Experiment · Blackhills.

	No lime.	Waste carbonate of lime. 4 tons per acre.	Shell lime. 2 tons per acre.	Gas lime. 4 tons per acre.
	tons cwt.	tons cwt.	tons cwt.	tons cwt.
Weight of bulbs .... per acre	18 8	19 12	19 5	18 6
Increase over no lime	—	1 4	0 17	—
Sound turnips .... per cent.	26·1	19·1	25·3	36·6
Slightly diseased .... per cent.	69·7	75·5	72·6	58·7
Badly diseased .... per cent.	4·2	5·4	2·1	4·7

The foregoing results are, as already indicated, incomplete, but so far as they go they show that for, at any rate, certain soils paper works waste carbonate of lime is at least as effective as the other forms of lime in ordinary use. As great quantities of this by-product are at present being wasted, it seemed to be desirable to publish these early results, for it will be to the interests both of agriculture and of the paper makers if this waste lime is used for application to the soil.

Journal and Patent Literature.

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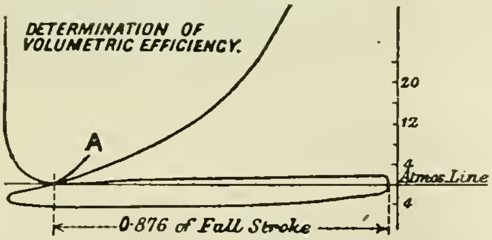
I.—GENERAL PLANT; MACHINERY.

Internal-combustion engines; Commercial tests of ——. W. A. Tookey. Engineering, 1914, **97**, 129—132.

THE author has made 763 tests of gas engines of various makes and sizes as found in actual use by consumers. In 66 per cent. of the cases, the working was improved by adjusting the gas and air supplies, the ignition and the valve-setting. The average increase in the power obtained at each impulse was 27 per cent., and the average reduction in the consumption of gas per indicated horse-power per hour was 13·3 per cent. The method of testing recommended consists in taking indicator diagrams, including diagrams with light spring, and observing the number of impulses and the gas consumption per min. On the light-spring diagram (see Fig.), the point, A, where the compression line crosses the atmospheric line, gives the "volumetric efficiency," which is multiplied by the piston displacement in order to find the "effective piston displacement." It is assumed that the compression curve follows the law $\frac{P_1}{P_2}=\left(\frac{V_1}{V_2}\right)^{1\cdot3}$, and from the observed compression pressure P_2, the ratio of V_1 (the cylinder volume corresponding to point, A, in the figure) to V_2, the clearance volume, is at once obtained. The clearance volume, V_2, is then equal to the effective piston displacement divided by $\left(\frac{V_1}{V_2}-1\right)$, and the total cylinder volume at the point, A, is equal to the clearance volume added to the effective piston displacement. This volume, divided into the volume of gas used per impulse, as shown by the meter, and multiplied by the calorific value of the gas, gives the "mixture strength," *i.e.*, the number of British thermal units per cb. ft. of the actual mixture of gas, air, and exhaust gases which is present in the cylinder at the point, A. The factor $\frac{\text{mean pressure of diagram}}{\text{mixture strength}}$ affords a valuable test of the working of an engine. A factor of 2·4 is considered very satisfactory.—A. T. L.



PATENTS.

Mills for grinding, crushing, pulverising, separating, or mixing materials. E. Allen and Co., Ltd., Sheffield, H. Grey, Rotherham, and L. D Parker, Sheffield. Eng. Pat. 5069, Feb. 28, 1913.

A SERIES of large and small balls are arranged in a revolving circular track and are kept in position by an overhanging segmental stationary track which carries a series of scoops. The material is fed into the track and the finely-ground material is forced outwards and upwards by centrifugal force and directed upwards under the guidance of the scoops, to a fan driven by the same shaft as the track, but at a higher speed. The fan, the indraught to which is regulated by an adjustable circumferential damper, discharges the finely ground portion of the material through annular discharge openings and allows the coarser portions to return to the grinding channel. —W. H. C.

Evaporating apparatus for liquids. Farbenfabr. vorm. F Bayer und Co., Leverkusen, Germany. Eng. Pat 15,624, July 7, 1913. Under Int. Conv., Feb. 18, 1913

IN evaporating apparatus working under a high vacuum the boiling points of the upper and lower layers of liqui differ greatly if the depth of liquid is considerable. Thi defect is avoided in the apparatus claimed, in which number of slightly inclined boiling tubes pass across steam space and are provided at the ends with sma chambers or pockets having vapour-escape openings a the top and overflow pipes at the bottom leading to the tubes arranged next below, the depth of the overflow pipes being such that the depth of the liquid to be evaporated cannot exceed the diameter of the boiling tubes. —H. H.

Evaporating apparatus. D. Cozzolins, San Diego, Cal. U.S. Pat. 1,082,411, Dec. 23, 1913.

A steam-jacketed evaporating vessel has a number of frames or grids fixed within the upper part, from which weighted sheets of fabric hang down into the liquid and expose a large surface from which evaporation takes place.—W. H. C.

Desiccating ; Apparatus and process for——. L. C. Merrell, Assignor to Merrell-Soule Co., Syracuse, N.Y. U.S. Pats. 1,082,468 and 1,082,469, Dec. 23, 1913.

The liquid to be desiccated is introduced periodically in the form of spray into a chamber containing a gaseous moisture-absorbent which is also admitted and discharged periodically by valves operated by mechanism connected with that controlling the liquid-supply valve in such a manner that the spray and moisture-absorbent are confined within the chamber for an interval of time before being discharged. The desiccated product is separated from the moisture-laden absorbent in a separate chamber connected with the outlet pipe, while a fresh charge of liquid is being desiccated in the main chamber. The process is specially applicable for desiccating organic liquids containing solids, heated air being employed as the moisture absorbent.—H. H.

Distilling apparatus. J. A. Houser, Marion, Ind. U.S. Pat. 1,082,525, Dec. 30, 1913.

Air under pressure is forced by a piston-pump into the lower portion of the still, which is fitted with a stirrer, a relief valve, and a pressure-regulating valve on the pipe leading to the condenser.—A. T. L.

Gases ; Method of treating ——. C. A. Weeks and R. M. Hunter, Assignors to T. R. Patton and F. C. Mencke, Philadelphia, Pa. U.S. Pat. 1,083,233, Dec. 30, 1913.

Gases produced by chemical action, for example in coke ovens or in furnaces, are withdrawn under reduced pressure, and successive separate portions of the gases are cooled and scrubbed in the presence of a body of liquid over which they travel with decreasing speed and at increasing pressure until the pressure reaches that of the atmosphere.—A. T. L.

Solution of solid substances : Process for the continuous ——, especially for slaking lime with sugar juice or water. H. Eberhardt, Maschinen- und Armaturenfabrik. Ger. Pat. 268,442, April 10, 1912.

The solid material is conveyed downwards by means of a screw through a vertical perforated cylinder disposed centrally within the dissolving vessel, through which the solvent liquid passes also from the top to the bottom. The vertical cylinder is provided externally with curved blades which force the solvent to pass through the solid material resting on the blades of the screw. The dissolving vessel is connected at the bottom, below the outlet for the solution, with the lower end of a worm elevator, the upper end of which is enclosed in a perforated casing and is at such a height that the undissolved (or unslaked) solid material is discharged in a dry condition. The apparatus s specially suitable for the preparation of milk of lime. —A. S.

gitating and aerating liquids or pulps ; Apparatus for ——. A. C. Howard, Assignor to Minerals Separation, Ltd., London. U.S. Pat. 1,084,210, Jan. 13, 1914.

EF Eng. Pat. 22,743 of 1912 ; this J., 1913, 1055.—T. F. B.

ubricating grease which may be used for preventing and removing incrustations from steam boilers. Eng. Pat. 17,288. *See* XII.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Natural gas ; Condensation products of ——. L. Singer. Petroleum, 1914, 9, 453—469.

Fractional condensation is now the method used for the liquefaction of natural gases (this J., 1914. 15). The highest pressure reached in the compressors does not exceed 17 to 24 atmos., with temperatures not below 0° C. The first stage of compression (up to 3½ atmos.) yields gasoline of sp. gr. 0·6955 to 0·672, whilst in the second stage a product of sp. gr. 0·6365 to 0·616 is obtained. Between the first and second compressors is a system of cooling coils which effects further condensation, whilst in the second compressor the process is completed by sudden expansion of the compressed gas from about 24 atmos. to the ordinary pressure. The gasoline obtained by a process of fractional cooling in ammonia expansion coils without the use of compressors is stated to be of better quality than that produced by the compressor system. The latter gasoline is impregnated with the so-called "wild product," which causes a loss of up to 25 per cent. in storage. It is also of a yellow tint and requires further purification. A condensation product of sp. gr. 0·6855 to 0·651 obtained by fractional cooling alone, contained about 30 per cent. of pentane, 30 per cent. of hexane, and less than 7 per cent. of hydrocarbons of lower sp. gr. than 0·779, together with butane and higher hydrocarbons. The sp. gr. of the moist gas was 0·964 to 1·04, and that of the petroleum oil, 0·8705 to 0·8464. The gases leaving the second-stage compressors, may be subjected to further treatment to obtain condensation products known as "liquid gas" and "gas oil." For this purpose Snelling's process (U.S. Pat. 1,056,845 ; this J., 1913, 414) is employed. A mixture of ethane, propane and hexane is thus obtained, and this when liquefied in steel cylinders is sold as "gas oil." The residual natural gas is better suited than before for all ordinary purposes. "Gas oil" is a colourless transparent liquid at a pressure of 28 atmos. and volatilises without condensation at the normal temperature. One vol. of liquid gas oil yields 350 vols. of gas of 21,360 small cals. per litre (2400 B.T.U. per cb. ft.). It has a flame temperature of 2300° C., and thus gives more light with a mantle than air gas (flame temperature 2150° C.) or ethane (2205° C.). It can be used with every type of burner. The price per cb. m. is about 14 Pf. (3s. 10½d. per 1000 cb. ft.). The sp. gr. of gasoline from natural gas ranges from below 0·590 to 0·724. According to the method of production it is liable to contain more or less dissolved gas, and accidents caused thereby in transport have led the Official Classification Committee (U.S.A.) to publish the following specifications with which these products must comply :—"*Liquefied petroleum gas* is a condensation product of the gas issuing from the casing head of petroleum springs. If it has a lower vapour pressure than 10 lb. per sq. in. at 100° F. (37·7° C.), or at 90° F. (32° C.) from Nov. 1 to March 1, it must be described and transported as "gasoline." "Should the vapour pressure exceed 10 lb. but not exceed 25 lb., the product must be termed "liquefied gas," and be transported in metal drums or casks, or in tank wagons approved by the Master Car Builders' Association. Products having a vapour pressure above 15 lb. must be dealt with as "compressed liquefied gas." Difficulties in pumping caused by the dissolved gas are eliminated by expelling the gas by hot water coils or a current of air, or, more recently, *in vacuo* during the process of condensation. The "liquefied gas" has given good results in motor engines. A condensation plant costs on the average about $8000 (about £1670), and the expenses of dealing with 100,000 cb. ft. of gas per day are estimated at $5000 (about £1040) or $9275 (about £1930) for 500,000 cb. ft. A plant for 1,000,000 cb. ft. could be worked by six men. The market price of the condensation products ranges from about 10 cents (5d.) per gall. (American galls.) in the Gillcrease district to 14 to 18 cents (7d. to 9d.) in California. According to Hill the total production of gasoline from natural gas in the United States by 250 works in 1912 was 12,081,179 galls. (7,425,839 galls. in 1911), and for 1913 the total output is estimated at over 16,000,000 galls. (See also this J., 1913, 999, 1096).—C. A. M.

Petroleum oil fractions; Specific heat of heavy —— at high temperatures. N. Karawajeff. Neftjanoje Djelo, 1913, No. 16. Petroleum, 1914, **9**, 550.

Determinations of the specific heat of heavy fractions of petroleum oils by means of Bunsen's ice calorimeter have given the following results :—The mean specific heat of the fractions examined increased rapidly with the temperature. The specific heat of most of the fractions approximated 0·48 at 100° C., but rose to about 0·60 at 400° C. Between 100° and 400° C. the specific heat could be expressed with sufficient accuracy as a linear function of the temperature, in the case of the majority of petroleum oil products, viz., $C_m = 0{\cdot}4825 + 0{\cdot}000385\,(t-100)$. The specific heat of petroleum oil fractions of different sp. gr. differed but slightly at the same temperatures. The true specific heat could be calculated by means of the formula—

$$\frac{dQ}{dt} = 0{\cdot}4825 + 0{\cdot}00077(t-100),$$

according to which the true specific heat at 400° C. approximates 0·7110.—C. A. M.

Petroleum production in the United States. Eng. and Min. J., Jan. 17, 1914. [T.R.]

The production of petroleum in the United States experienced a noteworthy expansion in 1913, which was stimulated by the high prices prevailing for crude oil in every field. The accompanying table, which is based upon reliable estimates, gives the details of the production during the last three years in barrels of 42 galls.

Field.		1911.	1912.	1913.
		barrels.	barrels.	barrels.
California		77,224,359	84,823,992	96,881,967
Colorado		226,926	200,000	(*a*)220,000
Gulf	Texas	9,256,474	11,778,324	(*f*)14,280,000
	Louisiana	10,720,420	(*e*)9,791,896	(*e*)12,750,000
Illinois		31,317,038	28,400,000	21,600,000
Lima	Indiana	1,695,289	1,200,000	3,814,000
	Ohio	2,960,711	3,000,000	
Mid-continental (*b*)		57,911,525	52,771,603	64,556,000
Kentucky-Tennessee		472,458	500,000	(*a*)500,000
Appalachian (*c*)		26,117,960	26,000,000	22,224,000
Wyoming (*d*)		194,690	500,000	2,354,000
Others		5,000	5,000	(*a*)50,000
Total		218,372,850	218,970,815	239,229,967

(*a*) Estimated. (*b*) Kansas and Oklahoma. (*c*) Pennsylvania New York, West Virginia, and eastern Ohio. (*d*) Includes Utah, (*e*) Includes Marion County, Texas. (*f*) Includes Panhandle field of Texas.

Although there was a diminished production in the Eastern fields, there was nevertheless great activity in them and general prosperity.

Abel-Pensky apparatus; Extension of upper limit of applicability of the ——. K. Scheel. Petroleum, 1914, **9**, 545—546.

Experiments made in connection with the work of the International Petroleum Commission have shown that the upper limit of the Abel-Pensky flash-point apparatus may be extended to 150° C. Oil with flash points ranging from 100° to 149° C. were tested in two standard Abel's apparatus and two Pensky-Marten's apparatus, a special cylinder oil being used for the bath of copper or hard-soldered brass, whilst with the Pensky apparatus the determinations were also made over a gas-flame with the aid of a stirring device (cf. this J., 1913, 1096). The rise of temperature was at the rate of 2° C. and 3° C. per min. After applying the corrections for errors inherent in the copper or brass bath, the errors in the results with both forms of apparatus ranged from —0·8° to + 0·4° C. The correction to be applied for any individual apparatus varies directly with the temperature, and it is sufficient to determine it by comparison with a standard apparatus at two given temperatures and to interpolate it for other temperatures.—C. A. M.

Oils for steam turbines; Testing and valuation of ——. F. Schwarz and J. Marcusson. Mitt. K. Materialprüfungsamt; Papierfab., 1914, **12**, 73.

Those oils are most satisfactory which form no emulsion when shaken with water but which separate out easily. A number of samples of oils, the behaviour of which in practical use with steam turbines was known, were tested, and the following characters established as indicative of satisfactory quality: Degree of fluidity at 20° C., 9—14; sp. gr. at 15° C., 0·890—0·905; "tar value," not exceeding 0·2, determined after 50 hours' uninterrupted heating at 120° C. The oils must be pure mineral oils free from acidity and soaps; the ash-content must not exceed 0·01 per cent.—J. F. B.

Ozokerite; Origin of ——. J. Marcusson and H. Schlüter. Chem.-Zeit., 1914, **38**, 73—74.

Evidence is adduced in support of the view that ozokerite and petroleum have been produced together (from organic remains) and have become separated by a process of natural upward filtration, the relatively insoluble amorphous hydrocarbons of high molecular weight being retained by the porous rock, etc., through which the oil has penetrated, whilst crystalline paraffins of low molecular weight have passed on in solution.—F. Sodn.

Commercial tests of internal combustion engines. Tookey. *See* I.

Patents.

Peat; Process of and apparatus for treating ——. J. Berglund, Eskilstuna, Sweden. Eng. Pat. 11,971, May 22, 1913.

The peat is disintegrated and macerated in water by cutter-rollers or other convenient disintegrators, stones, twigs, portions of trunks or branches of trees, etc., being removed by an endless band conveyor-strainer which allows the pulp and water to pass through. The mixture of water and peat pulp is drawn off into settlers in which the peat dries into lumps which have a high fuel value and low content of ash.—W. H. C.

Peat, etc.; Treatment of [extraction of water from] ——. E. A. Buckle, Prestwich, Assignor to The International Nitrogen and Power Co., London. U.S. Pat. 1,083,317, Jan. 6, 1914.

The peat is pulped, and an electric current is passed through it while heated to 100° or 120° C. under a pressure of 10 atmospheres.—A. T. L.

Gas furnaces; Method and means for mixing gas with air for ——. W. Hoeller, Köln-Ehrenfeld, Germany. Eng. Pat. 29,654, Dec. 24, 1912. Under Int. Conv., Dec. 27, 1911.

A conical gas nozzle is arranged so as to cause air to be drawn in by the gas in a current surrounding the current of gas, and a conical deflector is arranged opposite the air and gas nozzles, so as to spread the currents outwardly and to diffuse them uniformly in layers. The dimensions of the mixing chamber near the nozzle and deflector are such that the velocity of the currents is not affected by the varying temperature of the gases. The object is to prevent preliminary ignition and the deposition of tar.
—A. T. L.

Gas retorts; Continuous ——. W. von Oswald, Coblenz, Germany. Eng. Pat. 24,234, Oct. 25, 1913.

A "feeder" projects into the top of the retort and is connected above with a tapered "filler" which has a doubly tapered cross-piece disposed centrally. The coal is fed into the filler from a hopper above; the latter carries a number of stampers which are actuated by cams and tap

the coal into the filler and cause it to be packed evenly and fall regularly through the feeder and retort.
—W. H. C.

Gas producer. N. F. Egler, Assignor to The Blair Engineering Co., Chicago, Ill. U.S. Pat. 1,083,067, Dec. 30, 1913.

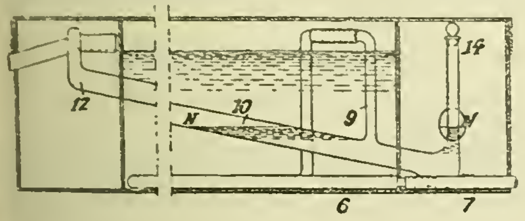
The body of the producer is cylindrical and rotates about an inclined axis. Fixed gas outlet and fuel feed devices are provided at the upper end of the producer and a fixed ash-discharge and an axial blast pipe at the lower end. The upper end of the blast pipe is screened by an inverted V-shaped hood having openings in its sides for distributing the blast. This hood projects horizontally from the blast pipe, and serves for stirring the fuel.—A. T. L.

Gas; Process of producing ——. J. H. Hirt, El Paso, Texas, Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,083,683, Jan. 6, 1914.

Finely powdered carbonaceous material is blown, together with sufficient air to form carbon monoxide, tangentially into a chamber in which the mixture burns, moisture is mixed with the hot gases, and a portion of the resulting gas is withdrawn and passed with the material into the furnace chamber.—A. T. L.

Benzol in illuminating gas, Apparatus for determining the quantity of ——. Soc. Roubaisienne d'Eclairage par le Gaz et l'Electricité, and R. R. L. H. Forrières. Ger. Pat. 267,491, May 16, 1913.

A known volume of the gas is passed through benzene and the quantity absorbed measured; the difference between this quantity and the total quantity contained in the gas when saturated with benzene gives the quantity originally present in the gas. A sheet iron tank (see Fig.) is divided into three compartments, the middle one being filled with water. The copper tube, 6, is connected by rubber tubing, 7, with the gas-supply tube. The gas rapidly acquires the temperature of the water, and passes through the glass tube, 9, 10, which is filled with benzene up to the level, NN; the exit end, 12, of the tube, 10, is constricted to a diameter of 1 mm. After about 10 litres of gas have passed and become saturated with benzene, the gas supply is cut off, and the quantity of benzene taken up by the gas ascertained by running in mercury at 14 from a measuring vessel until the benzene again stands at its original level, NN.—A.S.



Gas-cleaning mechanism. N. F. Egler, Assignor to The Blair Engineering Co., Chicago, Ill. U.S. Pat. 1,083,068, Dec. 30, 1913.

The gas passes upwards through the scrubber in a ircuitous path between fixed annular baffles, alternating with circular baffles carried by a rotating shaft. The baffles are dished downwards, and the fixed baffles are hollow and perforated for discharging water into the crubber. The shaft is rotated by a water motor arranged n a chamber at the top of the scrubber, and the water which has passed through the motor is supplied to the crubber through valved connections —A. T. L.

'as washing and cooling apparatus. E. F. Lloyd, Detroit, Mich. U.S. Pat. 1,083,885, Jan. 6, 1914.

HE apparatus comprises a series of chambers communiating at their lower ends through openings sealed by the ashing liquor. The first of these chambers serves for cooling the liquor. The gas is passed in succession upwards through each of the other chambers, and meets a descending spray of liquor, the quantity of which can be varied independently in each chamber, separate pumps being provided for raising the liquor from the bottom of one chamber to the top of the next. The cooling chamber contains a coil over which the hot liquid is caused to flow in a descending stream.—A. T. L.

Benzine, petrol, etc.; Process of and apparatus for refining ——. H. Wade, London. From V. Beer, Vienna. Eng. Pat. 29,833, Dec. 27, 1912.

In the continuous process of purifying petrol by admitting it to the lower end of each of a series of closed vessels containing acid or lye, through which the petrol rises by gravity, the petrol is forced through the vessels under an adjustable pressure, as by a pump, in order that the rate of flow may be under control. The petrol passes through two vessels containing acid, a settling tank, two vessels containing lye, another settling tank and finally two vessels containing water. Each vessel contains a sieve beneath, through which the petrol passes.—A. T. L.

Briquettes; Process of making ——. [*Use of sulphite-cellulose lyes.*] M. Platsch, Frankfort, Germany. U.S. Pat. 1,084,479, Jan. 13, 1914.

See Fr. Pat. 455,099 of 1913; this J., 1913, 864.—T. F. B.

Oil-gas producers. F. H. Bates, Philadelphia. Eng. Pat. 29,275, Dec. 19, 1912.

See U.S. Pat. 1,046,540 of 1912; this J., 1913, 77.—T. F. B.

Gaseous fuel; Method of producing ——. A. W. Southey, Edgware. U.S. Pat. 1,083,468, Jan. 6, 1914.

See Eng. Pat. 27,612 of 1911; this J., 1913, 77.—T. F. B.

Gas-producer. E. Ragot, Bettaincourt, and P. Pierre-Hervotte, Joinville, France. U.S. Pat. 1,083,507, Jan. 6, 1914.

See Fr. Pat. 435,691 of 1911; this J., 1912, 377.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Cellulose, starch, sugar and sulphite-cellulose lye; Decomposition of —— *by heat.* G. Bantlin. J. Gasbeleucht., 1914, 57, 32—41, 55—61.

The behaviour on dry distillation of cellulose, starch, and sugar, substances having the same percentage composition, was compared by heating them under the same conditions in an iron retort, 44 cm. long and 6·5 cm. diam., arranged in an electrically heated oven. A length of 21 cm. of the retort was charged with the material, and the temperature was raised gradually so as to reach 100° C. in 1½ hours and 500° C. in 7 or 8 hours. The products of distillation in percentage by weight of the dry substance, were as follows:—

	Cellulose.	Starch.	Sugar.
Coke	32·9	28·6	12·2
Water	31·7	29·7	6·29
Tar	3·25	2·69	55·04
Acetic acid	3·28	5·29	8·78
Aldehydes	5·82	5·66	6·15
Ketones	0·11	1·11	0·34
Total gases	17·33	22·70	5·96
Carbon dioxide	11·26	13·08	4·37
Ethylene	0·24	0·39	0·05
Hydrogen	0·02	0·03	0·01
Carbon monoxide	4·78	7·64	1·29
Ethane	0·35	0·74	0·11
Methane	0·68	0·82	0·13
Loss or not determined	5·23	4·20	5·38
Composition of tar:—			
Carbon	52·20	45·02	38·91
Hydrogen	6·86	6·31	6·19
Oxygen	40·94	48·67	54·90

The time-temperature curves showed that with cellulose an exothermic decomposition takes place between 250° and 300° C. and that this reaction is complete at 320° C. This phenomenon is not shown by starch and sugar. The stability towards heat increases in the order cellulose, starch, sugar, but the first two are more nearly alike in this respect than either is to sugar. Since cellulose does not yield methyl alcohol on dry distillation, it has been supposed that waste sulphite-cellulose lyes contain the constituents of wood which yield valuable distillation products. The lye was therefore partially separated from sulphur compounds by passing through it a current of air and steam, evaporated to dryness, and distilled. A very small yield of liquid products was obtained, and no methyl alcohol, whilst large quantities of hydrogen sulphide and of mercaptan were evolved.—A. T. L.

Hydrogen, The sorption [adsorption and absorption] of —— by wood charcoal at the temperature of liquid air. J. B. Firth. Z. physik. Chem., 1914, **86**, 294—308.

The "sorption," by which is meant either absorption (solid solution) or adsorption (surface condensation), of hydrogen by wood charcoal has a two-fold character: the adsorption occupies only a few minutes, while the equilibrium due to absorption is first attained after several hours. A particular specimen of cocoanut charcoal weighing 1·4645 grm. took up, at atmospheric pressure and the temperature of liquid air, 136 c.c. in 30 minutes and 139·8 c.c. in 12 hours (measurements at N.T.P.), and of this latter amount it is estimated that about 23 c.c. was absorbed. Wood charcoal invariably contains crystalline as well as amorphous carbon; the activity of the specimen depends chiefly upon the latter. The shell of the cocoanut yields material which, volume for volume, is far more active than that from the lining; but on a weight comparison the values are practically identical.—J. R.

Patents

Electric incandescent lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 2901, Feb. 4, 1913.

Cryolite or other double halogen salt or compound of aluminium and an alkali or alkaline earth metal is introduce into the bulbs of electric incandescence lamps for the purpose of increasing the efficiency or life of the lamp. A paste of very finely divided cryolite with a small quantity of inorganic or organic binding material is preferably applied to the supports or hooks carrying the filament, without actually touching the latter, or it may be supported upon a wire secured to the glass rod of the lamp in such a position relatively to the filament that it attains a temperature of between 300° and 700°—800° C. when the lamp is in use.—H. H.

X-Ray tubes, etc.; Method of producing high vacua in ——. C. A. Friedrich, New York. U.S. Pat. 1,083,677, Jan. 6, 1914.

During the process of exhaustion both the anode and the cathode are heated to bright redness by means of low potential currents in a relatively low vacuum, in order to expel all gases from the metal, and these gases are removed as they are set free.—A. T. L.

Arc-light electrode. J. L. R. Hayden, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,082,950, Dec. 30, 1913.

See Eng. Pat. 2027 of 1909; this J., 1910, 264.—T. F. B.

Arc-lamp electrode. C. P. Steinmetz, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,082,978, Dec. 30, 1913.

See Eng. Pat. 26,916 of 1904; this J., 1905, 270.—T. F. B.

Tungsten and method of making the same for use as filaments of incandescence lamps and other purposes. U.S. Pat. 1,082,933. *See* X.

III.—TAR AND TAR PRODUCTS.

Pitch; Determination of the temperature of softening of ——. M. Klinger. Chem.-Zeit., 1914, **38**, 63.

Discrepancies often occur, owing to the present loose definition of Krämer and Sarnow's method (this J., 1903, 291). An exact internal diameter of 6 mm. is now proposed for the glass tube employed in the estimation. This is charged by dipping into a layer of molten pitch some 7 mm. deep, at about 150° C. After one minute the tube is removed as with a pipette, and is rested with the lower end upon a cold glass plate. This gives a solid layer of about 5 mm. in thickness. 5 grms. of mercury are poured in, and the tube is finally transferred to a double water-bath at 40° C., the temperature being then raised by 1° C. per minute until the mercury sinks through. —J. R.

Benzol; Determination of total sulphur in commercial ——. K. Schenk. Chem.-Zeit., 1914, **38**, 83—84.

Irwin's method for the determination of total sulphur (this J., 1901, 440) is stated to give low results. The author describes a method and apparatus for the determination, in which the benzol is volatilised by an air current in a specially constructed flask, the escaping gas being ignited and the products of combustion conducted through hydrogen peroxide. The sulphuric acid thus formed is determined acidimetrically. The results obtained by this method are stated to be accurate.—W. R. S.

Nitrobenzenesulphonic acids; The formation of isomeric ——. A contribution on the "self-orientation" of substituting groups. J. Obermiller. J. prakt. Chem., 1914, **89**, 70—86.

By direct sulphonation of nitrobenzene the *m*-sulphonic acid is obtained, only about 2 per cent. of the *p*- and *o*-acid being formed. By nitration of benzenesulphonic acid, on the other hand, the yield of *o*- and *p*- acids can be raised as high as 50 per cent., more of the *o*-acid than of the *p*-acid being formed. The conditions favourable to this are decreasing concentration or quantity of the sulphuric acid in which the nitration is performed, and increasing temperature, the same conditions which favour *o*- and *p*-orientation in the case of the amino-group when working in sulphuric acid solution. In explanation of these facts, the author puts forward a theory of "self-orientation," viz., that the nitro-group, independently of other influences, tends on its own account to enter the ring as near as possible to the substituent already present, this tendency exerting itself the more as the ordinary *meta*-directing influence of the substituent is weakened. This power of the nitro-group is illustrated in the formation of the 1.8-derivative in the nitration of naphthalene-α-sulphonic acid, whereas by the sulphonation of α-nitro naphthalene the 1.5-derivative is formed exclusively. Another example is the exclusive *ortho*-orientation of the nitro-group in the nitration of *m*-toluic acid, the 6- and the 2-nitro-toluic acids (COOH=1) being formed. The old problem presented in technology by the predomination of the less valuable o-nitrotoluene in the nitration of toluene, and the predominance of the less valuable 1.8-isomeride in the nitration of α-nitronaphthalene, is illustrated by this theory.—J. B.

Patents.

Bituminous or tarry materials; Process for increasing the heat-resisting properties of ——. K. L. V. Zimmer, Hamburg, Germany. U.S. Pat. 1,084,520, Jan. 13, 1914.

See Ger. Pat. 228,497 of 1909 this J., 1911, 15.—T. F. B.

Anthraquinone-carboxylic acids and anthraquinone-aldehyde carboxylic acids; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 10,796, May 7, 1913. Under Int. Conv. Nov. 19, 1912. Addition to Eng. Pat. 10,791 of 1913.

See Fr. Pat 456,768 of 1913; this J., 1913, 1060.—T. F. B.

Anthraquinone compounds; Producing ——. J. Boner, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U S. Pat. 1,083,051, Dec. 30, 1913.

See Fr. Pat. 416,735 of 1910; this J., 1910, 1368.—T. F. B.

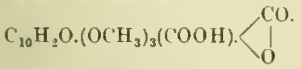
Halogenated 2·3-*naphthisatins.* W. Bauer, Vohwinkel, A. Herre and R. Mayer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,083,518, Jan. 6, 1914.

See Ger. Pat. 264,265 of 1912; this J., 1913, 972.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Galloflavin. J. Herzig and R. Wachsler. Monats. Chem., 1914, 35, 77—84.

Isogalloflavin can be readily obtained from galloflavin by allowing a solution of the latter to stand for some time and then acidifying and warming. Trimethylisogalloflavin, which is obtained, though in poor yields, from tetramethylgalloflavin by loss of a methyl group on hydrolysis, is shown to contain a carboxyl group and a lactone group, therefore it has the constitution:



$$C_{10}H_2O.(OCH_3)_3(COOH).\left\langle\begin{array}{l}CO.\\ \mid\\ O\end{array}\right.$$

The presence of the lactone ring is proved by its behaviour on treatment with caustic potash and methyl iodide or dimethyl sulphate, when a compound containing four methyl ether and two methyl ester groups is formed. This compound undergoes hydrolysis to yield a dibasic acid containing four methoxy groups.—J. B.

Patents.

Sulphurised [sulphide] dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 3660, Feb. 12, 1913.

See Fr. Pat. 454,782 of 1913; this J., 1913, 863.—T. F. B.

Cotton [azo] dyestuffs. A. Blank, C. Heidenreich, and J. Jansen, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,082,581, Dec. 30, 1913.

See Eng. Pat. 12,217 of 1913; this J., 1913, 938.—T. F. B

Cotton [azo] dyestuffs. A. Blank, C. Heidenreich, and J. Jansen, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,082,924 and 1,082,925, Dec. 30, 1913.

See Eng. Pat. 19,989 of 1912; this J., 1913, 745.—T. F. B.

Azo dyestuffs. A. Blank and W. Bergdolt, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,082,923, Dec. 30, 1913.

See Fr. Pat. 456,432 of 1913; this J., 1913, 1004.—T. F. B.

Monoazo dyestuffs and process of making same. H. Wagner, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,082,719, Dec. 30, 1913.

ee Fr. Pat. 415,017 of 1910: this J., 1910, 1297.—T. F. B.

Sulphur [sulphide] dyestuffs and process of making same. W. Hahnenkamm, Sindlingen, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,083,489, Jan. 6, 1914.

See Fr. Pat. 440,879 of 1912; this J., 1912, 809.—T. F. B.

Colouring matters containing sulphur; Blue ——. A. Lüttringhaus, H. von Diesbach, and E. Schwarz, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,083,110, Dec. 30, 1913.

See Fr. Pat. 431,981 of 1911; this J., 1912, 22.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Acetylcellulose and its commercial uses. C. P. Schwabe. J. Soc. Dyers and Col., 1914, 30, 13—15.

Commercially, the triacetate of cellulose is the most important. It occurs in various modifications, according to the method of preparation, differing in physical and chemical properties, but especially in regard to solvents. Dehydrating agents, for example, sulphuric, phosphoric, phenol, sulphonic and chloroacetic acids play an important part in the preparation. The chief commercial process is that of Eng. Pat. 7346 of 1903 (see addition to Fr. Pat. 317,007 of 1901; this J., 1903, 1015), in which cellulose is treated with equal parts of acetic acid and acetic anhydride as well as sulphuric acid. As acetylation progresses the process passes successively through a water-soluble, a water-insoluble, an alcohol-soluble, and finally an alcohol-insoluble stage, and is stopped at the point where the product is soluble in hot alcohol. The product can be separated by precipitating with water, and is probably a hydrocellulose derivative. Another method is that of Merck in which the cellulose is first treated with glacial acetic and benzenesulphonic acid and subsequently with a solution of acetic anhydride in benzene. The product is soluble in methyl formate. Camphor is added to the ordinary "triacetate" with the same object as with celluloid, and addition of naphthol benzoate, thymol and salol increases this effect. Camphor can be replaced for some purposes by methylacetanilide, trichloroaniline, etc. "Cellit" or "Cellon" (Ger. Pat. 238,348) is made by mixing the alcohol-soluble acetylcellulose with camphor in the presence of a liquid medium and allowing the solvents to evaporate. It is soluble in alcohol and is used for making cinematograph films, insulating masses, etc. Non-inflammable cotton or silk threads made from it, are treated with soluble acetates together with metallic powders to produce imitations of gold and silver threads. The soluble acetates are also applied in lacquering. Another application is in the "solidification" of alcohol by adding 10 per cent. of acetylcellulose. A triacetate soluble in alcohol and acetic acid is on the market under the name "Sericose L." It is employed for fixing bronze powder, etc., on textiles, either alone or together with phenol and formaldehyde, or with resorcinol (see this J., 1913, 422 and 1105). "Cellon," which is used for balloon coverings, is not absolutely non-inflammable, but a product introduced recently, "Cellon Emmillit," is quite non-inflammable. In the discussion it was stated that acetylcellulose did not give such good results as albumin in printing zinc oxide and barium sulphate, but this might be due to insufficiently deep engraving of the rollers. Artificial silk from acetylcellulose would cost almost as much as real silk. —J. B.

Paper sizes; Report on commercial ——. von Possanner. Chem.-Zeit., 1914, 38, 100.

In connection with a series of comparative experiments with commercial paper sizes instituted by the *Verein der Zellstoff und Papier-Chemiker*, the author has analysed 29 samples submitted. The sizes are classified in three groups: rosin sizes, colloid sizes and sizes with loading. Of these samples, 28 had an alkaline reaction and 1 was acid; the solid contents ranged from 30 to 88 per cent.; 16 samples showed solid contents between

30 and 40 per cent. The percentage of rosin ranged from 25 to 82; that of organic colloids from 0·1 to 9·8; that of inorganic colloids from 0·2 to 3·4; the ash from 2·3 to 8·4 per cent. As organic colloids, glue, starch, casein and neutral plant-mucilages were encountered; the inorganic colloid generally found was water-glass.—J. F. B.

Gelatins; Examination of commercial —— with regard to their suitability for paper-making. R. W. Sindall and W. Bacon. Analyst, 1914, 39, 20—27.

The examination of gelatin for use in the sizing of paper comprises determinations of ash, chlorides, moisture, fat, tenacity or strength of jelly, viscosity of solution, sulphurous acid and "chondrinogen." When the ash exceeds 2 per cent. a complete analysis is desirable, chiefly with a view to the determination of aluminium salts, which impart a fictitious value to the stiffness of the jelly. For the determination of chlorides, which may make the gelatin hygroscopic, the solution is hydrolysed with nitric acid, filtered and precipitated with silver nitrate. The clear liquid is siphoned off and the silver chloride dissolved in ammonia and re-precipitated. For the moisture, 5 grms. of the finely rasped sample are dried, first over sulphuric acid, after which the particles will not adhere when heated in the oven. The moisture usually ranges from 11 to 14 per cent. The same sample is digested overnight with dry ether and then extracted in a Soxhlet apparatus for the determination of the fat; re-extraction of the extract is desirable, to eliminate small quantities of glue substance which may have been absorbed by the ether. The test for stiffness of jelly must be made at a standard temperature (15° C.) on a 5 per cent. solution which has set for 6 hours. The authors use a tube with a bulb of ½ in. diam. at the end, the tube being loaded with mercury from a burette until it sinks through the jelly. The viscosity is determined from a 50 c.c. pipette with a hot-water jacket; observations are made on a 25 per cent. solution of gelatin at a temperature of 60° C. Gelatins which show a maximum stiffness of jelly with low viscosity of solution are considered most suitable for paper-making. Sulphurous acid is determined by distillation with phosphoric acid, the mixture being heated first in a water-bath and then on wire gauze. The "chondrinogen" test consists in heating 10 grms. of the sample with 200 c.c. of 5 per cent. nitric acid at 60° C. until the liquid becomes bright, collecting and weighing the insoluble matter; this should not exceed 0·4 per cent.—J. F. B.

Decomposition of cellulose, starch, sugar and sulphite-cellulose lye by heat. Bantlin. *See* IIa.

Utilisation of pine-apple by-products in Hawaii. See XIXa.

Patents.

Flax; Process of retting ——. W. J. Fernie, Dromara, Ireland. U.S. Pat. 1,083,074, Dec. 30, 1913.

See Fr. Pat. 460,092 of 1913; this J., 1914, 19.—J. B.

Balloons; Fabrics for spherical and dirigible ——. B. D. Porritt and North British Rubber Co., Ltd., Edinburgh. Eng. Pat. 1972, January 24, 1913.

The impermeable layer of rubber spread between the outer and inner fabric of the balloon material is protected from the action of light by dyeing the fabric, or preferably the yarn before weaving, with a resistant red or yellow dyestuff developed from a reduction product (vat dyestuff) or else with a dyestuff of the alizarin type in conjunction with a mordant.—J. F. B.

Viscose; Manufacture of brilliant filaments, ribbons, films and the like from ——. W. P. Thompson, Liverpool. From Vereinigte Kunstseidefabriken A.-G., Kelsterbach, Germany. Eng. Pat. 330, Jan. 6, 1913.

For the coagulation of filaments, etc., from viscose a precipitating bath consisting of formic acid, alone or in conjunction with salts, is employed. A cold saturated solution of common salt, mixed with 200 grms. of formic acid per litre may be used. Formic acid acts not only upon the saline impurities of the viscose but also decomposes the xanthogenic ester in a manner similar to the mineral acids but more gradually, and the coagulated material contains very little free sulphur.—J. F. B.

Paper pulp; Apparatus for the preparation of ——. J. D. Rice, Oakland, Cal., U.S.A. Eng. Pat. 5595, March 6, 1913.

The apparatus comprises two or more cylindrical "cookers" mounted at an angle of 45° and provided with a central hollow shaft through which steam is introduced into pipes which serve both for heating and stirring the charge when the central shaft is rotated, the lower end of this shaft being connected with a steam-trap. The digested material discharged from the bottom of the "cooker" is conveyed by means of a screw to a series of squeezing rolls which remove the liquid and deliver the pulp to the beating engines. The liquid draining through the screw conveyor and squeezed out by the rolls is pumped to a steam-jacketed evaporator in which it is concentrated and through which it is forced by means of screw-conveyors until it emerges in a semi-solid form. —J. F. B.

Lignocellulose and the like; Apparatus for treating —— with steam and hydrolysing agents. G. H. Tomlinson, Fullerton, La., U.S.A. Eng. Pat. 30,073, Dec. 31, 1912. Under Int. Conv., Jan. 29, 1912.

See U.S. Pat. 1,032,449 of 1912; this J., 1912, 832.—T.F.B.

Wood or like material; Treatment of —— and the production of useful products therefrom. F. R. von Walther, Dresden, Saxony. Eng. Pat. 304, Jan. 4, 1913. Under Int. Conv., Jan. 6, 1912.

See Ger. Pat. 258,180 of 1912; this J., 1913, 597.—T.F.B.

Filaments and films from viscose; Production of ——. F. Steimmig, Hannover, Germany. Eng. Pat. 11,104, May 10, 1913. Under Int. Conv., Feb. 15, 1913.

See Fr. Pat. 458,979 of 1913; this J., 1913, 1153.—T.F.B.

Cellulose; Process for preparing solutions of —— and for the production of cellulose products from such solutions. E. Berl, Tubize, Belgium. U.S. Pat. 1,082,490, Dec. 30, 1913.

See Ger. Pat. 259,248 of 1912; this J., 1913, 653.—T.F.B.

Carbohydrate esters [nitrocellulose]; Dissolved —— and process of making the same. W. S. Weedon, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,082,573, Dec. 30, 1913.

See Fr. Pat. 449,607 of 1912; this J., 1913, 509.—T. F. B.

Papers; Process for the manufacture of mottled and patterned ——. B. Zarnowiecki, Berlin. Eng. Pat. 3887, Feb. 14, 1913. Under Int. Conv., Feb. 14, 1912.

See Fr. Pat. 454,217 of 1913; this J., 1913, 865.—T. F. B.

Bleaching fibres for the manufacture of paper; Process of ——. A. Lannoye, Genval, Belgium. Eng. Pat. 7872, April 3, 1913. Under Int. Conv., Feb. 18, 1913.

See Fr. Pat. 457,006 of 1913; this J., 1913, 1063.—T. F. B.

Paper pulp; Method of preparing ——. Grinding, pulping, and pulverising machine. H. Jackson, Garstang. U.S. Pats. 1,083,102 and 1,083,213, Dec. 30, 1913.

See Eng. Pats. 25,051 of 1910 and 6019 of 1911; this J., 1912, 225.—T. F. B.

Regeneration of sulphides of alkalis or alkaline-earth [from polysulphides]. Eng. Pat. 29,711. *See* VII.

Insulating material [from paper pulp]. U.S. Pat. 1,083,755 *See* XI.

Treating waste wool and like animal fibrous waste for utilisation as a manure or fertiliser. Eng. Pat. 2982. *See* XVI.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Wool ; The absorption of acids by ——. M. Fort and L. L. Lloyd. J. Soc. Dyers and Col., 1914, **30**, 5—12.

Wool was treated with acid of different degrees of concentration at water-bath temperature under comparative conditions. After rinsing with cold water the acid baths were titrated and the amount absorbed by the wool estimated by difference. The wool was then repeatedly extracted with hot water until no more acid was removed and the amount of acid permanently retained by the wool after hot extraction found by titration and difference. These quantities —percentage of acid absorbed and percentage of acid permanently retained—were plotted on curves against the percentage concentration of the acid employed. The curves for five different acids—sulphuric, hydrochloric, oxalic, formic and acetic—all resembled one another: after a sharp rise the curve settled down to an approximately horizontal undulating line. The nodes and depressions in this undulating line appear to have chemical significance, for, taking a line through the nodes at the maximum point in the curve for acid permanently retained, the percentages of the different acids were found to be roughly in the ratio of their molecular weights, the formic : acetic acid ratio only being abnormal (*i.e.*, 51 : 47 instead of 46 : 60). This abnormality was, however, confirmed by experiments on another wool, merino sliver, a Botany flannel having been used in the first experiments. In these second experiments twice as much sulphuric acid was permanently retained as in the first experiments with concentrations up to 7 per cent., after which point, however, the quantities again become normal. These two points may be represented by the formation of the two additive salts, $W.(H_2SO_4)_2$ and $W.(H_2SO_4)$. Also in the curves for absorbed acid, when lines were taken through the corresponding nodes on the curves of the five acids, the ratios of percentage acid absorbed were very close to the molecular weight ratios of the acids. It is concluded that additive salt formation between the wool and the acid occurred.—J. B.

Indigo on woollen cloths ; The testing of ——. J. Soc. Dyers and Col., 1914, **30**, 15—21.

The report of a joint conference of the Soc. of Dyers and Colourists and of the Textile Institute on the report on the "Testing of Indigo on Woollen Cloth" (see this J., 1913, 823). According to J. Hübner difficulties in the use of the tintometer could be overcome by using artificial light, *e.g.*, the Gardner-Dufton lamp. In reply to other points, the authors emphasised the value of the older indigo tests as a preliminary to valuation by the new methods. Basic dyestuffs, for instance, would be discovered by preliminary treatment with alcohol or dilute acid. The dyestuff thus stripped would be estimated by difference in the tintometer, or by identification and re-dyeing on wool against a standard of the same dyestuff. Other vat dyestuffs occurring along with indigo would be estimated as indigo, but as those likely to be found on wool were of the indigo class their use would not constitute a fraud. Separation of indigo from the other vat dyes could be effected if necessary by extracting and sulphonating, when indigo alone was sulphonated and could be titrated. G. H. Frank doubted if indirubin was ever found on dyeings from natural indigo, and said both natural and synthetic indigo had been tested by the new methods.—J. B.

Diazo solutions for printing ; Improving the keeping qualities of ——. E. Justin-Mueller. Sealed note No. 653, dated Sept. 30, 1902, Soc. Ind. de Rouen. Rev. Gen. Mat. Col., 1914, **18**, 4.

Double salts of the diazo compounds are formed with zinc or stannic chloride, naphthalene-sulphone-sulphonic acids and picric acid. For neutralisation aluminium acetate is preferred to sodium acetate.—J. B.

Acetylcellulose and its commercial uses. Schwabe. *See* V.

Patents.

Dyeing and otherwise treating textile materials and fibres ; Beam or cylinder for ——. J., T., and E. Brandwood, Bury. Eng. Pat. 436, Jan. 7, 1913.

A hollow warp beam constructed from a thin, perforated, sheet of indifferent metal (*e.g.*, a nickel alloy), supported by rings and having flanges at the ends which will make a liquid-tight joint in the dyeing machine. One end of the beam may be closed.—J. B.

Dyeing, bleaching or like treatment of textiles on beams. J., T., and E. Brandwood, Bury. Eng. Pat. 551, Jan. 8, 1913.

An apparatus of the kier type for treating warps on the beam at a pressure higher than atmospheric pressure. The warp beams are perforated, have the top end closed and are pressed down vertically on a plate containing holes with which the open ends of the beams make liquor-tight joints. The machine has the usual circulation pump and is also fitted with means for circulating air through the beams.—J. B.

Textile materials [*cops*] *; Gaseous and like treatment of* ——. J., T., and E. Brandwood, Bury. Eng. Pat. 1762, Jan. 22, 1913.

The plate containing the spindles is held in a suitable frame over which descends a bell-shaped cover actuated by a compressed air piston, the cover making a tight joint with the plate. The piston is hollow and through it compressed air is admitted at high pressure and in large volume so that the material is very thoroughly penetrated and regular oxidation ensured.—J. B.

[*Dyeing*] *Treating textile fibres with liquids and gases ; Apparatus for* ——. J., T., and E. Brandwood, Bury. Eng. Pat. 5280, March 3, 1913.

A cop-dyeing machine allowing of the treatment of the material subsequent to dyeing, with air or gases under pressure, consists of a closed kier across which is fixed the plate holding the spindles with sufficient space below it in the interior of the kier to hold all the dye-liquor. The cops being impregnated and the liquor being all at the bottom of the kier, air is admitted under pressure above the plate containing the cops and makes its exit below the plate and above the level of the liquor in the kier. The kier has the usual circulating apparatus.—J. B.

Impregnating and coating fabrics, cords, cables, etc. ; Apparatus for ——. L. P. Destribats, Trenton, N.J., U.S.A. Eng. Pat. 20,103, Sept. 5, 1913.

A roll of the material is placed inside a vacuum drum from which it passes into the trough containing the impregnating liquid through a slot in open communication with the interior of the drum, and thence to a suitable dryer. The interior of the drum is fitted with heating pipes.—J. B.

Dyeing [*furs*] *; Process of* ——. C. Goldstein, New York. U.S. Pat. 1,082,627, Dec. 30, 1913.

After immersion for 24 hours in ferrous sulphate solution at 102° F. (39° C.) the furs are drained for 24 hours and then immersed for 12 hours at the same temperature in the dye-liquor, after which the temperature of the latter is lowered to 100° F. (38° C.) and the dyeing continued for 12 hours longer, the furs being finally dried. The dye-liquor is made by boiling ground and roasted nut-galls in water for ½ hour, subsequently boiling with sumac and afterwards cooling and adding a little lime water.—J. B.

Dyeing or impregnation of materials or substances. F. R. von Walther, Dresden, Saxony. Eng. Pat. 305, Jan. 4, 1913. Under Int. Conv., Jan. 6, 1912.

See Fr. Pat. 452,583 of 1912; this J., 1913, 653.—T. F. B.

Dyeing and otherwise treating hanks of woollen and other yarns; Machines for ——. J. Decock, Tourcoing, France. Eng. Pat. 8336, April 9, 1913.

See Addition of March 15, 1913, to Fr. Pat. 442,713 of 1912; this J., 1913, 1007.—T. F. B.

Colouring fabrics; Method of —— and apparatus for carrying out the said method. J. Rousseau, Sedan, France. Eng. Pat. 9200, April 19, 1913. Under Int. Conv., April 26, 1912.

See Fr. Pat. 443,310 of 1912; this J., 1912, 1028.—T. F. B.

Textile materials; Apparatus for treating —— with liquids. C. W. Fulton, Paisley. U.S. Pat. 1,083,360, Jan 6, 1914.

See Eng. Pats. 26,893 and 26,894 of 1911; this J., 1912, 1121.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Ammonia production in the United Kingdom in 1913. Bradbury and Hirsch, Liverpool. January, 1914. [T.R.]

Production of ammonia, calculated into sulphate (including that used in the manufacture of ammonia soda and for other chemical purposes), from all sources in the United Kingdom during 1913, is estimated at 420,000 tons, viz.:—

	1912.	1913.
	tons.	tons.
Gas works	172,000	182,000
Iron works	17,000	19,000
Shale works	62,000	62,000
Coke and carbonising works and producer gas	137,000	157,000
	388,000	420,000

Of this quantity it is estimated that England contributed 292,000 tons, Scotland 125,000 tons, and Ireland 3,000 tons. The exports during 1913 amounted to 325,000 tons and the home consumption to 97,000 tons, leaving a stock of 20,000 tons to carry forward to 1914.

Pyrites; Norwegian and Spanish ——, as raw material in the sulphuric acid manufacture. P. W. Uhlmann. Chem.-Zeit., 1914, **38**, 59—60.

The author controverts the views of Keppeler (Chem.-Zeit., 1913, **37**, 1219) upon the respective merits of the two kinds of pyrites and states that the Norwegian product is generally preferable: under similar conditions it has an effective sulphur content of about 7 per cent. more than the Spanish product. For the manufacture of an acid containing little arsenic it certainly has the advantage in the chamber-process and probably also in the contact-process.—J. R.

Pyrites; Determination of carbon in bituminous ——. R. Lepsöe. Tids. for Kemi, Farmaci og Terapi, 1913, No. 24. Apoth.-Zeit., 1914, **29**, 69.

A mixture of 0·5 grm. of the finely powdered pyrites and 10 grms. of sodium peroxide is melted over a small flame in a Ledebur porcelain crucible for 15 minutes. When cold, the melt is covered with water, transferred to a small flask and treated with hydrochloric acid. The flask is heated and the carbon dioxide evolved absorbed by a solution of barium hydroxide, the precipitated barium carbonate being filtered off and weighed.—F. Sodn.

Potassium chloride manufacture by the continuous method. E. Krüger. Chem.-Zeit., 1914, **38**, 60—61, 74—76.

Descriptions are given of lixiviating and crystallising plant of a continuous type now available for the treatment of salt deposits containing potassium chloride (carnallite, etc.).—F. Sodn.

Kelps [of Alaskan coast]; Composition of giant ——. A. R. Merz. J. Ind. Eng. Chem., 1914, 6, 19—20.

Analyses of samples collected from the Alaskan coast showed that the *Nereocystis* of Alaskan waters was, in regard to potash-content (12·74—30·12 per cent. K_2O), as important an economic source of potassium salts as that of the more southern waters (this J., 1912, 227). The *Macrocystis* contained a somewhat lower (6·92—22·48 per cent.) and the *Alaria* a decidedly lower percentage of potash (2·27—13·07 per cent.) than the *Nereocystis*, and the sea-weeds *Fucus* and *Porphyra* (about 3·5 and 7·3 per cent. K_2O respectively) were valueless as sources of potash. The potash content and the proportion of total soluble salts were invariably larger in the stems than in the leaves of the same plant, whilst the reverse was the case in regard to the content of ash and of nitrogen as is shown in the following table:—

No.	Name of plant.	Part of plant.	K_2O.	Total soluble salts.	Ash.	N.
			per cent.	per cent.	per cent.	per cent
1.	Macrocystis	Stem	18·28	36·78	2·36	0·51
		Leaves	9·90	25·94	3·88	0·84
2.	Nereocystis	Stem	28·26	52·88	3·60	1·06
		Leaves	15·44	39·40	4·34	2·27
3.	Nereocystis	Stem	24·69	56·40	3·10	1·15
		Leaves	14·78	38·44	4·30	2·02
4.	Nereocystis	Stem	23·88	49·44	10·66	1·53
		Leaves	12·74	34·38	5·12	2·87
5.	Nereocystis	Stem	30·12	63·74	2·76	1·07
		Leaves	15·12	40·10	4·34	3·06
6.	Nereocystis	Stem	27·02	58·86	3·22	0·81
		Leaves	19·63	47·26	3·46	1·04
7.	Nereocystis	Stem	28·76	64·44	2·90	0·59
		Leaves	16·74	42·74	5·66	1·52
8.	Nereocystis	Stem	24·80	53·54	3·68	0·98
		Leaves	17·67	44·40	4·98	2·01

—A. S.

Pure substances; Utilisation of diffusion processes in the preparation of ——. J. Johnston. J. Amer. Chem. Soc., 1914, **36**, 16—19.

Sparingly soluble substances can be precipitated in a state of great purity by allowing the reacting materials to come slowly into contact with each other as the result of diffusion. For example a large vessel is filled with water, or a saturated solution of the substance to be prepared, or a solution containing some foreign substance which increases the solubility of the substance to be prepared, but does not separate with it as a double salt. Two small dishes containing the reacting substances are placed at opposite sides of the large vessel. Or a vessel containing the main bulk of liquid, covered with a layer of paraffin to prevent evaporation, may be placed inside a steam bath, and the reacting solutions allowed to flow slowly in through siphons from flasks disposed above: the air-inlet tubes of the flasks are drawn out to very fine capillaries to ensure a very slow flow of the solutions through the siphons. Hexagonal prisms of calcium hydroxide, 2—3 mm. long by 1 mm. thick, were prepared in this way from calcium chloride and sodium hydroxide at the ordinary temperature and crystals of barium sulphate, 1—2 mm. long, and free from retained material, were prepared at 100° C. (Compare Dreaper, this J., 1913, 678.)—A. S.

Colloidal ferric hydroxide ; New method for the preparation of ——. T. Cohen. J. Amer. Chem. Soc., 1914, **36**, 19—23.

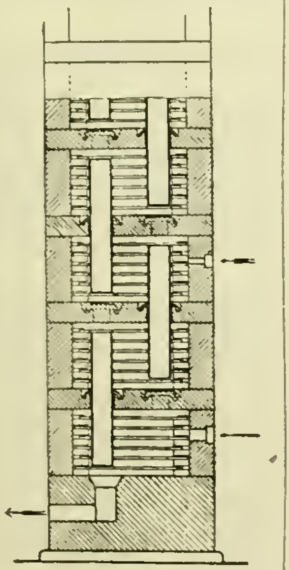
A red colloidal solution of ferric hydroxide is produced if a concentrated solution of ferric nitrate be boiled for a considerable time, but on cooling, the red colour disappears, probably owing to the action on the hydroxide of the nitric acid produced by hydrolysis of the ferric nitrate. If a metal (copper, iron, zinc), preferably finely divided, be added, this combines with the liberated nitric acid, and the colloidal solution persists even on cooling. —A. S.

Mercury-copper compounds ; Basic ——. B. Finzi. Gaz. chim. ital., 1913, **43**, II., 708—712.

Yellow mercuric oxide was added in small portions to a boiling, nearly saturated solution of copper nitrate. On filtering and allowing to cool, blue crystals separated containing water of crystallisation which was evolved at 100° C. The crystals were insoluble in, but rapidly decomposed by, water, with separation of mercuric oxide. When treated with caustic potash they became green, but neither cupric hydroxide nor mercuric oxide separated. Ammonia decomposed the blue substance with formation of a cuprammonium compound and white mercuriammonium nitrate. The blue compound had the composition, $Cu(NO_3)_2,HgO,3H_2O$. Compounds containing mercury were also prepared in a similar manner from cupric chloride and copper-potassium sulphate but not in sufficient quantity for analysis. (See also this J., 1912, 26.)—A. S.

Bromine ; Apparatus for the production of ——. K. Kubierschky. Chem. Apparatur, 1914, **1**, 2—5.

At the present time two-thirds of the world's total consumption of bromine (about 1,500,000 kilos.) are produced in Germany, mainly from the final liquors from the manufacture of potash salts, the bromine being liberated by means of chlorine, distilled over with steam, and the crude product thus obtained, containing about 3 per cent. Cl, purified by treatment with iron bromide or calcium bromide followed by a second distillation. The author describes, with illustrations, an installation whereby the bromine may be obtained continuously by a system of distillation and fractionation in column apparatus, 90—95 per cent. of the bromine being recovered with a minimum consumption of steam, chlorine and labour. The preheated liquor flows down through a tower of sand stone, granite, or volvic lava, at the bottom of which steam is supplied, and at a short distance higher, chlorine. To prevent the heavy bromine vapours from descending the tower, the latter is divided into eight compartments (Ger. Pat. 194,567), provided with Lunge-Rohrmann plates and connecting tubes as shown in the figure. The vapours from the upper end of the tower pass to a condenser; the condensed liquid consists of crude bromine surmounted by a layer of an aqueous solution of chlorine and bromine, which latter is returned to the tower. The crude bromine flows to a rectifying column (Ger. Pat. 174,848; this J., 1907, 824), in which it flows downwards in contact with an ascending current of bromine vapour, and is thus freed from chlorine. The vapours from the rectifying column pass through a condenser, the condensed portion, mainly bromine, flowing back to the column, whilst the uncondensed portion, mainly chlorine, is led to the upper part of the main tower, where it comes in contact with the fresh liquor. It is stated that with a tower of 700×700 mm. cross-section, up to 5 cb. metres of the liquor per hour can be treated.—A. S.



Hydrogen peroxide ; Displacement of acids [from salts] by ——. J. Sperber. Schweiz. Woch. Chem. Pharm., 1914, 5. Apoth.-Zeit., 1914, **29**, 69. (See also this J., 1913, 486.)

When a concentrated solution of hydrogen peroxide (perhydrol) is allowed to act upon calcium bromide, oxygen and hydrobromic acid are evolved but no bromine. Calcium chloride behaves in a similar manner. Calcium fluoride gives rise to hydrofluoric acid at the ordinary temperature, and at higher temperatures oxygen is evolved as well. The reaction with iodides is practically explosive at the ordinary temperatures, and free iodine is evolved even when the reaction is moderated by cooling with a freezing mixture.—F. Shdn.

Zirconium chloride ; Compounds of —— *with pyridine.* E. Chauvenet. Comptes rend., 1914, **158**, 128—130.

Besides the compound $ZrCl_4,2C_5H_5N$, described by Matthews (J. Amer. Chem. Soc., 1898, **20**, 815), another exists, $ZrCl_4,4C_5H_5N$, in prismatic, strongly polarising crystals, obtained by evaporation of a solution of zirconium chloride in pyridine, saturated at 19° C. It is very unstable, and is quickly decomposed by water. The molecular heats of formation of the two compounds were determined as 54 cals. and 70 cals. respectively.—J. T. D.

Arsenic ; Melting-point of ——. R. Goubau. Comptes rend., 1914, **158**, 121—122. (See also Jolibois, this J., 1911, 893.)

A 25 c.c. capacity bulb tube of quartz was filled to the neck with metallic arsenic, and a tube containing the wires of a thermo-couple inserted into it. On heating the bulb slowly in a large crucible filled with sand, the arsenic which volatilised formed an air-tight plug in the neck. The curve of rising temperature showed that fusion occurred at 817° C. At 900° C. the pressure burst the flask. After solidification the ingot of arsenic consisted of a series of crystalline plates.—J. T. D.

Patents.

Fuming sulphuric acid or oleum ; Apparatus for the manufacture of ——. T. L. Briggs, Flushing, N.Y., and H. F. Merriam, Summit, N.J., Assignors to General Chemical Co., New York. U.S. Pat. 1,082,301, Dec. 23, 1913.

An apparatus for converting sulphuric acid and sulphuric anhydride into oleum consists of a tower, through which the materials are passed, fitted with a gas inlet and an oleum outlet at the bottom, and an air outlet at the top. The tower is filled with a packing material to about the height of the air outlet, the acid is supplied by means of a distributor, and means are provided for cooling the tower from the outside, the proportions of the apparatus being such that there is one square inch of lateral cooling surface for every three cubic inches of effective tower space.—O. R.

Sulphur from metallic sulphides [other than iron pyrites] ; Process for the extraction of ——. W. A. Hall, New York. Eng. Pat. 26,595, Sept. 11, 1912.

Sulphides of zinc, copper, or lead, are agitated in a suitable furnace and subjected to the action of a reducing flame and a small quantity of steam; the latter, whilst insufficient to decompose the sulphide appreciably, prevents the formation of sulphur dioxide and carbon oxysulphide. Sulphur distils off, metallic oxide and hydrogen sulphide are formed, and the latter combines with the sulphur dioxide which is present, to form a further quantity of sulphur, so that the issuing gases are practically free from sulphur dioxide.—O. R.

Sulphides of the alkalis or alkaline earths [from polysulphides]; Regeneration of——. L. P. Wilson, Coventry. Eng. Pat. 29,711, Dec. 24, 1912.

Soluble polysulphides are converted into sulphides by treatment with an alkali or alkaline-earth hydroxide and a reducing agent, such as glucose, starch, or dextrin. The process is particularly suitable for the treatment of polysulphides obtained in desulphurising viscose artificial silk, or in the denitration of nitrocellulose.—O. R.

Alkali chromate solutions; Process of making——. J. H. Payne, Yorktown, Va., Assignor to F. E. Gigneux, Cape Elizabeth, Me. U.S. Pat. 1,081,625, Dec. 16, 1913.

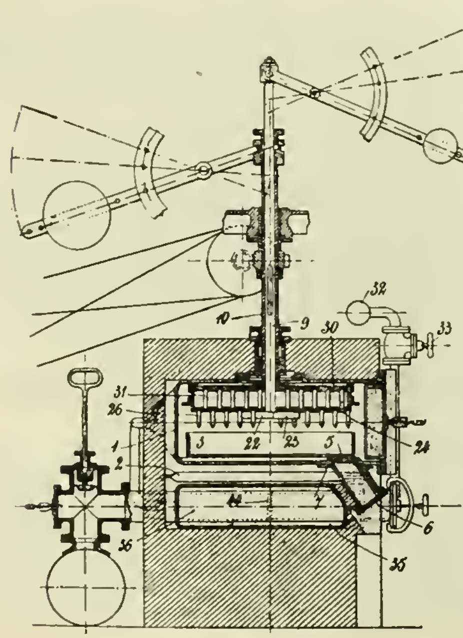
A wet mixture of chrome iron ore, lime, and sodium carbonate, is passed down an inclined, rotary cylinder, against a counter-current of oxidising gases, heated to a temperature which causes incipient fusion, and the resulting porous nodules are leached with water.—O. R.

Citrate of lime; Manufacture of——. L. Rose and Co., Ltd., and H. G. Rose, London. Eng. Pat. 4060, Feb. 17, 1913.

Lime or lemon juice is neutralised by chalk or whiting, sufficient of the mother liquor is withdrawn to leave the deposited calcium citrate in the form of a thick cream, and a thin, uniform layer of the latter is passed, whilst still hot, between the adjacent peripheries of a pair of heated cylinders, which are rotating in opposite directions. The cylinders may be suitably heated to about 260° F. (127° C.) by means of steam at a pressure of 30—40 lb., and the dried citrate is removed from the cylinders in the form of a fine powder by means of two stripping knives, and deposited in a settling cone by means of an exhaust fan. A small quantity of a binding material, such as gelatin, may be added to the liquid before evaporation, and the citrate is then obtained in the form of thin, moist sheets, which become quite dry on cooling.—O. R.

Alkali peroxides; Process and apparatus for the manufacture of——. E. Marguet, Valence, France. Eng. Pat. 11,174. May 13, 1913. Under Int. Conv., April 22, 1913.

A horizontal iron furnace, 1, disposed inside a brick chamber, is heated by means of an electric resistance, 2, and contains a circular, aluminium "boat," 3, which carries the alkali metal and is separated from the lower wall of the furnace by a space as shown. A discharging trap, 5, is fixed to a plug, 6, which slides inside a discharging tube, 7, and is held in place by a suitable tightening device. The roof of the furnace is traversed by a solid aluminium shaft, 9, which is free to move up and down inside, but can only rotate in conjunction with the hollow shaft, 10. The vertical movement is produced by means of levers and the rotation by means of pulleys and worm drives. The shaft, 9, carries at its lower end a double aluminium scraper, 22 and 23, two arms of 22 being straight, and two arms of 23 being curved. Two aluminium plates, 24 and 30, provided with a large number of teeth, 26 and 31 respectively, are bolted on to the lower part of the hollow shaft, 10, and the combination of the two shafts, the two toothed plates, and the double scraper, constitutes a device for subdividing the peroxide in the course of formation, stirring the contents of the boat, scraping and trimming the boat, and discharging the finished product, all with the exclusion of air. The air necessary for oxidation is supplied from a collector, 32, controlled by a valve, 33, traverses a metal chamber, 35, which is furnished with baffle plates, 44, and is strongly heated by circulating around pipes, 36, which serve for the discharge of the exhaust gases.—O. R.



Caustic alkali solutions; Treatment of —— containing sulphates, from the decomposition of natural rocks. Chem. Fabr. Rhenania and A. Messerschmitt. Ger. Pat. 268,282. March 7, 1912.

The sulphates are separated partly as potassium sulphate and partly as a double potassium sodium sulphate by concentration and suitable cooling.—A. S.

Calcium-magnesium carbonate; Production of a voluminous form of——. Lipsia, Chemische Fabrik. Ger. Pat. 267,543, May 19, 1912.

Burnt dolomitic lime is suspended in water, treated, under pressure, with carbon dioxide or gases containing the same, and the whole again decomposed by heating.—A. S.

Calcium hydrosulphide; Manufacture of——. E. Bindschedler. Ger. Pat. 267,870, March 11, 1913.

Spent solutions containing calcium hydrosulphide and nitrate are treated with sulphuric acid and the resulting mixture of calcium sulphate, sulphur, and organic matter, to which a porous substance such as powdered wood charcoal may be added, is heated to dark redness and treated with carbon monoxide or gases containing the same, the gaseous reaction products being led into contact with calcium sulphide and milk of lime.—A. S.

Dialkalicyanamide; Manufacture of——. Chem. Fabr. von Heyden A.-G. Ger. Pat. 267,595, Feb. 2, 1913.

Cyanamide or a polymeride thereof, especially dicyandiamide, is heated with caustic alkali :—

$$4NaOH + C_2N_4H_4 = 2Na_2CN_2 + 4H_2O.$$

The water partly escapes as steam, but in part reacts with the melt, with the formation of ammonia :—

$$Na_2CN_2 + 3H_2O = Na_2CO_3 + 2NH_3.$$

To avoid loss from this cause, as far as possible, substances capable of combining with water, *e.g.*, alkali or alkaline-earth metals or their oxides, amides, nitrides, carbides, or alloys may be added.—A. S.

Hydrogen; Production of —— by the alternate oxidation and reduction of iron. A. Messerschmitt. Ger. Pat. 263,390, July 24, 1912.

Instead of iron turnings or spongy iron, compact iron is used in the form of a framework, preferably consisting of removable pieces, or of tubes of relatively small cross-section, heated either directly or indirectly. When tubes are used, these may be exposed both inside and outside to the reacting gases, or the latter may be led alternately over the inner and outer surfaces respectively of the tubes.—A. S.

Hydrogen; Production of —— by the alternate oxidation and reduction of iron. A. Messerschmitt. Ger. Pat. 268,062, Nov. 3, 1912.

The vertical reaction-column is disposed within a heating chamber and is provided below with an extension, open at its lower end, which projects into a separate heating chamber. In the latter is a grate which serves to support the column of reaction-material (iron). Heating gases are supplied to both heating chambers in such a way that they flow in one direction through the interior of the reaction chamber and in the opposite direction around the outside of the latter, whereby uniform heating is ensured. The lower heating chamber is provided with discharge openings for the reaction material and with tangential air inlets.—A. S.

Hydrogen; Apparatus for the production of —— by the alternate oxidation and reduction of iron. A. Messerschmitt. Ger. Pat. 268,339, Oct. 18, 1912. Addition to Ger. Pat. 267,594.

A modification of the apparatus described in the chief patent (see Fr. Pat. 441,105 of 1912; this J., 1912, 1126), the annular reaction chamber being bounded externally by the brickwork of the column or shaft and communicating directly with the inner heating chamber.—A. S.

Carbon dioxide; Preparation, by compression and cooling, of liquid —— or other constituents of gaseous mixtures. H. Hirschlaff. Ger. Pat. 267,379, Sept. 17, 1912.

In order to attain the necessary degree of cooling at first, an auxiliary medium, such as compressed air, is passed, along with the compressed gaseous mixture, through the apparatus, flowing first through an expansion-device and then through a heat-exchanger surrounding the separating vessel. The supply of compressed air is continued until liquid carbon dioxide begins to deposit in the separating vessel.—A. S.

Aluminium hydrate; Method of precipitating ——. E. S. Fickes, Pittsburgh. Reissue No. 13,668, Jan. 6, 1914, of U.S. Pat. 1,070,438, Aug. 19, 1913.

See Fr. Pat. 451,593 of 1912; this J., 1913, 602.—T. F. B.

Oxides of nitrogen; Apparatus for forming ——. J. S. Island, Toronto. U.S. Pat. 1,082,529, Dec. 30, 1913.

See Eng. Pat. 11,363 of 1912; this J., 1913, 909.—T. F. B.

Mercury bichloride; Apparatus for manufacturing ——. F. Kaufler, Brückl, Austria-Hungary, and A. Klages, Salbke, Germany. U.S. Pat. 1,082,530, Dec. 30, 1913.

See Eng. Pat. 19,601 of 1912; this J., 1912, 1125.—T.F.B.

Mercuric chloride and process of producing same. F. Kaufler, Vienna, and A. Klages, Salbke, Germany. U.S. Pat. 1,084,346, Jan. 13, 1914.

See Eng. Pat. 19,601 of 1912; this J., 1912, 1125.—T.F.B.

Nitrates; Process for the dehalogenisation of halogeniferous ——. C. Uebel, Heidelberg, Germany. U.S. Pat. 1,082,781, Dec. 30, 1913.

See Fr. Pat. 451,069 of 1912; this J., 1913, 602.—T. F. B.

Cyanogen compounds and the like; Synthetic production of ——. J. E. Bucher, Coventry, R.I. U.S. Pat. 1,082,845, Dec. 30, 1913.

See Fr. Pat. 455,799 of 1912; this J., 1913, 943.—T. F. B.

Ammonia; Process for the production of ——. R. W. Wallace and E. Wassmer, London. U.S. Pat. 1,083,232, Dec. 30, 1913.

See Eng. Pat. 18,450 of 1912; this J., 1914, 22.—T. F. B.

Ammonia; Catalytic production of ——. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,083,585, Jan. 6, 1914.

See Fr. Pat. 436,472 of 1911; this J., 1912, 432.—T. F. B.

Ammonia and compounds of ammonia; Method of producing ——. F. Rothe, Dessau, Germany. U.S. Pat. 1,083,703, Jan. 6, 1914.

See Fr. Pat. 426,307 of 1911; this J., 1911, 1012.—T. F. B.

Sulphuretted hydrogen; Process for the production of ——. W. A. Hall, New York. U.S. Pat. 1,083,247, Dec. 30, 1913.

See Fr. Pat. 455,905 of 1912; this J., 1913, 943.—T. F. B.

Sulphur from metallic sulphides; Process for the extraction of ——. W. A. Hall, New York. U.S. Pat. 1,083,248, Dec. 30, 1913.

See Fr. Pat. 458,028 of 1912; this J., 1913, 1156.—T.F.B.

Sulphur; Process for the production of ——. W. A. Hall, New York. U.S. Pat. 1,083,249, Dec. 30, 1913.

See Eng. Pat. 20,760 of 1912; this J., 1913, 1009.—T.F.B.

Separation of the constituents of gaseous mixtures [air]; Process of ——. G. Claude, Assignor to Soc. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. G. Claude), Paris. U.S. Pat. 1,083,988, Jan. 13, 1914.

See Fr. Pat. 410,967 of 1909; this J., 1910, 949.—T. F. B.

VIII.—GLASS; CERAMICS.

Presence of traces of zinc in glass. Cause of error in studying the biological action of chemical reagents. Javillier. *See* XXIV.

Patents.

Drying apparatus for clay; Air ——. A. W. and E. Borlase, St. Austell, Cornwall. Eng. Pat. 104, Jan. 2, 1913.

The apparatus comprises a series of shallow trays supported and pivoted to a framing, a pair of levers holding the trays in an almost horizontal position, but readily allowing the same to fall into an inclined position for emptying.—B. N.

Translucency of thin plates of marble, alabaster and similar substances; Process for increasing the ——. H. W. Engel. Ger. Pat. 267,065, Feb. 17, 1912. Addition to Ger. Pat. 265,027 (see Eng. Pat. 28,361 of 1911; this J., 1913, 87).

The plates are soaked in liquid, non-volatile hydrocarbons, whereby, it is stated, their translucency is so augmented that they can be used in the manufacture of lamp globes and the like.—A. S.

Glazes; Production of white and coloured —— for pottery. O. Völkel. Ger. Pat. 267,191, Nov. 5, 1912.

A mixture containing an antimony compound and an alkaline-earth compound is added to an ordinary lead glaze mixture or to the fused glaze.—A. S.

Enamel, glass, and the like; Manufacture of white ——. Verein. Chem. Fabriken, Landau, Kreidl, Heller und Co., Vienna. Eng. Pat. 29,382, Dec. 20, 1912. Under Int. Conv., May 4, 1912. Addition to Eng. Pat. 1136 of 1912, dated Sept. 30, 1911.

See Addition of Jan. 18, 1913, to Fr. Pat. 438,908 of 1912; this J., 1913, 753.—T. F. B.

IX.—BUILDING MATERIALS.

Zinc chloride in treated wood; Determining the amount of ——. E. Bateman. J. Ind. Eng. Chem., 1914, **6**, 16—18.

Extraction of the zinc chloride from the wood by leaching is unsuitable, as organic substances are also dissolved and would have to be subsequently removed or destroyed. Incineration leads to inaccurate results owing to loss of zinc by volatilisation. The most satisfactory method of destroying the zinc is as follows:—Five grms. of finely ground wood or sawdust are treated with 50 c.c. of a saturated solution of potassium chlorate in concentrated nitric acid; after the violent reaction has subsided, 10 c.c. of concentrated sulphuric acid (sp. gr. 1·8) are added and after some time the solution is boiled, and when the colour darkens, a further quantity of the chlorate solution is added, and the boiling and treatment with chlorate continued until no further charring takes place on evaporating till fumes of sulphuric acid appear. The zinc is subsequently determined by titration with ferrocyanide in hydrochloric acid solution, using uranium acetate as outside indicator, or by the following method. 100 c.c. of the zinc solution are treated with 10 c.c. of a 2 per cent. solution of ferric chloride, 10 c.c. of dilute nitric acid, and 1 grm. of citric acid, then made slightly ammoniacal, and titrated with ferrocyanide until a drop of the solution when placed in the centre of a small quantity of a mixture of equal volumes of glycerin and glacial acetic acid, gives a blue or greenish blue colour. The solution should have a volume of 200 c.c. and be at 80° C. at the beginning of the titration. The two methods give equally accurate results, but the second is not affected by the presence of iron, nitrates, or phosphates, and is quicker. In both cases control determinations should be made with a sample of untreated wood.—A. S.

Patents.

Wood; Process of preserving ——. E. E. Somermeier, Columbus, Ohio. U.S. Pat. 1,082,658, Dec. 30, 1913.

Fibrous, organic materials are preserved by treating them with a solution of one or more compounds of copper, together with arsenious oxide dissolved in a dilute alkaline solvent.—W. C. H.

Cement and process for making the same. E. Duryee, Los Angeles, Cal. U.S. Pat. 1,082,684, Dec. 30, 1913.

Hydraulic cement is finely ground with natural colloidal silica, *e.g.*, diatomaceous earth (with or without the admixture of hydrated lime), in order to reduce the cement and diatomaceous earth to a finer state of division and to bring the finely divided particles into intimate contact with one another. By grinding a sufficient quantity of an active form of silica with ordinary basic hydraulic cement, the latter is converted into an acidic cement.
—W. C. H.

Blocks or the like suitable for road or other purposes; Formation of ——. J. S. Kruse, London. U.S. Pat. 1,082,752, Dec. 30, 1913.

About 19½ parts of asphaltum are heated with 78½ parts of a filling material, *e.g.* clinker, to 400° F. (204° C.) and after thorough mixing, 1½ parts of sulphur and ½ part of mineral oil are added, and the whole subjected to a pressure of at least 4 tons per sq. in. The resulting blocks are claimed to be capable of resisting a crushing stress of about 2 tons per sq. in.—W. C. H.

Mortar, artificial stone mixtures, and cements, especially Sorel cements; Process for gauging —— *by means of a solution of water-glass containing bases soluble in alkalis.* R. Eberhard. Ger. Pat. 267,031, Feb. 11, 1912.

The water-glass solution used for gauging contains such a quantity of alkali-soluble bases, especially aluminium hydroxide and lead hydroxide, that the material after setting has a composition and properties similar to those of the zeolites. For example a mixture of magnesia and magnesium chloride mixed with a solution of water-glass containing alkali aluminate and plumbite, yields a magnesia cement of great strength and hardness and showing complete constancy of volume.—A. S.

Sand; Treatment of —— *for the preparation of mortar.* J. Joachim. Ger. Pat. 267,681, Oct. 23, 1912.

The moist sand, as excavated, is covered with hydrofluosilicic acid, heated, the evolved gas led into water, and the latter together with the separated gelatinous silicic acid and the regenerated hydrofluosilicic acid used for treating a further quantity of sand. The presence of the gelatinous silicic acid renders the sand capable of reacting more readily with lime—A. S.

Roofing paper and the like; Manufacture of non-inflammable ——. A. Maschke. Ger. Pat. 267,407, Jan. 21, 1913.

A simple or mixed phosphoric acid ester of phenol or its substitution products or a mixture of these substances, *e.g.*, triphenyl phosphate, tricresyl phosphate or a mixed phenylcresyl phosphate, is added to the impregnating composition for the roofing paper.—A. S.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ores; Report of Committee (Verein Deutscher Chemiker upon methods of analysing —— E. Hintz. Z. angew. Chem., 1914, 27, 9—11.

Sampling:—The sample, which should be fairly finely ground and not exceed about 50 grms., is emptied in a heap upon paper, and divided into two parts with a spatula. One part is pressed out with a broad spatula, the other part is sprinkled on to the layer thus obtained, and the whole mass then pressed out in the same way. This treatment is repeated 20 times, the final heap being pressed flat with a glass plate and divided into sections with a quadrant. The two parts opposite each other are united to form one sample, the original thus giving two representative samples. *Iron*:—Five grms. of each of the samples are moistened with 1 to 2 c.c. of water in a 400 or 500 c.c. Erlenmeyer flask, 100 c.c. of hydrochloric acid (sp. gr. 1·19) added, and the flask covered with a watch glass and heated for 3 hours at 60° C. The liquid is then boiled to expel chlorine, diluted with 150 c.c. of water and filtered into a 500 c.c. flask. The residue is ignited, and fused with sodium bicarbonate, the melt dissolved in dilute hydrochloric acid, the iron oxidised and precipitated with sodium hydroxide, the precipitate washed and dissolved in hydrochloric acid, and the solution added to the main solution. Or the residue may be treated with hydrofluoric acid and sulphuric acid, and dissolved in hydrochloric acid before the precipitation of the iron. Residues from ores containing chromium are fused in a nickel crucible with sodium peroxide and sodium carbonate, the melt dissolved in hot water and filtered, and the residue of iron oxide dissolved in hydrochloric acid (1 : 3) and added to the main solution. The united solutions are made up to 500 c.c., and 100 c.c. of the liquid concentrated to 50 c.c., reduced with hot concentrated stannous chloride solution (an excess of 1 or 2 drops being given), then thoroughly cooled and treated with 25 c.c. of a 5 per cent. solution of mercuric chloride. After 2 minutes the liquid is poured into 2 litres of water containing 60 c.c. of manganese sulphate-phosphoric acid solution (200 grms. of manganese sulphate per litre treated with a mixture of 1000 c.c. of phosphoric acid of sp. gr. 1·3, 600 c.c. of water, and 400 c.c. of sulphuric acid of sp. gr. 1·84) with sufficient permanganate solution to give a pink colouration. The iron is then titrated with potassium permanganate solution (about 6 grms. per litre), which has been standardised upon pure iron oxide. In the case of ores containing copper the results for iron are not so accurate, but separation of the copper effects no improvement.—C. A. M

Iron and manganese ores: Analysed ——. Methods of analysis. U.S. Bureau of Standards, Washington, D.C. Circular No. 26, 3rd Ed., May, 1913.

The following methods were used, iron ores being dried at 100°—105° C. and manganese ores at 120° C. before analysis:—*Silica:* The "silica and insoluble" was fused with sodium carbonate, as usual, the silica obtained being evaporated with hydrofluoric and sulphuric acids. *Phosphorus:* (See Blair: "Chemical Analysis of Iron," 7th ed.). When titanium was present the procedure included a double fusion of the ore with sodium carbonate and precipitation of the phosphorus by a small quantity of ferric salt, the precipitate being subsequently dissolved and treated by the molybdate process. *Sulphur:* Fusion with alkali carbonate (alone or with nitre) followed by precipitation with barium chloride in a boiling, feebly acid solution, and filtration after standing for 36 hours. *Aluminium:* (1) The phosphate method was used, but is not recommended for ores containing much titanium, owing to the uncertain composition of the co-precipitated titanium phosphate. (2) Iron, separated by means of ether and the solution treated by the basic acetate process, the latter precipitate being dissolved in hydrochloric acid and re-precipitated by ammonia; as finally ignited and weighed the precipitate consisted of Al_2O_3,TiO_2, about 70 per cent. of the P_2O_5 (Wysor, this J., 1910, 355) and a little Fe_2O_3. (3) By the phenylhydrazine method (this J., 1899, 1053) the sum of $Al_2O_3+TiO_2+P_2O_5$ was obtained; reprecipitation was necessary to eliminate iron. (4) Electrolytic method of Drown and McKenna (this J., 1892, 268) the separation of iron was very satisfactory; the alumina, etc. was precipitated twice by ammonia and subsequently weighed as $Al_2O_3+TiO_2+P_2O_5$. (5) When vanadium was present in the ore the greater part of this element was found in the precipitates from methods (3) and (4) and was determined. *Titanium:* The usual gravimetric and colourimetric methods were employed for which latter the alumina precipitates from the preceding processes were used. *Vanadium:* One of the ores (magnetite) contained 0·08 per cent. V_2O_3, for the determination of which a combination of existing methods was employed, the vanadium solution being finally titrated with $N/100$ permanganate, reduced with sulphur dioxide and titrated again. *Total iron* was determined gravimetrically and by titration with permanganate in sulphuric and hydrochloric acid solutions. For the former titration reduction was effected by means of a Jones reducer (containing a column of zinc dust; see Chem. News, **60**, 93); the permanganate was standardised against pure sodium oxalate (Sörensen), corrections being made for the reducing substances derived from the reducer, for the volume of permanganate required to produce the tint in a solution of ferric sulphate of the concentration employed, and, in the case of the magnetite ore referred to above, for the reduced titanium and vanadium also. For the titration in hydrochloric acid solution the procedure outlined by Jones and Jeffrey (this J., 1909, 818) was followed, and similar corrections to the preceding applied; the results obtained were slightly high when the sodium oxalate titre of the permanganate was used, but accurate when the latter was standardised against an iron ore of known composition. The hydrochloric acid solution of the magnetite ore was reduced by sulphur dioxide before titration with permanganate by the preceding process. *Ferrous iron* was determined by the Pratt method (Bull. 422, U.S. Geol. Survey, p. 127): 0·5 grm. of ore was treated with 10 c.c. of sulphuric acid (1 : 3) and 40 c.c. of boiled water in a large platinum crucible, the air expelled from the covered crucible by a current of carbon dioxide, and after boiling the contents for some time, 7 c.c. of hydrofluoric acid added, and boiling continued for 10 mins. The mixture was poured into a large platinum dish containing 100 c.c. of 5 per cent. sulphuric acid, 200 c.c. of water (both freshly boiled and cooled) and a quantity of permanganate slightly less than required (as determined by a preliminary test), and quickly titrated with permanganate to the first pink. Allowance was made for the vanadium content of the ore. *Available oxygen* (in the manganese ore) was determined by effecting solution of the ore in the presence of a known amount of ferrous sulphate, or oxalic and sulphuric acids, and titrating the excess of ferrous sulphate or oxalic acid with permanganate; by treating the ore with sodium oxalate and sulphuric acid in an apparatus through which dry air was finally aspirated, the loss in weight being due to the evolution of 2 mols. CO_2 for each mol. MnO_2 present; and by distillation with hydrochloric acid, absorption of the chlorine in potassium iodide and subsequent titration of the liberated iodine with sodium thiosulphate, the latter being standardised against potassium permanganate, metallic copper and resublimed iodine. *Manganese:* For the gravimetric determination, the usual methods (see also this J., 1898, 796), or (this J., 1912, 1055); in each case the manganese remaining in the filtrate was determined colourimetrically. For the volumetric determination the methods of Volhard, Ford and Williams (Blair: "Chemical Analysis of Iron," 7th ed.), von Knorre (this J., 1902, 72), the persulphate colourimetric process, and the bismuthate method were employed. It is stated, as the result of an exhaustive investigation (this J., 1912, 1055) that the bismuthate method yields results of high accuracy. *Lime and magnesia* were determined by the usual methods, but in platinum vessels, iron, etc. being removed as basic acetate and manganese by means of bromine and ammonia. The calcium was precipitated twice as oxalate and the weighed oxide corrected for traces of occluded iron and silica; two precipitations of the magnesia were also made and the weighed pyrophosphate corrected for the presence of calcium. *Alkalis:* The method of J. Lawrence Smith (heating with calcium carbonate in the presence of ammonium chloride) was used, a blank test being made with the reagents employed. *Combined water:* The already dry ore was heated to redness for 15 mins. in a current of dry air and the water absorbed by calcium chloride and weighed. *Carbon dioxide* determined as usual.—W.E.F.P.

Irons and steels; Analysed ——. Methods of analysis. U.S. Bureau of Standards, Washington, D.C. Circular No. 14, 4th Ed., July 1913.

Methods for irons and ordinary steels:—*Total carbon:* Direct combustion with oxygen in porcelain tube, heated to 1000°—1100° C., iron being mixed with twice its weight of pure ferric oxide and steel heated alone. Combustion was conducted so as to produce a well-fused oxide, subsequently ground and re-burned. Lead peroxide (at 300° C.) or zinc (at room temperature) was employed for eliminating oxides of sulphur from the gases leaving the tube; and a blank test was made upon the oxygen employed. *Graphitic carbon and silicon,* determined as usual. *Titanium:* Metal dissolved in hydrochloric acid of sp. gr. 1·05, and the insoluble residue, containing practically all the titanium, treated as usual for the determination of the latter by the hydrogen peroxide colourimetric method. *Phosphorus:* Molybdate precipitation employed. (See this J., 1912. 927—928.) *Sulphur:* 5 grms. of the metal dissolved in nitric acid, a little sodium carbonate added, the solution evaporated to dryness, the residue baked, then re-dissolved in hydrochloric acid, and evaporation and baking repeated. Residue dissolved in hydrochloric acid, and solution evaporated to a syrup, diluted to 40—50 c.c and filtered, the insoluble portion being treated separately for recovery of sulphur, by fusion with alkali carbonate and nitrate. To the cold filtrate (about 100 c.c.), 10 c.c. of a 10 per cent. solution of barium chloride added, liquid filtered after standing for 48 hours, and precipitate washed, first with a hot dilute solution of hydrochloric acid and a little barium chloride and then with hot water, the washings being collected separately and evaporated for recovery of dissolved barium sulphate. In the evolution method the gaseous products from the dissolution of the sample were passed through a mixture of 25 c.c. of ammonia (sp. gr. 0·90) and 5 c.c. of a 3 per cent. solution of hydrogen peroxide, this liquid being subsequently acidified and precipitated with barium chloride as usual. *Manganese:* The bismuthate method (Blair, Chemical Analysis of Iron, 7th ed., p. 121) was used. In the case of steels containing small amounts of chromium as impurity, titration against arsenite solution was employed; or the chromium was removed by zinc oxide before the application of the bismuthate process.

Methods for special alloy-steels:—*Copper:* The metal was dissolved in 10 per cent. sulphuric acid, the hot solution saturated with hydrogen sulphide (to prevent possible solution of copper during filtration) and filtered, the residue being digested with nitric acid and evaporated (ultimately to dryness) with hydrofluoric and sulphuric acids. From the solution obtained by dissolving the residue in sulphuric acid (or fusing it with alkali bisulphate) the copper was deposited electrolytically or determined colourimetrically with ammonia. *Molybdenum (in small amounts) with and without copper :* The steel was dissolved as for copper, the residue digested with *aqua regia* without previous ignition, the solution evaporated nearly to dryness with sulphuric acid, the residue dissolved in water and the solution saturated with hydrogen sulphide. In absence of copper, the precipitated molybdenum sulphide was collected on a Gooch crucible, converted into trioxide by ignition, and weighed; when copper present, the sulphides were dissolved in nitric acid and the copper removed by boiling the solution with potassium hydroxide and filtering, the filtrate being acidified with sulphuric acid and saturated with hydrogen sulphide to precipitate the molybdenum. *Nickel :* The dimethylglyoxime method used, the nickel being precipitated direct from an ammoniacal tartrate solution of the alloy-steel; with iron or ordinary steel a larger quantity of the sample was used and the bulk of the iron removed by an ether separation before the addition of the precipitant. In either case the nickel precipitate was allowed to stand for 1 hour before filtering. *Chromium :* For small amounts Blair's method (*loc. cit.*, p. 209) was used, the final determination being made colourimetrically (Hillebrand, Bull. 422, U.S. Geol. Survey, p. 147.) For larger amounts the methods of Blair (*loc. cit.*) and Cain (this J., 1912, 132) were employed. *Phosphorus :* The acetate separation, followed by double precipitation as magnesium phosphate was used for steels containing vanadium. *Manganese :* Steels free from vanadium, dissolved in *aqua regia*, the bulk of the iron removed by means of ether, the solution treated with magnesia or zinc oxide and filtered, the filtrate evaporated to a small volume, the salts converted into nitrates, and the manganese determined by the bismuthate method. Cain's method (Bureau of Standards, Tech. Paper, No. 24) was also used, either as described by the author, or with substitution of zinc oxide for cadmium carbonate. *Vanadium :* 5—10 grms. of the steel were dissolved in hydrochloric acid (1 : 1) with the addition of a few drops of hydrofluoric acid, and filtered, the insoluble residue being ignited, fused with sodium carbonate, extracted with water and added to the main filtrate. After oxidation with nitric acid the bulk of the iron was removed from the solution by means of ether, the acid layer concentrated and finally evaporated to dryness with strong nitric acid. The solution obtained by dissolving the residue in strong nitric acid was diluted, nearly neutralised with sodium hydroxide and poured slowly, with vigorous stirring, into 150—200 c.c. of a 10 per cent. solution of the latter; after which the solution was filtered and the precipitate re-dissolved and re-precipitated until shown to be free from vanadium by solution in nitric acid and addition of hydrogen peroxide. The combined filtrates were nearly neutralised with nitric acid and the vanadium precipitated by the addition of mercurous nitrate, the precipitate filtered off, washed with dilute mercurous nitrate solution, dried and ignited, the impure vanadium pentoxide thus obtained being purified by two or more fusions with sodium carbonate, each followed by precipitation with mercurous nitrate and ignition of the product. The pure vanadium pentoxide finally obtained was fused with sodium carbonate, the melt dissolved in dilute sulphuric acid, the vanadium reduced by sulphur dioxide, the latter expelled by boiling, and the liquid titrated against $N/50$ permanganate. The methods of Cain and Cain and Hostetter (this J., 1911, 958; 1912, 333) were also employed. *Tungsten :* The *aqua regia* method was used.—W. E. F. P.

Iron ore ; Concentration and briquetting of —— in Scandinavia. A. Beielstein. Stahl u. Eisen, 1914, **34**, 41—46, 100—105.

The methods of concentrating (mechanically and magnetically) and briquetting iron ore at various Scandinavian works are described. The briquettes as first shaped in a press, contain 8 to 10 per cent. of water. They are then passed through a long tunnel furnace, in which they first receive a preliminary heating, and are then suddenly exposed to a temperature of 1200° to 1300° C. The author considers that the magnetic iron oxide thereby becomes oxidised to ferric oxide with evolution of heat, so that locally much higher temperatures are reached, which cause the particles to fuse together. This view is confirmed by the fact that hæmatite briquettes require higher temperatures and are not so strong as magnetite briquettes. The size of grain, as affecting the drying, and the relative amounts of lime and silica, as affecting desulphurisation and the final structure of the briquette, are discussed with special reference to the ores treated at the various works. —T. St.

Gray cast-iron ; The influence of manganese on the mechanical properties of ——. F. Wüst and H. Meissner. Ferrum, 1914, **11**, 97—112.

Four series, each of 10 samples, were prepared with Mn from about 0·2 to about 2 per cent. in each series; C (total) about 2·79 per cent. in the first series, 3·08 per cent. in the second, 3·32 per cent. in the third, and 3·89 per cent. in the fourth; Si about 1·5 per cent. in the first three series, and 1·7 per cent. in the fourth. Mechanical and microscopic tests were made on all the samples. The members of the fourth series, with the highest carbon content, gave markedly the lowest "strength" results. Of the other three series, the second, in which the combined carbon most nearly approached 0·9 per cent., gave the best results. In the fourth series the strength increased with increasing manganese due to the graphite lamellæ becoming smaller. In the first three series, tensile and transverse strength attained a maximum with about 1 per cent. Mn. Flexibility and impact strength fell with increasing manganese, the effect being greater, the lower the carbon content. Hardness rose with increasing manganese, but for the low manganese values it remained practically constant in consequence of the increasing separation of graphite. The formation of graphite increased as the manganese content rose to 0·3 per cent., but higher amounts up to 2·5 per cent. had no further effect.—T. St.

Steel ingots : The making of sound ——. B. Stoughton. J. Franklin Inst., 1914, **177**, 65—73.

The addition of titanium alloy to molten steel has been found most effective for preventing or remedying the occlusion of oxides by the metal. In steel containing normal amounts of phosphorus and sulphur, segregation does not occur to a dangerous extent provided the metal is properly deoxidised before teeming, is not "wild" in the moulds and is cast in ingots not exceeding 5 to 10 tons each: the larger the ingot required, the smaller shoul be the phosphorus and sulphur contents of the metal ingots of great thickness should not be used unless th central core is to be drilled out and discarded as in th manufacture of large guns. For the prevention or elimination of shrinkage cavities in steel ingots, suitable "cro ping" of the latter, in conjunction with careful inspectio is regarded as being in most cases an adequate safeguar against the occurrence of unwelded pipe in finished stee (See also this J., 1912, 987; 1913, 536.)—W. E. F. P.

Damascene steel ; The problem of the old ——. W. Guertle Int. Zeits. Metallog., 1914, **5**, 129—141.

Damascene steel contains 1·0 to 1·6 per cent. C, a consists structurally of extremely small grains of cementi in a ground mass of ferrite. The characteristic appeara and properties of the steel are due to alternations cementite-poor and cementite-rich zones. Prolong heating at elevated temperatures, as recommended in earlier literature, cannot possibly give the desired res The most promising method seems to be to heat suita steel, in which an extremely fine-grained structure has b induced, to a temperature below 700° C. for a sufficie lengthy period. The necessary preliminary structure r be produced by very rapid cooling, or by severe work above the eutectoid temperature.—T. St.

Ferrosilicon. M. v. Schwarz. Ferrum, 1913, **11**, 80—90, 1914, **11**, 112—117.

The specific gravities of ferrosilicons containing up to 95 per cent. Si are given, and the determination of the specific gravity is recommended as a quick control test when the silicon exceeds 25 per cent. The specific resistance of ferrosilicon with up to 40 per cent Si increased discontinuously with increasing silicon content, the curve changing direction at points corresponding approximately with the iron silicides. The hardness, determined by Shore's scleroscope, attained a maximum at 7·5 per cent. Si. The analysis of ferrosilicon is described in detail. With up to 15 per cent. Si, *aqua regia* is used to dissolve the alloys, which are first reduced to a very fine state of division in a glass-hard steel mortar; with higher percentages, distillation in a current of chlorine, or fusion with potassium hydroxide must be resorted to. Both methods give good results. The fusion is best carried out in a deep, narrow, nickel crucible, and the addition of an oxidising agent, such as potassium nitrate, or small quantities of sodium peroxide, is sometimes necessary. —T. St.

[*Silver.*] *Ore flotation; A study of* ——. D. G. Campbell. School of Mines Quart., 1913, **35**, 28—34.

An investigation to determine the best conditions for concentrating—by agitation and froth flotation—a silicious silver ore containing 5—6 per cent. of finely disseminated sulphide minerals (pyrites, stibnite, silver sulphide and antimonide) including about 150 oz. Ag per ton. In the tests, for each of which 100 or 200 grms. of ore were employed, mineral (cylinder and machine), sperm, fish, whale, corn (maize), cotton-seed, rape-seed, China-wood, resin, pine and pine-tar oils were used; and variations were made in the proportion of sulphuric acid used, the period and rate of agitation, and the temperature of the ore mixture. A peripheral speed of 1100—1200 ft. per min. of the agitator-blades was necessary for efficient concentration of the material; and pine-tar oil was found to be the best frothing-agent, the most satisfactory proportion being about 0·1 per cent. of the weight of ore. The froth was non-selective in the absence of acid; and the amount of the latter necessary to give the best results was about 0·4 per cent. of the weight of ore. The concentrate obtained at 150° F. (65·6° C.) contained much less gangue than that produced at 65° F. (18·3° C.); the percentage extraction was also greater, and the time of agitation and consumption of oil less, at the higher than at the lower temperature.—W. E. F. P.

Cupellation losses. J. Loevy. Chem.-Zeit., 1914, **38**, 82—83.

In the assay of gold bullion the loss of metal due to bsorption by the cupel must be determined at frequent ntervals even for the same make of cupel. The following igures represent averages from six determinations made under exactly the same conditions in cupels of different nanufacture. (The paper gives no information as to the omposition of the cupels.)

Cupel.	Loss per cent.		Cupel.	Loss per cent.	
	Au.	Ag.		Au.	Ag.
erman (No. 1) ..	0·197	1·190	German (No. 2) .	0·348	1·200
rench (Velter) ..	0·219	1·380	French (Deleuil)	0·368	1·330
rman (No. 6) ..	0·240	1·710	German (No. 5) .	0·370	1·400

—W. R. S.

pper; Resistivity of ——, *in temperature range* 20° *C. to* 1450° *C.* E. F. Northrup. J. Franklin Inst., 1914, **177**, 1—21.

IREE series of measurements were made, viz., in the nges 20° to 1143° C., 1394° to 20·5° C. and 1443° to ° C., and resistivity curves plotted from the data tained. The following values for copper of 99·39 per cent. conductivity are mentioned as having the highest probability of being correct:—

Temperature (° C.).	Resistivity (microhms per c.c.).
20	1·7347
1000	9·42
1082·6	10·20 (metal solid)
1082·6	21·30 (metal molten)
1100	21·43
1340	23·39
1450	24·22

—W. E. F. P.

Arsenic and antimony [*in copper*]; *Determination of* ——. E. E. Brownson. Min. and Eng. World, Dec. 27, 1913, 1155—1157.

The following methods, employed for converter and refined copper at the works of the Anaconda Copper Mining Co., Great Falls, Mont., U.S.A., and requiring about 24 hours for a single sample, are stated to give very accurate results.

Converter copper. 10 grms. are dissolved in a mixture of 30 c.c. of sulphuric acid, 20 of nitric acid and 50 of water, the solution boiled, diluted and electrolysed (current 4 amp.) until only about 0·25 grm. of copper remains unprecipitated: the liquid is made ammoniacal, acidified with hydrochloric acid, saturated with hydrogen sulphide, and after 30 mins. is filtered. The precipitate is dissolved in 25—30 c.c. of *aqua regia*, the solution evaporated to dryness, the residue boiled for 10—15 mins. with a solution of 4—5 grms. of potassium hydroxide in 30 c.c. of water, 25 c.c. of sodium sulphide solution (1 lb. of crystallised monosulphide in 2 litres of water) are added, the boiling continued for 5—10 mins. and the solution cooled and decanted through a small filter, the black residue being re-treated with a further 25 c.c. of sodium sulphide and finally washed, on the paper, with dilute sulphide solution. The filtrate (volume preferably 150—175 c.c.) is heated with 5 c.c. of hydrogen peroxide until the strong yellow colour fades, cooled, and electrolysed (0·10—0·15 amp.) to precipitate the antimony, re-solution of the latter being prevented by removing the cathode from the liquid as soon as the current is discontinued; the cathode is subsequently washed with water and alcohol, dried over an alcohol flame and weighed. The solution is acidified with sulphuric acid, saturated with hydrogen sulphide, and after 30 mins. filtered; the precipitate is dissolved in dilute ammonia (1 : 4), the solution acidified with sulphuric acid, in excess (7 or 8 c.c.), and the liquid evaporated until fumes of sulphur trioxide appear; the vessel is then covered and the solution heated strongly for 60—90 mins., after which it is successively cooled, diluted, neutralised with ammonia, acidified with hydrochloric acid, filtered, made alkaline with an excess of sodium bicarbonate, and titrated with iodine solution (5·105 grms. per litre) which has been previously standardised against arsenic trioxide. When the copper contains less than 0·04—0·05 per cent. As, the determination is best made on 20 grms.

Refined copper. The percentages of arsenic and antimony being usually very small, no attempt is made to separate the two elements. 25 grms. of the sample and 0·05 grm. of pure iron are dissolved in 85—90 c.c. of nitric acid and 75 c.c. of water, the solution boiled and diluted to 600—700 c.c. with very hot water: after which ammonia is added until the copper hydroxide first precipitated is redissolved, the liquid thoroughly stirred to coagulate the ferric hydroxide (boiling is not permissible), allowed to stand for 10—15 mins. and filtered. The iron precipitate, containing the arsenic and antimony, is washed with hot water and/or ammonia solution until most of the copper is removed, and dissolved, on the paper, in a boiling mixture of 3 c.c. of nitric acid, 5 of sulphuric acid and 50 of water, the solution being subsequently heated to boiling and electrolysed for 2 hrs. (current 0·5 amp.) to remove the last traces of copper. The liquid is then boiled, made ammoniacal, boiled again, allowed to stand, and filtered; the iron precipitate is dissolved in dilute hydrochloric acid, the solution neutralised with ammonia and reduced with ammonium bisulphite, or preferably with sodium hypophosphite, after which the liquid (freed from sulphur dioxide by boiling, if bisulphite has been used) is saturated with hydrogen sulphide and allowed to stand overnight. The precipitated sulphides are subsequently filtered on an asbestos felt in a platinum Gooch crucible, washed with water, alcohol, carbon bisulphide and alcohol, dried for 1 hour at 105° C. and weighed. When the assay is made on 25 grms. the percentage of arsenic and antimony combined is obtained by multiplying the weight of the mixed sulphides by the empirical factor 2·4.—W. E. F. P.

Copper-nickel matte ; The roasting of ——. E. F. Kern and M. H. Merris. School of Mines Quart., 1913—1914, 35, 1—21.

The paper is divided into sections dealing with the separation and determination of the sulphates, oxides and sulphides of copper and nickel in mixtures of these compounds: the determination of the reaction between copper oxide and nickel sulphide; and the roasting of a commercial copper-nickel matte. On heating a mixture of copper oxide and nickel sulphide, a small amount of the sulphate of each metal was produced between 525° and 600° C.: above 650° C. no sulphates were formed, but a mixture of the subsulphides of copper and nickel with cuprous sulphide, the formation of the latter being more rapid at higher temperatures; no reaction was observed on heating nickel subsulphide with copper oxide. In the roasting of copper-nickel matte, oxidation proceeded slowly below 600° C., while above 730° C. the particles became pasty and caking occurred. The best results were obtained by first roasting the powdered matte for about an hour at 450°—500° C., with free access of air, to cause a coating of oxide to form on the particles, and then raising the temperature to between 675° and 725° C., vigorous rabbling of the charge being maintained throughout the whole operation. —W. E. F. P.

Bronze, brass, and German silver ; Analysis of ——. L. Bertiaux. Ann. Chim. Analyt., 1914, **19**, 6—14.

Copper: 5 grms. are dissolved in a mixture of 10 c.c. of sulphuric acid (sp. gr. 1·84) and 20 c.c. of nitric acid (sp. gr. 1·33), diluted to 300 c.c. and electrolysed with a current of 2—3 amp. If much tin be present, the deposit of copper must be redissolved, and the solution again electrolysed, using 1 amp. At the end, the solution is removed and replaced (without breaking the electrical connections) by a beaker containing 2·5 c.c. of each acid and 300 c.c. of water; after 5 minutes, this is replaced by water: after another five minutes the electrodes are detached, the cathode washed with water, twice with alcohol, and dried for 10 minutes at 90° C. *Iron, nickel and cobalt, manganese, and aluminium:* The combined mother-liquors from the electrolysis are boiled down till they fume strongly, cooled, water added, the solution warmed till all salts dissolve, transferred to a beaker, saturated with hydrogen sulphide, and 1 or 2 c.c. of 50 per cent. ammonium sulphate added. The solution is filtered, heated to expel hydrogen sulphide, treated with 1 c.c. of perhydrol (hydrogen peroxide solution), and excess of ammonia, boiled, filtered, the precipitate redissolved in sulphuric acid, re-precipitated, filtered off, washed, dried, ignited in a silica crucible, and weighed. A few drops of sulphuric acid (1 : 1) and a few c.c. of hydrochloric acid are added, the oxides dissolved, and the solution evaporated to fuming; it is cooled, diluted to known bulk, and aliquot portions taken to determine iron and manganese. Aluminium is obtained by difference. The united filtrates from the ammonia precipitation are treated with 5 c.c. of sulphurous acid, 20 c.c. of 25 per cent. solution of magnesium sulphate and 25 c.c. of ammonia, heated to boiling, and electrolysed with a current of 0·1 amp., keeping very hot during the whole day during which the electrolysis goes on. This gives the nickel and cobalt together. *Zinc:* The mother liquor from the last electrolysis is boiled to concentrate it and remove sulphur dioxide, 50 c.c. of an 18 per cent. alcoholic solution of sodium hydroxide are added, and the solution concentrated to 200 c.c. A few c.c. of perhydrol and 20 c.c. of citric acid (10 per cent.) are added, and dilute sulphuric acid to neutrality, then a few drops of the sodium hydroxide and 20 c.c. of citric acid; the zinc is now deposited on a coppered cathode by a current of 0·4 amp. *Lead:* If manganese be absent, 5 grms. of the alloy are dissolved by means of so much copper solution (100 grms. of copper dissolved in 500 c.c. of nitric acid and made up to a litre) that there shall be 10 grms. of copper in all, and nitric acid so as to make 37 c.c. in excess. The solution is electrolysed with 0·3 amp. all night, and the anode weighed. If manganese be present, 5 grms. are dissolved as for the determination of copper, the solution evaporated to fuming, cooled, treated with water, warmed, and filtered through a close filter, washing with dilute sulphuric acid. The filter and precipitate are treated, in the original beaker, with 100 c.c. of the copper nitrate solution, 40 c.c. of ammonia (sp. gr. 0·92) and 80 c.c. of nitric acid (sp. gr. 1·33), kept just boiling for half an hour, filtered, diluted to 300 c.c., and electrolysed. *Tin:* From 2·5 to 10 grms. are treated with nitric acid (3·8 c.c. per grm., and 6 c.c. excess); after solution, the liquid is diluted to 450—500 c.c. with boiling water, a few c.c. of 50 per cent. ammonium nitrate added, the liquid boiled for a few minutes, filtered, and the insoluble residue washed, dried and weighed. In accurate work, it must then be fused with sodium carbonate and sulphur, and the impurities determined as usual.—J. T. D.

Aluminium ; Electro-plating —— *with nickel.* J. Canac and E. Tassilly. Comptes rend., 1914, **158**, 119—121.

The metal is passed through a bath of boiling potassium carbonate, washed, brushed with milk of lime, washed, dipped in 2 per 1000 solution of potassium cyanide, washed, dipped in a bath of 500 c.c. of hydrochloric acid and 500 c.c. of water in which 1 grm. of iron has been dissolved, till it acquires a "moiré" appearance, washed again, then placed in the depositing bath (in which nickel chloride gives better results than the sulphate). The nickel adheres so strongly as to be practically inseparable by any treatment which does not break the aluminium itself. Microscopic examination of the surface of the metal after the iron bath favours the view that the iron accentuates and localises the attack by the acid so as to produce a sort of cellular etching; by deposition in thes cellules the nickel is interlocked with the aluminium and thus firmly attached. Nickel-plated aluminium i permanent in moist air, and resists dilute sodium car bonate, glacial acetic acid, and saturated common sal solution. Its expansion-coefficient by heat is lowered and wires of it show no Thomson effect.—J. T. D.

Zinc-cadmium alloys ; Hardness and electrical conductivit of ——. A. Glasunow and M. Matweew. Int. Zeit Metallog., 1913, **5**, 113—122.

The alloys were prepared from the pure metals ar formed into rods by drawing up the molten metals in Jena-glass tubes. The rods were annealed for 84 hou at 225° C., and their conductivity then determine The curve obtained was a straight line, indicating t absence of solid solutions. The conductivity valu found for the pure metals were $\lambda_0 = 14·5$ for cadmiu and $\lambda_0 = 18·1$ for zinc. Tests made by Brinell's hardn curve, using a ball of 9·52 mm. diam. and a load of 2 kilos. with samples annealed at 225° C. for 72 hours, show a single maximum at the eutectic concentration, v 26·6 atomic per cent. Zn, but with alloys which had b first hammered and then annealed at 225° C. for 900 hou it was a straight line. The values for the pure metals we Zn 38·1 and Cd 22·0.—T. St.

Metals and alloys ; Experimental determinations of viscosity and density of some molten ——. R. A Int. Zeits. Metallog., 1914, **5**, 142—168.

The molten metal or alloy was drawn up from a grap crucible into a quartz vessel shaped like a pipette, and time measured for the outflow through a capillary t as the level passed two constrictions. The viscosity ve was surrounded by a glass tube on which a spira resistance wire was wound, whereby the determina could be made at a desired temperature. The experimental difficulty was to prevent oxidation of metal, and to cope with it an atmosphere of hydrogen containing methyl alcohol was provided inside the glass tube. In each case the coefficient of viscosity was calculated by Poiseuille's formula, the vessel being calibrated with mercury as the normal liquid. Determinations were made upon the pure metals Cd, Sn, Pb, and Bi, and upon Pb-Sn and Pb-Bi alloys, at temperatures ranging from the melting point to 550° C. The viscosity of all the metals investigated was of the same order of magnitude. The sequence of the viscosities was the same as that of the melting points. With cadmium, mercury, tin and lead, the fall in viscosity with rising temperature was larger in proportion as η was larger, but in the case of bismuth the fall was relatively less. The viscosity of the Pb-Sn alloys was somewhat smaller than would be the case if the law of mixtures held rigorously, and with the Pb-Bi alloys at low temperatures this discrepancy was even more marked. The viscosity temperature-coefficient of the Pb-Bi alloys was surprisingly small, and at higher Bi-concentrations appeared to be even lower than that of pure bismuth. The specific gravities of the same metals and alloys at different temperatures were determined using the same apparatus. The observed specific gravities of the alloys were very slightly lower than those calculated by the law of mixtures.—T. St.

Mineral and metal production in the United States. Eng. and Min. J., Jan. 10, 1914. [T.R.]

The following tables show the approximate production of the principal metals and minerals in the United States in 1913, figures for 1912 being added for comparison :—

Production of metals in the United States.

Metal.	Unit.	1912.	1913.
luminium	pounds ...	(*g*)40,000,000	(*h*)50,000,000
opper (*a*)	pounds ...	1,241.762,508	1,228,811,581
erromanganese .	long tons .	227,725	353,100
old (*b*)	dollars ...	93,451,500	88,301,023
ron	long tons .	29,525,412	30,808,300
ead (*c*)	short tons	410,006	433,476
ickel (*e*)	pounds ...	42.168.769	(*e*)38,614.745
uicksilver	flasks	(*f*)25,147	(*h*)21,000
ilver (*b*)	troy ounces	63,766,800	67,601 111
inc (*d*)	short tons	348,638	356,146

(*a*) Production from ore originating in the United States. *b*) The statistics for 1912 are the final and those for 1913 are he preliminary statistics reported jointly by the director of the int and the U.S. Geological Survey. (*c*) Production of refined ead from ore and scrap originating in the United States; antimonial lead is included. (*d*) Total production of smelters, except hose treating dross and junk exclusively; includes spelter derived rom imported ore. (*e*) Imports; for 1913, first 10 months only. his nickel is refined in the United States for the production of etal, oxide and salts. (*f*) As reported by U.S. Geological Survey.) As reported by the Metallgesellschaft, Frankfort am Main.) Estimated.

Production of mineral and chemical substances.

ubstance.		1912.	1913.
senic	pounds ...	5,852,000	4,624,140
al. anth (*b*) ...	short tons	84,478,527	90,099,903
al bitu. (*b*) ...	short tons	449,962,723	471,969,903
ke (*b*)	short tons	42,528,653	45,328,890
pper sulphate .	pounds ...	39,480,741	54,330,000
n ore	long tons	59,196,798	61,770,478

(*b*) The coal and coke statistics are the estimates of Coal Age.

Patents.

on.] *Magnetic body; Process for improving the magnetic qualities of a ——.* R. A. Hadfield, Sheffield. U.S. Pats. 1,082,947 and 1,082,948, Dec. 30, 1913.

e material, an alloy of iron with other elements (*e.g.*, con), is heated to 700°—800° C., or to 900°—1000° C., cooled slowly; then reheated to 900°—1000° C., to 700°—800° C., respectively, and cooled rapidly. —W. E. F. P.

Sintered product rich in metallic iron; Production of —— from fine iron ores, pyrites cinder, or the like. Metallbank und Metallurgische Ges. A.-G. Ger. Pat. 268,159, Nov. 13, 1910.

The fine ore or the like, mixed with a certain quantity of carbon, is subjected to a blast which is passed first through a layer of incandescent carbon below or above the charge and of such thickness that the gases which come in contact with the charge before sintering are as far as possible rich in carbon monoxide and free from oxygen. Several alternating layers of the charge and of carbon may be employed.—A. S.

[*Gold and silver.*] *Ores; Treating metal-carrying ——.* I. Kitsee, Philadelphia, Pa. U.S. Pat. 1,082,596, Dec. 30, 1913.

A cyanide process in which the solution is periodically subjected to the action of an electric current while in contact with the ore.—W. E. F. P.

Zinc; Condensation of ——. A. L. J. Queneau, Philadelphia, Pa. U.S. Pat. 1,082,765, Dec. 30, 1913.

The interior of the condenser is provided with carbon baffle-plates arranged transversely and longitudinally, or radially.—W. E. F. P.

Zinc; Process for precipitation of ——. F. L. Wilson and S. E. Bretherton, Berkeley, Cal. U.S. Pat. 1,083,785, Jan. 6, 1914.

In the electrolysis of zinc sulphate solution, the strength of the solution is maintained substantially constant by the addition of zinc carbonate. Acid ammonium carbonate is also added so that ammonium sulphate is formed, which acts as a catalytic agent and causes a more uniform deposition of the zinc. The ammonia and carbon dioxide liberated from the bath are recovered.—T. St.

Zinc; Separation of —— by the action of a blast of air on a mixture of the zinciferous material with fuel and, if necessary, with other substances. F. C. W. Timm. Ger. Pat. 268,427, Oct. 9, 1912.

The "blowing" is effected in stages, and between successive blowings the charge is moved from one part of the permeable hearth or grate, and then replaced thereon or on another part or moved from one grate to another one: during this operation portions of the charge at different temperatures may be mixed with one another. A rotating or tilting grate may be used, the blast being delivered only through that part covered by a sufficient depth of charge. The apparatus shown consists of a rotary converter with a grate let into the wall at one part. The blast is delivered below the grate with the converter in such a position that the grate is at the lowest part. After a period of blowing, the blast is cut off, the converter rotated several times to mix the charge, then restored to its original position, and the blast again delivered, and so on.—A. S.

Tungsten and method of making the same for use as filaments of incandescence electric lamps and for other purposes. W. D. Coolidge, Assignor to General Electric Co., Schenectady, N.Y. U.S. Pat. 1,082,933, Dec. 30, 1913.

A mass of pure tungsten, formed by agglomerating and sintering the powdered metal, is subjected to repeated hot swaging, until it becomes fibrous in structure, and then further reduced by hot drawing.—W. E. F. P.

(1) *Desulphurising ores;* (2) *recovering sulphur;* (3) *obtaining sulphur from sulphides;* (4) *desulphurising and briquetting ores;* (5) *extracting sulphur: Processes of ——.* W. A. Hall, New York. U.S. Pats. 1,083,246, 1,083,250, 1,083,251, 1,083,252 and 1,083,253, Dec. 30, 1913.

(1) For recovery of the "fixed sulphur atom," sulphide ores are exposed, in the presence of steam, to a non-oxidising flame, at a temperature sufficiently high to distil

the sulphur, without fusing the ore. (2) A layer of sulphide ore, especially pyrrhotite ore, in which no considerable amount of sulphide having both "fixed and feeble sulphur atoms" exists, is treated with a reducing flame obtained by burning gas containing much methane and ethylene, the temperature in the reaction zone being maintained at 700°—900° C.; steam may be added to the gases leaving the furnace. (3) Sulphide ores are exposed to the simultaneous action of a flame and steam, preferably with agitation, in a series of successive steps in each of which the quality of the flame and the relative amount of steam is different: at first a highly reducing flame and much steam may be employed, then a flame of less reducing power with less steam, and finally an oxidising flame almost in the absence of steam. (4) A moving body of ore is subjected to a non-oxidising flame (*e.g.*, of oil fuel) projected downwards upon it, and the vaporous products, from which the sulphur (expelled as such) may be recovered, are withdrawn from below the body of ore which may be heated to sintering temperature. (5) A moving mass of pyrites (whilst being agitated) is heated, in the substantial absence of materials capable of combining with it, to a temperature at which the loosely combined sulphur atom is expelled, fresh pyrites being continuously introduced into the heating chamber and the desulphurised ore withdrawn.—F. Sodn.

Aluminium; Process for obtaining ——. P. C. McIlhiney, Great Neck, N.Y. U.S. Pat. 1,083,691, Jan. 6, 1914.

Felspar is treated with aqueous hydrofluoric acid, and the solid aluminium fluoride obtained is added to a fused bath of aluminium fluorides and a fluxing ingredient. Water or steam is added at the same time in sufficient quantity and in such a manner as to react with the aluminium fluoride to produce hydrofluoric acid and alumina. The fused mixture is subjected to electrolysis to obtain metallic aluminium, fresh quantities of aluminium fluoride being continuously added, and the hydrofluoric acid recovered and used again. The potassium silicofluoride formed from the felspar is treated to yield potassium hydroxide.—T. St.

Aluminium alloy; Hard ——. W. de l'Or, geb. Feyjean. Ger. Pat. 268,515, March 8, 1913. Addition to Ger. Pat. 265,924 (this J., 1913, 1160).

The alloy described in the chief patent consisting of Al 84, Pb 11, and "glass" 5 per cent., is stated to be considerably improved by the addition of about 2 per cent. Sn.—A. S.

Nickel alloy of high chemical resistance and which can be worked mechanically. W. and R. Borchers. Ger. Pat. 268,516, June 12, 1913. Addition to Ger. Pat. 265,328.

The nickel in the alloy described in the chief patent (this J., 1913, 1160) may be partly (up to 90 per cent.) replaced by iron.—A. S.

Furnace; Metallurgical ——. L. Addicks, Perth Amboy, and C. L. Brower, Chrome, N.J. U.S. Pat. 1,083,719, Jan. 6, 1914.

The furnace has a lining of magnesite bricks laid with a mortar of magnesite dust and a solution of sodium silicate, the walls and roof being of chrome brick.—T. St.

Molten metal; Process of mixing minerals and metals with ——. S. L. Boggs, Pittsburgh, Pa. U.S. Pat. 1,083,724, Jan. 6, 1914.

Flue dust, or other fines, is added to molten metal as this runs from the furnace spout into a receiving vessel. The metal is then further agitated and its temperature maintained by the introduction of a blast.—T. St.

Alkali metals; Electrolytic production of —— from fused caustic alkalis. Oesterreichischer Verein für Chem. und Metall. Produktion. Ger. Pat. 267,897, Jan. 23, 1912.

Concentric electrodes are used, separated by an annular partition of the solidified electrolyte produced by artificial cooling. In order to prevent the aqueous alkali gradually formed at the anode, as the result of the production of water by the discharge of hydroxyl ions, from reaching the cathode compartment and so diminishing the current yield, the partition is made to dip into the fused electrolyte to a lower level than the electrodes.—A. S.

Soaking pits. [" *Tiefōfen.*"] O. Uehlendahl. Ger. Pat. 266,974, Jan. 19, 1913.

One or more of the pits are connected with fore-hearths. The waste gases from the pits are utilised in part for preheating the air used for combustion of the heating gases for the pits and for the fore-hearths and in part for directly heating the fore-hearths.—A. S.

Soaking pit. F. Siemens. Ger. Pat. 268,379, Jan. 25, 1913.

Partitions or pillars of refractory chequerwork, acting as heat-accumulators, are interposed between the ingots in the pit.—A. S.

Heating or annealing easily oxidisable articles in regenerative furnaces. F. Siemens. Ger. Pat. 268,278, June 5, 1912.

The heating or annealing is effected by non-oxidising gases which have been heated in the regenerators, and after leaving the annealing chamber, these gases are burnt in order to heat the cooled regenerators.—A. S.

Steel ingots and castings; Process and apparatus for the thermal treatment of ——. E. C. R. Marks, London. From Soc. Anon. Italiana Gio. Ansaldo & Co., Genoa, Italy. Eng. Pat. 2484, Jan. 30, 1913.

See Fr. Pat. 453,712 of 1913; this J., 1913, 794.—T. F. B.

Metals; Process for rendering non-ductile —— ductile. C. Trenzen, Cologne, Germany. Eng. Pat. 26,800, Nov. 21, 1912. Under Int. Conv., Aug. 14, 1912.

See U.S. Pat. 1,074,993 of 1913; this J., 1913, 1017. —T. F. B.

Metals and alloys; Preparation of ——. A. P. Strohmenger, Westminster. Eng. Pat. 27,643, Nov. 30, 1912.

See U.S. Pat. 1,073,543 of 1913; this J., 1913, 981.—T.F.B.

Metallic surfaces; Cleaning ——. C. H. Thompson, Amblecote, Stafford. Eng. Pat. 9, Jan. 1, 1913.

See Fr. Pat. 458,524 of 1913; this J., 1913, 1074.—T. F. B.

Condensation of vapours of volatile metals, especially o zinc vapour; Process and apparatus for the ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 1616 Jan. 20, 1913. Under Int. Conv., Feb. 17, 1912.

See Fr. Pat. 454,399 of 1913; this J., 1913, 871.—T. F. B

Ores; Process of chloridizing ——. A. D. Ledou Summit, N.J. U.S. Pat. 1,082,509, Dec. 30, 1913.

See Fr. Pat. 460,579 of 1913; this J., 1914, 88.—T. F.

Metallurgical furnace. L. A. Smallwood, Birmingha U.S. Pat. 1,082,828, Dec. 30, 1913.

See Eng. Pat. 14,812 of 1909; this J., 1910, 958.—T. F.

Alloys; Process of improving ——. A. Wilm, Schlach ensee, Germany. U.S. Pat. 1,083,903, Jan. 6, 1914.

See Eng. Pat. 6485 of 1910; this J., 1910, 1210.—T. F.

Metals from their ores; Apparatus for extracting — H. S. MacKay, Assignor to MacKay Copper Proc Co., Riverside, Cal. U.S. Pat. 1,084,351, Jan. 13, 19

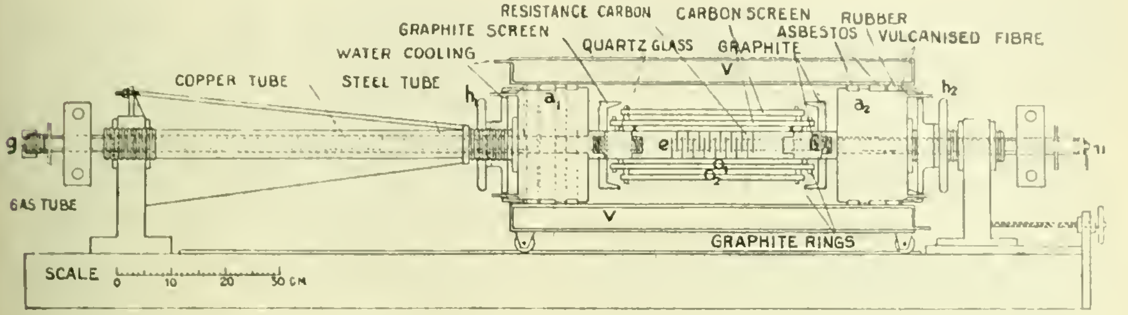
See Fr. Pat. 428,521 of 1911; this J., 1911, 1167.—T. F

XI.—ELECTRO-CHEMISTRY.

Electric vacuum furnace for high temperatures. J. Wolf and E. Müller. Z. Elektrochem., 1914, 20, 1—4.

The furnace which is represented diagrammatically in the figure has a heating unit consisting of a carbon or graphite tube, e, provided with slits about 1—2 mm. wide, 10 mm. apart, extending two thirds of the diameter alternately from opposite sides. This gives a certain elasticity and avoids fracture. The outer cooling jacket, v, which is mounted on wheels, can be readily removed to expose the interior, and can be made gas-tight by turning the wheels (h_1 h_2) which compress the rubber rings between the outer jacket and the end jackets (water-cooled pistons) a_1, a_2. The rubber is protected from the hot gases by rings of asbestos. The carbon tube screens, o_1, o_2, are each divided by horizontal slits so that the heating element can be easily exposed; they are spaced apart and insulated by quartz blocks, x. The substance to be heated is contained in a carbon boat, 1 cm. wide and 10 cm. long, to which is attached a long graphite rod which facilitates introduction into and removal from the furnace at a. If the object is to be suddenly cooled, a steel tube carrying an iron receiver is attached at g. When the boat is passed into the steel tube and inverted, the object falls into the receiver which may then be removed. Temperatures are measured optically through g, the copper tube being blackened inside. Very high and constant temperatures can be reached very rapidly, while the cost of the furnace and of the energy consumed at a given temperature is very low.

—W. H. P.



Tentative specifications and analytical procedure for 30 per cent. Hevea rubber insulating compound. See XIV.

Patents.

Furnaces; Electric ——. F. C. Wardall and J. Marchant, Huddersfield, Yorks. Eng. Pat. 2718, Feb. 3, 1913.

The furnace, provided with a vacuum casing, has a tapping tube constructed of alumina, extending through the lining and the metal wall to the base of the hearth. A carbon or like tube surrounds the portion of the tapping tube which extends through the lining and wall, with means for temporarily putting the carbon tube into an electric circuit, thus preventing the congealing of material in the vent hole during tapping. A wad, adapted to fuse at a given temperature, or a special valve, is used to close the vent hole. The outer end of the tapping tube is surrounded by a cylinder, the interior of this and of the tapping tube being in communication with the vacuous space in the casing. The upper part of the furnace casing forms a dome, and is provided with a controlled outlet for the gases. When the wad begins to soften, the valve in the dome is closed, and the gas pressure rises in the interior of the furnace; on the outlet side of the wad there is a diminished pressure, and the wad is thus forced towards the outlet end of the tapping tube.—B. N.

Furnace: Electric ——. P. Eyermann, Witkowitz, Austria. Eng. Pat. 9381, April 21, 1913.

The furnace, of the tilting variety, is so constructed that the hearth may be rotated in relation to the stationary cover, or the latter may be rotated whilst the hearth is stationary, or both may be rotated continually or periodically in the same, or in opposite directions, at the same or at different angular velocities, the tilting frame of the furnace remaining stationary in all cases. The central line between the electrodes is disposed eccentrically to the central line of the hearth. Both electrodes may pass through the cover of the furnace, or through the base and lateral walls.—B. N.

Furnace; Electric ——. J. Burke, Erie, Pa., Assignor to Burke Electric Co. U.S. Pat. 1,082,459, Dec. 23, 1913.

The furnace is supplied with polyphase currents through a transformer, which converts an alternating current into several secondary alternating currents of different phases by means of secondary coils unconnected with each other. Each secondary current is conveyed to a separate pair of electrodes disposed in the furnace in arcing relation to the charge.—B. N.

Ozone generators; Electric ——. C. W. Denny, London. Eng. Pats. 4355 and 17,969, Feb. 20 and Aug. 7, 1913.

The generator comprises a number of elements, each consisting of an outer and inner tubular or cylindrical electrode, arranged concentrically and separated by an annular space. The inner electrode consists of a metallic stationary tube provided on its periphery with a great number of integral points, produced from the metal of the tube by a "knurling" process, the surface being cut up by longitudinal and circumferential grooves. Each element is mounted by means of a clip upon a radial arm carried by a central boss or spindle, so as to be situated in the current of air created by a fan. In an alternative form, the outer electrode consists of a chain wound upon an insulating tube.—B. N.

Diaphragm for electrolytic apparatus. H. D. Rul m, Buffalo, N.Y., Assignor to Niagara Alkali Co., Niagara Falls, N.Y. U.S. Pat. 1,082,286, Dec. 23, 1913.

The diaphragm comprises a wire gauze cathode, and a number of superposed permeable layers, one or more of the inner layers being supported by and secured to the cathode, and one or more of the outer layers only loosely retained in position. The thickness of the diaphragm may thus be readily varied by adding or removing layers, a removable arrangement being provided for holding the loose layer or layers in position.—B. N.

Insulating compound. T. A. Edison, Llewellyn Park, West Orange, N.J. U.S. Pat. 1,083,354, Jan. 6, 1914.

The compound contains six parts by weight of tetrachloronaphthalene in tough flexible crystals, the interstices

being filled with one part by weight of a fusible substance, such as asphaltum, to render the compound non-porous.
—B. N.

Insulating material [from paper pulp] and process of making the same. J. C. Peabody, Assignor to The Republic Manufacturing Co., Boston, Mass. U.S. Pat. 1,083,755, Jan. 6, 1914.

A MIXTURE of sizing and free or uncombined resin is added to paper pulp in suspension in a liquid, in the proportion of at least 3 oz. of resin to 1 lb. of the dry fibre. The resin is distributed uniformly over the surface of the fibres by beating the mixture, the liquid being then extracted, and the residue subjected to heat and pressure to render it dense and homogeneous.—B. N.

Chemical compounds [nickel hydroxide for use in alkaline storage batteries]; Art of forming ——. T. A. Edison, Llewellyn Park, West Orange, N.J. U.S. Pat. 1,083,355, Jan. 6, 1914.

NICKEL hydroxide is formed by rubbing together in an undissolved condition, a dry pulverised salt of nickel containing water of crystallisation and an excess of a dry soluble hydroxide. The resulting mass is dried, washed to remove the soluble salt, and the nickel hydroxide finally dried.—B. N.

Battery; Storage ——. T. A. Edison, Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat 1,083,356, Jan. 6, 1914.

THE active material for the positive electrodes of alkaline storage batteries is obtained by adding to a solution of a nickel salt, containing a small percentage of a cobalt salt, from 2 to 12 per cent. of alkali in excess of the amount necessary to effect complete precipitation. The precipitated nickel hydroxide, containing not more than 5 per cent. of cobalt hydroxide, is dried, together with the excess of alkali and the soluble reaction products, the latter and free alkali being afterwards washed out and the residue dried.—B. N.

Chemical reactions [production of nitrogen oxides, etc.] in gases by means of electric arcs. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 974, Jan. 13, 1913.

SEE Ger. Pat. 265,413 of 1912; this J., 1913, 1068.—T. F. B.

Electrode for preventing cathodic reduction. A. Pietzsch and G. Adolph, Munich, Germany. U.S. Pat. 1,083,132, Dec. 30, 1913.

SEE Eng. Pat. 22,028 of 1912: this J., 1913, 31.—T. F. B.

Fireproof electrically-conducting bodies and process of manufacturing the same. G. Egly, Treptow, Assignor to Gebr. Siemens und Co., Lichtenberg, Germany. U.S. Pat. 1,084,199, Jan. 13, 1914.

SEE Fr. Pat. 420,183 of 1910; this J., 1911, 372.—T. F. B.

Furnace; Electric ——. G. Méttler, Berlin. U.S. Pat. 1,084,466, Jan. 13, 1914.

SEE Fr. Pat. 436,947 of 1911; this J., 1912, 499—T. F. B.

Manufacture [sterilisation and purification] of sugar. Eng. Pat. 29,524. *See* XVII.

XII.—FATS; OILS; WAXES.

Palm oil; Mechanical separation of ——. W. Kemner. Verhandl. Ölrohstoff-Kommission der Kolon.-Wirtsch. Komitees, 1913, 1, 17—22.

BY the native method of separating the oil from the palm fruit in the Cameroons (viz., heating over free fire and hand expression) it is estimated that 10 men can produce about 400 kilos. of palm oil in a month, so that about 22,000 natives would be required for the year's production of about 13,000 tons of palm kernels and 3500 tons of palm oil. In Haake's process, introduced in 1907, the fruit is broken up, repeatedly heated with hot water, and expressed, and the fragmentary residue of shells separated from the kernel pulp by centrifugal force. On the average 15 kilos. of oil and 14 kilos. of kernels are thus obtained from 100 kilos. of fruit, and 15 to 20 men can deal with 4 to 5 tons of fruit a day. The quality of the oil is similar to that produced by the native process, but the high proportion of free fatty acids (sometimes over 30 per cent.) renders the product only suitable for soap or candles. The oil is inferior to the best native soft Lagos oil. The process recently introduced into the Agu plantation in Togo gives much better results, the proportion of free fatty acids being usually below 8 per cent. In this process the entire fruit, after removal of the central core, is heated for some time at 100° C., within two hours of gathering, and is then mechanically pounded and expressed once only. From 16 to 17 per cent. of palm oil and 10 to 11 per cent. of kernels are thus obtained. The preliminary heating checks the formation of free fatty acids during the expression, though it probably causes a loss of aroma
—C. A. M.

Palm oil as an edible fat. F. Hupfeld. Verhandl. Ölrohstoff-Kommission der Kolon.-Wirtsch. Komitees, 1913 1, 23—30.

PALM oil containing only 7 per cent. of free fatty acids fetches M.25 per metric ton (24s. 10½d. per ton) more than oil containing 12 per cent. of free acids, and a premium of M.2.50 per metric ton (2s. 6d. per ton) is offered by one German firm for each reduction of 0·5 per cent. below 12 per cent. of free fatty acids. Now that it is possible to produce palm oil with a smaller proportion of acidity, it is suggested that a distinction should be made between ordinary palm oil and "edible palm oil," and that the latter should contain not more than 8 per cent. of free acids, 0·5 per cent. of dirt and 0·5 per cent. of water. There would be no difficulty with regard to the German Customs, since such palm oil would not be suitable as such for food, but only for the manufacture of edible fats.
—C. A. M.

Para rubber seed [oil]; Utilisation of ——. Bull. Imp. Inst., 1913, 11, 551—559.

THE results of examination of further samples of Para rubber seed, oil and oil-cake are given (see also this J., 1905, 1117; 1907, 764; 1910, 35; 1911, 755, 1265). Samples of oil were submitted to several paint and varnish manufacturers who stated generally that the oil was suitable for use in paints and varnishes, although it dried more slowly than linseed oil. A sample of the oil which caused "feeding up" of the paint, was found to have high acidity (acid value about 41); the "feeding up" of the paint appeared to be due to the free acid, as the oil when ground with white lead gave a stiff pasty paint, while the oil from which free acids had been removed gave a fluid paint. The oil appeared to be unsuitable for linoleum manufacture (cf. this J., 1914, 33), but could be used for the production of soft soap. The general conclusion was that the oil is less valuable than linseed oil for paint manufacture but that it should fetch from 25s.—30s. per cwt. (July, 1912). Small experimental consignments of oil, seed, and cake have been sold already in the United Kingdom. A sample of Para rubber seed cake contained: moisture, 8·75; crude protein, 30·19; true protein, 24·85; fat, 8·71; starch (by diff.), 41·74; fibre, 5·01; and ash, 5·60 per cent., corresponding to a nutrient ratio of 1 : 2·0, with 139 food units. The cake was free from alkaloids or saponin, but cyanogenetic glucosides were present in the above sample in quantity equivalent to about 0·02 per cent. HCN. Feeding trials on a fairly extensive scale were carried out at the South-Eastern Agricultural College, Wye. Sheep refused to eat the cake even when admixed with other foods. The cake produced a laxative effect when fed to young cattle at the rate of 5 lb. per diem, but dairy cows consumed

14 lb. per diem without any injurious effect upon the milk or butter produced, while satisfactory increases in weight were obtained. Trials on a larger scale are considered necessary to determine more exactly the value of Para rubber-seed cake as a food for cattle.—R. G. P.

Oil seeds and oils; Some new or little known ——. Bull. Imp. Inst., 1913, **11**, 559—574.

Safflower (*Carthamus tinctorius* L.) from Nyasaland. The seeds contained 29·6 per cent. of oil and 5·7 per cent. of moisture. Oil seed crushers reported that the seeds contained rather more moisture than is usual in average quality Indian seed, and would be worth about £7 10s. per ton in London (Feb., 1913). "*Raina*" *seed* (*Amoora Rohituka* W. and L.) from Bengal. The tree yielding these seeds is an evergreen growing in Northern and Eastern Bengal and Assam where the oil is used locally for burning, and medicinally. The seeds were nearly spherical, brownish-black with a pale brown hilum, and consisted of a thin brittle husk which adhered to the kernel; weight of 1 seed about 0·7 grm. Two samples of seed contained 42·5 and 43·5 per cent. of oil respectively. The oil was viscous, clear, and yellow brown; it had an unpleasant smell and bitter taste. Sp. gr. at 15° C. 0·929—0·931; saponification value, 193·0—192·3; iodine value, 131·7—132·5; Hehner value, 92·4; unsaponifiable matter, 1·2 per cent.; Reichert-Meissl value, 1·2; solidif. pt. of fatty acids (titer test), 32·4° C. The oil would be suitable for soap-making. The residual cake could be used only as manure on account of its bitter taste. Nominal value of seed £9 per ton in the United Kingdom (April, 1913). "*Toramani*" *seed* (*Eruca sativa* Mill.) from India. This Cruciferous plant is extensively grown as a green fodder in India, where the seed oil is used as an illuminant and as an edible oil, the cake being used as cattle food. The seed is occasionally imported to the United Kingdom as a substitute for rape seed. The very small seeds (100 weigh only 0·25 grm.) were dark brown or dark grey and yielded 30·8 per cent. of clear yellow oil with a slight mustard-like odour and taste. Sp. gr. at 15° C., 0·915; saponification value, 175·7; iodine value, 101·6. The oil could probably be used as a substitute for rape or colza oil. The seeds contain rather less oil than rape seed and were valued at 40s. per quarter (416 lb.) in London when rape seed was at 49s. 3d. per quarter. "*Panang*" *seed* (*Calophyllum Inophyllum*) from Bengal. The seeds were brownish black, almost spherical, ¾—1 inch in diameter and consisted of an easily-broken shell surrounding a round, soft, whitish kernel which weighed about 4 grms. The kernels contained 13 per cent. of moisture and 55 per cent. of viscous, green, bitter oil. A large sample of kernels from Bengal contained 3·3 per cent. of moisture and 71·4 per cent. of oil having the sp. gr. at 15° C., 0·950; acid value, 45·9; saponification value, 193—203; iodine value, 97·7. Oilseed crushers stated that the oil was excellent for soap-making and that the kernels would be worth £16 per ton. The residual cake is bitter and therefore would only be suitable for use as manure. A sample of the oil prepared in Fiji ("Ndilo" oil) was of deep blue colour, probably owing to contact with an iron vessel during preparation, as the oil contained iron and it is known that iron compounds give a blue colour with oils of *Calophyllum* species. "*Nahar*" *seed* (*Mesua ferrea* L.) from Assam. The seeds were brown and generally pear-shaped; they consisted of a shiny, brittle, woody shell containing a single buff-coloured kernel. Shell, 34 per cent., kernel 56 per cent. The kernels contained 76 per cent. of reddish-brown oil with a sweetish smell and slight bitter taste. The oil became semi-solid on standing at 15° C. Sp. gr. at 15° C., 0·935; saponification value, 204; iodine value, 90. The oil should be worth about £25—£27 per ton in the United Kingdom (July, 1913) for use in soap-making. The esidual cake is bitter and probably poisonous (cf. Bull. nst. Botan. Buitenzorg., 1904, **21**, 4): it would only e of value as manure. The whole seeds would be worth 10—£11 per ton, the kernels £17—£18 per ton. *Telfoiria edata* (Hook) seeds from Uganda. The kernels contain early 63 per cent. of viscous reddish-brown oil. The hells contain a bitter principle, which contaminates the oil when the whole seeds are crushed and no machine has yet been devised for removing the shells (see this J., 1912, 692, 731). "*Illipé*" *oil* (*Bassia latifolia*) from Mauritius. This was a pasty yellow fat with a slightly rancid taste of somewhat softer consistence than that of samples of *B. latifolia* fat previously examined. Sp. gr. at 100°/15° C., 0·861; acid value, 20·3; saponification value, 196·2; iodine value, 52·6. The fat would be suitable for soap-making but probably not for edible use. It would probably be better to export the kernels as there is a large market for such material at about £11 per ton. *Pentadesma butyracea* (Don) fruits and kernels from West Africa. The fruits were lemon-shaped, about 5 to 6 in. in length, 2½ to 3½ in. in diameter, and of dark brown colour. Each fruit contained about 8 kernels imbedded in dark coloured pulp. The fruits yielded 37 to 41 per cent. of moist kernels of irregular shape, about 1½ in. long and 1 in. in diameter. On drying in air the kernels lost up to 74 per cent. by weight. The fat content of the air-dried kernels was very variable, probably owing to imperfect drying and differences in degree of ripeness, results varying from 7·0 to 40 per cent. being recorded. The fat was of pale yellow colour and had a pleasant taste and smell. Sp. gr. at 100°/15° C., 0·857; acid value, 3·1; saponification value, 186; iodine value, 46·5. The residual cake is of no value for cattle feeding. Kernels in good dry condition should be worth £8—£10 per ton. "*Gru-gru*" *nuts* (*Acrocomia sclerocarpa*) and kernels from the West Indies. The gru-gru palm is a native of the West Indies and South America and is widely distributed in Trinidad but does not usually occur in such abundance as to enable kernels to be exported commercially, while there is a local demand for kernels for edible use (cf. this J., 1914, 9). This palm also occurs in Grenada, St. Vincent, St. Lucia and the Leeward Islands. The nuts had a hard brittle, woody shell about ⅛ in. in thickness; the kernels resembled oil palm kernels (*Elaeis guineensis*). Trials showed that the nuts could be shelled fairly well by a palm nut cracking machine. The kernels contained about 7 per cent. of moisture and 56—57 per cent. of fat resembling cocoanut and palm kernel oils. Sp. gr. at 100°/15° C., 0·868; acid value, 1·5; saponification value, 255; iodine value, 16—21; Reichert-Meissl value, 5·7—6·8; Polenske value, 10·0—12·6; solidif. pt. of fatty acids (titer test), 20·5° C. The kernels should fetch about the same price as palm kernels if exported in fair quantities.—R. G. P.

Drying oils; Note on the insoluble bromide test for ——. J. A. L. Sutcliffe. Analyst, 1914, **39**, 28—30.

The method for the determination of the amount of insoluble brominated glycerides resulting from the bromination of linseed oil has led to such variable results, according to the conditions of experiment, that the value of the test has been called in question. The author recommends the following procedure as giving standard results: One grm. of the oil in a tared flask is dissolved in 40 c.c. of redistilled ether, 5 c.c. of glacial acetic acid are added and the contents of the flask cooled to about 11° C. Bromine is added, drop by drop, with constant shaking, until an excess is indicated by a red colour. The closed flask is allowed to stand in water over-night. The liquid is filtered through a Gooch crucible having a disc of filter-paper over the asbestos. The precipitate is retained in the flask as far as possible during the first three washings, each with 10 c.c. of cooled ether, and is transferred to the crucible with the two last washings. The crucible and the flask are dried for 3 hours in the water-oven and weighed. Finally the melting point of the insoluble bromides is determined; in the case of linseed oil this should be 141°—144° C. The percentage of bromide obtained is related to the iodine value of the oil graphically as a straight line, which may be expressed by the formula: per cent. of bromide = (0·63 iodine value)—78·0.

—J. F. B.

Fat from the seeds of Trichilia subcordata. J. Östling. Ber. deuts. Pharm. Ges., 1913, **23**, 667—671.

The seeds of the German E. African tree, *Trichilia subcordata*, yielded 55·7 per cent. of a fat consisting in the main of palmitin and stearin with a little olein, and glycerides of butyric and other volatile fatty acids. The fat had the following characters :—M. pt. 45° C. ; solidif. pt. (not sharp), 30°—24° C. ; acid value, 39·6 ; saponif. value, 201·5 ; iodine value, 39·94 ; Reichert-Meissl value, 3·3 ; m. pt. of fatty acids, 54°—55° C. ; solidif. pt. of fatty acids, 51·5 ; and iodine value of fatty acids, 42·45. The fat is suitable for the manufacture of soap and candles. —C. A. M.

Iodine in oils ; Detection and determination of small quantities of ——. G. Fendler and W. Stüber. Z. physiol. Chem., 1914, **89**, 122—132.

Twenty-five grams of the oil are saponified in a platinum dish, with 50 c.c. of alcoholic potassium hydroxide solution (14 grms. KOH and 70 c.c. alcohol per 100 c.c.). After evaporation of the alcohol, the soap is carefully charred over a rose burner and the char ground and carefully heated again until the greater part has been burnt. The residue is treated with hot water, cooled, filtered and washed with cold water so long as the washings are alkaline. The filtrate (about 150 c.c.) is treated with 50 c.c. of dilute sulphuric acid (about 24 per cent.) and 20 c.c. of a 10 per cent. solution of potassium bichromate, and shaken with successive small quantities of carbon tetrachloride (altogether about 10—15 c.c. in the case of cod-liver oil). The united extracts are washed with water and the washings shaken with a few c.c. of carbon tetrachloride which is afterwards mixed with the main extract and titrated with $N/100$ sodium thiosulphate solution until colourless ; no indicator is required. Minute traces of iodine (*e.g.*, 0·0005 per cent. of the oil) are best determined by colorimetric comparison of the carbon tetrachloride extracts. All reagents should be tested by a blank experiment.—J. H. L.

Soaps ; Determination of free caustic alkali in ——. E. Bosshard and W. Huggenberg. Z. angew. Chem., 1914, **27**, 11—20.

The following modification of the method of Davidsohn and Weber (Seifensiederzeit., 1907) is rapid and gives accurate results :—Five grms. of the soap are dissolved in 100 c.c. of 50 per cent. alcohol on the water-bath, the solution rapidly cooled in water, the soap precipitated with 15 to 20 c.c. of 10 per cent. barium chloride solution, and the free alkali titrated with $N/40$ stearic acid solution, after the addition of 2 to 5 c.c. of α-naphtholphthalein solution as indicator. The stearic acid solution is prepared by dissolving 7·1 grms. of stearic acid in 1000 c.c. of absolute alcohol, filtering and standardising against alkali, whilst the indicator consists of 0·1 grm. of α-naphtholphthalein in 150 c.c. of alcohol and 100 c.c. of water. For the determination of alkali carbonate a second portion (5 grms.) of the soap is dissolved in 100 c.c. of 50 per cent. alcohol, and titrated in the cold (without precipitation of the soap) with the stearic acid solution with phenolphthalein or α-naphtholphthalein as indicator. If the liquid remain colourless even on boiling, free fatty acids are present, and may be titrated with $N/10$ alcoholic alkali. The amount of free caustic alkali that escapes determination by this method does not exceed 0·01 per cent. when the total free caustic alkali is less than 0·1 per cent. or 0·025 per cent. for amounts below 0·2 per cent.—C. A. M.

Patents.

Molten fats and such-like substances ; Cooling ——. G. J. Lemmens, London. Eng. Pat. 1924, Jan. 23, 1913.

The melted fat, etc., is exposed to a blast of compressed cold air, the sudden expansion of which abstracts heat from the fat and causes rapid solidification.—C. A. M.

Fat-melting apparatus. L. Wright, London. Eng. Pat. 5797, March 8, 1913.

The fat is melted in a horizontal steam- or water-jacketed tank, provided with a shaft carrying beaters, and with steaming devices and chambers at each end to receive the melted fat.—C. A. M.

Lubricating grease which may be used for preventing and removing incrustations from steam boilers. J. Oliveras, Barcelona. Eng. Pat. 17,288, July 28, 1913. Under Int. Conv., July 26, 1912.

The grease consists of a mixture of animal fat (*e.g.*, 100 parts of pig or horse tallow), lampblack (3 to 10 parts), and benzene (1 to 5 parts).—C. A. M.

Soap ; New —— *and process of making same.* C. Billing, Leytonstone. Eng. Pat. 27,572, Nov. 30, 1912.

Potassium or ammonium monoborate (prepared *e.g.*, by adding a slight excess of potassium hydroxide solution to a solution of boric acid) or a mixture thereof, is added to the soap, with or without further addition of alkali. —C. A. M.

Soap, soap powders, cocoa, chocolate ; Apparatus applicable for use in the manufacture of —— *and analogous processes.* K. B. Edwards, Berkhamsted, and H. Rance, Watford. Eng. Pat. 4654, Feb. 24, 1913.

The substances are heated, mixed, dried and powdered in a vessel provided with a heating and cooling jacket, and with blades rotating on shafts in such a way as to propel the mixture from the ends to the middle of the vessel.—C. A. M.

Soap. A. Kreutzinger and E. Juenger, London. Eng. Pat. 6691, March 18, 1913.

A soap, preferably in powdered form, is made from a mixture of sawdust (say 200 or 400 parts), powdered soap (200), calcined soda (150), pumice stone (150 or 350), potato meal (50), and chalk (50).—C. A. M.

Cleansing purposes ; Preparation for ——. H. F. Slack, West Bridgford, Notts. Eng. Pat. 8934, April 16, 1913.

A paste miscible with water is obtained by incorporating an organic solvent such as benzene, toluene or other hydrocarbon or mixture thereof (with or without carbon tetrachloride or other substituted hydrocarbon) with a neutral potash soap in the proportion of about 20 to 50 per cent. or more. The composition may be prepared by dissolving melted stearic acid in the organic solvent, adding sufficient potash solution at 60° C. to form a soap, and stirring the mixture with a strong solution of ammonia until a homogeneous cream is obtained.—C. A. M.

Shaving compositions ; Manufacture of ——. J. Jellinek, Vienna. Eng. Pat. 10,222, April 30, 1913.

Vaseline oil (say 20 to 30 grms.), ether (10 grms.), and shaving soap (2 to 5 grms.) are emulsified with a solution of borax (say 20 grms. per litre), with or without addition of scent.—C. A. M.

Fatty acids and glycerin ; Process of manufacturing ——. E. Twitchell, Wyoming, Ohio. U.S. Pat. 1,082,662, Dec. 30, 1913.

See Fr. Pat. 456,956 of 1913 ; this J., 1913, 1119.—T. F. B.

Fatty substances from oil ; Manufacture of solid ——. J. Schlinck, Hamburg, Germany. U.S. Pat. 1,082,707, Dec. 30, 1913.

See Eng. Pat. 8147 of 1911 ; this J., 1911, 1322.—T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Prussian blue ; The constitution of ——. P. Woringer J. prakt. Chem., 1914, **89**, 51—68.

The author advances the view that Prussian blue is ferrous ferricyanide, contrary to the opinions of K. A Hofmann (this J., 1904, 1209 ; 1907, 199), and E. Mülle (J. prakt. Chem., 1909, **79**, 81, **80**, 153 ; 1911, **84**, 353 who state that it is a ferrocyanide, the latter holding th the same product must result whether by reacting on a ferric salt with a ferrocyanide or on a ferrous salt with a ferricyanide. The first step in the reaction between ferric chloride and potassium (or sodium) ferrocyanide appeared to be the formation of the soluble product, $KFe(FeCy_6)$, which in the presence of an excess of ferric salt suffered further change:—

$$3KFe(FeCy_6)+FeCl_3 = Fe_7Cy_{18}+3KCl,$$

the tendency of the reaction in a right-handed direction being influenced by the excess of iron salt. For the formation of the soluble potassium blue compound an excess of ferrocyanide was required. In attempting to form it by the use of exactly equimolecular quantities of ferric chloride and potassium ferrocyanide, the ratio of extra-radical to intra-radical Fe in the product was not exactly 1 : 1 but 1·06 : 1, and the filtrate contained potassium ferricyanide, and not ferrocyanide. With an excess of ferrocyanide, also, ferricyanide was found in the filtrate, but the ratio of extra- to intra-radical Fe in the blue compound was exactly 1 : 1. More ferricyanide was found in the filtrate the greater the excess of ferrocyanide used. These facts indicate that simultaneous oxidation and reduction of the ferrocyanide and the ferric salt take place thus:—

$$\left(\overset{\mathrm{II}}{\mathrm{Fe}}\,\mathrm{Cy}_6\right)^{''''} + \overset{\mathrm{III}}{\mathrm{Fe}}{}^{\cdots} = \left(\overset{\mathrm{III}}{\mathrm{Fe}}\,\mathrm{Cy}_6\right)^{''} + \overset{\mathrm{II}}{\mathrm{Fe}}{}^{\cdot\cdot}$$

the resulting ferro-ions attaching themselves to the ferricyan-ions to form

$$\mathrm{K}\overset{\mathrm{II}}{\mathrm{Fe}}\left(\overset{\mathrm{III}}{\mathrm{Fe}}\,\mathrm{Cy}_6\right),$$

which reacts with further free ferro-ions to form either

$$\overset{\mathrm{II}}{\mathrm{Fe}}_3\left(\overset{\mathrm{III}}{\mathrm{Fe}}\,\mathrm{Cy}_6\right)_2 \quad \text{or} \quad \mathrm{K}\overset{\mathrm{II}}{\mathrm{Fe}}_4\left(\overset{\mathrm{III}}{\mathrm{Fe}}\,\mathrm{Cy}_6\right)_3$$

Very careful decomposition of Prussion blue with alkali showed that alkali ferricyanide was formed, which, however, is readily reduced to alkali ferrocyanide by the ferrous hydroxide also formed, unless special precautions be taken. Almost quantitative separation of ferricyanide was obtained and the relationship was not disturbed by using a blue previously treated with hydrogen peroxide.—J. B.

Copal from the Congo. Lamont. Roy. Bot. Gard. Kew. Bulletin, 1913, [5], 194.

This resin is derived in the Congo from *Copaifera demeusei*, and other trees of the leguminous family. It is found chiefly in marshy forests bordering rivers. Two kinds of resin are found: fresh copal, collected from the trees, and fossil copal, dug up from trees in decay, sunk under the soil. Before exporting, it is divided into parcels, hard and soft. The former is treated with a solution of caustic soda of one per cent. strength for half an hour and then washed in water and dried in the sun. The softer copals of whitish or yellow texture and of recent formation, are simply scraped, before packing. Exposed to the air for a certain time they become clearer and harder. The Congo copal is classified in the Antwerp market under five heads:—(1) Sorted, white, best quality. (2) Sorted, clear, transparent. (3) Assorted, less transparent. (4) Somewhat opaque. (5) Not sorted. The exports during the last eight years are as follows.—1904, 938·6 metric tons; 1905, 754·0; 1906, 912·3; 1907, 1060·3; 1908, 1608·9; 1909, 826·5; 1910, 975·5; and 1911, 2138·8 metric tons.

The price at Antwerp varies from 6d. to 1s. 3d. per lb. The kind most valued is that which is hard, transparent, and with a fracture like glass.

Resins; Synthetic ——. L. V. Redman, A. J. Weith, and F. P. Brock. J. Ind. Eng. Chem., 1914, **6**, 3—16.

In all of the methods hitherto described for the preparation of artificial resins by the condensation of phenolic compounds with compounds containing active methylene groups (formaldehyde, etc.), the reaction appears to have been carried out in aqueous solution. The authors have found that by working with anhydrous substances (phenol or the like and hexamethylenetetramine) the process is considerably simplified, more uniform products of higher dielectric strength are obtained, and the sole by-product of the reaction is ammonia. If 12 mols. or more of phenol be used for 1 mol. of hexamethylenetetramine, the reaction is very rapid on heating, the nitrogen of the hexamethylenetetramine is evolved quantitatively as ammonia, and the reaction-product consists of a soluble rosin consisting of 13 phenol residues connected by 12 methylene groups (phenylendeka-saligenosaligenin, $C_6H_5OCH_2(C_6H_4OCH_2)_{11}.C_6H_4OH$), dissolved in excess of phenol. The reaction appears to proceed in stages and aminosaligenosaligenin, $NH_2.CH_2.C_6H_4.CH_2.O.C_6H_4OH$, has been isolated as an intermediate product. The soluble resin has properties practically identical with those of Baekeland's "Novolak" (see Lebach, this J., 1913, 559). When less than 12 mols. of phenol per mol. of hexamethylenetetramine are used, the reaction product changes in character, becoming harder and more brittle as the proportion of phenol is diminished, until with 6 mols. of phenol, a hard, dense, transparent resin, with a tensile strength of 4000—5200 lb. per sq. inch is obtained, which softens very little even at high temperatures. By so working that the evolution of ammonia proceeds slowly, a homogeneous solid product can be obtained, whilst by heating rapidly, *e.g.* to 180° C., a spongy mass is produced, which can be more readily pulverised; the fine powder yields a transparent homogeneous solid of maximum mechanical strength, highest dielectric properties, and chemical inertness when pressed in hot moulds under a pressure of 4—6 tons per sq. in.—A. S.

Patents.

Paints; [Damp-proof and fire-proof] ——. A. McKechnie, London. Eng. Pat. 228, Jan. 3, 1913.

A resin (*e.g.* colophony) and a basic substance, such as lime, are ground separately, and then mixed and incorporated with paraffin oil (with or without boiled or raw linseed oil or other medium) and a pigment. Or the rosin and paraffin oil may be separately heated, mixed with the pigment, and added to the lime, which has been made into a paste, before grinding.—C. A. M.

White lead; Method of making ——. A. S. Ramage, Buffalo, N.Y., U.S.A. Eng. Pat. 17,857, Aug. 5, 1913.

A basic carbonate of lead is prepared by the interaction of lead sulphate and an alkali carbonate in insufficient quantity to convert the whole of the sulphate into carbonate, and the resulting product is treated with an alkali hydroxide.—C. A. M.

Lead pigments; Manufacture of ——. C. D. Holley. Assignor to Acme White Lead and Color Works, Detroit, Mich. U.S. Pat. 1,082,953, Dec. 30, 1913.

"Basic lead oxide" is boiled with a dilute aqueous solution of an alkali nitrate (containing a small proportion of nitric acid if metallic lead is present), the mixture evaporated to dryness and the residue heated in a furnace to produce massicot.—W. E. F. P.

Crayons; Process for producing a substance for manufacturing water- and temperature-proof coloured marking chalk or pencils, artists' —— *and the like.* A. Herda, Iserthal, Austria. Eng. Pat. 12,109, May 24, 1913.

A wax, such as candle wax (46 per cent.) is melted, mixed with a pigment (54 per cent.), and cast in suitable moulds such as paper tubes. (Reference is directed to Eng. Pats. 2493 of 1877, 2430 of 1878, 3762 of 1881 and 11,182 of 1902.)—E. W. L.

Rosin and turpentine from wood; Process of obtaining ——. C. Howard, New York. U.S. Pat. 1,082,526, Dec. 30, 1913.

Comminuted coniferous wood is subjected to the action of a vacuum and then treated under pressure with a solvent of rosin, *e.g.* turpentine. During the treatment the charge is agitated by means of currents of heated air under pressure, introduced in a downward direction, and the pressure is alternately increased and diminished. —A. S.

Turpentine and resin extractor. J. H. Castona, Moss Point, Assignor to Castona Improved Process Co., Gulfport, Miss. U.S. Pat. 1,083,802, Jan. 6, 1914.

THE apparatus comprises a vertical cylinder containing a cage for the material to be extracted, with a space outside the cage for the discharge of volatile products, a heating chamber at the bottom of the cylinder a central vertical steam pipe within the cage, and a space above the heating chamber to receive the extracted resin. —C. A. M.

Resinous compound; Process of producing a ——. Resinous compounds. D. Whipple, New York, Assignor to Standard Chemical Co., Bayonne, N.J. U.S. Pats. 1,083,168, 1,083,169 and 1,083,170, Dec. 30, 1913.

(1) RESIN is heated in the presence of moisture to about 135° C. so as to break up the complex turpentine products and volatilise the same together with the volatile organic acids, then the temperature is raised to 140° C. and the residue treated with an oxidising agent, *e.g.* a current of dry air. (2) Claim is made for resin derivatives in the form of a soft non-drying, plastic, gummy mass, of sp. gr. about 0·98, and having a high electrical resistance. (3) An insulating composition consisting of a soft, non-drying, plastic resin derivative and a non-drying, non-oxidising, unsaponifiable oily resin derivative.—A. S.

Resin-soap and resin; Manufacture of ——. J. Aktschourin, Aktschourin-Tupik, Russia. Eng. Pat. 27,890, Dec. 3, 1912.

SEE Ger. Pat. 257,015 of 1912; this J., 1913, 499.—T. F. B.

Oil varnish substitutes from animal oils; Process for the manufacture of ——. W. Kaempfe, Grossenhain, Saxony. Eng. Pat. 6463, March 15, 1913. Addition to Eng. Pat. 15,012, June 27, 1912.

SEE Addition of April 1, 1913, to Fr. Pat. 445,565 of 1912; this J., 1913 983.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc; Addition reactions of ——. F. Kirchhof. Kolloid-Zeits., 1914, 14, 35—43.

IT was shown previously (see this J., 1913, 799) that vulcanised rubber behaved differently to raw rubber when oxidised by air or oxygen; besides differences in the velocity of oxidation, the vulcanised rubber behaved as though only one double linkage was present in the $C_{10}H_{16}$-molecule. Experiments with different kinds of raw rubber have now shown that these when treated with air carrying sulphur chloride or bromine vapour also behaved as though the $C_{10}H_{16}$-mol. contained only one double linkage, products approximating to the composition $C_{10}H_{16}S_2Cl_2$ and $C_{10}H_{16}Br_2$ respectively being formed. On warming the dibromide or on carrying out the treatment at 80° C., a monobromide was formed, with elimination of hydrobromic acid. When solutions of rubber were treated with sulphur chloride, there was first a diminution of the viscosity of the solution, followed by a continuous increase. In explanation of these facts the author develops a hypothesis based on the assumption that in raw rubber the $C_{10}H_{16}$ mols. are held loosely together by partial valencies, and that in addition reactions these are converted into full valencies with simultaneous addition of two atoms of halogen or the like. The greater reactivity of rubber in solution and the decrease of viscosity observed at first when the solution is treated with sulphur chloride is considered to be due to depolymerisation of the caoutchouc which follows quantitatively in solution, but only partially with solid caoutchouc, in which case a condition of equilibrium of opposing tendencies to depolymerisation and repolymerisation results. In vulcanisation the chief action of the sulphur is held to be that of a catalytic (or condensing) agent causing the breakdown of the loosely-bound caoutchouc complex into stable condensed systems, probably with the formation of tetramethylene rings; in the subsequent chemical combination of sulphur, the isocyclic tetramethylene-ring is converted into a heterocyclic six- or seven-membered ring by introduction of atoms of sulphur.—A. S.

Rubber insulating compound; Tentative specifications and analytical procedure for 30 per cent. Hevea ——. J. Ind. Eng. Chem., 1914, **6**, 75—82.

THE preliminary report of a joint committee appointed in Dec., 1911 by a group of manufacturers and users of rubber insulating compounds, including representatives of the American Chemical Society and the U.S. Bureau of Standards. The specification is as follows: A 30 per cent. fine Para or smoked first latex Hevea rubber compound with mineral base shall be furnished, containing only rubber, sulphur, inorganic mineral matter, and refined solid paraffin or ceresin, and free from red lead or carbon. The vulcanised compound shall conform to the following requirements, the figures representing percentage by weight of the whole sample: rubber, 30—33 per cent.; waxy hydrocarbons, not more than 4 per cent.; free sulphur, not more than 0·7 per cent. The permissible limits for other constituents and for specific gravity for compounds containing respectively 30 per cent. and 33 per cent. of rubber are as follows: for intermediate rubber contents the permissible limits are varied in proportion.

	Permissible limits:			
	30 per cent. compound.		33 per cent. compound.	
	Max.	Min.	Max.	Min.
Saponifiable acetone extract	1·35	0·55	1·50	0·60
Unsaponifiable resins	0·45	—	0·50	—
Chloroform extract	0·90	—	1·00	—
Alcoholic potash extract	0·55	—	0·60	—
Total sulphur*	2·10	—	2·30	—
Specific gravity	—	1·75	—	1·67

* The limit of total sulphur may be omitted at the option of the purchaser.

The acetone solution shall not fluoresce and the acetone extract (60 c.c.) shall not be darker than a light straw colour. The hydrocarbons present shall be solid, waxy, and not darker than a light brown colour. The chloroform extract (60 c.c.) shall not be darker than a straw colour. Failure to meet any requirement of the specification shall be sufficient cause for rejection. The specification should be supplemented by clauses relating to tensile strength, elasticity, insulation resistance and dielectric strength. The method of analysis is described in minute detail, with illustrations of the grinding machine for the preparation of the sample and of the extraction apparatus. In outline it consists in extracting 2 grm.-samples (20 mesh-size) with acetone for 8 hours, and the residue with chloroform for 4 hours. The final residue is saponified with alcoholic potash and the solution acidified and extracted with ether. The acetone extract is saponified with alcoholic potash and in the aqueous portion the free sulphur is determined, whilst the unsaponifiable material is used for determining the waxy hydrocarbons and the unsaponifiable resins. The filling materials and total sulphur are determined in separate samples, the former by using first a mixture of terebene and xylene and then terebene alone to dissolve and remove the rubber, and the latter by fusion with a mixture of sodium peroxide and potassium carbonate, followed by precipitation as barium sulphate. Duplicate determinations should agree within 0·01 for specific gravity, 0·05 per cent. for free sulphur, 0·5 per cent. for tillers, free from sulphur, and 0·1 per cent. for the other constituents determined. The rubber is ascertained by difference. The committee desires to obtain the results of experience with the methods during the ensuing year and then issue a final report with any improvements found desirable.—A. S.

Rubber; Formic acid in the regeneration of ——. A. Dubosc. Caoutchouc et Guttapercha, 1914, **11**, 7944—7948.

In separating textile material from vulcanised rubber, although a partial separation may be effected mechanically, it is necessary to destroy the cellulose chemically. This may be effected either by strong acids, or by dilute acids at a high temperature and pressure. The author describes the use of acetic and formic acids; certain solvents can be found for cellulose triacetate and triformate, which do not dissolve rubber. If the esterification is continued however, products soluble in water are obtained, esters of cellobiose. Acetic anhydride is expensive and it is necessary to apply heat, hence formic acid is preferable. The acid (90 per cent. strength) may be saturated with dry hydrochloric acid gas to aid the reaction. The amount of acid used should be twice the weight of the waste material. At ordinary temperatures, aided by a little petroleum benzine, the reaction is over in about 12 hours. The liquid first becomes viscous and opalescent, and then mobile again. At 60°—70° C., the reaction is over in 4 hrs. The rubber is then filtered off, washed and dried; the properties of the product are stated to be excellent.—H. E. P.

Utilisation of Para rubber seed. See XII.

Patents.

Rubber milk or latex; Apparatus for treating —— and sheeting the coagulated product. L. Norzagaray, London. Eng. Pat. 29,369, Dec. 20, 1912.

Over a smoke-producing fireplace is built a chimney consisting of rectangular metal sections, each with the exception of the top one containing a rotating flanged drum, a scraper and baffle-plates. Latex is supplied to feed-rollers in the top section, and passes down through the chimney from drum to drum, being removed from each by a scraper. From the bottom roller the rubber is removed either by a fixed scraper, from which it passes between pressing-rollers, or by means of one of a pair of corrugated rollers acting as a scraper. Baffle-plates are provided to give the smoke the desired direction up the chimney.—E. W. L.

Caoutchouc; Process for manufacturing synthetic ——. C. K. F. L. Gross, Bevön, Norway. Eng. Pat. 13,826, June 14, 1913. Under Int. Conv., June 15, 1912.

See Fr. Pat. 459,987 of 1913; this J., 1913, 1164.—T. F. B.

Caoutchouc substance and process of making same. F. Hofmann and C. Coutelle, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,084,333, Jan. 13, 1914.

See Fr. Pat. 422,955 of 1910; this J., 1911, 637.—T. F. B.

Caoutchouc-like substances; Vulcanised ——. F. Hofmann, C. Coutelle, K. Delbrück, and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,084,334, 1,084,335, 1,084,336, 1,084,337, and 1,084,338, Jan. 13, 1914.

See Eng. Pat. 6642 of 1911; this J., 1911, 969.—T. F. B.

Vulcanised froth; Process of manufacturing ——. F. Pfleumer, Dresden, Germany. Reissue No. 13,667, Dec. 30, 1913, of U.S. Pat. 1,038,950, Sept. 17, 1912.

See Fr. Pat. 430,473 of 1911; this J., 1911, 1323.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin; Comparison of the extraction of vegetable materials containing —— in copper and glass. C. R. Oberfell and L. M. Richeson. J. Amer. Leather Chem. Assoc., 1914, **9**, 28—32.

The differences obtained in the tannin content on both new and spent material were well within the limits of accuracy of the method and indicated that the copper flask and extractor had no appreciable effect. In the case of new materials the average difference per determination was 0·0125 per cent. higher with glass than with copper and with spent materials 0·046 per cent. higher with copper than with glass.—D. J. L.

Vegetable tannins; Qualitative differentiation of ——. E. Stiasny. J. Amer. Leather Chem. Assoc., 1914, **9**, 19—25.

Lauffmann (this J., 1913, 53) from his test of precipitating tannin solutions with ammonium molybdate and ammonium chloride concluded that quebracho extracts containing no pyrogallol tans (formaldehyde test) and no wood-pulp (aniline test) could be regarded as adulterated with mangrove if the molybdenum figure (weight of precipitate from 100 grms. of tannin) was higher than 30—40. The author in conjunction with C. D. Wilkinson has confirmed Laufmann's results. Mangrove can also be detected when mixed with sulphited quebracho, but the variations of the figure obtained for quebracho and sulphited quebracho lessen the value of the test. Sulphited quebracho extracts yield figures from 5 to 37 according to the extent of the sulphiting. A strongly sulphited quebracho extract (Mo figure 5) can be adulterated with 20 per cent. of mangrove (Mo figure 125) without reaching the limit of 30. A scheme is given for the qualitative determination of vegetable tannins in which three main groups are formed according as precipitation is complete, partial, or absent on boiling with formaldehyde and hydrochloric acid.—D. J. L.

Tanning materials; Determination of pentoses in —— with special reference to quebracho and mangrove extracts. J. L. van Gijn and H. van der Waerden. Collegium, 1913, 639—645.

Quebracho extract was found to be almost free from pentosans and pentoses and contained no methylpentoses, while mangrove extract contained a considerable quantity of methylpentoses. With mixtures of quebracho and mangrove extract it was possible to detect 10 per cent. of mangrove extract when mixed with untreated quebracho, but with sulphited quebracho extract not less than 25 per cent. of mangrove extract could be detected. The inhibiting effect of the sulphite could be prevented by means of iodine. The following method (see this J., 1901, 396; 1902, 875; 1905, 212; 1911, 242, 1181) therefore provides a reliable test for mangrove in quebracho extract. 10 grms. of the sample are placed in a distillation flask with some glass beads and a little paraffin wax to prevent foaming. If the extract is sulphited, sufficient iodine to oxidise the sulphite and 100 c.c. of 12 per cent. hydrochloric acid are added, and after boiling gently for 16 mins. under a reflux condenser, the solution is distilled. For every 30 c.c. of distillate obtained in 10 mins., 30 c.c. of 12 per cent. hydrochloric acid are added to the distillation flask from a dropping-funnel. Distillation is continued until the distillate gives only a pink colour with aniline acetate. Usually 420 c.c. of distillate are sufficient; this is made up to a known volume, filtered, and to an aliquot part, an excess (200 mgrms.) of phloroglucinol dissolved in 12 per cent. hydrochloric acid is added. After standing 15—24 hours the precipitate is collected in a Gooch crucible, washed free from acid and weighed after drying for 3 hours at 98°—99° C. The precipitate is then treated with 30 c.c. of 96 per cent. alcohol at 60° C., washed with 50 c.c. of alcohol and weighed again after drying. The loss of weight represents methylfurfural-phloroglucide. The change of colour on adding the phloroglucinol is very characteristic and shows of itself whether a quebracho extract is pure. In that case the liquid becomes yellow, then green, and finally a black precipitate forms, leaving the supernatant liquid colourless. With a mangrove extract the colour is first yellow, then red and finally a red precipitate is produced, turning brown on standing. —D. J. L.

Mangrove; The determination of —— in admixture with other tanning materials. G. A. Kerr. J. Amer. Leather Chem. Assoc., 1914, **9**, 23—28.

The test proposed is based on the production of furfural by distillation with hydrochloric acid and precipitation in the distillate with phloroglucinol. (See van Gijn and van der Waerden: preceding abstract.)—D. J. L.

Tans; Rendering powdered —— (phlobaphenes) soluble by hydrolysis with sulphurous acid and the action of dextrin glucose on tannin-glucosides. E. O. Sommerhoff. Collegium, 1914, 3—5.

Pure hot solutions of quebracho extract probably contain compounds of a starchy and cellulosic character, which, on cooling, separate partly as the so-called phlobaphenes, but under the prolonged action of sulphurous acid are hydrolysed to dextrin-glucose. The dextrin-glucose formed thus and also the glucose originally present act in a similar manner to cane sugar (this J., 1913, 952) in that, on gentle warming, they rapidly render soluble sparingly soluble tannins. The action of sodium bisulphite in rendering soluble sparingly soluble tanning extracts becomes apparent only after 2—3 hours, hence secondary products must also influence the solubility of the extract. The mechanism of the action may be as follows. The insoluble tannins (phlobaphenes) are transformed into dextrin-glucose and hence are partly lost as far as tanning effect is concerned, as dextrin is only absorbed by hide to a small extent. The action of cane sugar or glucose on tanning extracts becomes of more importance since recent investigations have shown that tannins are taken up as glucosides or other compounds containing sugar, the hydrolysis of which would be retarded by addition of glucose. An objection to the addition of excess of glucose to a tanning extract is that it chokes up the pores of the hide in the earlier stages; dextrin-glucose renders hide slimy. This corresponds with the effect of sugar in preventing the setting of gelatin solutions. Since glucose is a strong anti-coagulant, a large quantity of a coagulating electrolyte, having a salting-out action, such as sodium sulphite, must be added to the extract to compensate for this effect. Easily soluble extracts only produce flat leather and should only be used in cases where a very light-coloured leather is required. Phlobaphenes contain a yellow-red colouring matter which is very sensitive to light. The ash of phlobaphenes in the pure state contains traces of heavy metals. —D. J. L.

Depilating; Notes on ——. A. Rogers. J. Amer. Leather Chem. Assoc., 1914, **9**, 42—52.

The view that, owing to the limited solubility of lime in water, there is no danger of destroying a pack of hides by using an excessive amount, is misleading as there is great danger of damage by improper lime treatment. On a practical scale several packs of skins treated with 5 per cent. of lime showed 40 per cent. increase of weight and absorbed 1·3 per cent. CaO in 2 days; with 10 per cent. of lime there was a 50 per cent. increase of weight and 3·65 per cent. CaO absorbed. A new lime has a greater solvent effect on hide substance than an old lime, and a pack of skins treated with a fresh lime every day for several days lost much more hide substance than one remaining in a liquor improved by addition of the same amount of lime. Records of pack weights at different stages of liming showed that the greatest weight occurred on the fourth day; the decrease following the fourth day was due to loss of hair. A typical increase in weight of samples freed from hair and depilated with 5 per cent. of lime made fresh every day (A), and from a series treated with 5 per cent. of lime made up to strength every day (B) was as follows:—

	A.	B.
Percentage increase after 1 day	42·10	42·93
,, ,, ,, 2 days	2·60	2·10
,, ,, ,, 3 ,,	4·14	4·10
,, ,, ,, 4 ,,	1·30	1·41
,, ,, ,, 5 ,,	1·70	1·70
,, ,, ,, 6 ,,	0·30	3·60
Totals	52·14	55·84

Estimations of lime and ash in the hides gave the following results:—

	A.		B.	
	Ash.	CaO in ash.	Ash.	CaO in ash.
Originally	0·66	33·67	0·51	32·80
After 1 day	3·15	59·82	3·14	56·61
,, 2 days	3·30	74·45	3·71	78·98
,, 3 ,,	4·25	76·58	4·19	80·49
,, 4 ,,	4·52	78·46	4·50	90·64
,, 5 ,,	4·21	86·69	4·81	86·07
,, 6 ,,	5·18	82·69	4·67	84·23

Practically all the fat which was saponified became so during the first 24 hours.

The loss of hide substance during 6 days was as follows:—

	A.	B.
After 1 day	0·51	0·55
,, 2 days	0·25	0·39
,, 3 ,,	0·43	0·59
,, 4 ,,	0·66	0·64
,, 5 ,,	0·24	0·17
,, 6 ,,	0·25	0·34
Totals	2·34	2·68

From these results it seems that the proper way to apply a lime solution is to enter the stock into a lime liquor only a few days old and work up through the series to a fresh liquor. Sodium sulphide when used for removing hair should be used before lime as it has no solvent action on hair which has once been treated with lime, although rapidly dissolving clean hair. Good results are obtained by the use of a mixture of sodium sulphide and calcium chloride; the goods are run in a 20° Bkr. sulphide solution containing calcium chloride to a ¼ of the weight of sulphide. —D. J. L.

Tannage; Alcohol —— and photochemical autoxidations. E. O. Sommerhoff. Collegium, 1914, 5—7.

The tanning effect of alcohol is usually explained as being due to its dehydrating action, but this hypothesis is probably incorrect, as the author has found that acetone, which has similar dehydrating properties, has no tanning effect. Dilute (10 per cent.) alcohol has an apparent tanning action in the presence of much air and light, but in an atmosphere of carbon dioxide has no tanning effect. Alcohol in the presence of much light and air has a similar action to dilute formaldehyde and air although much weaker. Practical tanning with spirit is best carried out by soaking a delimed lamb-skin in spirit and hanging in the light and air, remoistening with spirit from time to time. The alcohol is oxidised to acetaldehyde, and an autoxidising action of the aldehyde and hide-albumin takes place. The effect is similar to the resinification of plant juices. Tanning may be regarded as an oxidation of the hide, and polymerised or "resinified" albuminous substances of high molecular weight are produced which are insoluble in boiling water. A delimed lamb-skin is tanned by Italian red wine much quicker than by 10 per cent. alcohol. It appears that the small quantities of tannin in the wine act on the alcohol catalytically as oxygen-carriers and hasten the process. Beer, containing carbon dioxide, has scarcely any tanning action, although containing as much tannin as wine. If raw flesh be boiled in wine in sunlight, acetic acid is produced, and the yield of extract is much less than if water alone is used. No acetic acid is produced if air or light be excluded or if dilute alcohol alone be used. A double oxidation takes place in tanning with wine in the air, albumin being oxidised and acetic acid formed from the wine, both the tannins and the albumins acting catalytically. The tannin has strongest catalytic effects when in the colloidal state; small quantities of quebracho tannin added to spirit produce a much less tanning effect on the hide, being coagulated.—D. J. L.

Tanning with alcohol. W. Eitner. Gerber, 1914, **40**. 17—18.

According to a recent German patent, hide is tanned with dilute alcohol in the presence of oxygen and a catalytic agent. As catalysts, phlobaphenes, vegetable tannins, metallic hydroxides or soaps may be used, all in smaller quantities than in usual tanning processes. The author points out that by the action of strong alcohol a product similar to leather is produced from skin, but there is no real change into leather. The effect of the alcohol is due less to dehydration than to coagulation and precipitation of the colloidal hide components by means of which the clinging together of the fibres during drying is prevented. After washing with water and drying out, the skin is perfectly untanned again. When dilute alcohol is used the precipitating effect is much slower. The hanging in the air, as described in the patent, has no other effect than a removal of water which allows the strong alcohol to penetrate. A calf skin after twice treating with 10 per cent. alcohol was almost unchanged; after 8 treatments a weak tanning effect was produced. It is only when tanning substances, used according to the patent as oxygen-carriers, are added that any real tanning effect is produced which will vary according to the quantity and kind of tannin added. The alcohol in the solution causes a much quicker penetration of the tannin but hinders complete and full tanning. The cost of alcohol has prevented its being used for the purpose of quick vegetable tanning; in mineral tanning it has no effect. Metallic soaps mentioned in the patent as catalysts are quite insoluble in 10 per cent. alcohol and therefore useless for the purpose.—D. J. L.

Examination of commercial gelatins with regard to their suitability for paper-making. Sindall and Bacon. *See* V.

Patents.

Tanning; Processes for mineral and vegetable —— in one operation. W. A. Klipstein, New York. Eng. Pat. 16,844, July 22, 1913.

See Fr. Pat. 460,870 of 1913; this J., 1914, 95.—T. F. B.

Hides and skins; Process of depilating and reducing ——. O. Röhm, Darmstadt, Germany. U.S. Pat. 1,082,911, Dec. 30, 1913.

See Eng. Pat. 18,770 of 1911; this J., 1911, 1224.—T. F. B.

Disinfecting hides and skins in the manufacture of leather; Process of ——. O. Röhm, Darmstadt, Germany. U.S. Pat. 1,083,300, Jan. 6, 1914.

See Ger. Pat. 254,131 of 1911; this J., 1913, 438.—T.F.B.

Adhesives or cements for leather. "Ago" Lederkitt Industrie Ges. m. b. H., Trieste, Austria. Eng. Pat. 4016, Feb. 17, 1913. Under Int. Conv., Feb. 15, 1912.

See Fr. Pat. 454,379 of 1913; this J., 1913, 878.—T. F. B.

XVI.—SOILS; FERTILISERS.

Humus; Determination of —— in heavy clay soils. W. Beam. Cairo Scientific J., 1913, **7**, 219—224.

The method described previously (this J., 1912, 695) is improved if very dilute hydrochloric acid (0·02 per cent.) instead of carbonic acid is used for washing after removal of the calcium and magnesium. A small quantity of chloride is retained by the soil in this case, and subsequently extracted by the ammonia, but this can be determined in an aliquot portion of the filtrate and a correction applied. The extraction of the humus is much more rapid under the new conditions. Further data are given showing the accuracy of the author's colourimetric method for determining humus, if the standard and the soil to be tested are of approximately the same composition as regards clay and humus.—W. H. P.

Mono-, di-, and tri-calcium phosphates; Action of ammonium citrate on ——. T. Warynski and J. Langel. Ann. Chim. Analyt., 1914, **19**, 1—6.

The three calcium phosphates are all soluble to an appreciable extent in ammonium citrate solution; so that a rigorous separation of them by solution in ammonium citrate is not possible. The action of the citrate in dissolving them is fairly rapid, equilibrium being attained in about an hour (with manures, containing in addition other substances, probably a longer time is necessary). The differences in the solubilities of the three phosphates are greatest in the cold, and when the citrate solution is saturated.—J. T. D.

Superphosphate-vinasse ("Superphosphatschlempe"), a new fertiliser. H. Stoltzenberg. Chem.-Zeit., 1914, **38** 81—82.

Vinasse is a valuable fertiliser on account of its high nitrogen and potash content, but the residue from the evaporation of the pulp ("*Dickschlempe*") is too hygroscopic for use as a solid manure; this is due to the presence of bases, especially betaine. A non-hygroscopic salt of the latter base is the acid phosphate. On warming a mixture of 3 parts of superphosphate and 2·5 of pulp, acid fumes are given off and the paste breaks up into friable lumps which can be kept for months without change. A sample was found to contain: N 2·25, K_2O 6·33, citrate-soluble P_2O_5 11·53, water-soluble P_2O_5 8·48, fixed residue 57·32 per cent.; one-half of the material was soluble in water, while 30 per cent. consisted of unaltered organic matter, which increases the humus content of the soil.—W. R. S.

Sugar beet; The so-called "catalytic action" of manganese and boron compounds on the cultivation of the ——. H. Pellet. Bull. Assoc. Chim. Sucr., 1913, **31**, 419—424.

Attention is called to the experiments of Munerati, Mezzadroli, and Zapparoli, who have found at the Rovigo (Italy) Experiment Station that different compounds of manganese and boron, both singly and in combination with aluminium compounds, have no effect at all on the growth or yield of the sugar beet, or on the purity of its juice. The results which have led others to attribute a favourable action to the use of these compounds are held to be untrustworthy, principally for the reason that they have been obtained from an insufficiently large number of experiments, and without adequate control experiments.—J. P. O.

Patents.

Waste wool and like animal fibrous waste for utilisation as a manure or fertiliser; Method and means for treating ——. J. H. Kirk, Stalybridge. Eng. Pat. 2982, Feb. 5, 1913.

The waste is heated in a kiln to 300°—400° F. (149°—204° C.) and "converted into an ammoniacal salt" by means of hydrochloric acid or other acid gas.—O. R.

Fertilisers; Manufacture of —— from the residues left after the extraction of alkalis from potash-bearing silicate rocks which have been treated with lime or calcium compounds. Chem. Fabr. Rhenania and A. Messerschmitt. Ger. Pat. 267,875, July 31, 1912. Addition to Ger. Pat. 255,910 (this J., 1913, 439).

The residues are calcined and the resulting fine powder is mixed with a highly concentrated solution of nitric acid freshly neutralised with lime. The lime present in the residues combines with the calcium nitrate to form a basic nitrate and the water is fixed by the double silicates also present, so that the mixture soon solidifies to a dry mass.—A. S.

Fertilisers; Method for production of ——. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,083,553, Jan. 6, 1914.

See Ger. Pat. 255,910 of 1911; this J., 1913, 439.—T.F.B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; The most promising varieties of —— under trial at the Tucumán Experiment Station. A. H. Rosenfeld. Intern. Sugar J., 1914, **16**, 12—23.

Thin canes gave the best results, having not only a higher sucrose content, but attaining a greater height, so that the average weight of stalk was generally equal to, and sometimes surpassed, that of the thicker varieties. The thin canes contained more fibre, but the greater difficulty in milling was compensated by the increased fuel value of the bagasse. Comparative trials with 10 "foreign" varieties of plant canes, viz., J. 36, J. 100, J. 139, J. 213, J. 234, Sumatra, Manteica de S. Barbara, Honduras, Bois Rouge, and Kavangire, and native purple and striped canes, showed that though the sucrose content was practically the same in the "foreign" and native canes, the former gave somewhat better yields, namely an average of 2320, as compared with 2201 kilos. of sugar per hectare (2065 and 1960 lb. per acre). Subsequent comparison of the ratoon canes showed that the sugar content was about the same as with the plant cane, but there was a large increase in the yield of sugar from the "foreign" varieties, namely an average of 4439 kilos. as compared with 2417 kilos. of sugar per hectare (3951 and 2151 lb. per acre) for the native canes; two varieties stood out prominently, viz., Kavangire with 8030, and J. 213 with 7296 kilos. of sugar per hectare (7147 and 6493 lb. per acre). The greater yield from the ratoon canes than from the corresponding plant canes is stated to be generally true for Tucumán, though the contrary obtains in almost every other cane-growing country of the world.—J. P. O.

Sugar recovery; Battelle process of ——. R. S. Norris. Special Report, Expt. station, Hawaiian Sugar Planters' Assoc., July, 1913.

In the Battelle process (see U.S. Pats. 1,044,003 and 1,044,004; this J., 1912, 1195), the raw mixed juice from the mill is treated with 2—3 per cent. of calcium saccharate, quicklime or milk of lime, and the defecated juice heated to boiling point, in order to destroy reducing sugars. After single or double carbonatation, depending upon the amount of reducing sugars originally present and the amount of lime used, the subsequent procedure is the same as in a beet sugar factory, and, whether raw or white sugar is being made, after the second boiling the second molasses is treated by the lime separation method. As the result of an exhaustive examination of the process at the Ewa plantation, the following general conclusions were arrived at: The Battelle process may be worked on a manufacturing scale to produce either raw or white sugar, and the lime saccharate method of extraction may or may not be applied to the waste molasses. When operated without the saccharate method of treating the waste molasses, the recovery of sugar, compared with that effected by the ordinary defecation-sulphitation process, is so much less as to make manufacture unprofitable. The increased recovery of sugar by the application of the saccharate extraction method to the waste molasses leads to an increase of profit to the manufacturer of white sugar over that at present obtained by the defecation process, amounting to \$8·34—\$9·97 (£1 14s.—£2 1s.) per ton; but notwithstanding this increased recovery, owing to the greater cost of working, it is less profitable to manufacture raw sugar by the Battelle process than by the ordinary defecation-sulphitation method.—J. P. O.

Sugar refractometer; New —— for determining the apparent dry substance of juices and syrups. O. Schönrock. Z. Ver. deut. Zuckerind., 1914, 10—20.

A simplified form of the Abbe refractometer has been designed for use in the sugar laboratory. It comprises a double prism, capable of being heated, upon which is placed the substance under examination; a compensator, enabling observations made by ordinary light to be read in the equivalent of sodium light; and a telescope tube, controlled by a thumb-screw, which is turned until the border line coincides with the point of intersection of the cross threads. It is so graduated that the percentage of dry substance in the product may be read off directly without reference to tables, the table of the author from 0—60 per cent., and that of Main from 60—85 per cent., having been used for constructing the scale. Two types of instrument are described: one for use at 20° C., and the other for 28° C., a table of corrections being applied for other temperatures. It is stated that with this instrument the difficulty of reading dark-coloured liquids without dilution or previous treatment is overcome by a method of observation with reflected light.—J. P. O.

Sugars; Rôle of magnesia in the carbonatation process of making white ——. W. H. T. Harloff. Intern. Sugar J., 1914, 16, 25—27.

In the double carbonatation process the presence of magnesia introduced by the use of impure lime causes little trouble, since being practically insoluble in an alkaline solution it is almost all removed at the first stage, at which the partially carbonatated juice is filtered while still containing an appreciable quantity of calcium hydroxide. But in the single process, in which the juice is carbonatated almost to neutrality in one operation, the magnesia originally insoluble gradually passes into solution with the decrease of alkalinity, forming magnesium bicarbonate, which subsequently decomposes in the evaporators, increasing the amount of incrustation. Moreover, the presence of magnesia causes oversaturation, since so long as magnesium carbonate be present the reaction will remain alkaline, only approaching neutrality when all has passed into the form of bicarbonate. Such over-saturation causes the re-solution of certain impurities, notably calcium and potassium organic acid salts and colouring matters, so that the clarification is defective, and the yield and quality of the finished product are both very unsatisfactory. Even in the single process, however, limestone containing 0·1—0·5 per cent. MgO may be used, provided that carbonatation be arrested while the juice is still distinctly alkaline, and filtered, the remaining alkalinity being neutralised by sulphurous acid after the juice has passed through the presses.—J. P. O.

Iron; Accurate and rapid determination of traces of —— in invert sugar, starch glucose, and caramel. J. J. Eastick, J. P. Ogilvie, and J. H. Lindfield. Intern. Sugar J., 1914, 16, 23—24.

The sulphide colourimetric process, previously described by the authors for direct application to cane and beet sugar factory and refinery products without the inconvenience of incineration (this J., 1912, 831), also give satisfactory results with invert sugar and starch glucos the values found directly with a solution of the sampl and those obtained with a solution of the ash of th same, being practically identical. Results obtained wit caramel are also given, but in ascertaining these the solutio of the ash was always used, a direct determination i such a dark-coloured substance being impossible.—J. P. C

Maple products, Analysis of ——. II. A comparati study of the delicacy of methods. J. F. Snell and J. Scott. J. Ind. Eng. Chem., 1913, 5, 993—997.

In comparative experiments with three genuine map syrups to which varying quantities of a solution of sucro were added, the conductivity value, the ash-content a the different lead values (see this J., 1906, 830, 95 1908, 1076) all decreased as the maple syrup was dilut with sucrose solution. The Winton lead method (t

J., 1906, 957) gave better agreement of duplicates than the Canadian method (McGill, Lab. Inland Revenue Dept., Ottawa, Bull. 228, 1911, p. 5) but the Canadian value fell away most rapidly. The narrowest range for genuine maple syrups was shown by the conductivity value (this J., 1913, 954). In making a blank determination in Winton's method the use of a solution of sucrose instead of acetic acid as recommended by Bryan (see this J., 1911, 299) is suggested. In the Canadian method washing with water at 80° and 100° C. respectively gave practically the same results; variation of the quantity of wash water from 100 to 150 c.c. was also without effect, but higher results were obtained when only 50 c.c. were used. The results differed according to whether the lead value was determined with a fixed quantity of syrup and calculated to dry substance or determined directly with a quantity of syrup equivalent to a fixed quantity of dry substance. In the Canadian method the calculated results were lower and in the Winton method higher than those determined directly.—A. S.

Decomposition of cellulose, starch, sugar, and sulphite-cellulose lye by heat. Bantlin. *See* IIB.

So-called "catalytic action" of manganese and boron compounds on the cultivation of the sugar beet. Pellet. *See* XVI.

Influence of ammonium sulphate on the specific rotation of lactose. Rosemann. *See* XIXA.

PATENTS.

Evaporating and boiling apparatus; Vacuum —— for sugar houses and refineries. J. B. Swaryczewski. Ger. Pat. 266,336, March 11, 1911.

THE lower part of the evaporator is hexagonal with two of the opposite sides curved (see Fig. 2). The chambers, 2 and 3, are connected by pipes, 6, and the chambers, 4 and 5, by pipes, 7. All the chambers are divided by horizontal partitions into compartments, and the chambers, 2 and 4, also have vertical partitions; the several compartments are provided with the necessary connections, 9, for the introduction of steam and 10, for the discharge of condensed water. In the spaces, 8, surrounded on all sides by heating surfaces, the syrup is rapidly heated and a vigorous upward circulation is produced, the juice then flowing downwards in the spaces, 16, bounded along one side by a surface which is not heated. The crystals are discharged by opening the door, 19.—A. S.

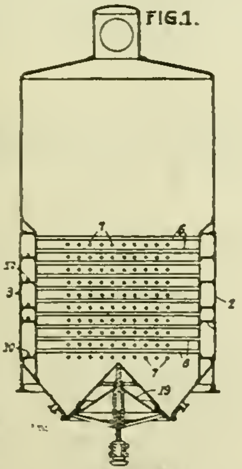


FIG.1.

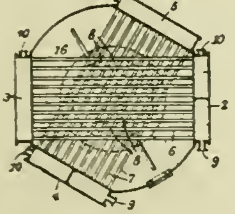


FIG.2.

ugar; Manufacture [sterilisation and purification] of ——. A. Shelmerdine and F. C. Lewis, Liverpool. Eng. Pat. 29,524, Dec. 23, 1912.

UGAR solutions, while passing through a conduit, are bjected to the action of a high-tension alternating lectric current (1000—2000 volts) acting longitudinally rough the conduit. The electrodes are placed at tervals in enlargements or pockets of the tubular conuit, a portion of the electrode standing in the direct path of the liquid, which is thus caused to dip under and round the edges of the electrode, taking a "bent course."—J. F. B.

Sugar solutions; Purification and decolourisation of liquids, especially of ——. F. Tiemann. Ger. Pat. 268,047, Nov. 14, 1912.

THE solution to be treated is brought into contact with porous substances (kieselguhr, bone charcoal, or the like), on which mordants have previously been fixed by the methods used in the dyeing industry, whereby colouring matters, pectin substances, etc., are separated and fixed by the porous material in an insoluble form. Different mordants may be fixed together on the porous material. Tin salts (oxalate, fluoride) are mentioned as being specially suitable.—A. S.

Process for the continuous solution of solid substances, especially for slaking lime with sugar juice or water. Ger. Pat. 268,442. *See* I.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Determination of glycogen in ——. F. Schönfeld and E. Künzel. Woch. Brau., 1913, 31, 9—12.

THE method is a modification of that described by Pflüger (Arch. ges. Physiol., 1909, 129, 362) for the determination of glycogen in animal tissues. The yeast is washed with water for a short time and pressed; these operations should not be unduly prolonged, for the glycogen-content of the yeast is very liable to change. From 10—15 grms. of the yeast are heated with 25 c.c. of 60 per cent. potassium hydroxide solution for 3 hours in a bath of boiling water. The cooled product, washed into a larger vessel with 50 c.c. of water, is mixed with 200 c.c. of 96 per cent. alcohol and left over night. The supernatant liquid is decanted, with as little solid matter as possible, through a filter connected with a pump. The residue, treated with a few drops of brine, is washed with 66 per cent. alcohol (100—150 c.c.) until the washings are colourless, then twice with absolute alcohol and twice with ether. The glycogen is redissolved by heating with water for some time, the solution is filtered into a 200 c.c. flask, neutralised with hydrochloric acid (sp. gr. 1·19) and made up to the mark. It is then heated in a bath of boiling water for 3 hours with 10 c.c. of hydrochloric acid (sp. gr. 1·19), cooled, neutralised with a 60 per cent. solution of potassium hydroxide, and again made up to 200 c.c. and well mixed. The quantity of dextrose in 25 c.c. of the solution is determined by Allihn's method: 1 grm. of dextrose corresponds to 0·927 grm. of glycogen. A bibliography relating to yeast-glycogen is appended to the paper.—J. H. L.

Yeasts; So-called black ——. H. Will and F. Noldin. Z. ges. Brauw., 1914, 38, 13—16.

EXAMINATION of three "black yeasts" (Forms I., II., and III.) of different origins, shows that they are so similar morphologically and physiologically, that they are very probably only varieties of the same species. The three organisms are *Hypomycetes*, forming a typical and a vegetative mycelium. The typical mycelium appears slightly branched and bears conidia directly or on short lateral branches: no sporulation occurs in the vegetative cells. The surface growth on nutrient solutions is either soft, more or less smooth, and of a shining black colour, or tenacious, thick, velvety or woolly, and grey to dark green in colour. The organisms do not grow at temperatures above 35° C., and their growth in wort is arrested by 4 per cent. of alcohol by volume; they are only slightly resistant to acids and have no fermenting power. The experimental results so far obtained do not justify a systematic classification or a new designation of the species in question and its varieties, but the names *Saccharomyces niger*, *Torula nigra*, and "black yeast," used by earlier workers, should be abandoned.—L. E.

Alcoholic fermentation; Formation of (1) *lactic acid,* (2) *glycerol, in ——.* M. Oppenheimer. Z. physiol. Chem., 1914, 89, 45—62, 63—71.

(1) Yeast juice prepared by Lebedeff's method (this J., 1911, 147) was found to contain small quantities of lactic acid (0·11—0·22 per cent.) which increased slightly when the juice was kept for several days under aseptic conditions. Addition of 1 grm. of dextrose, dihydroxyacetone or glyceraldehyde, to 100 c.c. of the fresh juice increased the quantity of lactic acid formed, by amounts ranging from 0 to 0·12, 0 to 0·11, and 0·02 to 0·23 grm. in the respective cases. Sodium pyruvate on the other hand, lessened the production of lactic acid. The author concludes that lactic acid is formed from sugar during fermentation by yeast juice, and that its immediate precursor is more probably glyceraldehyde than dihydroxyacetone or pyruvic acid (cp. Buchner and Meisenheimer, this J., 1904, 262; 1905, 246; 1906, 998; von Lebedeff and Griaznoff, this J. 1912, 1195). The absence of lactic acid from the products of fermentation of living yeast, which was established by Pasteur and others, may be due to the greater vigour of the process, as compared with the cell-free fermentation, for Pasteur found that other by-products, *viz.*, succinic acid and glycerol, are produced in larger quantities by weak than by vigorous yeasts.

(2) Fresh yeast juice contained 0·17—0·25 per cent. of glycerol, which increased by about 0·04 per cent. in the course of a few days. Addition of 1 per cent. of dextrose, glyceraldehyde or dihydroxyacetone increased the amount of glycerol formed, by 3—12, 9·4—15, and 11·7—19·2 per cent. of the added substance in the respective cases (cp. Buchner and Meisenheimer, this J., 1910, 894).—J.H.L.

Alcohol in beer; Determination of —— by means of Malligand's ebullioscope. J. C. Cain. Chem. News, 1914, **109**, 37.

The method depends on the fact that the solids in beers and wines exert no practical influence on the boiling point, which varies according to the alcohol-content. The apparatus (see Malligand and Brossard-Vidal, Comptes rend., 1874, **78**, 1470) has been found to give very exact results with foreign beers and wine, and the author shows that the same holds for English beers.—L. E.

Vinegar; Canadian standard of quality for ——. Board of Trade J., Jan. 22, 1914. [T.R.]

The "Canada Gazette" of the 27th December last contains an Order-in-Council, dated 19th December, 1913, establishing certain standards of quality and limits of variability for vinegar and similar articles under the Adulteration Act of the Dominion of Canada. Under this Order-in-Council it is stated, *inter alia*, that vinegar shall contain not less than 3½ per cent. and not more than 10½ per cent. of acetic acid. Various standards are specified for certain kinds of vinegar (*e.g.*, wine vinegar, spirit vinegar, grain vinegar, malt vinegar, etc.). Vinegars made by the acetous fermentation of dilute alcoholic liquors whose alcohol may have had its origin in the fermentation of fruit sugars of various kinds, or of ordinary sugar, must bear distinctive names, indicating the source of the saccharine matter.

Superphosphate-vinasse [" *Superphosphatschlempe* "]*: a new fertiliser.* Stoltzenberg. *See* XVI.

Patents.

Distilling apparatus; Continuous ——. A. C. Badger, Newton Center, Mass. U.S. Pat. 1,082,064, Dec. 23, 1913.

A continuous column still is connected with a series of tubular heaters or dephlegmators through which the "mash" or other liquid to be distilled is pumped into the column. By means of suitable valves the amount of vapour brought into thermal contact with the incoming "mash" can be adjusted so that the composition of the uncondensed vapour passing to the final condenser can be varied at will.—W. H. C.

Cellulosic materials; Treatment of —— to obtain fermentable sugars and the like therefrom. G. H. Tomlinson, Fullerton, La., U.S.A. Eng. Pat. 30,072, Dec. 31, 1912. Under Int. Conv., Jan. 29, 1912.

See U.S. Pat. 1,032,450 of 1912; this J., 1912, 832, 833.—T. F. B.

XIXa.—FOODS.

Lactose; Influence of ammonium sulphate on the specific rotation of ——. R. Rosemann. Z. physiol. Chem., 1914, **89**, 133—140.

The specific rotatory power of lactose, which in pure aqueous solutions is +52·53°, is +50·47° in solutions saturated with ammonium sulphate, and +51·55° in solutions containing about 40 grms. of this salt per 100 c.c. The latter concentration corresponds to the conditions prescribed in Salkowski's method for the determination of lactose in milk (this J., 1912, 507). For milk containing 4—6 per cent. of lactose, the results obtained by Salkowski's method should accordingly be 0·07—0·11 per cent. low, but the author does not recommend a corresponding correction, since according to Kretschmer (this J., 1913, 708) the results actually obtained tend to be high.—J. H. L.

Proteins in milk; Decomposition of —— by the action of lactic ferments. W. C. De Graaff and A. Schaap. Ann. Falsif., 1913, 6, 639—645.

The aldehyde figure (see this J., 1911, 148) of butter-milk is much larger than that of fresh milk, the increase being due to the decomposition of the proteins by proteolytic enzymes produced by certain micro-organisms. Of the latter, *Streptococcus lactis* and *B. casei*, are the more numerous and play the greater part in the decomposition. The enzyme which ferments lactose does not peptonise the proteins and, consequently, does not affect the aldehyde figure.—W. P. S.

Mineral waters; Formation of sediment in —— when stored in bottles. Determination of silica, iron, and aluminium in mineral waters. L. Dede. Chem.-Zeit., 1914, **38**, 53—55.

The sediment often found in bottles of mineral waters consists chiefly of hydrated iron oxide, alumina, silica, and calcium carbonate; it does not appear to be due to the presence of considerable quantities of iron and calcium salts in the water, but rather to the content of dissolved alumina and silica or suspended clay, the alumina and silica together with certain other constituents being carried down by hydrated iron oxide produced by the oxidation of ferrous bicarbonate. The presence of alumina and silica seems to be essential, since highly ferruginous waters free from these substances yield only traces of sediment. For collecting samples of mineral water for analysis, the author uses a bottle of about 10 litres capacity, which is treated for 24 hours with 5 per cent. hydrochloric acid, rinsed, dried, filled with carbon dioxide, and then the water introduced through a tube reaching t the bottom of the bottle. For the determination o silica, etc., the water is made neutral to methyl orang with hydrochloric acid, evaporated to a small volum in a silver basin, then transferred to a platinum basi treated with an excess of hydrochloric acid, evaporate to dryness, the residue heated to 110° C. for 30 mins. treated with hydrochloric acid and water, and the insolubl residue of silica, barium sulphate, and titanic acid collecte ignited, and weighed. The weighed residue is treate with ammonium fluoride and sulphuric acid, the loss weight after this treatment giving the silica, and t remaining residue is fused with potassium pyrosulphat the titanic acid being then separated from traces of iro etc., by dissolving the fused mass in dilute sulphuric ac adding ammonia, acidifying the solution with hydr chloric acid, and evaporating to dryness. The iron a aluminium are best separated by precipitating the iron sulphide from an ammonium citrate solution.—W. P. S

Turmeric [in pepper]; Detection of ——. E. J. Parry. Chem. and Drugg., 1914, 84, 34—35.

According to a trade custom white pepper is sometimes tinted with minute quantities (*e.g.*, 0·05 per cent.) of turmeric. Such traces cannot be detected with certainty by microscopic examination or by the boric acid test with silk dyed in the alcoholic extract, but can be detected by Bell's test as follows:—One grm. of diphenylamine is dissolved in 20 c.c. of 90 per cent. alcohol, 25 c.c. of sulphuric acid are added and the mixture cooled. A drop of the reagent is placed on a microscope slide and a little of the sample spread on a cover-glass, which is then inverted so that the powder falls evenly and not in clots. On microscopic examination of the prepared slide, every particle of turmeric is found to be stained a fine purple colour, and the proportion may be estimated approximately by comparison with standard preparations. The stain is not permanent and the slides must be examined soon after mounting.—J. F. B.

Pine-apple by-products; Utilisation of —— in Hawaii. Board of Trade J., Jan. 15, 1914. [T.R.]

Experiments have been made recently in Hawaii with a view of ascertaining what uses can be made of pine-apple by-products. The leaf fibre is of great strength and about 68 inches long; about 70 lb. of fibre can be obtained from a ton of leaves. It is stated that the fibre can be used for the manufacture of paper of a high class and also for cordage; its production, however, on a commercial scale has not yet been undertaken. This is the same fibre that is used for piña cloth, the "pineapple silk" of the Philippines, where, however, fresher leaves are used from which a finer fibre is obtained than would be the case in Hawaii, where fibre would be extracted merely as a by-product from the stumps when dug up every four years or so. Vinegar of excellent quality can be made from the fruit juice, much of which is now wasted. A good deal is, however, utilised more profitably for concentration into syrup, the juice of the fruit ripened on the plant containing 10 to 15 per cent. of sugar. The average of all analyses made at the experiment station shows 4·22 per cent. of reducing or invert sugar and 7·84 per cent. of sucrose, giving a total percentage of sugar content of 12·06. The stumps of the plant contain nearly as much starch as potatoes and cassava, but it is doubtful whether it can be extracted profitably.

Palm oil as an edible fat. Hupfeld. *See* XII.

Utilisation of Para rubber seed. See XII.

Patents.

Panning or roasting and drying tea leaf and the like; Methods and apparatus for ——. G. W. Sutton, Stevenage. Eng. Pat. 29,641, Dec. 24, 1912.

The materials pass over superposed, hollow, heating plates arranged in an open frame, being pushed forward, gathered together into heaps and again spread upon the plates by curved conveyor blades attached to endless chains at the sides of the plates. Rows of pins project upwards through tubes in the plates and are attached to a frame below by which they are periodically withdrawn at the moment that the conveyor blades pass over the spot. —W. H. C.

Beverages, perfumes and the like; Production of ——. U. E. Wegener, Berlin, Lichterfelde, Germany. Eng. Pat. 20,061, Sept. 5, 1913.

So-called "frosted" beverages—the bottles containing which are covered on the inside with crystals—are produced by the use of the comparatively insoluble sugars, such as lactose, galactose, raffinose, maltose, mannitol, etc., instead of the cane or beet sugar usually employed. Crystallisation may be effected in a number of ways. A solution of the sugar, containing alcohol, may be introduced into the bottles and allowed to crystallise, the mother-liquor being afterwards drained off and the bottles filled with the beverage in which some of the sugar used for crystallisation has already been dissolved. A salt and an acid such as sodium bicarbonate and tartaric acid may be added, in addition to the sugar, sodium tartrate crystallising out with the sugar. The crystal-forming substances may be added in the form of a powder to the pure beverage. A solution in diluted alcohol of the sugar, together with aromatising, colouring, and improving substances, and alcohol sufficient for preservation may be formed and simply added to spirit and water to produce a frosted liqueur. The methods described may be applied to hair-washes and other toilet preparations.—E. W. L.

Apparatus applicable for use in the manufacture of soap, soap powders, cocoa, chocolate, etc. Eng. Pat. 4654. *See* XII.

XIXb.—WATER PURIFICATION; SANITATION.

New sewage process adopted by the Dublin Corporation (Dickson treatment). Presidential Address, J. D. Watson. Inst. Roy. Sanitary Eng., Jan. 7, 1914. (See also Dickson, Eng. Pat. 25,108, Oct. 28, 1910; this J., 1911, 504.

The principle of the Dickson process to be shortly applied to the Dublin sewage, is founded on the fact that the addition of a small quantity of yeast to sewage causes the sludge to rise to the surface, leaving a very tolerably clear effluent beneath; the best results are obtained at a temperature of 95° F. (35° C.). Crude Dublin sludge contains 9—11 per cent. of solids and 89·91 per cent. of water; after fermenting with yeast and drawing off the effluent, the content of solids is 18·22 per cent., so that the cost of drying is cut down to one-half. Further, there is no loss of nitrogen, both the dried raw sludge and the dried treated sludge containing about 3 per cent. of that element. The city sludge, in the new process, passes direct into a mixing tank, where it is treated with about ½ per cent. of yeast and about 3 per cent. of already "fermented" sludge, and the whole is heated to 90°—100° F. (32°—38° C.). From the mixer the material runs into a series of eight parallel troughs made of concrete. Each trough measures about 50×4×2½ ft., and has a capacity of 20 tons, so that the capacity of the whole is equal to one day's output of city sludge. Below the troughs are an equal number of hot-air ducts of the same material, and in this way the temperature is maintained at about 90°—95° F. (32°—35° C.). In less than 24 hours the suspended solids are floating on the surface, but are sufficiently mobile to be run off through sluice-valves into a receiver-trough. In this receiver-trough the sludge may be mixed with phosphates and kainite. The sludge effluent, containing about six parts of solids per 1,000, is run out through a siphon pipe, perforated in such a manner that no clogging takes place. The separated sludge, containing about 80 per cent. of water, is next pumped to the top of the "dryer," in which it is pulverised and completely desiccated. This apparatus consists of a large, vertical, cylindrical tower provided with a number of perforated platforms, which are alternately fixed and rotating. The under-side of each platform is provided with a rake which scrapes the material on to the platform below. A blast of hot air is blown through this tower from the bottom upwards by means of a large fan. The temperature at the base is 400° F. (204° C.), and the waste heat issuing from the top is utilised for maintaining the temperature of the mixing tank and the air-ducts beneath the fermenting troughs: the waste gases pass back into the furnace. By drying at this low temperature practically no organic matter is lost. A final pulverisation in a small air-disintegrator completes the process. The entire plant, which occupies less than one acre of ground, works automatically and continuously, and does not require more than one engineer and four labourers to each shift. The horse-power for all operations is 50, and, except for a slight odour in the trough-house the process is neither unpleasant nor unhealthy. The dried and powdered sludge contains 3 per cent. of nitrogen and 60 per cent. of organic matter, and the greater part of the former is in a state immediately available for plant life. The presence of so much organic matter greatly enhances its value and makes it superior to purely artificial fertilisers. By the addition of phosphates and kainite, a complete manure containing 15 per cent. of soluble phosphate, 2½ per cent. of potash, and nearly 2 per cent. of nitrogen has been prepared and marketed. The great defect of most sewage effluents and also of waste liquors from manufacturing processes, is, that they are deficient in dissolved oxygen, and consequently when they pass into rivers and streams fish life is threatened if not extinguished, and the door is opened to the multiplication of virulent anaerobic microbes. A long series of tests has shown that such effluents may be completely aerated and deodorised, and nearly all the suspended matter contained in them eliminated by a "hydro-extractor," a centrifugal machine, similar to those in use in sugar refineries, in which the cage or basket is provided with a layer of sand or other filtering material through which the effluent has to pass. A simple mechanical contrivance allows of the removal of any desired amount of sand without interrupting the motion, and fresh sand introduced into the effluent, forms a clean new surface for filtration. The "hydro" occupies only six square yards and is calculated to filter 10,000 gallons per hour. This system has been found to be equally effective for treating the effluent from the Dickson process and from that of crude Dublin sewage. Experiments made in September, 1913, with Dublin effluent showed that the total solids were diminished by 10—11 per cent. after passing through the "hydro" and that the dissolved oxygen was raised from practically nil to 99·2 per cent. of the total possible. The treated effluent had no injurious effect on fish-life.

Assuming the average sewage output to be 25 gallons per head per day, the cost of a complete plant for a town of 150,000 inhabitants would be approximately £125,000, and the annual charges (including operating) would be much more than covered by the sale of the fertiliser, for which there is a ready market. If the process could be worked in conjunction with a refuse destructor the cost of treatment would naturally be greatly reduced. The cost of production of the dried sludge in Dublin is 25s. per ton, inclusive of fuel (15s.), labour, power, and all other charges except those of capital and administration. Its market value is at least 50s. per ton. The application to creamery effluents is now an accomplished fact. The Solohead Co-operative Dairy Society, near Limerick Junction, Tipperary, is working the system in conjunction with small precipitation tanks with signal success. The waste matter from such creameries, when mixed with phosphate, makes a high-grade fertiliser containing 44·4 per cent. phosphates (43 per cent. soluble) and 0·42 per cent. of nitrogen.

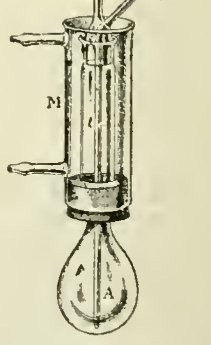
Calcium carbonate; Solubility of —— and its bearing on certain processes for the treatment of water supplies. W. T. Burgess. Inst. Water Engineers, Dec. 13, 1913. 13 pages.

The lime softening process does not remove the whole of the calcium carbonate from water. Water free from dissolved carbon dioxide dissolves calcium carbonate to the extent of 1·5 parts per 100,000. The complete separation of the precipitated calcium carbonate requires a much longer time than is usually supposed; even after the precipitate has settled, the clear water continues to deposit crystalline calcium carbonate for some days. The more perfectly the water is softened the greater the necessity for giving it a long period for subsidence. When it is desired to use the water as soon as possible after the precipitate has settled, it may be treated with a small quantity of carbon dioxide to prevent deposition of calcium carbonate in the mains (compare Archbutt and Deeley's process; this J., 1891, 511); as little as 0·3 part of carbon dioxide per 100,000 of water is sufficient. In the method described by Houston (this J., 1912, 508) for sterilising water by the addition of an excess of lime and subsequent removal of the excess by carbon dioxide or sodium bicarbonate, it would be necessary, owing to the slow deposition of the last portions of the calcium carbonate, to take precautions to prevent the precipitation of calcium carbonate in the water mains.—W. P. S.

Water; Action of —— on lead service-pipes. J. F. Liverseege and A. W. Knapp. Public Works, Jan., 1914. (See also this J., 1913, 881.)

The water contained 5·90 parts of total solids and 2·4 parts of total alkalinity per 100,000; it was allowed to stand in pipes attached to the supply, in detached 6-foot lengths of pipe, closed with corks, and in consumers' pipes. The quantity of lead dissolved was unaffected by sand filtration, increased by addition of carbon dioxide, and usually diminished by a rise in alkalinity; it increased with time of contact up to 44 weeks, and decreased, for daily periods of contact of 17 hours, up to seven months, except in corked pipes, which gave conflicting results. Maximum protection was attained most rapidly in regularly used pipes, and was reached in one year. Pipes which had been used for hard water were as sensitive to soft water as pipes used for much shorter periods with soft water only. A high lead content was in one case attributed to stray electric currents.—O. E. M.

Carbon monoxide from blood; Apparatus for the extraction of ——. M. Nicloux. J. Pharm. Chim., 1914, 9, 57—61.



A flask, A, of 200—40 c.c. capacity, is closed by a hollow ground stopper which bears a tube, t, reaching to the bottom of the flask, and is terminated upwards in the tube, t'. Both these tubes are furnished with stopcocks. The tube, t', ends in an enlargement, s, to which a shallow funnel, C, can be adapted by a ground joint. A small open tube, E, can be adapted by another ground joint to the tube, t. The neck of the flask can be kept cool by a current of cold water passing through the sleeve, M. The flask should be of 200 c.c. capacity when dealing with 15—25 c.c. of blood. For determining the quantity of carbon monoxide in 25 c.c. of blood, 25 c.c. of phosphoric acid of 45° Bé. (sp. gr. 1·453) and 40 c.c. of water are introduced into the flask. Water is allowed to flow round the neck of the flask, the tube, t, filled with distilled water, the stopcock, R, closed and R′ left open The flask is put into a calcium chloride bath at 110° C. and exhausted by means of a water pump. The enlarged portion of the tube, t', is then filled with water. The tube, E, containing the blood is put into position. The blood is allowed to flow slowly into the flask and washed in with water. A quantity of foam is produced, which rapidly subsides except in the neck of the flask. It is removed by filling the funnel, C, with hot water, lifting the flask out of the calcium chloride bath and opening the tap R′, so as to admit water but not air. When the neck has been cleared in this way, the heating is continued for 10—15 mins. The flask is removed from the bath and hot water allowed to flow in from the tube, E, till the contents are at atmospheri pressure. The gas is then transferred to a suitabl tube inverted over the enlargement, s, in the funnel, C The results agree with those obtained by means of mercury pump.—F. Shdn.

Lime-sulphur-lead arsenate spray mixture; Chemical studies on the ——. W. E. Ruth. Oil, Paint and Drug Rep., Dec. 27, 1913.

Lead arsenate (Pb 64·23, total As_2O_5 26·47, water-soluble As_2O_5 0·44 per cent.) was mixed with a large excess of lime-sulphur solution (1 of lime sulphur concentrate of sp. gr. 1·291 to 40 of water) and after several hours, with frequent stirring, the insoluble residue was collected, washed, and dried at 40° C. It contained: Pb 45·62, total S 22·51, free S 19·44, Ca 5·08, As_2O_5 9·09 per cent., and no sulphide, sulphite or sulphate, but a small quantity of thiosulphate; and possibly some of the lead was present as thioarsenate for on adding several drops of concentrated lime-sulphur solution to a small quantity of lead arsenate suspended in water, the same colour change (reddish-yellow through brown to nearly black) was observed as is produced when lead thioarsenate is precipitated by the interaction of lead acetate and sodium thioarsenate. The effect on the composition of the lime-sulphur solution of mixing with lead arsenate was found to be diminution in the content of sulphide and calcium and increase in that of thiosulphate and sulphate (including sulphite). This increase of thiosulphate and sulphite would account for the increased fungicidal value of lime-sulphur when mixed with lead arsenate, if Haywood's view (this J., 1911, 41) that the fungicidal action is due to the presence of thiosulphate and sulphite be correct. (See also this J., 1910, 837, 967.) —A. S.

Patents.

Insecticide. C. Ellis, Larchmont, N.Y., Assignor to Chadeloid Chemical Co., New York. U.S. Pat. 1,082,507, Dec. 30, 1913.

An emulsion composed of wax dissolved in a highly volatile and almost insoluble organic liquid, and an aqueous solution of an inorganic salt having powerful insecticidal properties to which a "thickener" may be added to impart consistence. A solution of paraffin in carbon bisulphide, emulsified with an equal volume of mercuric chloride solution thickened with Irish moss, is mentioned. —F. Sodn.

Sewage; Treatment of ——. T. K. Irwin, London. U.S. Pat. 1,083,833, Jan. 6, 1914.

See Eng. Pat. 16,237 of 1912; this J., 1913, 1125.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine and its derivatives; Some new salts of ——. D. Angeloni. Boll. Chim. Farm., 1913, 52, 675—685. Chem. Zentr., 1914, 1, 154—155.

Preliminary experiments showed that 1000 c.c. of ether dissolve 35·7 grms. of acetylsalicylic acid (aspirin), 8·6 grms. of anhydromethylenecitryldisalicylic acid (novaspirin), 4·0 grms. of succinyldisalicylic acid (diaspirin), 50·0 grms. of salicylsalicylic acid (diplosal), 33·3 grms. of euquinine (quinine ethylcarbonate), 2·0 grms. of aristoquinine (quinine carbonic ester), 2·5 grms. of saloquinine (quinine salicylic ester), and 20 grms. of quinaphenine (the phenetidide of quininecarbonic acid, $C_2H_5O.C_6H_4.NH.CO.C_{20}H_{23}N_2O_2$) respectively. The following salts of quinine and its derivatives with salicylic acid and its derivatives were prepared, except where otherwise stated, by mixing ethereal solutions of the components. Basic quinaphenine salicylate, m. pt. 125°—126° C. after crystallisation from a mixture of alcohol and a little ether: it was slightly soluble in water and was decomposed even by very dilute hydrochloric acid; neutral salt of euquinine and novaspirin, crystalline powder, m. pt. 95° C.; neutral salt of saloquinine and novaspirin, m. pt. 116° C.; neutral salt of quinaphenine and novaspirin, crystals, m. pt. 118°—120° C.; basic salt of quinine and diaspirin, very fine needles, m. pt. 125° C.; neutral salt of quinine and diaspirin: it was necessary to use excess of diaspirin, otherwise a mixture of the neutral and basic salts resulted; neutral salt of quinaphenine and diaspirin, m. pt. 116° C.; basic salt of quinine and diplosal, crystals, m. pt. 105° C.; basic salt of quinaphenine and diplosal, m. pt. 86° C. Neutral quinine salicylate was obtained by mixing aqueous solutions of quinine bisulphate and sodium salicylate. It was a yellowish powder, which melted below 100° C., with decomposition, and was converted into the basic salt (m. pt. 175° C.) by treatment with ether or alcohol. The basic salt of euquinine and novaspirin, pentagonal plates, m. pt. 178° C., and the neutral salt of aristoquinine and novaspirin, m. pt. 89°—90° C., were obtained by mixing alcoholic solutions of the components.—A. S.

Peru balsam; Artificial and genuine ——. K. Dieterich. Ber. deuts. Pharm. Ges., 1913, 23, 622—657.

Samples of genuine Peru balsam gave the following values:—Sp. gr. at 15° C., 1·160; acid value, 74·02—76·92; sapon. value, 214·34—243·07; iodine value, 22·07—25·87; cinnamein, 56·56—77·56 per cent.; sapon. value of cinnamein, 253·61; iodine value of cinnamein, 7·48—7·91; resin esters, 24·95 per cent.; and insol. in ether, 2·45—4·38 per cent. Artificial and "synthetic" balsams gave results differing, as a whole, considerably from the recorded limits, although individual values were frequently normal. Of the tests for the identification, etc., of Peru balsam only the following were found distinctive:—Hager's petroleum spirit test; determination of the solubility in alcohol, chloroform, chloral hydrate and carbon bisulphide; the nitric acid test; the zone reactions (see this J., 1908, 468), and the qualitative tests of the Swiss Pharmacopœia. A new colour reaction of genuine Peru balsam is described:—One drop of the sample is shaken with 5 c.c. of petroleum spirit, and about half of the liquid poured off. The remainder is mixed with 5 c.c. of ether, and shaken with a few drops (10 to 15) of sulphuric acid, added drop by drop, when genuine Peru balsam gives a violet to blue colouration, whilst artificial products give quite different colourations. This reaction is due to the cinnamein of the balsam. As supplementary tests Halphen's bromine reaction, the behaviour towards alkalis and ammonia, determination of resin esters, and substances insoluble in ether, the behaviour of the balsam on exposure to air, and sublimation and distillation tests may be applied. (See also this J., 1897, 829; 1898, 267, 806; 1899, 53.)—C. A. M.

Cineol [eucalyptol]; Addition compounds of ——. *Contribution to the knowledge of oxonium salts.* I. Bellucci and L. Grassi. Gaz. chim. ital., 1913, 43, II., 712—735.

The behaviour of cineol with a number of aromatic compounds was studied by the method of thermal analysis. The results indicated that 1 mol. of cineol combined with 1 mol. of each of the following substances to form definite compounds, the melting points of which are given in brackets: phenol (8° C.), α-naphthol (75° C.), β-naphthol (48° C.), *o*-cresol (50° C.), *m*-cresol (—5° C.), *p*-cresol (1·5° C.), pyrocatechol (39° C.), resorcinol (89° C.), guaiacol (5° C.), methyl salicylate (—15° C.), thymol (4·5° C.): in the case of quinol, 2 mols. of cineol combined with 1 mol. of quinol, the compound melting at 106·5° C. Negative results were obtained with *o*-, *m*-, and *p*-nitrophenol, *o*- and *m*-aminophenol, *o*- and *m*-hydroxybenzoic acid, and phenyl and naphthyl salicylates. With *p*-hydroxybenzoic acid a compound appeared to be formed which decomposed before melting.—A. S.

The Japanese mint industry. Chem. and Drugg., Jan. 31, 1914, 214.

The bulk of the mint grown in Japan is cultivated on the sides of the hills, but that grown on low-lying ground, which can be alternately used for rice, is the richest in menthol. Although mint is grown in various parts of Japan, the best oil is produced in Okayama and Hiroshima

Prefectures, where three crops are obtained—viz., in May, June, and August. The first crop yields on distillation an oil containing about 47 per cent. of menthol, the second about 53 per cent., and the third about 60 per cent. In Yamagata Prefecture two crops are obtained, and in the Hokkaido only one, but the acreage planted in Hokkaido is far larger than that in the other districts, so that even though Hokkaido oil contains only about 45 per cent. of crystals and there is only one crop, more than half the menthol comes from that province. The process of distilling the oil is the same throughout the different producing districts. It lasts four hours, and 82 lb. of dried herb of the first crop should produce 14 oz., of the second crop 24 oz., and of the third crop 21 oz. of oil, the figures depending on the quality of the herb and the extent to which it is dried. The second crop is the most plentiful—a field, for instance, which will produce 300 lb. of herb for its first crop will give 800 lb. for the second, and 600 lb. for the third. Roughly speaking, one acre produces 5000 lb. of dried herb, which should produce 80 lb. of crude oil. The oil having been distilled, is sold to the large refiners. In the Okujoto, Bingo, and a few other districts there are "Peppermint Guilds," which examine the oil and give a certificate as to its weight and purity, but from many districts the refiner has to take his chance. When the oil has been dementholised in Yokohama or Kobe, as the case may be, the menthol and oil are put separately in tins of 5 lb. each, twelve in a case, and are ready for export. The oil is of an inferior character as compared with English and American peppermint, but it enters into cheap confectionery to a large extent, and competes with the better-class oils.

Camphor; Yield of oil from Tansui —— tree. U.S. Consular Reports, Oil, Paint and Drug Reporter, Jan. 5, 1914.

It is stated that Tansui, an island just north of the Philippines, seems specially a field for the production of the camphor tree. Two kinds of oil are specially mentioned in this report as being products of the Island of Tansui; one, the chong-guh oil, is an essential oil with a sweet aromatic odour, and the other is yu-chin oil, produced from a tree growing in Southern Tansui, closely related in properties to the camphor tree, but which fails to yield camphor.

According to a statement by a member of the Kosempo camphor distillery, the comparative output of camphor and the oil is in the proportion of 25 to 75, indicating that an enormous amount of oil is producible. In Banshoryo, Shinkoko, Naiboryu, and Dateku, noted for the rich growth of the real yu-chin tree, the yield of camphor is not over 10 per cent. of the oil produced.

Ketones; Comparative value of catalysers in the preparation of ——. J. B. Senderens. Bull. Soc. Chim., 1914, **15**, 84—89.

In view of the work of other investigators (see this J., 1913, 806) the author draws attention to his previously recorded experiments on the action of catalysts in the preparation of ketones (see this J., 1909, 489; 1912, 660; 1913, 767). There is no doubt that the activity of the various oxides varies in so far that they behave differently when used with alcohols or organic acids respectively for the preparation of ketones.—W. P. S.

Succinic and malic acids; A reaction of ——. W. O. de Coninck. Bull. Soc. Chim., 1914, **15**, 93—94.

When a concentrated solution of succinic acid is added to a few grms. of calcium salicylate moistened with a small quantity of water and the mixture is heated gently, a red colouration develops gradually; this colouration is stable for many hours even when exposed to sunlight. Under similar conditions, malic acid also yields a red colouration, but the colour fades after a few hours and the solution is then coloured yellowish-brown; the colouration also disappears gradually when the mixture is boiled.
—W. P. S.

Chlorohydrocarbons; Properties of some —— and their use in chemical analysis. L. Gowing-Scopes. Analyst, 1914, **39**, 4—20.

The author has made a study of the series of chlorohydrocarbon solvents ranging from *cis*-dichloroethylene, boiling at 48·8° C. to hexachloroethane, boiling at 185·5° C., chloroform and carbon tetrachloride being included for purposes of comparison. Physical constants have been established, including boiling and freezing points, density, coefficient of expansion, heat of vaporisation, refractive index, viscosity at various temperatures, specific heat. For purifying these solvents the liquid is shaken vigourously with a strong solution of ammoniacal silver nitrate, washed free from ammonia, dehydrated over lime for 12 hours and distilled, the distillate being again fractionated from phosphorus pentoxide. The boiling points of binary and ternary mixtures with water and alcohol have been determined for certain members of the series. The action of the more important members of the series at their boiling points upon a number of common metals is tabulated. It would appear that nearly all are attacked to some extent in presence of water. Aluminium has a vigorous action upon the chloroethanes and is practically resistant to the chloroethylenes. The solubility of certain inorganic substances in the chlorohydrocarbons has been studied; tetra- and pentachloroethanes are excellent solvents of sulphur. Tables are given indicating the solvent action of the various liquids upon 248 organic substances and 45 dyestuffs, and the possibility of separations in certain cases is discussed. As general rules it is stated that if a compound contains only one hydroxyl group it is generally soluble, whilst if it contains two or more hydroxyl or carboxyl groups or one of each, it is more or less insoluble. Ortho-compounds are generally more soluble than meta- or para-compounds. The solubility of a compound generally decreases as the chlorine content of the solvent increases. An accumulation of nitro groups tends to decrease solubility. Certain uses of the chlorohydrocarbons as solvents in chemical analysis are discussed and the chemical reactions and tests for various members of the series described. Aluminium trichloride reacts only with the chloroethanes and tetrachloroethylene to form double compounds. Pentachloroethane reacts in a characteristic manner with phenylhydrazine, forming a solid compound with evolution of gas.—J. F. B.

Ether for narcosis. J. Herzog. Apoth.-Zeit., 1914, **29**, 68—69.

When ether is left in contact with ordinary cork it dissolves substances from the cork which give a yellow to yellowish golden colour when tested with potassium hydroxide, thus rendering the ether incapable of satisfying the tests of the German Pharmacopœia.—F. Shdn.

Ethyl iodide and ethyl alcohol; Relation between the boiling point and composition of mixtures of ——. S. C. Jana and J. N. S. Gupta. J. Amer. Chem. Soc., 1914, **36**, 115—118.

The boiling points, at atmospheric pressure, of mixtures of ethyl iodide and ethyl alcohol were as follows:—

Percentage of ethyl iodide.	B. pt., ° C.	Percentage of ethyl iodide.	B.pt., ° C.
26·69	70·2	78·36	61·9
35·69	68·8	84·87	61·4
41·38	67·0	88·35	61·3
52·86	64·8	90·5	61·5
57·28	64·0	94·50	62·0
62·70	63·3	97·63	64·0
69·42	62·2		

A mixture of 87 per cent. of ethyl iodide and 13 of eth alcohol distilled as a homogeneous substance at 61·2°
—A. S.

Iodine tincture; Permanent ——. Courtot. J. Phar Chim., 1914, **9**, 69—71.

100 grms. of iodine, and 36 grms. of sodium iodide, 40 grms. of potassium iodide, are made up to 1000 gr

in strong alcohol. The use of smaller proportions of iodine, or heating during the solution, tends to produce a tincture which develops hydriodic acid on keeping.
—F. Shdn.

Patents.

Aldehydes; Method of producing condensation products of ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, U.S.A. Eng. Pat. 22,621, Oct. 4, 1912.

See Fr. Pat. 449,604 of 1912; this J., 1913, 507.—T. F. B.

Products for medical, surgical, and hygienic purposes; Manufacture of ——. F. R. von Walther, Dresden, Saxony, and W. Dederich, London. Eng. Pat. 27,733. Dec. 2, 1912.

See Fr. Pat. 451,446 of 1912; this J., 1913, 672.—T. F. B.

Bismethylaminotetramino-arsenobenzene; Manufacture of a —— and of an intermediate product. A. G. Bloxam, London. From C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. Eng. Pat. 996, Jan. 13, 1913..

See U.S. Pats. 1,075,279 and 1,081,079 of 1913; this J., 1913, 1128; 1914, 41.—T. F. B.

Hexanitrodiphenylsulphide; Manufacture of ——. H. Wade, London. From C. Hartmann, Schlebusch, Germany. Eng. Pat. 18,353, Aug. 12, 1913.

See Fr. Pat. 460,571 of 1913; this J., 1914, 44.—T. F. B.

Fatty acid containing arsenic; High-molecular ——. *Pharmaceutical compound.* E. Fischer, Berlin, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,082,509 and 1,082,510, Dec. 30, 1913.

See Eng. Pat. 18,732 of 1912; this J., 1913, 109.—T. F. B.

Oxycarboxydiarylcarbinols; Manufacture of ——. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,082,574, Dec. 30, 1913.

See Ger. Pat. 254,122 of 1911; this J., 1913, 189.—T. F. B.

Pharmaceutical compounds [esters of 2-piperonylquinoline-4-carboxylic acid]. A. Thiele, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,082,780, Dec. 30, 1913.

See Fr. Pat. 459,180 of 1913; this J., 1913, 1128.—T. F. B.

Isoprene; Producing ——. F. Webel, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 1,083,164 and 1,083,165, Dec. 30, 1913.

See Fr. Pat. 440,130 of 1912 and Addition thereto; this J., 1912, 735; 1913, 884.—T. F. B.

Production of beverages, perfumes, and the like. Eng. Pat. 20,061. *See* XIXa.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Sulphite-quinol solutions; Oxidation and protection of ——. J. Pinnow. Z. wiss. Phot., 1913, 13, 41—45. Chem. Zentr., 1914, 1, 102.

The stability of the sulphite-quinol developer is stated to be increased about four-fold by the addition of a small quantity of acetic acid (0·05 grm.-mol. per litre). (See also this J., 1913, 214, 451.)—A. S.

Patent.

Development of photographic images. W. H. Caldwell, Inverness. U.S. Pat. 1,082,622, Dec. 30, 1913.

See Eng. Pat. 14,744 of 1911; this J., 1912, 747.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Gunpowder and process of making the same. C. D. McDowell, Pontiac, Mich. U.S. Pat. 1,083,371, Jan. 6, 1914.

Seven oz. of granulated sugar are dissolved in a boiling solution of glycerin (1 drachm) in water (2 drachms). While the mass is heated, but below the boiling point, 8 oz. of potassium chlorate are stirred in until dissolved, and the final product is granulated by passing through a sieve.—T. St.

Nitrocellulose; Process for the production of ——. Verein. Kunstseidefabriken A.-G., Kelsterbach on Maine, Germany. Eng. Pat. 5553, March 5, 1913. Under Int. Conv., March 5, 1912.

See Fr. Pat. 455,011 of 1913; this J., 1913, 886.—T. F. B.

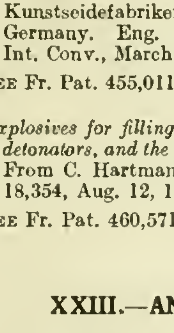
Explosives for filling projectiles, mines, torpedoes, primers, detonators, and the like; Use of ——. H. Wade, London. From C. Hartmann, Schlebusch, Germany. Eng. Pat. 18,354, Aug. 12, 1913.

See Fr. Pat. 460,571 of 1913; this J., 1914, 44.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Thermo-regulator; An electrical contact vapour-pressure ——. A. L. Feild. J. Amer. Chem. Soc., 1914, 36, 72—76.

The thermoregulator described was devised for the purpose of keeping constant at 30° C. the temperature of a water-bath of 350 litres capacity, heated by means of carbon filament electric incandescence lamps, supplied with current by two dry batteries, the thermoregulator and a 150-ohm relay being interposed in the circuit. The regulator (see fig.) consists of a U-tube provided with a three-way cock, A, and a tap, B, for filling. In the closed shorter limb is a layer of ether (or other suitable volatile liquid), above which is ether vapour mixed with air; in the other limb, above the mercury, the air is displaced by dry carbon dioxide. The thermoregulator (after proper adjustment of the mercury level) being immersed in the bath, if the temperature of the latter rises too high, the mercury rises in B, till it reaches the upper platinum contact, whereupon the relay is operated and the heating current cut off. The regulator rapidly acquires the temperature of the bath and has proved sensitive to 0·1°—0·005° C.—A. S.

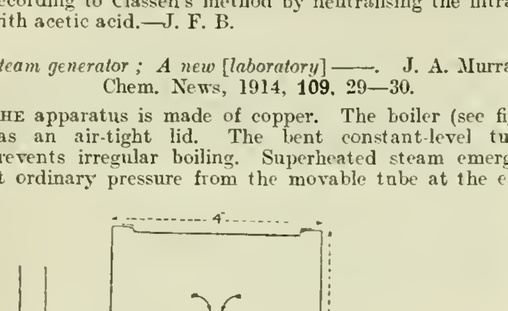


Calcium and magnesium; Separation of ——. F. Halla. Chem.-Zeit., 1914, 38, 100.

In presence of an excess of magnesium, in ammoniacal solution, the calcium is only incompletely precipitated by ammonium oxalate, but a quantitative precipitation is obtained in neutral solution when an excess of solid ammonium oxalate is added. When the proportion of magnesium chloride to calcium chloride is less than 12 : 1, the calcium oxalate is contaminated with some magnesium, but with larger proportions of magnesium the results come within the limits of experimental error. The neutral solution is treated at boiling point with an excess of solid ammonium oxalate until the precipitate of magnesium oxalate, at first produced, is redissolved and the residue of calcium oxalate remains unaltered. The solution is allowed to stand for some hours, filtered and the crystallised ammonium oxalate dissolved by warming with a little water. The precipitate is washed at first with hot water, then with cold and the calcium precipitate after incineration is covered with a little alcohol and a few drops of sulphuric acid, ignited and weighed as sulphate. The magnesium oxalate dissolved in the form of a double salt is precipitated according to Classen's method by neutralising the filtrate with acetic acid.—J. F. B.

Steam generator ; A new [laboratory] ——. J. A. Murray. Chem. News, 1914, **109**, 29—30.

THE apparatus is made of copper. The boiler (see fig.) has an air-tight lid. The bent constant-level tube prevents irregular boiling. Superheated steam emerges at ordinary pressure from the movable tube at the end of the coiled delivery tube (½ in. between the folds) into the bath, oven, etc. to be heated. The latter may be made of zinc or tin. Using a Bunsen burner for heating the steam generator, a bath measuring 9 × 4½ × 4½ inches was heated to 140° C. in 14 minutes.—J. R.



Aluminium ; Detection of traces of ——. G. H. Petit. J. Pharm. Chim., 1914, **9**, 66—69.

THE hydroxides of iron, chromium and aluminium precipitated in the usual way are washed thoroughly, transferred to a beaker by means of water, heated to boiling with solid barium hydroxide and filtered. The filtrate is acidified with hydrochloric acid, boiled and made alkaline with ammonia which has been kept over barium chloride. Aluminium when present is immediately precipitated. Where traces only of aluminium are present, the filtrate obtained after boiling the precipitate with barium hydroxide is made slightly acid with sulphuric acid, concentrated, filtered and ammonia added drop by drop (not more than 4—5 drops). It is then heated just to boiling and allowed to stand, when the aluminium hydroxide settles down if present. This method will detect 5 mgrms. of aluminium in the presence of 5 grms. of iron.—F. SHDN.

Mercury ; Determination of —— *as metal.* C. Duccini. Gaz. chim. ital., 1913, **43**, II., 693—699.

THE method of Purgotti (Gaz. chim. ital., 1899, **26**, II., 559 ; see also Rimini, this J., 1904, 208), in which the mercury salt is reduced to metal by hydrazine sulphate in presence of alkali, and the liberated nitrogen measured, gives accurate results if at least 1 grm. of the mercury salt be used. If instead of measuring the nitrogen, the reduced mercury be washed by decantation with dilute hydrochloric acid and water, collected on a weighed filter, washed successively with cold water, 98 per cent. alcohol, and ether, dried in a desiccator over calcium chloride and weighed, accurate results can be obtained even with 0·2—0·25 grm. of the sample. The method can be applied directly to the chloride and nitrate of mercury and to mercury potassium chloride, but the cyanide must be first converted into the chloride.—A. S.

Vanadium ; Volumetric determination of ——. G. Wegelin. Z. anal. Chem., 1914, **53**, 81—99.

TITRATION with permanganate after reduction with sulphur dioxide gives a maximum error of 0·2 per cent. The error caused by chloride can be eliminated by adding manganese sulphate. In presence of iron the reduction is effected with alcohol. The iodometric estimation, involving the use of potassium ferrocyanide, is very reliable. The production of the very pure pentoxide from vanadium oxychloride is described ; but for ordinary purposes it is sufficient to ignite commercial ammonium vanadate which has been four times recrystallised.—J. R.

Silica ; Modification of the usual method of correcting ——, *for included salts.* S. B. Kuzirian. Amer. J. Sci., 1914, **37**, 61—64.

THE silicious residue, obtained by evaporation of the hydrochloric acid solution of the substance, filtration, and ignition, is treated with sulphuric acid, gently ignited, and weighed again. It is now treated with hydrofluoric and sulphuric acids, the residue ignited to the same degree as before, and the loss of weight taken as silica. The error is not wholly eliminated by this treatment, but is in ordinary cases so lessened as to be negligible. A Bunsen burner is sufficient for the ignitions. (See also this J., 1914, 44.)—J. T. D.

Oxygen ; Determination of —— *in organic compounds.* M. C. Boswell. J. Amer. Chem. Soc., 1914, **36**, 127—132.

THE method previously described (this J., 1913, 383) having been found to give high results in the case of compounds containing less than 40 per cent. of oxygen, a modified method has been devised by which oxygen can be determined to within 0·3—1 per cent. and hydrogen to within 0·3 per cent. A quartz tube, 12 mm. internal diam., and 980 mm. long, is filled for a length of 570 mm. (starting 110 mm. from one end) with asbestos which has been impregnated with a solution of about 4 grms. of copper in nitric acid and then heated to convert the copper into oxide. The available oxygen in the copper oxide is determined by heating in hydrogen for 90 mins. and absorbing the water vapour produced, and the reduced copper is then re-converted into oxide by heating in oxygen for 45 mins. after the glow ceases. A quartz boat containing 0·2 grm. of the substance is placed in the quartz combustion tube which is supported in a combustion furnace without the usual iron trough and tiles. After passing a rapid stream of nitrogen for 20 mins., the whole layer of copper oxide is heated to the highest attainable temperature, the flow of nitrogen diminished to about 1 bubble per second, and the substance heated very gently at first, and later at the highest temperature attainable, after which the heating is continued for 20 mins. longer with a more rapid flow of nitrogen ; the water produced is absorbed by sulphuric acid and carbon dioxide by soda lime. After replacing the absorption apparatus by another absorption tube containing sulphuric acid, the copper oxide is reduced completely by heating in hydrogen for 30 mins. after the gas passes freely from the combustion tube. By subtracting the total oxygen available from the copper oxide from the sum of the quantities present in the water, carbon dioxide, and unreduced copper oxide, the oxygen derived from the sample is obtained ; the hydrogen is calculated from the quantity of water. The reduced copper is oxidised by heating in oxygen for 45 mins. after the glow ceases and is then ready for another determination.—A. S.

Nitro- and nitroso-compounds ; Volumetric determinatio of —— *by means of titanium trichloride.* H. Salvaterra Chem.-Zeit., 1914, **38**, 90—91.

KNECHT's method (see this J., 1903, 232 ; 1905, 154 is modified by the author in the following manner in orde

to render it more rapid and to make the end-point of the titration more definite. The solution of the nitro- or nitroso-compound is treated while boiling in an atmosphere of carbon dioxide with a definite excess of titanium chloride solution; after a short time, a measured quantity of methylene blue solution (standardised against the titanium chloride solution) is added, and the hot mixture is titrated with titanium chloride solution. At the end of the titration the green colouration changes sharply to yellow.
—W. P. S.

Extension of the upper limit of applicability of the Abel-Pensky apparatus. Scheel. *See* IIA.

Testing and valuation of oils for steam turbines. Schwarz and Marcusson. *See* IIA.

Determination of the temperature of softening of pitch. Klinger. *See* III.

Determination of total sulphur in commercial benzol. Schenk. *See* III.

Examination of commercial gelatins with regard to their suitability for paper-making. Sindall and Bacon. *See* V.

Testing of indigo on woollen cloths. See VI.

Determination of carbon in bituminous pyrites. Lepsöe. *See* VII.

Determining the amount of zinc chloride in treated wood. Bateman. *See* IX.

Report of Committee (Verein Deutscher Chemiker) upon methods of analysing iron ores. See X.

Analysed iron and manganese ores. Methods of analysis. U.S. Bureau of Standards. *See* X.

Analysed irons and steels. Methods of analysis. U.S. Bureau of Standards. *See* X.

Cupellation losses. Loewy. *See* X.

Determination of arsenic and antimony [in copper]. Brownson. *See* X.

Analysis of bronze, brass, and German silver. Bertiaux. *See* X.

The insoluble bromide test for drying oils. Sutcliffe. *See* XII.

Detection and determination of small quantities of iodin in oils. Fendler and Stüber. *See* XII.

Determination of free caustic alkali in soaps. Bosshard and Huggenberg. *See* XII.

Tentative specifications and analytical procedure for 30 *per cent. Hevea rubber insulating compound. See* XIV.

Qualitative differentiation of vegetable tannins. Stiasny. *See* XV.

Determination of pentoses in tanning materials, with special reference to quebracho and mangrove extracts. Van Gijn and van der Waerden. *See* XV.

Determination of mangrove in admixture with other tanning materials. Kerr. *See* XV.

Determination of humus in heavy clay soils. Beam. *See* XVI.

New sugar refractometer for determining the apparent dry substance of juices and syrups. Schönrock. *See* XVII.

Determination of traces of iron in invert sugar, starch glucose and caramel. Eastick and others. *See* XVII.

Analysis of maple products. II. Comparative study of the delicacy of methods. Snell and Scott. *See* XVII.

Determination of alcohol in beer by means of Malligand's ebullioscope. Cain. *See* XVIII.

Influence of ammonium sulphate on the specific rotation of lactose. Rosemann. *See* XIXA.

Formation of sediment in mineral waters when stored in bottles. Determination of silica, iron, and aluminium. Dede. *See* XIXA.

Detection of turmeric [in pepper]. Parry. *See* XIXA.

Artificial and genuine Peru balsam. Dieterich. *See* XX.

Reaction of succinic and malic acids. De Coninck. *See* XX.

Properties of some chlorohydrocarbons and their use in chemical analysis. Gowing-Scopes. *See* XX.

Patents.

Pyrometers; Optical ——. Siemens Bros. and Co., Ltd., London. From Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 17,927, Aug. 6, 1913.

In pyrometers of the kind in which a small incandescence lamp is arranged within the barrel of a telescope, the regulating resistance for varying the luminosity of the lamp is mounted on the telescope so that the hands need not be removed from the telescope in making an observation. Greater accuracy is also obtained by using a yellow or green screen in the eyepiece, together with a screen of tinted glass, in place of the usual red screen. The connecting socket for the leads of the lamp circuit is arranged opposite to the lamp on that side of the barrel which is the underside when the lamp-filament is in a vertical position.—A. T. L.

Extraction apparatus. H. J. Cary-Curr, Assignor to E. H. Sargent and Co., Chicago, Ill. U.S. Pat. 1,082,304, Dec. 23, 1913.

The distilling flasks of the extraction apparatus are heated by a rotatable hot plate arranged above and heated by a second electrically-heated hot plate fixed on a stand. The condenser tubes are cooled in a rotatable and adjustable tank supported on a central adjustable rod.—W. H. C.

Gases, liquids, and solids; Process for the determination of the density of ——. A. Kalähne. Ger. Pat. 268,353, May 12, 1912.

The process depends upon the fact that the frequency of the vibrations of a sounding device varies according to the density of the surrounding medium. A solid sounding device (tube, plate, bell, or the like), fixed in a holder and set in vibration either directly or by resonance in any suitable manner, is placed in the medium of which the density is to be determined, and is connected with mechanical or electromagnetic devices by which the change in the frequency of vibration can be measured and indicated. The process is specially applicable to cases in which the density of a gas or liquid may be altered by the introduction (*e.g.*, by diffusion) of another gas or liquid, for instance in controlling the purity of the gas in balloons and airships, detecting firedamp in mines, etc.—A. S.

XXIV.—MISCELLANEOUS ABSTRACTS.

Freezing mixtures containing solid carbon dioxide; The temperature of ——. A. Thiel and E. Caspar. Z. physik. Chem., 1914, 86, 257—293.

Despite conflicting statements in the literature, the equilibrium temperature of mixtures of solid carbon dioxide and ether, alcohol or acetone is, as theoretical considerations based upon the phase rule would indicate, practically identical with the subliming temperature of the pure solid phase, which has the mean value —78·35° C.

In accordance with this result the partial pressure of the solvent is negligible. Air was excluded during the experiments, and slight discrepancies of not more than +0·1° C. were traced to the effect of the hydrostatic pressure of the liquid above the thermometer bulb. The appreciably lower temperatures on record are due to the considerable absorption of heat attendant upon solution. Such temperatures would naturally be temporary. The temperatures were compared in a novel and effective manner by means of a "vapour-pressure" thermometer charged with solid carbon dioxide free from air which was solidified in the bulb beforehand: commercial carbon dioxide "snow" was found to contain considerable quantities of air.—J. R.

Biological action of chemical reagents; Cause of error in studying the ——. Presence of traces of zinc in glass. M. Javillier. Comptes rend., 1914, **158**, 140—142.

Experiments on the action of zinc compounds on the growth of *Aspergillus niger*, conducted in vessels of quartz or of Bohemian glass, showed them to have a considerable influence; but the same experiments in vessels of Jena glass showed the same effect as when zinc was present in the other cases, whether zinc had been added or not. Investigation showed that the Jena glass contained zinc, and that the small amount dissolved by the culture medium was sufficient to produce the effect of that added in the other cases.—J. T. D.

Ectoproteases; Specificity and other properties of ——. C. Fermi. Zentr. Bakter. u. Parasitenk., 1913, I. Abt., **69**, 465—474. Chem. Zentr., 1913, **2**, 1931—1933.

Experiments were made with preparations of trypsin, pepsin, and papain and of proteolytic enzymes from different bacteria, with regard to the effect of different influences and treatments on their power of decomposing albumin, serin, fibrin, casein, and gelatin respectively. By exposure to heat and to light, by filtration through porous porcelain, and by dialysis, in all case the enzymes lost their albumolytic activity first and their gelatinolytic activity last. Treatment of the enzyme preparations with acids, alkalis, salts, alkaloids and narcotics respectively gave, on the whole similar results, as also did fractional precipitation with alcohol of different concentrations, treatment with natural anti-enzymes (normal serum and albumin), and selective absorption with the corresponding proteins (gelatin, albumin, serin, and casein); and the conclusion is drawn that the proteolytic enzymes are not specific, but that if present in sufficient concentration and with the requisite degree of activity, each enzyme is capable of effecting simultaneously the hydrolysis of albumin, serin, casein, fibrin, and gelatin. When the activity and concentration of the enzyme were diminished, it became successively incapable of decomposing albumin, serin, fibrin, casein, and gelatin respectively, in the order given; hence it was possible to obtain preparations capable of decomposing only gelatin, or only casein and gelatin, but not only albumin and serin. An enzyme capable of hydrolysing albumin and serin was also always capable of hydrolysing fibrin, casein and gelatin. In the experiments on the action of chemicals on the enzymes, it was observed that phenol had a much more injurious action than thymol or toluene, especially on the serolytic, caseinolytic, and fibrinolytic activity. Hydrochloric, acetic, lactic, butyric, formic, and malic acids were less injurious than sulphuric and nitric acids. The activity of trypsin diminished more rapidly in water than in solutions of sodium carbonate or sodium chloride; of the two salts the chloride was the better preservative. The gelatinolytic power of pepsin was inhibited by hydrochloric, propionic, butyric and valeric acids, but became apparent after neutralisation. The inhibition of the secretion of proteases by bacteria in saccharine nutrient media was found to be due to the formation of lactic acid, which prevented the development of the bacteria: normal growth and secretion of protease resulted after neutralisation of the acid. The formation of lactic acid was greatest with dextrose, less with sucrose, and least with lactose. Of the different proteins, gelatin was most readily hydrolysed by chemical reagents (acids and salts), followed by fibrin, casein, serin and albumin in the order given. Fibrin was more readily attacked than casein and gelatin by a 1·5 per cent. solution of potassium hydroxide. Casein was more resistant to 75 per cent. sulphuric acid than to 25—50 per cent. lactic acid.—A. S.

Trade Report.

Russian chemical industry; Development of ——. U.S. Consular Reps., through Oil, Paint and Drug Rep., Jan. 22, 1914.

According to a report prepared by the U.S. Consul at Moscow and issued by the Bureau of Foreign and Domestic Commerce, U.S. Dept. of Commerce, the chemical industry of Russia has developed to such an extent in recent years that the annual output has now a value of about £15,500,000. For statistics relating to the production of sulphuric acid and soda, see this J., 1913, 532. The alkali works are mostly situated near the salt mines in the provinces of Perm and Viatka and in the southern part of the province of Ekaterinoslav, but the sulphuric acid factories are located in the districts where the acid is consumed. The factories near the Black Sea and the Baltic use pyrites from Asia Minor and Portugal; those nearer Moscow and on the river Volga obtain pyrites of good quality from the Urals. The high selling price of soda is due to the high freight charges from the factories which are about 700 miles distant from the places of consumption. This applies also to chloride of lime the price of which is about 6s. per 100 lb. at the works, whilst the freight charge amounts to about 50 per cent. of the selling price at Baltic ports. In 1911, the production of chloride of lime was about 54,000,000 lb. and the imports 722,000 lb. In 1912, 464,940 tons of fertilisers were imported (see also this J., 1913, 1079): this total included 187,750 tons of superphosphate and 52,110 tons of natural phosphorites, the corresponding figures for 1911 being 169,663 and 31,878 tons respectively. In 1910, only 14,000,000 lb. of superphosphate were produced in Russia, but two new factories were opened in 1912 and the industry is making considerable progress, though having to depend upon imported raw material. A deposit of phosphorite in Kostroma province was investigated by the Ministry of Agriculture and although the material was of lower grade than that found in Podolia province, it proved suitable for the manufacture of superphosphate and a factory on the Volga is now using it. The Russian production of organic dyestuffs, in the districts of Riga, Warsaw and Moscow, is based exclusively on the working up of partly manufactured foreign materials. Attention is called to the development of coke production in by-product ovens in the Donetz district (see this J., 1913, 478). There is a considerable demand for sodium sulphate, which cannot be produced in sufficient quantity in Russia owing to the impossibility of disposing of the hydrochloric acid. The natural deposits cannot be utilised t any considerable extent owing to the high freight rate due to the requirement of the railway companies that th material shall be transported in sacks. The imports o Stassfurt (potash) salts increased from 74,808 tons in 191 to 91,350 tons in 1912, and the imports of sodium nitrat rose from 34,866 tons in 1911 to 60,736 tons in 191 There is a vigorous demand and ready sale for Norwegia saltpetre (calcium nitrate). The centre of the Russia chemical industry is gradually moving towards the eas the raw materials (*e.g.* pyrites, salt and fuel) being tran ported by way of the Volga, whilst the development the railway lines crossing this river offers facilities f exportation; this region is also favourably situated f supplying the Persian and Siberian markets.—A. S.

Brazil; Position of chemical industries in ——. Chem Zeit., 1914, **38**, 57—58.

Chemical industries are, as yet, little developed in t country. The few small factories and works are confin to Rio de Janeiro, Sao Paulo and a few other ports. There is, for instance, a small sulphuric acid chamber-plant in Sao Paulo which utilises American sulphur, but which is barely able to compete with the imported product. Extensive progress is to be anticipated, however, upon the alteration of the present unfavourable conditions of government. There is a great demand for pharmaceutical preparations and cosmetics, which are all imported from Europe and N. America. Despite the high quality and abundance of the ores, the iron industry is quite undeveloped. This is largely due to the lack of suitable coal, practically all of which is imported from England; and probably no considerable advance will be made until it is found possible to utilise the cheap water power of the country in the industry. There is a fair number of breweries, except in the north. The cellulose and wood industries are neglected, although much first-class material is available. The textile industry is growing rapidly. The position of the works-chemist, in view of the cost of living, undesirable climate, and uncertain legislation, is at present unenviable.—J. R.

Books Received.

Handbuch der Arbeitsmethoden in der anorganischen Chemie. Unter Mitwirkung von Zahlreichen Chemikern und Physikern. Herausgegeben von Dr. Arthur Stähler. Privatdozent an der Universität Berlin. Dritter Band. Allgemeiner Teil. Physikochemische Bestimmungen. Erste Hälfte. Verlag von Veit and Comp. in Leipzig. 1913. Price M.22. Bound M.25.

Volume (9⅞ by 6⅜ ins.) containing 692 pages of subject matter, with 354 illustrations. The contents of this first half of the third volume, are classified as follows:—I. Weight determinations. II. Volume determinations. III. Determining the density of solid and liquid substances. IV. Determining the densities and molecular weights of gases and vapours; (A. Laboratory methods. B. Methods of extreme accuracy). V. Determination of the molecular weight of dissolved substances (osmotic methods). VI. Determination of osmotic pressures. VII. Critical points. VIII. Determination of compressibility. IX. Determining the compressibility of liquid and solid substances. X. A practical thermostat. XI. Determining surface tensions. XII. Determinations of expansion by heat. XIII. Estimating melting points. XIV. Metallography. XV. Estimation of boiling and sublimation points. XVI. Determinations of solubility, adsorption and absorption. XVII. Determination of the solubility of gases in liquids. XVIII. Viscosity. XIX. Diffusion. XX. Conduction of heat. XXI. Calorimetry. XXII. Specific heat. XXIII. Measuring thermal effects (Wärmetönungen).

Handbook of Photomicrography. By H. Lloyd Hind and W. Brough Randles. George Routledge and Sons, Limited, Broadway House, 68–74, Carter Lane, London, E.C. 1913. Price 7s. 6d. net.

Volume (8⅜ by 5⅜ ins.) containing 278 pages of subject matter, with 44 plates, comprising 8 three-colour reproductions of direct colour-photomicrographs, and 85 half-tone reproductions of photomicrographs, with further 71 text-illustrations. There is an alphabetical index of subjects. This is an account of the methods employed in photomicrography, with a description of the apparatus and processes. The subject matter is classified as follows:—I. Apparatus. II. The microscope. III. Objectives and eyepieces. IV. Lamps and illuminants. V. Condensers. VI. Experiments on illumination. VII. Low power photomicrography. VIII. Photomicrography. IX. Colour screens and colour sensitive plates. X. Exposure. XI. Oblique and dark-ground illumination. XII. Opaque objects. Metallography. XIII. Colour photomicrography. XIV. Photographic operations. XV. Applications of photomicrography. XVI. Appendix of formulæ, etc.

Die Chemie und Technologie der Natürlichen und Künstlichen Asphalte. Von Dr. Hippolyt Köhler. Zweite vollständig umgearbeitete und stark vermehrte Auflage, Herausgegeben von Dr. Hippolyt Köhler und Dr. Edmund Graefe. Verlag von Friedr. Vieweg und Sohn, Braunschweig. 1913. Price M.18. Bound, M.19.20 net.

Volume (9⅝ by 6¼ ins.) containing 491 pages of subject matter, with 259 illustrations and numerous tables. The subject matter is subdivided and classified as follows:—I. Scientific section: Introduction. I. Historial; on the occurrence, origin, and employment of asphaltum. II. Occurrence of the natural asphaltum. III. The origin of the bitumens, etc. IV. Physical and chemical properties, composition, and constituents of the asphaltums and asphaltites (hard asphaltums). V. Artificial asphaltum; origin, properties and composition (Asphaltums from coal tar; lignite tar; petroleum; from the gasification of mineral oils). II. Technical section: Introduction. VI. Asphalt ("*Stampfasphalt*") and its preparation. VII. Cast asphalt, and its preparation. VIII. Rolled asphalt; preparation and working. IX. Street-making, and use of tar for tar-macadamised roads. X. Manufacture of roofing-material (paste-board basis), roofing-paper, etc. XI. Use of roofing-paper; also lacquers, varnishes, and mixed asphaltums, etc. Electrotechnical insulating materials; rubber substitutes; cements and adhesives, etc. III. Analytical section. XIII. Physical methods for examining the natural and artificial asphaltums. XIV. Chemical methods for examining natural and artificial asphaltums. XV. Technical examination and testing of asphaltic substances. (i. and ii.) Preased asphalt and cast asphaltum. (iii.) Testing mixtures for rolled asphalt. (iv.) Roofing paper, boards; insulating plates; etc. (v.) Tars, cements, adhesives, wood cements, etc.

Die Industrie der Cyanverbindungen; Ihre Entwickelung und ihr Gegenwärtiger Stand. Von Dr. Hippolyt Köhler, Direktor der Rütgerswerke-Aktiengesellschaft, Berlin. Verlag von Friedr. Vieweg und Sohn, Braunschweig. 1914. Price M.8. Bound M.9 net.

Volume (9⅝ by 6¼ ins.) containing 188 pages of subject matter, with 30 illustrations, and alphabetical indexes of names and subjects. The text is subdivided and classified as follows:—I. Scientific section: Chemistry of cyanogen and cyanogen compounds. II. Technical section: II. Manufacture of cyanogen compounds from animal deposits and remains, and products of dry distillation. III. Obtaining cyanogen compounds from atmospheric nitrogen. IV. Cyanogen compounds from ammoniacal nitrogen. V. Preparation of various cyanogen compounds from sulphocyanides and ferrocyanides, etc. III. Analytical section: VI. Testing and investigating the cyanogen compounds. (i.) Qualitative and quantitative analysis of the cyanogen compounds. (ii.) Testing and investigating the raw materials. (iii.) Testing the residual gas-purifying materials of the gas works. (iv.) Cyanide mud and wash liquors. (v.) Testing and examining the final products.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Güldner*, H.: Das Entwerfen u. Berechnen der Verbrennungskraftmaschinen u. Kraftgas-Anlagen. 3., neubearb. u. bedeutend erweit. Aufl. Mit 1282 Text-fig. 35 Konstruktionstaf. u. 200 Zahlentaf. (XX. 789 S. u. 1 Bl). Lex 8°. Berlin. J. Springer. 1914. Cloth M. 32.

Lieckfeld, G. : Die Petroleum- u. Benzin-Motoren m. besond. Berücksicht. der Treiböl-Motoren. Ein Handbuch f. Ingenieure, Motorenbesitzer u. Wärter, aus der Praxis f. die Praxis bearb. 4. Aufl. (VII, 320 S. m. 295 Abbildgn. u. 1 Taf.) gr. 8°. München, R. Oldenbourg. 1913. Cloth M. 11.

Spielmann, Dr. F. : Verbrennungskraftmaschinen u. Generatoren. Ein Handbuch f. Fabrikanten, Ingenieure, Monteure u. Studierende techn. Lehranstalten. (Neue [Titel-] Aufl.) 2. u. 3. Taus. (VIII, 176 S. m. 169 Abbildgn.) gr. 8°. Leipzig, J. J. Weber [1907]. 1913. Cloth M. 3.

Supino, G. : Moteurs Diesel, marins et fixes, ill., in-8°. Ch. Béranger, Paris. 1914. 20 fr.

Hiller, E. G. : Steam Boiler Construction : Rules of The National Boiler and General Insurance Co., Ltd., with notes on Material, etc., etc. 8vo. pp. 168. Taylor, Garnett, London. 1914. Net 1s. 6d. ; bds., net 1s.

Hiller, E. G. : Working of Steam Boilers ; Being instructions respecting the working, treatment, and attendance of Steam Boilers. 8vo. pp. 148. Taylor, Garnett, London. 1914. Net 2s. ; bds., net 1s. 6d.

Seufert, F. : Dampfkessel, Dampfmaschinen u. andere Wärmekraftmaschinen. Ein Lehrbuch zum Selbststudium u. zum Gebrauch an techn. Lehranstalten. 8. Aufl. (des Thdr. Schwartze'schen Katechismus), vollständig neu bearb. (Neue [Titel-] Aufl.) 2. u. 3. Taus. (XII, 345 S. m. 408 Abbildgn. u. 5 Taf.) gr. 8°. Leipzig, J. J. Weber [1909]. 1913. Cloth M. 6.

Inchley, W. : The Theory of Heat Engines. 8vo. pp. 502. Longmans, London. 1914. Net 7s. 6d.

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Stetefeld, I. : 3. internationaler Kältekongress Chicago. Referat üb. die anlässlich des 3. internationalen Kältekongresses geh. wichtigsten Vorträge der 6 Sektionen. Im Auftrage der "Eis- u. Kälte-Industrie" bearb. (20 S. m. 4 Fig.) 32×24·5 cm. Wittenberg, A. Ziemsen. 1913. M. 1.

Kalender f. den praktischen Ofenbau 1914. Erstes kurzgefasstes Nachschlagebuch f. Kachelofenfabrikanten, Hafner, Töpfer u. Ofensetzer. Hrsg. v. Aug. Fichtner. 2. Jahrg. (XII, 134 S. u. Schreibkalender.) kl 8°. Halle, C. Marhold. Cloth M. 2.

IIA. *Thomson*, J. H., and Sir B. *Redwood* : Handbook on Petroleum. 3rd edition, revised, and enlarged. 8vo., pp. 360. C. Griffin, London. 1914. Net 8s. 6d.

Westcott, H. P. : Handbook of natural gas. Erie, Pa., Metric Metal Works. c. 2+7-14+529 p. il. fold. pl. fold. chart. tabs. (1 fold). 12°. 1914. Leath., $4.

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III. *Drexler*, F. : Zur Frage der Schweröl- (Teer-, Teeröl-) Ausnutzung in Verbrennungsmotoren. (35 S. m. 24 Fig.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1913. M. 1.50.

V. *Korschilgen*, J. P., u. E. L. *Selleger* : Papierfabrikation. 65. Lfg. Berlin, O. Elsner. 1914. 50 Pf.

Pannain, E. : Le fibre tessili e la loro lavorazione. Milano. 16°. fig., p. viii., 298. 1914. Lire 3.

Woolman, Mrs. M. S. V., and E. B. *McGowan*. Textiles ; a handbook for the student and the consumer. N.Y., Macmillan. c. 11+428 p. (3 p. bibl.) il. 1914. D. $2.

VI. *Erban*, Prof. F. : Die Spannrahmen u. deren konstruktive Ausbildung f. die Zwecke der Appretur. (35 S.) 8°. Wittenberg, A. Ziemsen. 1913. Cloth M. 2.

VIII. *Heinersdorff*, G. : Die Glasmalerei. Ihre Technik u. ihre Geschichte. Mit e. Einleitg. u. e. Anh. üb. moderne Glasmalerei v. Karl Scheffler. (56 u. 155 S. m. 159 Abbildgn.) Lex 8°. Berlin, B. Cassirer. 1914. Cloth M. 12.

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IX. *Eckel*, E. C., and others : Portland cement materials and industry in the United States. Wash., D.C., Gov. Pr. Off. 401 p. (6¼ p. bibl.) fold. maps. tabs. O. (U.S. Geological Survey bull. 522), pap. 1914.

Protokoll der Verhandlungen des Vereins deutscher Portland-Zement-Fabrikanten (Eingetragener Verein) am 10., 11. u. 12. 2. 1913. (523 S. m. Abbildgn.) gr. 8°. Berlin (Tonindustrie-Zeitg.) 1913. M. 4.

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Hobart, J. F. : Soft Soldering, Hard Soldering, and Brazing. Cr. 8vo. Constable. 1914. Net 4s.

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XII. *Coghlan*, H. L. and J. W. *Hinchley*, : Cocon Cultivation and Plantation Machinery. Illu trated. Cr. 8vo, pp. 140. C. Lockwood, London. 191 3s. 6d.

XV. *Paessler*, Prof. J., u. R. *Lauffmann* : Wörterbuch d wichtigsten in der Lederindustrie angewandt Fachausdrücke. Deutsch-englisch u. englisch-deutsc (139 S.) 8°. Berlin, F. A. Günther & Sohn. 191 Cloth M. 2.50.

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XVI. *Niklas*, H. : Die Kolloidchemie u. ihre Bedeutung f. Bodenkunde, Geologie u. Mineralogie. Vortrag. (21 S. m. 1 Taf.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1913. M. 1.50.

XVIII. *Feitler*, Prof. S. : Technolgie der landwirtschaftlichen Industrien 3 Tl. Gärungstechnik. 1. Abtlg. : Die Bierbrauerei. (X. 269 S. m. 110 Abbildgn.) gr. 8°. Wien, A. Hölder. 1914. Cloth M. 6.

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XXI. *Allen*, H. S. : Photo-Electricity ; the Liberation of Electrons of Light, with chapters on Fluores-ence and Phosphorescence and Photo-chemical Actions and Photography. 8vo, pp. 234. Longmans, London. 914. Net 7s. 6d.

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London Section.

Meeting held at Burlington House on Monday, February 2nd, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

OXYGEN AND METALLIC ANTIMONY IN CRUDE ANTIMONY.

BY W. R. SCHOELLER, PH.D.

In a previous paper read before this Section (this J., 1913, 260) I have shown that the percentage of sulphur in crude antimony was much lower than that corresponding to the formula Sb_2S_3, and that the result of the complete analysis of crude disclosed a more or less considerable deficiency; this was ascribed to the presence of oxygen, and the assumption supported by the observation that crude, unlike stibnite, was partly dissolved by cold solutions of sodium bitartrate. The present investigation was undertaken with a view to obtaining more convincing evidence of the presence of oxygen.

I. *Analysis of the material.*—The material experimented upon (Hu-nan crude) was crushed to pass a 90-mesh and analysed like the previous samples. The figures show a shortage of over 3 per cent., with low sulphur and unusually high antimony content:—

	per cent.	
Antimony	73·56	
Sulphur	22·45	As, Zn: traces.
Iron	0·70	Cu, Pb, Ag not determined.
Insoluble	0·05	
	96·76	

II. *Determination of oxygen.*—Oxygen was next tested for by fusing the material in a current of hydrogen sulphide. Hydrogen reduces both antimony oxide and sulphide to metal, whereas hydrogen sulphide acts only upon the oxide, thus:—$Sb_2O_3+3H_2S=Sb_2S_3+3H_2O$. Crude antimony containing oxide would thus increase in weight, and give off water.

The sample was dried for two hours at 107° C. and weighed out into a bulb tube connected at one end with three calcium chloride tubes for drying the hydrogen sulphide, and at the other with a condenser and a calcium chloride tube for collecting the water. After the air had been displaced from the apparatus the crude was gently heated, when water soon began to condense. The heat was increased until the mass had fused. It was then left to cool under hydrogen sulphide which was displaced by air before weighing. In this way 3·18 per cent. of oxygen was found, which accounts for the deficiency as 96·76 + 3·18 = 99·94. The residue showed an increase in weight of 3·53 per cent. and was found to consist of nearly pure sulphide: antimony 71·13 per cent.; sulphur 27·56 per cent.; iron and insoluble 0·73 per cent.; total 99·42 per cent. The presence of oxygen in Chinese crude is thus placed beyond doubt.

III. *Action of bitartrate.*—The original crude and the product obtained by fusion under hydrogen sulphide were tested as to their behaviour towards cold sodium bitartrate solution of the same strength as the one previously used. After 20 hours' digestion the following quantities of antimony were dissolved:—Original crude, 8·72 per cent.; fused sulphide, 0·89 per cent. The result of the replacement of oxygen by sulphur is the comparative insolubility of the fusion product.

IV. *Antimonious oxide is present in crude.*—The amount of oxygen found, viz., 3·18 per cent., is equivalent to 15·90 per cent. of antimony in the form of trioxide. That the lowest oxide is present in crude was proved by the following three tests in which the total antimony and that existing as trioxide were estimated in aliquot portions of solution, the former by precipitation with hydrogen sulphide, solution of the sulphide in sulphuric acid and titration with permanganate, the latter by addition of sodium bicarbonate and titration with iodine.

1. It was shown above (III.) that cold bitartrate solution dissolved 8·72 per cent. of antimony. The estimation of the antimonious oxide in the same solution gave 8·35 per cent. of metal.

2. An attempt was made to extract the whole of the oxide by boiling 5 grms. of crude with 100 c.c. of 7 per cent. tartaric acid solution for 45 minutes. The determination of the total and trivalent antimony in the filtrate gave: Total antimony, 10·69 per cent.; antimony as Sb_2O_3, 10·81 per cent. The residue from this extraction was not pure sulphide, as it assayed 72·40 per cent. of antimony.

3. The preceding test was carried out on 90-mesh material. A sample was now ground down to extreme fineness, and 1·25 grm. boiled with 100 c.c. of 10 per cent. tartaric acid for 45 minutes. The filtrate contained 13·29 per cent. of antimony, against 12·88 per cent. determined by iodine titration.

The last experiment shows that at least four-fifths of the total oxygen is present as trioxide; whether the remaining fifth exists partly as pentoxide could not be ascertained, as the test for pentoxide fails when sulphide is also present. I think, however, it is safe to assume that practically the whole of the oxygen is combined with antimony in the form of trioxide, because an excess of oxygen is necessary for the formation of the pentoxide. The experiments further show that part of the oxide is easily soluble in the cold, while a small proportion remains insoluble even on boiling and after most thorough crushing. As a possible explanation for this behaviour I would suggest that the bulk of the oxide is present in the free state, either dissolved in, or intermixed with, the sulphide, while the remainder has combined with the sulphide to form an oxysulphide. I shall have an opportunity later on of referring again to this matter. (VI.)

V.—*Presence of metallic antimony in crude.*—By recasting the complete analysis, the composition of the sample of crude is represented by the following figure:—

Analysis.		Calculated composition.		Calculated increase after fusion under H_2S.	
	per cent.		per cent.		per cent.
Insol.	0·05	Insol. ..	0·05	Insol.	0·05
Fe	0·70	Fe_2	1·10	FeS	1·10
S	22·45	SbS_3 ..	77·17	Sb_2S_3	77·17
O	3·18	SbO_3 ..	19·08	Sb_2S_3	22·27
Sb	73·56	Excess Sb	2·54	Sb_2S_3	3·55
Total ..	99·94		99·94		104·14

Apparently 2·54 per cent. of antimony remains uncombined. If these figures are correct, the metal should remain undissolved when crude is treated with hydrochloric acid. This was verified by experiment, by extracting powdered crude repeatedly with hot strong hydrochloric acid. The residue was washed with water and alcohol, and dried at low temperature; it showed the characteristic light-grey colour of powdered regulus, easily distinguishable from the bluish tinge of antimony sulphide: 0·5 grm. was assayed for antimony, giving 97·17 per cent. of metal: this is conclusive proof of the presence of regulus in crude antimony. The separation of the metal from the sulphide was also accomplished by caustic alkali which dissolves the latter, as well as the oxide. It is no doubt due to the presence of metallic antimony in the crude that its increase in weight in the oxygen determination is 0·61 per cent. lower than the calculated increase (see table): for, while antimony oxide is easily converted into sulphide when heated in a current of hydrogen sulphide, the metal itself combines less readily under the same conditions. This is also borne out by the low sulphur content (27·56) of the fused product and its slight solubility in bitartrate solution which is known to have a strong solvent action on regulus. (Cf. my previous paper, *loc. cit.*)

VI. *Glass of antimony.*—A fragment of black glassy crust, sometimes found on the surface of ingots of crude, was also examined. The glass is soft and heavy, and on crushing yields a powder the colour of which is more violet than that of ferric oxide. The quantity at my disposal was not sufficient for a thorough investigation, and its composition as far as ascertained is given by the following figures: Soluble antimony 73·28 per cent.; antimony tetroxide and insoluble 1·23 per cent.; sulphur 16·18 per cent.; oxygen 6·32 per cent.; iron 1·35 per cent.; total 98·36 per cent. Part of the soluble antimony was found to be present in the metallic state, remaining as a grey residue insoluble in hydrochloric acid but soluble in *aqua regia*; the amount of metal appeared to be at least as large as that observed in crude. The colourless residue from the *aqua regia* treatment consisted chiefly of antimony tetroxide. The determination of oxygen was carried out as described for crude, the substance showing an increase in weight of 6·70 per cent. after fusion.

Judging from the behaviour of crude towards bitartrate solution and the high oxygen content of glass of antimony, one would expect the latter to be strongly attacked by that solvent, but the reverse was found to be the case: after 18 hours' contact in the cold, the dissolved antimony amounted to no more than 1·31 per cent.; this was present as trioxide. The oxysulphide which is the chief constituent of glass of antimony is thus insoluble in bitartrate, and this may account for the incomplete extraction ot the oxide from crude, by assuming that the latter contains a subordinate quantity of oxysulphide. (IV.) Other tests bearing on this point could not be carried out for want of material.

VII. *Conclusions.*—The results of the above experiments prove that Chinese crude antimony contains a considerable proportion of antimonious oxide together with a less important amount of metallic antimony. These facts are in contradiction with the generally accepted notion that crude antimony obtained by liquation is pure unaltered sulphide, as no mention is made in the standard books on metallurgy and chemistry of a possible contamination with oxide due to absorption of oxygen by the molten sulphide. No doubt in an inert atmosphere the latter melts without undergoing decomposition, and a liquation process in which air is excluded will yield a sulphide free from oxide, but this is difficult to attain in practice. For this reason liquation in vertical tubes should give a purer product than in reverberatory furnaces. In the type of furnace used in China, the molten sulphide discharges continuously into a cavity which is only separated from the outside air by a loosely fitting cover, where the material remains in the liquid state until ladled into moulds two hours after the beginning of the operation. During this time absorption of oxygen takes place, which sometimes leads to the formation of a film or crust of glass of antimony on the surface of the crude. The liquation residue (which was described in my previous paper) is of course subject to oxidation like the crude itself.

It seems strange that the absorption of oxygen by, and consequent oxidation of, fused antimony sulphide should not be mentioned in modern technical literature, all the more so because the effect of the fusion was known long before the establishment of chemistry as an exact science. The iatro-chemists, with whom antimony compounds were great favourites on account of their vigorous physiological action, were well acquainted with the fact that stibnite undergoes a change on being fused, though they were unable to assign a cause to it. They taught that the natural sulphide, "on account of the Regulus being corrected by the Sulphur, is not only safe, but in many cases a medicine ot great service; *that by simple fusion, it acquires a degree of malignity*; . . . that equal parts of Antimony (*i.e.*, stibnite) and Nitre, melted together, yield a virulent mass."[*] In other words, the emetic properties become more pronounced as the solubility increases with the progressive replacement of sulphur by oxygen. Decoctions of crude antimony appear to have been used as diaphoretics,[*] and the following experiment shows that it is actually attacked by water: 1 grm. of 90-mesh material was boiled with 100 c.c. of distilled water for five minutes. The acidified filtrate treated with hydrogen sulphide gave a stable fluorescent solution of colloidal antimony sulphide. This was coagulated by adding salt and passing more gas through the boiling solution: 1·66 per cent. of soluble antimony was found.

The simultaneous presence of sulphide, oxide, and metal in crude seems difficult to explain if we accept the statement, found in most books, that sulphido and oxide of antimony, unlike the corresponding lead or copper compounds, are incapable of reacting upon one another with formation of metal and sulphur dioxide, but fuse together to a glass of oxysulphide. The fact that metallic antimony occurs in crude makes it more than probable that the reaction $Sb_2S_3+2Sb_2O_3=6Sb+3SO_2$ takes place, though to a very limited extent. I have found at least one statement, reproduced in Bloxam's Chemistry,[†] to the effect that the fusing together of oxide and sulphide results in the formation of metal, though the reaction is represented as taking place between sulphide and tetroxide. As regards the formation of glass of antimony, this does not, apparently, take place when the relative amount of oxide falls below a certain minimum: for the ratio of oxide to sulphide in the glass of antimony is very nearly 1 : 1·4, whereas in the case or the crude under examination it is almost exactly 1 : 4, and this material retains the crystalline structure and physical properties of antimony sulphide, while unlike glass of antimony it gives up most of its oxide content to bitartrate or tartaric acid solution.

Within a few years of opening up her mineral resources, China has become the foremost producer of antimony and especially of crude. The latter has been shown to be a more complex product than was generally supposed, and this knowledge may be of practical interest. Thus the purchase and sale of crude is not done on a certificate of assay, on the assumption that the article is pure sulphide containing 70—71 per cent. of antimony. Not only does this percentage vary within wider limits, but it may also be found desirable to ascertain the amount of metallic antimony and oxide in the material. In the preparation of antimonious chloride and other salts from crude the presence of metal is objectionable because it remains insoluble in hydrochloric acid, whereas it is rather advantageous in smelting for regulus by the precipitation method. Finally, the accidental formation of metallic antimony in the liquation process raises an interesting question, namely, whether it would be possible to convert the sulphide into metal by applying bessemerizing in the production of regulus from sulphide ores.

In conclusion I desire to thank Messrs. G. T. Holloway and Co., Ltd., for their courtesy in permitting the publication of this investigation which was carried out in their laboratory.

THE ESTIMATION OF ZINC IN COINAGE BRONZE BY VOLATILISATION.

BY T. K. ROSE, A.R.S.M., D.SC.,
Chemist and Assayer of the Mint.

This is not a new method, but a very old one, the origin of which has been lost. A similar method for zinc ores is referred to by Percy[‡] as having been used "formerly" and he states that the process is "still" (*i.e.*, in 1861) "occasionally resorted to by some assayers." Percy gives the reasons for regarding the method as untrustworthy in the case of ores. The method was unknown to Agricola (1556), Ercker and Sir John Petty (1686), and is not mentioned in Thenard's Chemical Analysis, 1818, or in Vauquelin's Manuel de l'Essayeur, 1836. It is described by Makins,[§] who says that "at the Mint, the bronze, mixed with exactly twice its weight of pure tin, is enclosed in a porous carbon pot, luted up in a crucible and strongly heated in an assay muffle for eight hours." According to tradition at the Mint the charge was embedded in anthracite in a wind furnace and left all night. The method was allowed to pass out of use in 1870, probably because the temperature was often too low to be efficacious. It is also possible that the use of proof assays in this connection was not understood. The addition of tin appears to be objectionable. I tested the process in 1913 and found it trustworthy and useful, if due precautions are observed.

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[*] The Chemical Works of Caspar Neumann, M.D. By William Lewis. London, 1759, p. 131.

[*] "La décoction de l'antimoine cru est sudorifique. Mais si l'on y mesle quelque drogue acide, elle sera vomitive." Dr. N. Lemery, Traité Universel des Drogues simples, Paris, 1698, p. 46.

[†] Chemistry, inorganic and organic. C. L. Bloxam, 10th edition, 1913, p. 476.

[‡] Metallurgy: Fuel, Copper, Zinc, &c., 1861, p. 956.

[§] Manual of Metallurgy, 2nd Edn., 1873, p. 524.

The method consists simply in heating the bronze in a carbon crucible, driving off the zinc by volatilisation and weighing the residue. The old crucibles are still used. They are made of gas carbon and are hexagonal prisms outside, about 2·2 cm. across and 2·2 cm. in height. A receptacle for the bronze is hollowed out inside, 1·1 cm. in diam. and 1·5 cm. deep, and is provided with a closely-fitting lid. They can be used many times before being worn out.

The crucibles each containing 1 gram of bronze are placed close together inside a salamander crucible and completely covered by powdered charcoal. The cover pot is then strongly heated for two hours in an ordinary gas injector furnace. The final temperature by thermocouple was found to be 1375°, but probably higher temperatures would be equally good. The boiling point of zinc is 905·7°.* A number of the carbon crucibles are disposed in a ring inside the large pot. The number in a ring at the Royal Mint is eight, but a second ring of eight can be placed above, making 16 determinations, of which four are check assays made on pieces of trial plate of known composition. The pot is rotated through 90° every 15 minutes to ensure uniform heating. When the cover pot and its contents are cold the carbon crucibles are taken out, and the bronze residue is cleaned by brushing and weighed. A cover pot is necessary in a gas furnace as otherwise the carbon crucibles burn completely away. The high temperature is absolutely necessary. Attempts to drive off the zinc in a gas assay-muffle urged to the highest attainable temperature, about 1200°, proved unavailing. In two hours in the muffle furnace, the loss of weight was insignificant, only about one-tenth of the 1 per cent. of zinc present being expelled.

The use of check or proof assay pieces is necessary, as the loss varies considerably with the temperature. Coinage bronze contains copper 95 per cent, tin 4 per cent, and zinc 1 per cent., and the usual loss by volatilisation is about 1·2 per cent. The difference between two duplicate assays varies from 0 to 0·1 per cent., the average difference being about 0·02 to 0·03 per cent.

It is obvious that accuracy depends on the whole charge being uniformly heated. This work is successfully done at the Mint by Mr. W. E. Jenkins, who has exercised much care and skill in overcoming the difficulties in the furnace work.

The following are specimens of results which have been obtained :—

Charge 1.

Bronze bar. Composition by ordinary analysis.

	per cent.
Zinc	1·055
Iron	0·08
Tin	4·07
Copper	94·70
	99·905

Loss by volatilisation : (1) 1·160 per cent. ; (2) 1·155 per cent. ; (3) 1·170 per cent. ; (4) 1·165 per cent. ; Mean, 1·162 per cent.

The residues contained 0·03 per cent. of zinc. It is clear, therefore, that 0·13 per cent. of copper and tin have been volatilised.

Charge 2.

	Loss per cent. by volatilisation.	Corrected results.
	per cent.	per cent.
Trial plate (Cu 95, Sn 4, Za 1·00)	1·235 1·215	1·01 0·99
Penny blank	1·185 1·17	·96 ·945
Another blank	1·14 1·20	·92 ·98

Charge 3.

	Loss per cent. by volatilisation.	Corrected results.
Trial plate	1·15 1·15	1·00 1·00
Penny blank	1·10 1·065	0·95 0·915
Another	0·98 0·91	0·83 0·79
Bronze bar, containing about 1·2 per cent. zinc	1·31 1·355	1·16 1·205

Although most of the determinations have been made on coinage bronze, there seems to be no reason why the method should not be applicable to brasses and bronzes containing any proportion of zinc, if proper precautions are taken. The volatilisation of zinc causes volatilisation of copper, and if much zinc is present it is better not to hasten the operation until most of the zinc has been boiled off. The zinc is soon reduced to about 5 per cent. at a temperature of 1000°.

The following are losses of copper and tin with different proportions of zinc :—

Alloy.	Loss by volatilisation.	Loss of copper and tin by volatilisation.	
		On whole alloy.	On copper and tin.
	per cent.	per cent.	per cent.
Cu 96 Sn 4 Za 0	0·14	0·14	0·14
Cu 95 Sn 4 Zn 1	1·22	0·22	0·22
Cu 92·35 Zn 7·26	7·69	0·43	0·48
Cu 8·75 Za 91·25	91·55	0·30	3·44

Duplicate determinations are in about as close agreement with high percentages of zinc as with low ones, and by using pieces of the one per cent. trial plate as check assays, results from brasses are obtained which are only about 0·1 to 0·2 per cent. too high in zinc. With suitable trial plates correct results should be obtainable.

The sources of error in the determination are as follows :

(1) The presence of volatile constituents other than zinc, such as cadmium. These would all be reckoned as zinc. In coinage bronze, however, there is only about 0·1 per cent. of impurities other than copper, tin and zinc and part of this is oxygen, and iron.

(2) The presence of oxygen in the alloy. This is in the form of oxide of zinc. The oxygen is almost entirely removed during the heating and would be reckoned as zinc. The amount is trifling in coinage bronze. A large addition of zinc oxide to the assay piece makes practically no difference to the result all the zinc being reduced and volatilised.

(3) The retention of zinc in the residual metal. This has been found to be about 0·03 per cent., under ordinary conditions, when the loss on heating had been about 0·2 per cent. more than the zinc present. The amount of 0·03 per cent. of zinc is retained whatever had been the original amount of zinc present. The use of check assays removes this error.

(4) The loss of copper and tin by volatilisation. This usually amounts to about 0·2 per cent., and is determined and allowed for by means of the check assays.

(5) The adhesion of dirt to the residual metal. This appears to be sulphide of copper, due no doubt to the entry of gases into the cover pot. The results are defective and must be rejected. The defect seldom occurs.

The advantage of the method is merely the saving of time. The errors may reach about 0·03 per cent., or about the same as may be expected in the gravimetric or volumetric processes. The time saved is very great, as an assistant looks after the heating and cleans the buttons. The assayer merely weighs the metal in and out, the time for a duplicate determination being about five minutes, including the necessary entering of the result in the books.

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* Heycock and Lamplugh, Proc. Chem. Soc., 1912, **28**, 3.

Discussion.

The Chairman made some remarks as to the eminently satisfactory character of the operation and on the boiling-point of zinc.

Mr. Edward Gardner asked what weight sample was taken. He also asked whether Dr. Rose had had any experience of what he termed artificial carbon crucibles, made in the same way, and of the same materials as electric light carbons. He saw that the crucible used by Dr. Rose was made from gas retort carbon, and he had had some experience with crucibles made from both materials.

Mr. Arnold Philip asked how exactly the correction was applied from the trial plate to the actual sample under test. Dr. Rose had said he had examined other alloys. In his own practice, he rather shrank from making determinations of zinc: even with the most careful work such determinations tended to come out high; separation of the sulphide was always avoided if possible; the best method they found was to precipitate the carbonate, but then the results were high even with the most favourable and careful work. At Portsmouth they were specially interested in determining zinc in gun metals, containing about 2 per cent. of zinc, and a really rapid method for determining it would be very useful in checking other results. The present practice was to determine very carefully everything else except the zinc. Would Dr. Rose explain exactly how the correction for the trial plates was applied and whether he had made any determinations on alloys of the character of the Admiralty gun metal which contained 2 per cent. of zinc, 88 per cent. of copper, and 10 per cent. of tin? He was also surprised to hear that Dr. Rose did not lay very great stress on the loss due to volatilisation of tin. He, himself, would have imagined that tin would have been more readily volatile than copper. About a year or so ago Professor Turner had described the determination of zinc and other volatile metals by heating alloys *in vacuo*: that, of course, must necessitate very special apparatus and possibly difficulties, which this extraordinarily simple method Dr. Rose had described did not require.

The Chairman said he thought Professor Turner's experiments were to see if all the zinc could be driven out of different kinds of brasses by heating in a current of hydrogen. He did not know it was intended to be a quantitative operation, but simply to find whether zinc could be driven out. He thought it was mainly a question as to whether the zinc was retained as a compound or as a common mixture.

Dr. Rose, in reply, said that the weight of alloy taken for the determination was one gramme. The hard gas carbon crucibles in use were very durable, and did not appear to be altered in any way after being used many times. None had been worn out yet. He had had no experience with soft carbon crucibles, but he should have expected that any carbon crucible would do. He was interested to hear about Mr. Philip's problem. In preparing a trial plate at the Mint, they melted together 95 parts of copper, 4 of tin, and 1 of zinc, cast an ingot, rolled it out, and analysed it carefully by the usual methods. They had made one trial plate, by good luck, that contained exactly 1·00 per cent. of zinc, but what the exact composition was did not matter, provided that it was accurately known. As an example of the use of the trial plate, the author quoted the following results:—

Charge D. Nov. 24, 1913.

Loss of weight on the trial plate, duplicate results, 1·235 per cent. and 1·215 per cent.: mean loss 1·225 per cent., when the zinc present was 1·00 per cent. Penny blank: loss of weight, 1·185 per cent. and 1·17 per cent.; mean loss 1·177 per cent. The percentage of zinc in that penny was obtained by deducting 0·225 per cent. (the loss of copper and tin in the trial plate determinations) from the loss of weight in the penny assay pieces. Deducting 0·225 per cent. from 1·177 per cent., they obtained as the result 0·95 per cent. of zinc in the penny. Another penny gave losses of 1·14 per cent. and 1·20 per cent. Deducting 0·225 from the mean of these figures, they obtained 0·945 per cent. of zinc as the amount contained in the second penny, or as individual determinations, 0·915 per cent. and 0·975 per cent. generally the difference between duplicate results was less than that. He would be glad to try Mr. Philip's two per cent. alloy if he would send him a piece. His impression was that tin did not volatilise any more easily than copper, and that the loss on 88 per cent. of copper and 10 per cent. tin would not be very different from the loss on 95 copper and 4 of tin; it would be of the same order. Consequently, if a trial plate was made up of that composition, the error due to the difference between duplicate results would probably be no greater in that gun metal than with their coinage bronze. As he had stated in the paper, he considered that the error in the reported result was not more than ±0·05 per cent. when a trial plate was used.

NICKEL TANNATES.

BY PURAN SINGH.
Forest Research Institute, Dehra Dun, India.

I. While working with nickel hydroxide as a substitute for hide powder in tannin estimation, it was considered of interest to examine the nature of the salts yielded by the interaction of nickel hydroxide and tannic acid. It seems that two different salts of nickel with tannic acid are formed according to the conditions of precipitation. By precipitating the solution of nickel hydroxide in ammonium salts by adding a tannic acid solution in the presence of an excess of nickel hydroxide, a salt with higher content of NiO is formed, while the salt precipitated in presence of an excess of tannic acid by adding to a tannic acid solution the solution of nickel hydroxide in ammonium salts, has about one-third the NiO content of the other salt.

It is extremely difficult to prepare tannic acid salts of standard purity for the salts are all amorphous, and there is no suitable solvent for them for subsequent purification. I have only been able to judge of their purity by observing the nickel content of the salts on incineration. Thus their comparative purity has only been apparent to me after the nickel contents of the two salts on repeated incinerations have been uniform.

II. Nickel hydroxide freshly precipitated and washed free of alkali and sulphates was dissolved in ammonium chloride. To this nickel hydroxide solution which was kept stirred, a solution of Kahlbaum's "extra pure" tannic acid was added, leaving an excess of nickel hydroxide solution. The salt when freshly precipitated was greenish white which slowly changed into deep brown. On drying it became blackish brown. It was insoluble in water and other solvents, dissolving only in strong alkalis and in strong solution of tannic acid with evident decomposition. The salt was washed thoroughly by decantation till it was free from chlorides.

The well-washed salt was first dried over sulphuric acid *in vacuo*, it was then incinerated and its moisture determined at the same time, this latter being determined at 100° C. This salt was prepared on different occasions, at times after the lapse of months, and the following are the results of incinerations:—Percentages of NiO found, 28·15, 28·50, 28·40, 27·94, 28·67.

III. In a second series of experiments, the nickel hydroxide solution was added to the tannic acid solution and the salt was precipitated in the presence of some excess of tannic acid. The salt was almost white when freshly precipitated but slowly acquired a slight greenish-yellow tinge. Unlike the salt mentioned in I., this salt changes its colour but little and that only superficially. Owing to the presence of tannin, it was slightly soluble in water. It was also washed by decantation till free from chlorides. The results of incineration done on different occasions were:—NiO, 7·44, 8·17, 8·94, 8·96, 9·85, 10·0 per cent.

IV. The same as in II., but instead of using nicke hydroxide dissolved in ammonium chloride, the sam dissolved in ammonium acetate was used. Two trial were made and the washing of the salt was considere defective till it gave a similar NiO content as obtain in II. The results of the two trials were :—NiO, 23·76 and 28·29 per cent.

V. The same as in III., only the nickel hydroxide solution used in IV. was employed in this case also. The results of the two trials were :—NiO, 8·61 and 10·12 per cent.

VI. In this case nickel hydroxide was dissolved in liquor ammoniæ fort. and tannic acid solution was added in excess. Owing to the presence of excess of ammonia, the salt precipitated was completedly dissolved. The solution became dark brown out of which a deep brown salt was precipitated by adding an excess of alcohol. The precipitate was filtered and washed completely with alcohol and dried at 100° C. till constant. On incineration this salt gave 10·25 per cent. of NiO.

Though it has not been possible to obtain absolutely pure salts, it can safely be said from the results obtained that only two theoretical salts have been formed. The one with lower nickel content is the normal salt represented by the following equation :—

$$(C_{14}H_{10}O_9)_2+Ni(OH)_2=(C_{14}H_9O_9)_2Ni+2H_2O.$$

According to this formula the calculated NiO in this salt is 10·69. The salts prepared on different occasions have towards the end of these experiments yielded 10 per cent. NiO.

The second salt with the higher nickel content comes nearest to the empirical formula $Ni_3(C_{14}H_7O_9)_2$. The percentage of NiO required by this formula is 27·53. The average result of the incinerations mentioned in II. is 28·33 per cent. This percentage is also supported by the final result given in IV., viz., 28·29.

Discussion.

Professor Donnan thought the author had not brought much evidence forward to show that the amorphous substances which he analysed were really definite and pure chemical compounds, and not mixtures or "adsorption-complexes."

Dr. E. K. Rideal said he had found they could not get any definite compound by the action of an iron salt on tannic acid, although he had tried for a long time. The exact composition of tannic acid was unknown; indeed, according to some investigators chemically pure tannin contained at least three distinct acids. When in solution, tannin was present, partly, at any rate, as a colloid, as was evident from the hide powder test.

THE OXYGEN CONTENT OF THE GASES FROM ROASTING PYRITES.

BY LEWIS T. WRIGHT.

(This J., Feb. 16, 1914, pp. 111—113).

Discussion.

Page 112, col. 1, lines 8 to 5 from bottom, for "D. M. MacKechnie" read "R. D. MacKechnie," and in place of the last two lines of the paragraph, read "ferrous oxide was usually present in small quantity."

Newcastle Section.

Meeting held at Armstrong College, on Wednesday, November 12th, 1913.

MR. T. W. LOVIBOND IN THE CHAIR.

SOME OF THE TERNARY ALLOYS OF IRON, CARBON AND PHOSPHORUS.

BY J. E. STEAD, D.SC., D.MET., F.R.S., ETC

Introduction.

Part I.

Note.—A Bibliography of the researches referred to is given in Appendix III.

In order to understand intelligently the alloys of iron, carbon and phosphorus, it will be necessary to allude briefly to the binary alloys iron-carbon and iron-phosphorus.

Since my original work on iron and phosphorus was published, together with notes on the ternary alloys Fe, Fe_3C, Fe_3P, much careful work has been done, mainly in Germany. Saklatwalla repeated my own experiments on the alloys of iron and phosphorus and supplemented them with an equilibrium diagram.

Iron and phosphorus—binary alloys.

First.—Iron and iron phosphide form solid solutions (see Appendix I.) in all proportions up to the point of saturation when about 1·7 per cent. phosphorus and 98·3 per cent. iron, or 10·9 per cent. phosphide of iron (Fe_3P) and 89·1 per cent. iron are associated. It is, however, only by long continued heating at temperatures above 1000° C. of rapidly solidified alloys containing 1·7 per cent. phosphorus that saturation can be effected.

Alloys containing between 1 per cent. and 1·7 per cent. phosphorus, if cast in small moulds, will not be homogeneous but will consist of an aggregate of crystal grains enveloped by a eutectic. The centre portions of the crystals will contain relatively less phosphorus than the outer parts, the proportion increasing gradually with the distance from the centres of the crystals and are saturated at the points where they meet the eutectic envelopes.

By long continued heating of these eutectic enveloped alloys at temperatures just above the fusion point of the eutectic, the phosphide will diffuse towards the centre of the crystals and eventually the whole mass will consist of homogeneous crystals which will meet without there being any intervening eutectic.

On annealing alloys containing 2 per cent. phosphorus and 0·12 per cent. carbon in ore so as to remove the carbon, or even in charcoal at temperatures below 1000° C. much of the phosphide will separate and will be found in the cold alloy, apparently along the cleavages of the iron crystals.

Second.—When the proportions of phosphide and iron saturated with phosphide are as given below :—

			Constitutional Composition.
Iron saturated with phosphide	38·6	=	0·65 per cent. phosphorus
Free iron phosphide	61·4	=	9·55 ,, ,,
	100·0		10·20 ,, ,,

the mixture will be the binary eutectic which has only one freezing point at about 1000° C., and when cold is composed of cells of iron saturated with phosphorus in a mass of iron phosphide.

In very grey pig irons containing little manganese and much silicon the phosphorus always exists in the binary eutectic derived by decomposition of the ternary eutectic which is the last portion to freeze in all phosphorettic pig irons, whether grey or white in fracture. (Photo 1.)

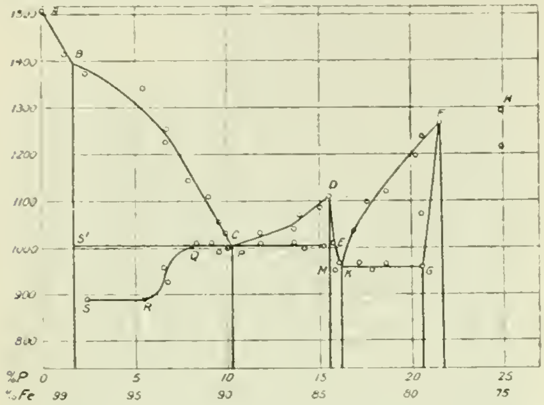
It not infrequently happens that the cell substance of the binary eutectic in grey pig iron consists of pearlite. In such cases it is certain that at the point of solidification the cell substance can contain little phosphide in solid solution and must consist of austenite. Whether phosphide diffuses into the cells in cooling down cannot be determined, but judging from the way austenite resists the diffusion of phosphide into it, it may be accepted that until the carbide separates at Ar. 1-2-3 (700° C.) it would not, and at lower temperatures than 700° C. the diffusion would be exceedingly slow.

The eutectic containing pearlite cells, although three elements are present, would at the point of solidification contain only two constituents, viz., phosphide, and solid solution of carbide in iron, and must therefore be considered as binary, not ternary. If the carbide entirely replaced the phosphide in the cell substance it would probably have the following composition, viz. :—

Free iron phosphide	61·4 per cent.
Austenite	38·6=0·35 carbon
	100·0
Phosphorus about	9·55 per cent.

All the alloys containing between 1·7 per cent. and 10·2 per cent. contain crystallites of iron more or less saturated with phosphide of iron which crystallise out in advance during the solidification and are found in the alloy, when cold, embedded in the eutectic containing 10·2 phosphorus.

The diagram slightly altered from that drawn by Saklatwalla indicates this and other points of interest.



The remarkable feature in this diagram is the apparent erratic freezing point of the eutectic along the line SRQ. Commenting on this, the author suggests "that this strange behaviour may be due to the existence of a definite phosphide corresponding to somewhat between 6·5 per cent. and 8 per cent. phosphorus, and that what freezes at below 900° C. may have a different composition to that which freezes at about 1000° C." As an alternative he suggests that it is of the same composition along the whole line, but undergoes a thermal change at the lower temperature.

My own more recent trials have shown that the eutectic, whether present in minute quantity or in greater amount, as in the alloys containing 2 per cent. and 9 per cent. respectively, melt at the same temperature and that the line SRQ on the melting point diagram should be straight. A new line has been introduced to the diagram showing this. Whether there is a thermal change, as suggested, I have no proof, negative or positive. It seems, however improbable, that there is a definite chemical substance with less phosphorus than is represented by Fe_3P.

Third.—When the alloy is of the composition of Fe_3P, it contains 15·56 per cent. phosphorus and consists of homogeneous crystals of iron phosphide. (Photo 2.)

Fourth.—With increasing proportions of phosphorus, according to Saklatwalla, a second eutectic appears consisting of Fe_3P and Fe_2P containing about 16 per cent. phosphorus freezing at 980° C.

Fifth.—The mixtures containing between 15·56 per cent. phosphorus and 24·6 per cent. (Fe_2P) consist of crystals of Fe_3P in the second eutectic. I had previously isolated the compound Fe_2P, but the second eutectic escaped my notice.

Sixth.—Some of the properties of the compounds Fe_3P and Fe_2P have been studied. The former is soluble in HCl and HNO_3 and is strongly attracted by the magnet. It is hard and brittle and appears to crystallise in rhombic prisms. The compound Fe_2P is only with difficulty soluble in nitro hydrochloric acid and cannot be attracted by an ordinary magnet.

Brinell hardness.

The hardness of pure Fe_3P is under that of quartz, and it is not so hard as Fe_3C. It is too brittle to test by Brinell's method. Saklatwalla says it corresponds to No. 6 on Mohr's scale, or of the hardness of felspar.

The hardness of saturated solid solutions of phosphide of iron in iron increases with the phosphorus content by about 1·3 points for each 0·01 per cent. phosphorus. The resistance of solid solutions of phosphorus in iron to corrosion is proportional to the amount of phosphide present.

Seventh.—Iron containing phosphide in solid solution is more resistant to the attack of etching reagents than pure ferrite or iron containing less phosphide in solid solution. It is more rapidly oxidised on heating—a property which enables one to ascertain whether or not the phosphorus is evenly distributed in commercially produced iron and steel, for when polished specimens are heated to about 300° C. the phosphorus rich portions become coloured blue by the time the purer have assumed a red or brown tint. This method of identification has for convenience been called "heat tinting."

Iron and carbon binary alloys.

A.—Iron and carbon combine to form a definite chemical compound which may be represented by the expression Fe_3C. It contains :—

Iron	93·334 per cent.
Carbon	6·666 ,,
	100·000 per cent

It is present in all annealed steels and may be isolated by dissolving out the associated free iron.

It may be produced in an almost pure state by the action of certain carbonaceous gases on pure iron when they are heated together at temperatures below 700° C.

B.—Solid iron carbide dissolves in solid iron, or, expressed differently, the two bodies interdiffuse to form what are described as solid solutions (see Appendix I.). They are saturated, the one with the other, at about 1130° C. when about 30 per cent. carbide and 70 per cent. iron saturated with 2 per cent. carbon are together. On cooling from 1130° C. this saturated solid solution gradually parts with carbide and as the temperature falls the separated carbide appears as plates or is crystallised on the cell walls.

The remaining solid solution, just above 700° C., is the eutectoid of iron and carbon, and contains :—

Iron	86·5 per cent.	
Carbide	13·5 ,,	= 0·90 per cent. carbon
	100·0 per cent.	

On cooling further a critical change occurs. Much heat is absorbed, as is indicated by a long arrest of temperature at the point called Ar. 1-2-3, and during this arrest the carbide and iron completely separate from each other and appear in the alloy when cold in the form of laminæ of iron carbide, and free iron in juxtaposition. This portion of the alloy contains, both before and after the critical change, 0·90 per cent. carbon or 13·5 per cent. Fe_3C, and 86·5 per cent. iron, and is called "pearlite" after the dissociation.

Dr. Arnold describes it as saturated steel, but when using this expression it must be remembered it is only when heated to just above the critical point Ac. 1 about 730° C. that the term is admissible. After cooling slowly through Ar. 1-2-3 the two substances—iron and carbide—are no longer in solution, but in the free state.

On heating pearlite for a long time at about 670° C. to 680° C. just under the critical point Ar. 1, the laminæ or thin plates of carbide slowly break up and form minute globules. These, on touching each other, behave just as if they were drops of water, and under the influence of surface tension, coalesce and form larger globules, and after this the enlarged globules come into contact with others and coalescence again occurs. By long heating the globules have been obtained so large as to be easily seen with a simple magnifying glass. If time were afforded there can be little doubt they would assume much greater dimensions and would probably eventually form idiomorphic crystals of Fe_3C similar to the carbide crystals called Cohenite in certain meteoric irons.

D.—If the carbon is between 2 per cent. and just under 4·3 per cent. when the fluid alloy completely solidifies at a temperature of about 1130° C. it is composed of fir-tree crystallites of iron saturated with carbide (=about 2 per cent. carbon) bedded in a eutectic containing 4·3 per cent. carbon.

E.—If there is 4·3 per cent. carbon and 95·7 per cent. iron in the alloy it freezes at one single point 1130° C. and consists entirely of a eutectic mixture composed of honey combed Fe_3C, the cells of which are filled with iron saturated with iron carbide, in the following proportions. (Photo 3.)

Carbide of iron	— 50 per cent.	
Iron saturated with carbide	— 50 „	15 per cent. Fe_3C.
	100 per cent.	

In cooling down, the excess carbide over the eutectoid proportion falls out of solid solution and crystallises on the cell walls of the eutectic cementite and co-incidentally reduces the size of the cells. On cooling through the critical point Ar. 1-2-3 the remaining solid solution is resolved into pure iron and iron carbide. The analyses of the binary eutectics at the point just above and below the critical temperature are as follows :—

	Above Ar. 1.2.3.	Below Ar. 1.2.3.
	per cent.	per cent
Iron carbide (free)	59·0	59·0
Iron saturated with 13·5 per cent. carbide in solid solution	41·0	—
Pearlite consisting of free carbide and free iron	—	41·0
	100·0	100·0
Carbon in the eutectic	4·30%	

In alloys containing more than the eutectic proportion of carbide, the excess Fe_3C falls out of solution above 1130° C. —the eutectic point—in the form of flat plates and finally when the excess is all out of solution and the eutectic proportion of 50 per cent. Fe_3C and 50 per cent. iron saturated with carbon is reached the whole residue solidifies at about 1130° C.

Commercial white irons, free from phosphorus, containing more than 4·3 per cent. carbon, never contain plates of carbide bedded in the eutectic, for silicon is always present and this element induces the excess carbide to decompose at, or near to, the eutectic point, into graphite and iron saturated with carbide, and the alloys, when cold, are grey or mottled.

F.—All solid solutions of carbide in iron are called Austenite and contain the iron in the gamma allotropic state and are non-magnetic, but it is only the saturated or nearly saturated alloys that can be essentially retained in that condition by sudden quenching in ice-cold water from a temperature of about 1000° more or less.

Iron-carbon-phosphorus ternary alloys.

In my paper on iron and phosphorus (Journal of the Iron and Steel Institute, 1900, Vol. II, page 87) the ternary eutectic of iron phosphorus and carbon was first described as "a complex compound mixture of the binary eutectic iron and phosphorus, and thin plates of carbide of iron." It was not fully described but it was suggested that it contained about 2 per cent. carbon.

In 1876 I described an experiment in which Cleveland iron was, when partly frozen, subjected to hydraulic pressure and a part of the last liquid portion was squeezed out of the mass. The analysis of the metal used and the liquid pressed out are given below :—

	Metal.	Substance pressed out.
	per cent.	per cent.
Iron (by difference)	93·37	90·27
Carbon	3·00	1·75
Manganese	0·35	0·29
Silicon	1·63	0·79
Sulphur	0·12	0·06
Phosphorus	1·53	6·84

When allowance is made for the carbon equivalent to the silicon, which the latter replaces, in the proportion of about 1 carbon to 5 silicon (0·79 per cent.=0·16 per cent. carbon) the total becomes 1·75 per cent.+0·16 per cent.=1·91 per cent. carbon. Excluding the silicon and sulphur, etc., the analysis of the remaining mass calculated into percentages would be, viz. :—

		Per cent.
Iron and manganese	90·56	— 91·19
Carbon	1·19	— 1·92
Phosphorus	6·84	— 6·89
		100·00

This corresponds most closely with the analyses of the ternary eutectic as determined later by Wüst and Goerens, which were as follows, namely :—

	Wüst.	Goerens.
	per cent.	per cent.
Iron	91·30	91·15
Carbon	2·00	1·96
Phosphorus	6·70	6·89

It was shown in 1900 that in ternary alloys containing 0·12 per cent. carbon and about 2 per cent. phosphorus the last portion to freeze contained both phosphorus and carbon in a eutectic, and during cooling down after complete solidification the carbon diffused out of this into the surrounding metal. It was further shown that in white pig iron the eutectic always contained three constituents while that in very grey irons, high in silicon, was always binary containing only two. Photo 2, 3, 4, 5.

It was shown that phosphide of iron diffuses in iron and tends to become intimately mixed with it to form homogeneous solid solutions, and that the presence of carbon greatly retards the diffusion and prevents it entirely if the quantity is great.

In the early days of the pyrometer, many of the records were sometimes lower than the truth and the melting point of the binary eutectic—about 910° C.—given by Osmond and myself, is about 35° C. below the truth.

The very careful and elaborate researches of Wüst on the ternary alloys are an important addition to the preliminary work published eight years previously. The same may be said of the work of Goerens and Gutowsky and others.

Wüst was the first to fully study and prepare the ternary eutectic, the melting point of which he found to be about 945° C.—a result confirmed by Goerens, Gutowsky and Carpenter. He proved that each 1 per cent. phosphorus added to pig iron reduced the initial melting point about 27° C.

Gutowsky confirmed what I had previously shown that the eutectic remaining in cold grey pig irons containing phosphorus, is sometimes of a binary character. His work is of high order of merit, and contains much valuable information as it shows the gradual changes that occur during freezing and melting of phosphorettic pig iron. He says that the melting of grey pig iron begins with the fusion of the binary eutectic at about 980° C., but that the melting point is lowered as the binary eutectic (by absorption of iron carbide) passes into the ternary eutectic, melting at 944° C.

A research published by Goerens and Gutowsky, bearing indirectly on the ternary alloys, on the formation of graphite in pig iron when cooling is of the greatest importance. They conclude, confirming Wüst and others, including myself :—

(*a*) That the formation of the graphite which remains in the solid iron occurs during the solidification process.

(*b*) That it occurs only after the previous separation of the eutectic cementite, and that graphite in pig iron is a disintegration product.

(*c*) That the graphite plates become coarser the slower their formation, and more copious the slower the eutectic interval is traversed.

These conclusions practically coincide with the careful observations of practical metallurgists long before the more refined methods of research were available. It had long been noticed that if the cooling of cast iron were accelerated —as it is in making chilled rolls—the carbides of iron first to form remain undecomposed in the chilled outer layer, and that below the chill, where the cooling is slower, graphite plates appear which increase in size with the distance from the chilled surface, and that the graphite plates are smaller in thin than in large castings—due to the less rapid cooling in the former as compared with the latter.

Although the author's remarks applied to non-phosphorettic iron, they equally apply to phosphorettic pig irons. It is for that reason they are here referred to.

Phosphorus, like silicon, if added to highly carburetted white iron when molten containing about 4 per cent. carbon, causes the iron to become grey on cooling, due to the separation of graphite, indeed, if the quantity of phosphorus added is 16 per cent. practically the whole of the carbon will be thrown out of solution even when the metal is still liquid and will appear as graphite on the surface.

By calculation, the constitution of the ternary eutectic is as follows, namely :—

	Per cent.
Iron phosphide (free)	44·3
Iron free from phosphide	26·3
Carbide of iron	29·4
	100·0

If, however, the third constituent contains iron saturated with phosphorus it will have the following composition :—

	Per cent.
Iron phosphide (free)	41·5
Iron saturated with phosphide	29·1
Carbide of iron	29·4
	100·0

It is possible that the constitution of the cold alloy varies with the rate of cooling.

Difference in microstructure between iron-carbon, iron-phosphorus and iron-carbon-phosphorus eutectics.

The iron-carbon and iron-phosphorus eutectics are very similar so far as structure is concerned: indeed the phosphide-iron eutectic previous to 1900 was mistakenly called iron carbide.

Solidified under like conditions the honeycomb cells are larger in the iron-carbon eutectic than in the other, but by cooling the iron-phosphorus eutectic very slowly and the other rapidly, the order of size of cell can be reversed. The iron-carbon eutectic, when cold, consists of massive cementite containing cells filled with pearlite, whilst that of the iron-phosphorus eutectic consists of massive phosphide of iron (Fe_3P) with similar cells, but the cell substance consists of iron saturated with phosphide in solid solution.

The main difference between pure iron-carbon eutectic and pure iron-phosphorus eutectic is that the former contains pearlite and the latter does not, but one can conceive that on heating the iron-carbon eutectic at just below Ar. 1-2-3 for a long time the carbide of iron (Fe_3C) of the pearlite cells will globularise and join the preformed massive cementite, leaving pure ferrite cells, but these will not blacken on treatment with acid, while the others—iron-phosphorus cells—always do.

In the perfectly pure binary iron-phosphide eutectic, the cell substance is homogeneous solid solution, but slight traces of carbon yield pearlite cells and therefore the presence of pearlite in the cell substance is not a proof that it is the carbide eutectic.

Phosphide of iron of the eutectic, on heating polished sections to 325° C. assumes a purple colour by the time the carbide has become a deep red. It is by this means that one can distinguish the two substances when together in an alloy. The purple colour of the phosphide is different from the blue colour assumed by the carbide when heated past the red stage—being heliotrope in shade. With a little experience one can judge by this alone whether a eutectic is that of phosphide or carbide.

The photos (3 and 2) show the structure of the iron-carbide eutectic as it appears in white Swedish iron containing 4·3 per cent. carbon, and of the iron-phosphide eutectic in very slowly cooled siliceous Cleveland pig iron. A peculiarity in the latter is that it differs in one material feature from the carbide eutectic: the elongated cells are frequently divided by a white band of solid phosphide never present in the other. This is clearly shown in the photograph No. 1.

The ternary eutectic, having carbide in plates embedded in what appears to be the binary eutectic is only capable of being resolved by the heat tinting process. Developed properly the carbide has a red colour, the phosphide a purple colour, while the tint of the iron-phosphide solid solution or pearlite, if present, will be nearly white. In the photographs 4 and 5 the darkest portion represents the carbide, the half-tone the phosphide, and the white parts represent the third constituent.

Part II.

A STUDY OF SOME OF THE IRON-CARBON-PHOSPHORUS ALLOYS.

Having given a brief account of what has been previously published on the ternary and other alloys, the more recent researches on some of the alloys which may be, and are, commonly met with, will now be discussed under the following headings, viz. :—

First.—An alloy containing about 2 per cent. phosphorus and 0·12 per cent. carbon, its constitution and the effect of carburising it by cementation.

Second.—An alloy containing 1·2 per cent. phosphorus and the influence of increasing proportions of carbon alloyed with it by fusion.

Third.—Alloys containing about 0·3 per cent. carbon and 0·5 per cent. phosphorus, and a study of what occurs during the solidification of steels in general.

Fourth.—The alloys represented by phosphorettic pig metals, and a study of what occurs during freezing, including a description of the metal in the centre of a "bear" found in the hearth of a blast furnace at the Skinningrove Iron Works.

No. 1.—An alloy containing about 2 per cent. phosphorus and 0·12 per cent. carbon.

One of the most interesting alloys referred to in my paper on "Iron and Phosphorus" (Iron and Steel Inst. 1900) has since been a constant source of interest, wonder, and research. It was made by melting puddled iron and phosphorus together in a crucible and allowing the metal to cool down in the furnace. It contained :—

	Per cent.
Iron (by difference)	97·9
Carbon	0·12
Sulphur	0·02
Phosphorus	1·96

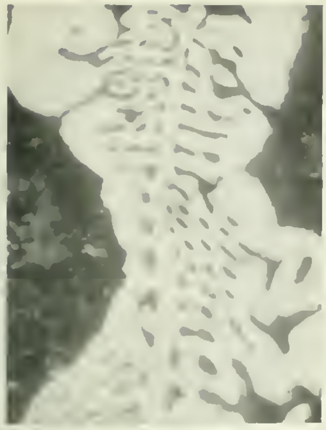
Photographs 6 and 7 give the micro-structure of a portion of this alloy.

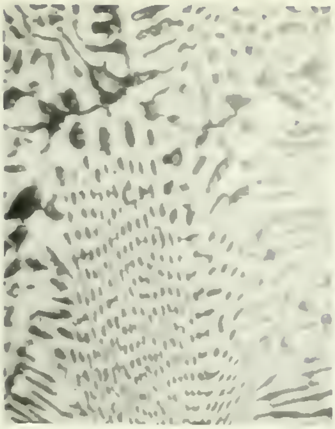
As will be observed, the structure is that of a plain ground in which is embedded irregular shaped masses of the binary eutectic surrounded by a peculiar fringe of hair-like particles. The question as to how the eutectic got into the positions shown, why it is surrounded by a fringe, what the fringe consists of, and what phenomena underlie this particular arrangement, have been carefully studied.

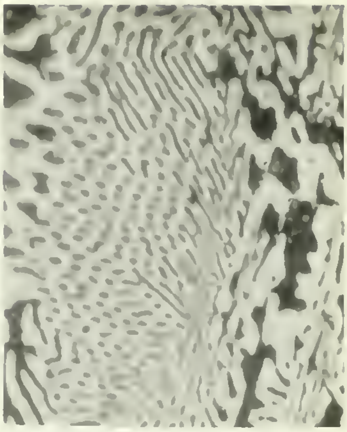
In my original paper I described the fringe as being pearlite, which was true as it contained laminæ of carbide of iron and iron plates in juxtaposition, but more recent research has proved the presence of laminæ of free iron phosphide.

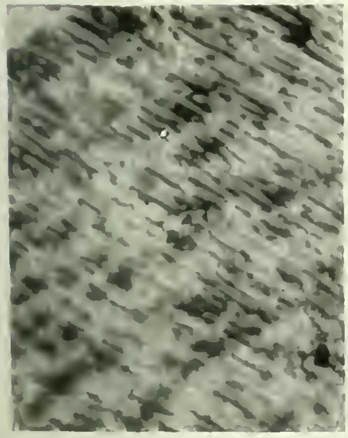
When the alloy was slowly reheated to above 1200° C., and was then quenched in water, the eutectic areas were free from any fringe and had increased in volume; the whole of the carbide originally in the fringe together with the phosphide joined the pre-existing binary nucleus and contained iron, carbide of iron, and phosphide in a eutectic. We may assume that the alloy just at a point a little before the eutectic solidified was exactly of this ternary character without any fringe whatever. The fringe must therefore have been formed after complete solidification.

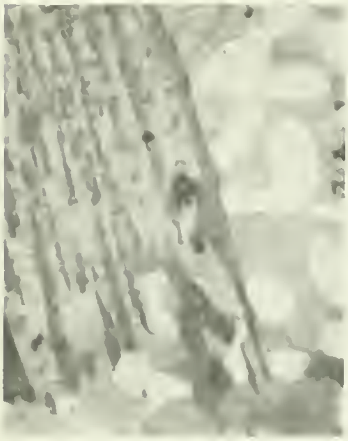
On heat tinting the original metal, it was clearly seen that there were three differently coloured laminæ in the


No. 1.—Binary eutectic of iron-phosphorus in grey pig iron. x 330.

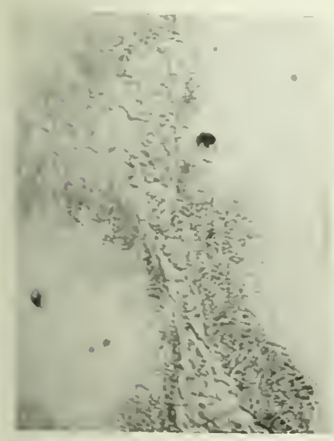

No. 2.—Pure binary eutectic of iron-phosphorus containing 10·2 per cent. phosphorus. x 330.

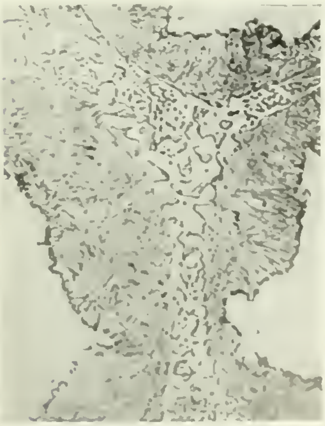

No. 3.—Binary eutectic of iron-carbon containing 4·3 per cent. carbon. x 330.

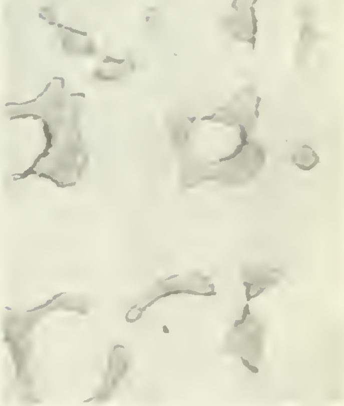

No. 4.—Ternary eutectic of iron-carbon-phosphorus in slowly cooled pig iron. The specimen was heat tinted.
Dark parts, carbide of iron; white parts, iron saturated with phosphorus; half tone, iron phosphide. x 330.

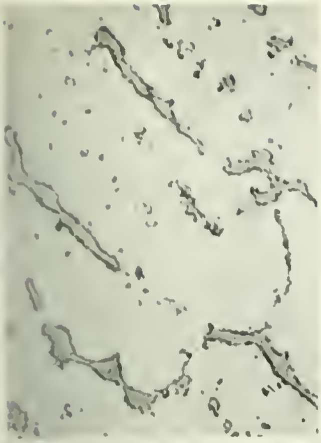

No. 5.—Ternary eutectic iron-carbon-phosphorus. A portion of what was squeezed out of the Skinningrove "bear" during cooling. Very slow cooling has led to the segregation of the constituents into relatively large masses. x 330.

No. 6.—Alloy containing 2 per cent. phosphorus and 0·12 per cent. carbon slowly cooled. x 50.

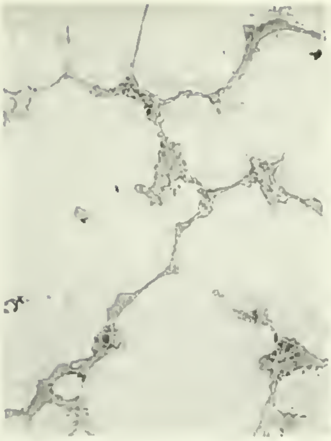

No. 7.—Same alloy as No. 6. Highly magnified—330 diameters. The central portion is the binary eutectic of iron-phosphorus: the outer part of the fringe, laminæ of iron phosphide, the darker part near to the eutectic, iron phosphide, iron, and iron carbide.


No. 8.—Same alloy as No. 6. Heated to 900° C., and quenched in water. Carbide diffused outwards between the phosphide plates shown in No. 7, and has been fixed in solid solution as Martensite. x 330.

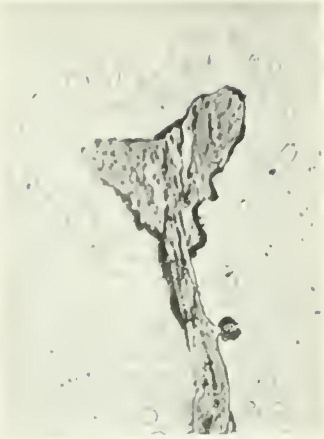

No. 9.—Same alloy as No. 6. Heated slowly to 1200° C. and quenched in water. x 50.



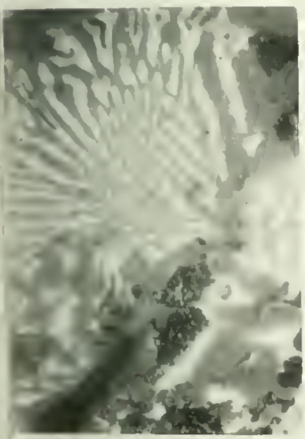
No. 9b.—Same alloy as No. 6. Heated to 1100 C. and cooled rapidly. x 50.



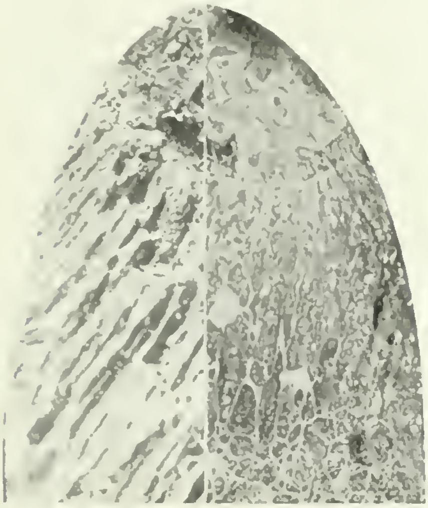
No. 10.—Same alloy as No. 6. Heated rapidly to 1200 C. and quenched in water.



No. 11. Same as No. 10, showing that the terminations of the original phosphide had liquefied and that the carbides have fallen into the original eutectic.



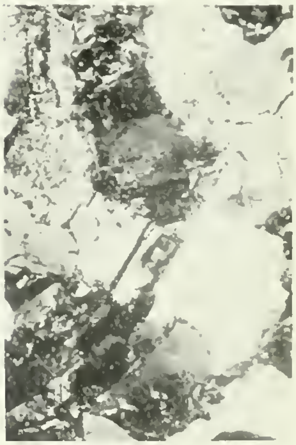
12 The ternary eutectic liquated on rising by cementation of the same as No. 6. Owing to slow cooling the dark parts in the photo—have segregated, leaving the binary eutectic in patches. x 330.



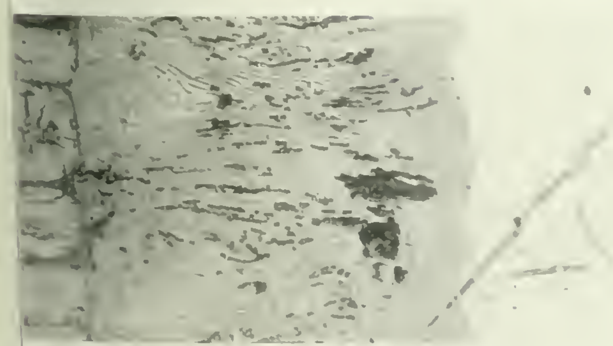
No. 13. No. 14

No. 13.—Fractured section of the cemented alloy showing the columnar arrangement and the nucleus at the top of the photograph of apparently unaltered metal. x. 5.

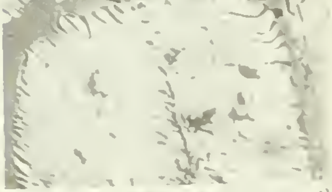
No. 14. Same as No. 13 after polishing and etching the specimen. x 5. The white patches represent pools of the binary eutectic.



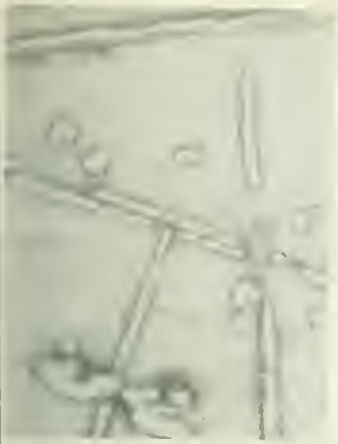
No. 15.—Fracture of the original alloy No. 6. Natural size.



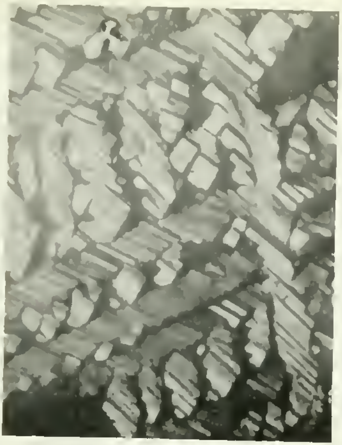
No. 16. Structure of the junction between the unaltered and carburised portion of the cemented alloy. Half tone laminæ, phosphide of iron; the darker portions, segregated carbide of iron, the layers between the phosphide laminæ, iron. x 200.



No. 17. Carburised portion of the cemented alloy in which the half tone portions represent phosphide of iron. The very dark portions are carbide of iron in spear-like particles projecting from the patches of binary eutectic. x 330.

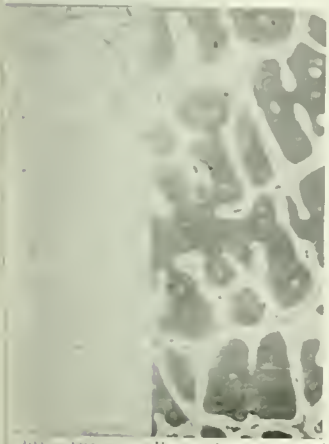


18.—Portion of the uncarburised ma-
ss of the cemented alloy, in which the
ite lines represent imperfect plates of
n phosphide, surrounded by a border
ntaining little phosphorus, the ground
ass being iron more or less saturated with
phosphide of iron.

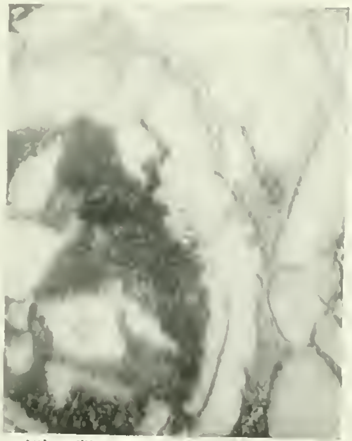


No. 18a.—Side of one of the plates shown in 18, after removing the iron by acid. x 330.

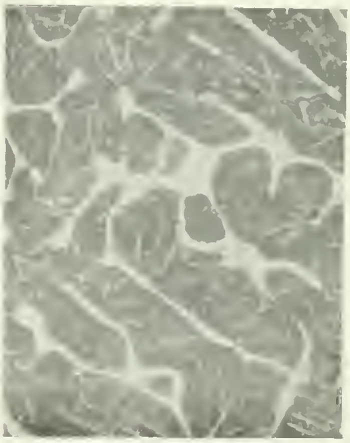
No. 19.—Alloy containing 1·2 per cent phosphorus in solid solution in iron and 0·12 per cent. carbon. The dark patches represent pearlite and the ground mass, phospho-ferrite. x 50.



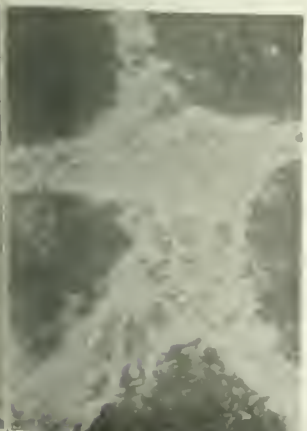
19a.—The same alloy as No. 19 melted
h arbon to give 0·30 per cent. The
k lines on the left-hand side of the
t represent the ternary eutectic of iron-
n-phosphorus. On the right is
wn the heat tinted structure in which
dark parts represent pearlite; the
te portions, iron rich in phosphorus;
and the half tone, the eutectic.



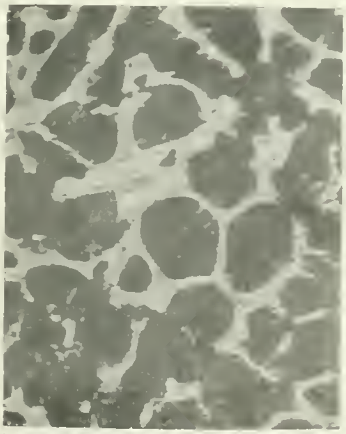
No. 19b.—The same as No. 19a magnified 330 diameters, etched with picric acid.



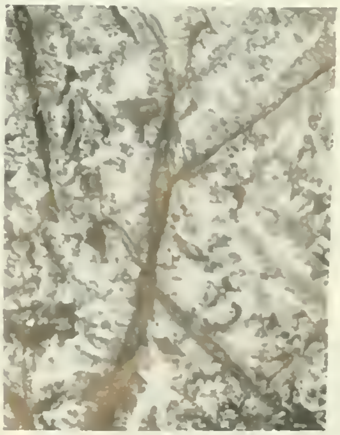
No. 20a.—Alloy containing 1·2 per cent. phosphorus and 1·2 per cent. carbon. The broad white patches are the ternary eutectic; the dark parts, pearlite with embedded carbide plates. x 50.



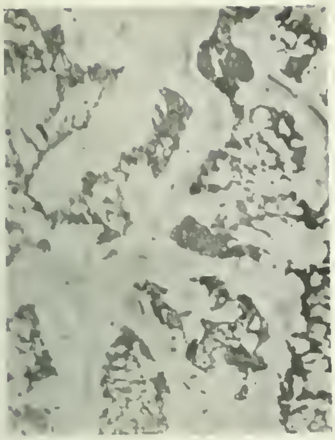
2 b.—Detail of No. 20a showing the
ture of the ternary eutectic. x 330.



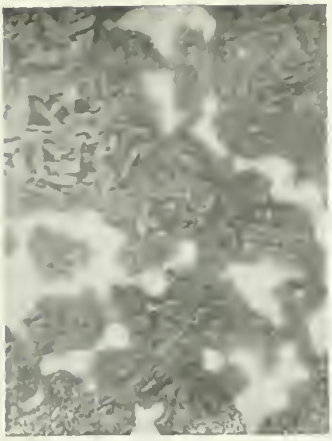
No. 21.—Alloy containing 1·2 per cent. phosphorus and 1·5 per cent. carbon, in which are broad white plates of carbide of iron in the eutectic. x 50.



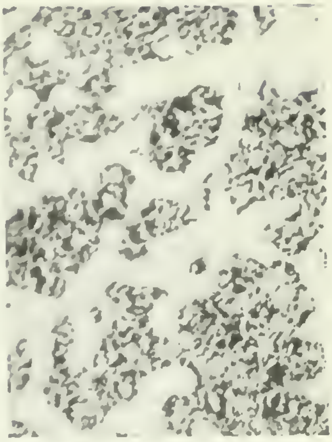
No. 22.—Alloy containing 1·2 per cent phosphorus and about 4 per cent. carbon. Dark bands graphite; half tone, pearlite; white portions, ternary eutectic. x 50.



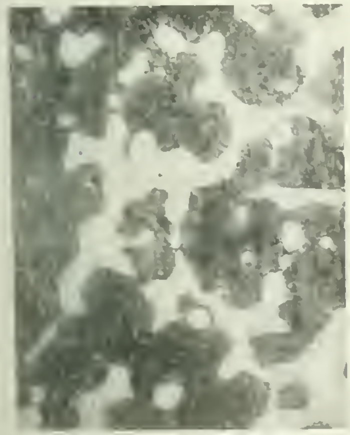
No. 23.—Alloy as cast containing 0·5 per cent. phosphorus and 0·30 per cent. carbon. Dark parts, pearlite; white, ferrite; half tone, iron rich in phosphorus.



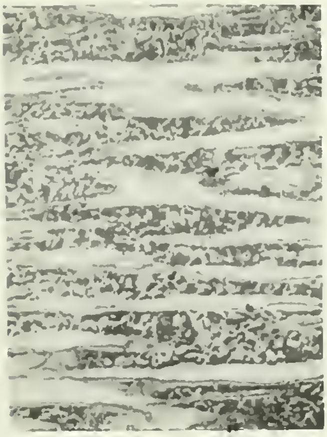
No. 24. Same as No. 23. Heat tinted so as to show the phosphorus concentrations, white on a dark ground. x 50.



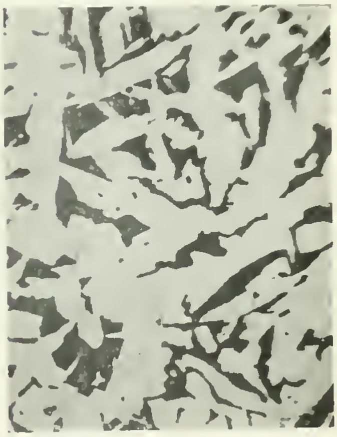
No. 25.—Same as No. 23. Heated to 1000 C. and cooled in the air. x 50.



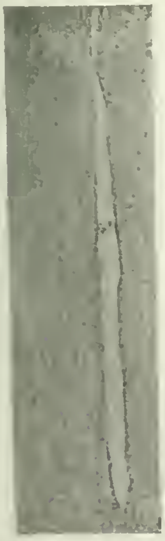
No. 26.—Same as No. 23. Heated to 1000 C. and quenched in water. Dark portions, Martensite; white, phosphorus-rich concentrations into which carbon would not diffuse at 900° C. x 50.



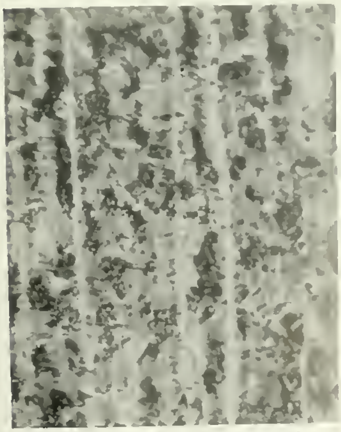
No. 27. Same as No. 23. Forged. The specimen was heat tinted. White parts, phosphorus-rich concentrations; half tone borders, ferrite containing little or no phosphorus; dark patches, pearlite. x 50.



No. 28.—Same as No. 27. Heated to a high temperature and cooled very slowly. Dark patches, pearlite; white, homogeneous solid solution of phosphorus in iron. x 50.

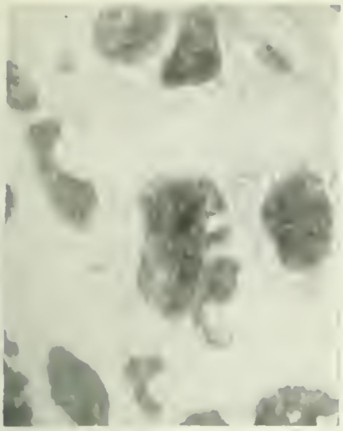


No. 29.—"Ghost" line in a steel forging very rich in phosphorus. Natural size.



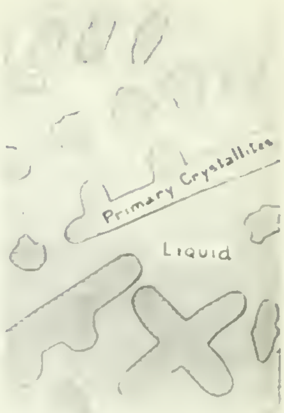
No. 30.—Micro-ghost lines in a steel tyre slightly etched showing white portions rich in phosphorus passing through pearlite and ferrite. x 50.

No. 31.—Horizontal section, through a "ghost plate" slightly etched showing border rich in carbon. x 330.

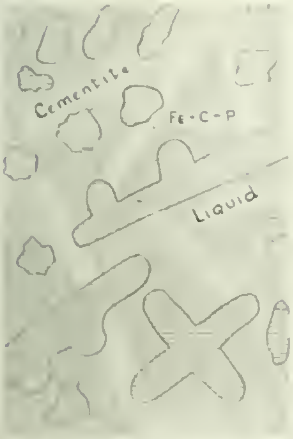


No. 32.—Structure of white iron containing 1·5 per cent. phosphorus.

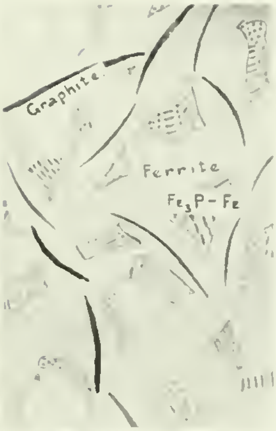
No. 32a.—Structure of grey iron containing 1·5 per cent. phosphorus. x 330.



No. 33a. Progressive changes in cooling metal. Crystals which first form.



No. 33b. Same crystals with addition of crystals of cementite or carbides and liquid ternary eutectic.



No. 33c. Structure of the grey metal after solidification by very slow cooling. Graphite, ferrite and binary eutectic of iron-phosphorus.

No. 34.—Fractured surface of the Skinningrove "bear" half size.

No. 34a.—Polished section of No. 34. Dark portions, porosities between the columns, half size.

No. 35.—Decarburised speck in portion of the columns shown in No. 34.

No. [illegible].—Steel plate, with central segregation rich in phosphorus, heated at one end and quenched in water. The critical line A . 1-2-3 is shown higher in the phosphorus zone than the other parts.

fringe and that the eutectic nucleus contained only traces of carbide, and was therefore nearly pure binary eutectic. The phosphide of this latter was coloured blue and some of the laminæ of the fringe were of the same blue tint and evidently consisted of iron phosphide. Between the blue laminæ there were strips of a brownish red colour and other strips of a bright red. The latter were carbide of iron, and the brownish red strips, iron containing no carbon and probably little or no phosphorus.

It must be remembered that the metal surrounding the phosphide eutectic "pools" just before solidification, must have been fully saturated with phosphide of iron, and that being saturated the carbide could not enter this zone without displacing some of the phosphide. As will be presently shown carbide of iron drives phosphide of iron out of liquid solution previous to and during solidification, but it is now evident that solid carbide is capable of driving out *solid* phosphide from solid solution.

The eutectic solidified at about 945° C., but long after it froze the carbide was capable of diffusing into iron, whilst as the temperature fell the phosphide itself would be held less strongly in solid solution and would tend to separate in the free state, proof of which will be given later.

Knowing these facts, let us follow exactly what most probably took place when the metal slowly cooled.

As soon as the ternary eutectic solidified, and the temperature fell, the iron of the surrounding metal would begin to weaken in its power to hold the phosphide in solid solution, and the carbide's opportunity thus developed, it would take away the iron from the phosphide to form with it a solid solution of carbide of iron in iron or austenite. At first the precipitated phosphide would be in the form of minute ultra-microscopic particles embedded in austenite, but these—due to surface tension—would coalesce into larger globules at minute distances apart. Between them, at the boundary of the central eutectic, the carbide, free to diffuse radially, would then attack the iron phosphide solid solution beyond the first layer and the particles of freed phosphide would naturally join themselves to the larger particles of previously separated phosphide, and in this way would be forced to lengthen radially. As the carbon continued to diffuse outwards between the growing walls of solid phosphide the inevitable result would follow—the walls or laminæ of phosphide would develop into long radial plates surrounding the eutectic, interstratified with radial layers of solid solution of iron and carbide (austenite). These layers would constitute passages along which the carbide could readily diffuse. Just as in the ordinary process of carburisation by cementation, the greater amount of carbide is located near to the source of the carbon.

As the temperature fell the diffusion of the carbide would become less active, and when the critical point Ar. 1·2·3 was reached, or even before, it would stop completely. During the passage through the point Ar. 1·2·3, the carbide and iron would then separate to form pearlite.

On very slow cooling through the following hundred degrees Centigrade, 700 to 600, the carbide would globularise, coalescing into larger masses concentrating towards the point where it had first entered. The colour photo-raphs (shown at the lecture) clearly show this con-entration and that the outer portion of the fringe consists entirely of iron phosphide and iron free from carbide. The darker parts in photo No. 7 represent the carbide ear to the eutectic nucleus.

On heating to about 900° C., the carbide again passed into solid solution forming austenite, and on quenching the specimen, martensite and austenite replaced the iron us carbide areas. (Photo 8.) On *slowly* heating the loy to 1200° C.—a temperature well above the melting point of the eutectic—and then quenching it, eutectiferous asses free from any fringe remained—a condition we may assume that existed at the same temperature on slowly cooling down the original molten alloy. (Photo 9.) On heating another portion of the alloy rapidly, instead slowly, to about 1200° C., the terminations of the nge, formed with a portion of the surrounding metal ible globules of eutectic which were retained *in situ* by sudden quenching. The greater part of the fringe close to the original eutectic had evidently melted also and must have flowed into the existing nucleus increasing its volume, for there is an absence of independent globules close to the eutectic. (Photos Nos. 10 and 11.)

In order to determine the effect of carburising this alloy containing 2 per cent. phosphorus and 0·12 per cent. carbon, a piece of the highly crystalline metal was kindly cemented for me by Messrs. T. Sorby and Sons, and a careful examination was made of the carburised metal. To what was the under side of the metal when in the furnace adhered a solidified drop of metal evidently liquated from the mass. This was detached and examined; it contained about 5 per cent. phosphorus and about 1·4 per cent. carbon. It consisted of primary crystallites of pearlite surrounded with masses of the ternary eutectic. The structure is shown in photo 12.

The cemented lump when broken up had the fractured surface illustrated in photo 13. The central part was of the original coarse crystalline structure and was a striking example of how phosphorus completely prevents the gamma change at about 1100° C. and coincident recrystallisation. Radiating from this unaltered and, as was proved by analysis, uncarburised portion, there were columns of metal cased more or less completely with a brittle substance. (Photos 13, 14, and 15.) Analysis and microscopic examination proved that the brittle material was the binary eutectic, while in the centre of the columns there were globules of the ternary eutectic occasionally enveloped by massive carbide.

The main volume of the columns consisted of pearlite containing little or no phosphorus. The junction between the columns and the unaltered central part consisted of a phosphide-carbide-iron fringe of exactly the same character as the fringes round the eutectic particles in the original alloy, but as the result of the very slow cooling in the cementing furnace, the components were of much greater size and were further apart. Photo 16.

Analysis showed that the phosphorus diminished in the columnar portion of the metal with the distance from the centre, and with the increase of carbon, as is shown in the following analysis.

	Carbon.	Phosphorus.
		per cent.
Centre of nucleus	Traces	1·96
1 Outside the nucleus, 1st layer ..	0·89 per cent	1·52
2 Below 1st layer	0·93 ,,	1·30
3 Below 2nd layer	1·20 ,,	1·05
4 Below 3rd layer	1·31 ,,	0·91

There was very much more imprisoned eutectic near to the kernel than in the outside layer.

On making laboratory trials by cementing the original metal in a crucible and quenching the cemented metal in cold water so as to arrest or prevent the changes that occur when cooling slowly, it was possible to see under the microscope exactly how the carbide on diffusing into the metal caused the phosphorus to leave it as a fusible eutectic.

At the extreme point where carbon had diffused, there was no fringe but a multitude of minute globules of the eutectic. These were inversely proportional to the distance from the carburising source, then finally joined together to form continuous streams, radiating from the kernel or uncarburised portion.

The streams terminated in what had been a liquid rich in carbon and phosphorus. It is evident that as the carbide diffused inwards at a temperature of about 1100° it expelled the iron phosphide, and this, with a portion of the carbide and the iron, liquefied in the form of dew-like drops, and these with time coalesced to form larger drops and eventually to make separate streams along which the liquid ran from the point of its genesis to the outside of the metal where it accumulated as a fusible liquate.

The presence of the ternary eutectic in the centre of the columns while only the binary mixture existed at the junctions is explained on the probable assumption that the internal eutectic being imprisoned got supersaturated with carbon and, in cooling, it was only the excess of dissolved carbide that had time to diffuse outwards, resistance also being offered to it doing so by the carbide in the surrounding austenite. This view is supported by the fact that many of the globules were surrounded by thick layers of carbide.

The original ternary eutectic between the columns as soon as it was formed flowed away and liquated out of the metal, and what remained would become solid and could not therefore become supersaturated with carbide.

As soon as the temperature fell sufficiently the carbide diffused into the columns, leaving only the binary eutectic behind, and appeared in section in the form of spear-like projections of free carbide. Photo 17.

The remarkable feature in this cemented metal is that the centre of the kernel, where the original coarse crystalline structure persisted, was quite free from carbon although it originally contained 0·12 per cent.; that the eutectic of iron and phosphide with its fringes had been concentrated near the junction; and that free phosphide in plates had appeared. Photo 18.

We must conclude that the carbon together with some of the iron and phosphorus had become liquid and flowed outwards and that the flat plates of phosphide—nonexistant in the original alloy—must have crystallised out of solid solution during cooling.

The analyses of this peculiar kernel and of the original metal are as follows:—

	Original alloy.	Kernel.
	per cent.	per cent.
Phosphide in solid solution	10·8	6·00
,, in the free state	1·8	6·00
Iron carbide	1·8	Nil
Phosphorus	1·96	1·86
Phosphide that passed out of solid solution	--	4·8

The total phosphorus in the kernel is a little in excess of that required to make with the iron a saturated solid solution. Although one cannot be certain it appears to be probable that at some undetermined temperature the whole of the phosphide was in solid solution and that in cooling the excess crystallised out in the cleavages of the iron crystals in the form of imperfectly formed plates.

The examination of the heat tinted section proved that the metal immediately surrounding the plates contained little or no phosphorus and that it gradually increased in that element with the distance from them. Photo 18a. This observation leads to the second conclusion, that after the excess of phosphide had crystallised out by crystallic attraction it induced more Fe_3P to leave the solid solution and join the preformed free phosphide.

Whether a saturated solid solution of Fe_3P in iron free from any excess of iron phosphide would part with phosphide under similar conditions of heating and cooling remains to be determined.

The greater coarseness of the fringe of phosphide-iron-carbide near to the point at which the carbon had penetrated from the external charcoal in the cementation furnace enabled one more perfectly to study its composition and structure. The main difference between it and the fringes round the eutectic "pools" in the original less slowly cooled metal was in the carbide which had segregated into larger masses leaving the plates of phosphide and intervening iron practically free from any laminæ of carbide. Photo 16.

If the conjecture just advanced—that free phosphide once formed attracts phosphide from solid solution, one would expect that the outer terminations of the phosphide fringe would have the same influence. After the carbide had ceased to diffuse and precipitate free phosphide the ends of the phosphide plates would terminate in a saturated solid solution of phosphide in iron and these quite independent of the influence of the carbide should attract phosphide from the solution.

That such actually happened was proved by the microscope, for at some distance beyond their terminations the iron contained little or no phosphorus, and as the attraction must have been radial the phosphide would be drawn from a large reservoir of phosphide in solution to the ends of the plates, and these would naturally be obliged to thicken and form thickened rims, or ends, exactly such as were found.

(*No.* 2)—*An alloy with* 1·2 *per cent. phosphorus and* 0·12 *per cent. carbon.*

From what has preceded it will be inferred that if a fusible eutectic is formed by introducing carbon into phosphorus-iron alloys by cementation, the eutectic would also be formed on carburising the same alloys by melting carbon with them. That such an inference is correct it is now proposed to demonstrate.

The alloy selected containing the 1·2 per cent. phosphorus and 0·12 per cent. carbon when rapidly cooled from the liquid state consisted of crystallites containing less phosphorus in the central portions than at their boundaries, while more or less completely surrounding them were thin and non-continuous strips of eutectic. When this alloy was cooled very slowly through the solidifying range only very large crystallites remained, no eutectic was present, while the carbon was located in isolated patches of pearlite. On heating polished sections at 270° C. these pearlite segregations assumed a brown tint by the time the surrounding metal had become blue, proof that they contained less phosphorus than the parts that assumed a blue tint. It was with the object of determining what amount of carbon in austenite would be completely antagonistic to association with phosphide of iron in solid solution that the following trials were made.

Mixtures of the alloy and carbon were melted in magnesia crucibles and the melts slowly cooled in the furnace in about half an hour. The proportion of carbon varied between 0·2 per cent. and 4·6 per cent.

The photographs Nos. 19—19a, 19b, 20—20a, 21 and 22 sufficiently illustrate the effect of carbon in throwing out the phosphorus, or rather in preventing it from remaining in solid solution.

The first example—shown in Photo No. 19—is that of the original alloy in which no eutectic is present. The polished specimen was heated until the surface appeared to be blue—shown white in the photograph. The pearlite areas, on examination under the microscope, appeared as brown patches and are the dark parts in the photograph.

In the first alloy mixture the carbon was 0·3 per cent., and its structure is clearly shown in the photos No. 19a—19b, which were taken from a polished specimen, "heat tinted" to the degree when pearlite assumed a brown tint. The central portion of the crystallites consiste mainly of pearlite in which were globular inclusions of th eutectic surrounded by phospho-ferrite. The oute portions adjoining the eutectic were free from carbon and were coloured sky blue—an indication that they wer rich in phosphide in solid solution. They correspon with what is called phospho-ferrite. Between the crystallites, in irregular formation, the eutectic was locate containing that portion of the free phosphide prevente from remaining in solid solution by the dominatin influence of 0·3 per cent. carbon.

As the carbon is increased little by little the centr areas of pearlite in the primary crystallites increase i volume, while the areas of phospho-ferrite boundari decrease, and the eutectic increases until eventually, wh about 1 per cent. carbon is present, there is no longer a phospho-ferrite, and the alloy consists of pearlite crysta lites enveloped by the ternary eutectic of iron carbi and phosphide.

Photos 20a—20b are those of an alloy etched with pic acid containing 1·2 per cent. carbon in which the round masses consist of pearlite and free carbide in the form plates. These primary crystallites were surrounded b network of the eutectic. With a further quantity carbon the volume of the eutectic does not appear increase and the excess carbon appears in the form thicker and thicker plates of carbide (Photo 21), a finally when the carbon approaches 4 per cent. th carbide plates decompose on cooling into graphite a austenite, which is resolved into pearlite after passing critical point Ar. 1-2-3 (Photo 22)

It is possible that if the rate of cooling of the alloys with 0·5 per cent. and less carbon were to be varied, there would be variation in their constitution; consequently the results given must be regarded as being those obtained when cooling down from the fluid to the solid and cold state in about half an hour.

With the evidence available it is possible to follow out the changes which occur progressively when the alloys described pass from the liquid to the solid state.

In the alloy containing 0·3 per cent. carbon, the first solid substance to fall out of solution could contain very little phosphorus and carbon, the greater part of these elements at this stage would remain in the liquid. As the temperature fell the ability of the pure solid crystallites to retain carbon in solid solution would increase and some of the carbon would pass from the liquid to the solid; the remainder would be concentrated with the phosphorus in the liquid.

Near to the point of complete solidification the remaining liquid would continue to part with carbon which would pass into the central parts of the primary crystallites. When the eutectic proportions of iron-carbon-phosphorus in the still liquid part approached 1000° C. the solid metal surrounding the eutectic would be nearly saturated with phosphorus and would have little solvent power for carbide of iron. Incidentally the concentration of the carbon in the primary solid crystallites would force out of solid solution some of the phosphide initially crystallised with the iron, and this would then appear in the form of globulæ of ternary eutectic. There is no other explanation for the actual appearance of these globules in the crystallites.

As the metal cooled down the carbides migrated inwards away from the solid border of the solid solution envelopes of phosphorus and iron, leaving a border of ferrite containing little or no phosphorus only slightly coloured by aqueous solution of picric acid—a reagent that readily colours dilute solutions of phosphorus in iron.

The eutectic itself contained very little carbide and must be regarded mainly as binary in character.

When the carbon was increased to 1·2 per cent. the cold alloy consisted of crystallites surrounded by meshes of the ternary eutectic. The crystallites themselves must have contained too much carbon to enable them to hold any phosphorus at the time they fell out of solution. As they cooled, just as in the alloy containing 0·3 per cent. carbon, their capacity to absorb carbon would increase, and some of that element in the liquid would pass into them making them more and more resistant to the entrance of phosphorus.

As a result probably all of the phosphorus would be concentrated in the eutectic the very last portion to freeze.

The absence of globules in the primary crystallites in the higher carbon alloy justifies the conclusion that no phosphorus was included in the crystallites that first fell out of solution.

No. 3. *Alloy containing* 0·3 *per cent. carbon and* 0·5 per cent *phosphorus.*—This alloy was specially prepared for me by Messrs. Wm. Shaw and Co., Ltd., Wellington Cast Steel Foundry, Middlesbrough. To a steel casting charge in a ladle there were added sticks of pure phosphorus. The metal was stirred to effect perfect incorporation. and it was then cast into a 6 in. cube in a sand mould.

This alloy, containing the same carbon and a little less han half the phosphorus present in one of the alloys escribed in the previous section, is useful in showing ow the carbon may cause local concentration of hosphorus without the formation of any eutectic. The icrostructure was similar to that of the alloy containing ·2 per cent. phosphorus and 0·3 per cent. carbon, with is important difference that eutectic envelopes were uite absent. In freezing, pure crystallites first fell out solution and the carbon passed back to them from the rtion last to freeze, leaving thick bouodaries of ferrite uite free from carbon. In the centre of the ferrite velopes is located the residue of what was the last rtion to freeze, and, just before freezing, was a conntrated solution of phosphorus, carbon and iron, from ich the carbon diffused as the alloy cooled. The two otographs, Nos. 23 and 24, one heat tinted and the other etched with picric acid, clearly show the final structure. The ferrite immediately surrounding the central portions of pearlite contain little or no phosphorus, while the phospho-ferrite probably contains nearly 1·5 per cent., or even more. After re-heating a piece of this alloy to 900° C., and cooling in the air, the carbon in the cold alloy was found to be distributed evenly in patches, intermixed with ferrite, round the phospho-ferrite concentrations, into which the carbide was incapable of diffusing at 900° C. (Photo 25). Another specimen, heated to 900° and quenched in water after etching, is shown in Photo 26, which indicates that the carbon has diffused only up to the borders of the phosphorus rich concentrations.

The dark parts are martensite; the white parts, phosphorus rich concentrations.

On forging the specimen heated at 900° C. the phospho-ferrite, of course, extended with the surrounding metal and appeared in lenticular-shaped forms in a mass of metal containing probably about 0·5 per cent. carbon (Photo 27). On heating this specimen to about 1300° C., in a ladle of blast furnace slag containing about 3 tons of slag, and allowing it to cool down with the slag, the structure when cold was completely reorganised (Photo 28). There were patches of pearlite equally distributed, and the whole of the external ferrite was quite homogeneous and free from concentrations rich in phosphorus The exceedingly slow cooling had admitted of the diffusion of the phosphide into the ferrite previously quite free from it. The lenticular-shaped phosphorus-rich ferrite lines suggest an explanation for the presence of streaks called "ghost lines," so common in steel forgings, which are always the more pronounced in steel the higher the phosphorus and the larger the casting. Photo 29 is an example of a "ghost" streak in a large steel shaft. It represents the residue of the last portion of the steel to freeze, and is free from carbon, which, although originally present, had diffused out of it during the cooling of the steel. Sometimes the segregations are so slightly enriched with phosphorus that the carbon during cooling has not time to diffuse out of them completely, and not at all if the cooling has been accelerated. Photos 30—31 illustrate these two conditions.

Photo No. 30 represents a steel cooled in oil in which the carbon had insufficient time to diffuse out of the phosphorus rich portions. Heat tinting, however, and feeble etching proved that phosphorus-rich lines or plates were present.

Experience has shown that in commercial steels it is only when less than 0·9 per cent. carbon is present that ferrite ghost lines can be obtained, which, interpreted, means that even in somewhat impure steels, when the steel is hot, the solution pressure of the carbide in iron resists the reception of more carbide and no ferrite can appear. The phosphorus, nevertheless, exists in richer concentration the higher is the carbon, and this phosphorus-rich portion more or less surrounds the crystals of purer metal, and, being very brittle, makes the whole mass fragile. This is the reason why a given amount of phosphorus is more dangerous in high than in low carbon steels, and why it is absolutely necessary to reduce the phosphorus in steel rails, &c., if the carbon is increased in order to have non brittle material.

It will be noticed that in the paler central portions in the photograph, the pearlite patches are in half tone, while they are darker in the surrounding metal. It will also be noticed that surrounding the paler portion there is a concentration of carbon as is indicated by the greater proportion of pearlite. There can be no doubt that the phosphorus-rich portion at its freezing point was richer in carbon as well as phosphorus than the average of the steel, and that, when cooling, the carbon began to diffuse out of it and was arrested before the exodus was complete, and that the excess carbon at the boundaries is a portion of what had migrated.

Photo 31 represents a section of steel containing in the central part a portion slightly richer in phosphorus in one part than the metal exterior to it. This was primarily proved by heat tinting, and confirmed by etching with very dilute acid in alcohol, a reagent which with other weak reagents, more vigorously attack pure than phosphorised steel so that the pearlite in the former is more rapidly developed than that in the latter.

The effect of phosphorus on raising the critical point Ar. 1-2-3.

Professor Arnold has stated as the result of his trials that when the amount of phosphorus is high in steel the critical point Ar. 1-2 3 is raised.

I have confirmed this repeatedly and Professor Carpenter, experimenting on the same specimens, has confirmed my results. The steels contained 0·3 per cent. carbon. and 0·05 per cent., 0·30 per cent., and 0·50 per cent. phosphorus respectively.

The carbon and other constituents were constant, the phosphorus only being variable.

		Ar. 1-2-3.
	per cent.	
Phosphorus	0·05	698°
,,	0·30	710°
,,	0·50	720°
Average rise for each	0·1 Phos. = 4·9°	

The effect of phosphorus in raising the Ac 1-2-3 point can be graphically shown by heating small bars of soft steel, containing an axial segregation of phosphorus, at one end only in the manner described in my paper on a simple method for determining critical points, and then quenching in water and afterwards polishing and etching longitudinal sections. Working in this way the critical division between the hardened and unhardened parts of the phosphorus-rich segregate is always found to be higher than it is in the metal surrounding the segregate. This is shown in photo 36.

The slightest difference in the phosphorus has its effect, and as a consequence when steels containing about 0·05 per cent. or even less are tested by the method referred to the slight normal variation of phosphorus in different parts makes the critical division line always more or less uneven.

The practical significance of this peculiarity of phosphorus is great for it shows that in reheating steels containing 0·05 per cent. or more phosphorus either in the cast or worked condition it is necessary to heat to a higher temperature than that suggested by the equilibrium diagram of the iron carbon series in order to break up the coarse structure throughout the mass.

All steel castings contain crystals more or less surrounded by ferrite envelopes richer in phosphorus than is present in their central portions.

It will be obvious that if the temperature of heat treatment has to be raised higher than is necessary to refine the purer part of the steels in order to also refine the phosphorettic parts, the former will be coarser in structure than the latter, *i.e.*, if the temperature has been correct for the breaking up of the structure of the phosphorettic portions.

No. 4.—Commercial ternary alloys such as pig irons.

Pig irons of commerce can scarcely be called ternary alloys, as apart from the small amount of sulphur and manganese present they invariably contain silicon and should therefore in correct terms be called quaternary. As, however, they do contain the three elements, iron, carbon and phosphorus, and are of such practical interest they are referred to here.

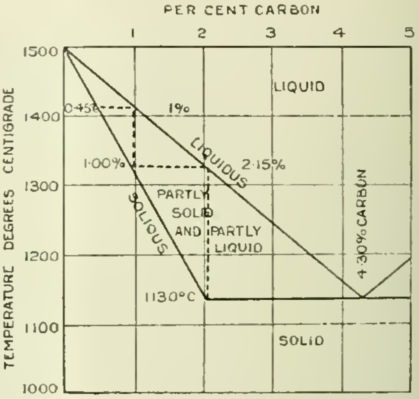
Although much has been written about the metallography of pig irons, there is still much to learn.

The equilibrium diagram of the iron-carbon series of alloys teaches much, but when phosphorus and silicon are present it must be altered materially.

A portion of the original diagram of Carpenter and Keeling is here introduced, which indicates that the first portions to freeze of any of the carbon-iron steels contain less carbon than the last portions that solidify.

From what has been stated in previous sections it may be tentatively assumed that in metal containing anything like 3·6 per cent. carbon it is impossible for any phosphorus to crystallise out with the primary crystallites because they would contain more than 1 per cent. carbon.

It is not at all proved what part the silicon plays when pig iron solidifies, but from the work that has been done it is certain that it behaves in a similar way to carbon and tends to prevent phosphorus from remaining in solid solution. It is known that some silicon crystallises with the first portions to freeze in the octahedral crystallites always present in commercial foundry irons.



When the silicon is high there is some evidence to show that a portion only so crystallises and the balance forms carbo-silicides which decompose readily almost as soon as formed during the solidification period.

The rôle played by silicon, however, cannot be considered at length in this paper. It is sufficient to note that whether the silicon is 0·6 per cent. or 6 per cent. in grey pig iron the phosphorus eutectic segregations are invariably in the same position with relation to the graphite plates, always at a distance from them.

The photo 32a shows the typical structure of all grey pig irons that contain much phosphorus. The white portions represent the eutectic; the black stripes the graphite plates; while the half tone intermediate spaces may be either pearlite or carbonless ferrite. These spaces or areas between the graphite and the eutectic have great significance, and there can be little doubt they represent a decomposition product of what at an early stage of the solidification were either carbide or silico-carbide plates which were solid before they decomposed.

By calculation it is found that the relative specific gravity and volumes of iron carbide and its decomposition products are as follows:—

Carbide of iron	Sp. gr.	7·6
Iron	,,	7·8
Pearlite		7·8
Graphite	,,	2·2

Decomposition product by volume.

	Fe_3C 100 vols.	
Iron	—	90·3
Graphite	19·8	22·7
Carbide of iron	—	—
Pearlite	91·8	—
	111·6	113·0

The volume by decomposition, partially to graphite a pearlite, and totally into graphite and iron, is great by 11·6 per cent. and 13 per cent. respectively, and t volume ratio of graphite to iron, and graphite to pearli are as 1 to 4·0 and 4·5 respectively.

It is clear then that if solid carbide is first forn and completely decomposes afterwards there should for each 1 volume of the graphite plates about 4 volur of iron, which should be found on one side or the othe divided on each side of the graphite. This concept being correct it sufficiently accounts for the phosph free strips on each side of the graphite plates.

In order to have a better idea of how the ternary eutectic is imprisoned originally during the cooling process, reference to the structure of white phosphorettic Cleveland iron must be made, for according to the hypothesis advanced all grey iron before it becomes grey must be very similar to white iron. This is shown in photo 32. The globular dark portions represent the primary crystallites; the white smooth parts the carbide plates that crystallised later; and the mixed structure—white and dark—the ternary eutectic which was imprisoned between the other constituents and the last to freeze. Imagine just such a structure as this in the cooling of grey iron before the carbide commenced to decompose. If a thick line in ink one-fifth of the diameter of the carbide plates is drawn through their centres, one then obtains some idea of the spaces that will be left between the phosphorus eutectic and the graphite.

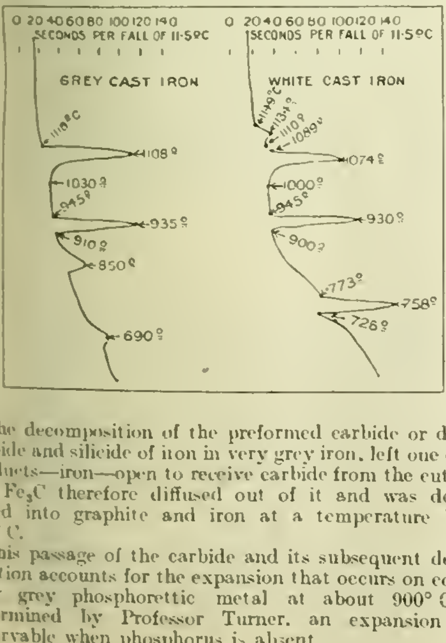
In order to enable one to follow the progressive steps that follow one another when grey pig iron passes from the liquid state, diagrammatic sketches are given in photo 33a, b, c, the first showing the primary crystallites; the second, the same after the carbide plates have formed: and the third, after the plates have decomposed into graphite and iron.

The evidence seems strong enough to dispose of the theory held by some, that the graphite falls directly as such from solution, for if it did it would be found in positions having no relation to the positions taken by the phosphide eutectic.

Professor Carpenter some years ago took for me the cooling curves of two phosphorettic Cleveland irons, one white and the other very grey and rich in silicon. The analyses are as follows:—

	White.	Grey.
	per cent.	per cent.
Combined carbon	2·98	Trace
Graphite	Traces	3·300
Manganese	0·29	0·676
Silicon	1·89	4·321
Sulphur	0·27	0·025
Phosphorus	1·62	1·660

The cooling curves show a long and pronounced arrest at about 935° to 945° C., the solidifying range of the ternary eutectic. When slowly cooled the eutectic in the white iron was ternary, and in the grey iron binary.



The decomposition of the preformed carbide or double rbide and silicide of iron in very grey iron, left one of the oducts—iron—open to receive carbide from the eutectic, e Fe_3C therefore diffused out of it and was decomsed into graphite and iron at a temperature below 5° C.

This passage of the carbide and its subsequent decomsition accounts for the expansion that occurs on cooling y grey phosphorettic metal at about 900° C. as ermined by Professor Turner, an expansion not ervable when phosphorus is absent.

The character of phosphorettic grey foundry iron as compared with similar irons free from phosphorus at temperatures a little above the point when the eutectic solidifies at 945° must be profoundly different, for in the former the metal will be more or less plastic containing as it does in Cleveland iron about 20 per cent. of fluid, whereas in the latter the whole mass must be quite rigid. It is on this account one explains why the total apparent contraction on cooling the long bars of phosphorettic iron in Professor Turner's trials was so much less than that of similar bars of non-phosphorettic iron.

The phosphorettic bars being plastic at a time when the others were quite rigid the friction on the sides of the former by the sand of the mould would check the longitudinal contraction in the early stages of cooling above 945° C.

The final and true contraction assuming that the same amount of graphite is formed in each case should be equal, but distributed over a longer range in the case of the phosphorettic metal than in the metal free from phosphorus.

On a "bear" from the hearth of a blast furnace at the Skinningrove Iron Works.

It has previously been stated that the primary fir-tree crystallites which form in pig iron and in alloys rich in carbon and phosphorus must be free from phosphorus.

On subjecting partially solidified cast-iron to pressure it is possible to express some of the more fusible portions, but no one has ever succeeded in squeezing out practically all the phosphorus ternary eutectic so as to leave only the primary crystallites behind. Fortunately, however, Nature has actually done this for us in the hearth of a blast furnace.

The furnace referred to is one of several furnaces owned by the Skinningrove Iron Co., Ltd., Carlin How, Yorkshire, and the metal was a portion of a huge mass which had solidified in the hearth.

Mr. T. C. Hutchinson, the managing director, having supplied me with a specimen and its analysis, I made a careful examination of it with the results that follow:—

The specimen handed to me consisted of a series of columnar masses of iron 3 to 4 inches in length. These were separated at intervals by porosities and by oxide scale and free carbon. The analyses were as follows:—

	Stead.	Skinningrove.
	per cent.	per cent.
Iron	93·400	—
Combined carbon	0·562	0·480
Graphite	1·640	1·050
Manganese	0·173	—
Silicon	1·166	1·410
Sulphur	0·103	0·082
Phosphorus	0·155	0·090
Oxygen, etc.	2·801	—
	100·000	

Specific gravity .... 7·14
Phosphorus squeezed out .... about 90 per cent.

The metal represented such interesting features that by the courtesy of Mr. Hutchinson, I visited the works and examined portions of the "bear" which had been blasted out of the hearth. There were about 500 tons of broken up pieces. From information kindly given me it appeared that the lining at the top of the furnace fell in when the furnace was being blown out more than ten years ago, and the blast was turned off while the furnace shaft still contained unburnt coke and other material. The whole mass, including the liquid metal below the hearth level, was then allowed to cool naturally. When blasting out this "bear" the workmen came upon a quantity of metal exactly in the centre of the mass exceedingly tough and difficult to break. When broken up it presented the appearance of a columnar basaltic formation with vertical columns one-eighth inch to one-quarter inch in diameter and above a foot in length. Photos 34 and 34a. On analysis it was found to be nearly free from phosphorus, and as nothing but phosphorettic pig iron had been made in the furnace during its life, it surprised everyone.

On examination of the pieces of metal I noticed the columnar arrangement of the iron referred to and immediately surrounding this, metal which was coarsely graphitic in character and quite different from the portion in the centre. This on fracturing I found had a schistose appearance; other pieces were found which resembled in fracture the ternary eutectic, and others which had protruded into the ground outside the hearth. The fracture of the latter at the outer extremity was white and granular and evidently contained very little carbon. All these specimens were carefully examined. The results of examination are given below, viz.:—

First.—The central basaltic mass with columns at least three feet in length contained little phosphorus. The columns were coated with magnetic oxide and free carbon.

Second.—The iron columns were decarburised at their boundaries where oxide of iron existed.

Third.—The ferrite juxtaposed to the oxide was radial in structure—a condition which proved that decarburisation had occurred at temperatures between 700 and 900° C. Photo 35.

Fourth.—The little masses outside the columns, found in portions of the lumps, had a fracture corresponding to that of the ternary eutectic, and was proved to consist of that substance. Photo 5.

Fifth.—The columns in the metal from the second ring contained 1·3 per cent. phosphorus, and were divided by more or less vertical plates of graphite and had a schistose appearance.

Sixth.—The tongue-like piece of metal which had penetrated into the ground outside the hearth contained only 1·7 per cent. carbon and consisted of grains of pearlite surrounded by the ternary eutectic. The partial decarburisation had evidently been effected by moisture and steam from the damp soil; moreover the iron itself had been oxidised, for a thick layer of oxide had formed which adhered to the surface.

With the evidence available before us, it is possible to trace what had occurred after the stoppage of the furnace. The huge mass of liquid iron, considerably over 600 tons, had cooled with extreme slowness, being under the ground level and covered with a mass of hot material. The outer portions would, of course, solidify first and the enormous solid cylinder of metal so formed in cooling must have contracted and compressed the fluid inside, and as long as the latter was quite fluid the central mass would rise vertically, but in course of time it would begin to freeze and the first purer crystallites of the fir-tree type would separate from the liquid and eventually the whole central column would become a mixture of pure solid interlacing crystals with the liquid ternary eutectic between their branches.

When this stage was reached and the surrounding solid ring continued to contract round the pasty mass, only one thing could happen, the same as what occurred when I squeezed nearly solid Cleveland iron, the eutectic was forced to pass away from the solid crystallites, and in doing so was obliged to pass upwards and make a series of parallel vertical passages along which to flow. The solid crystallites were thus pressed together into solid vertical columns, while along the junctions continuous streams of the eutectic would flow upwards and escape into the upper layers. After the inside of the columns had been freed from liquid the continued pressure would finally squeeze out practically all the phosphorus rich liquid still existing between the junctions of the columns. At this point, when no more liquid could be expressed, the whole plastic highly heated mass—probably at a temperature of 1000° C.—would itself have to elongate upwards, and it was at this stage the columns must have been sliding one against another along the original junctions where traces of the mother liquor remained mechanically imprisoned. Incidentally, the cylinder of grey metal which enveloped the columnar central mass and which had retained most of the phosphorus originally present, not being able to freely compress the solid mass inside of it and being itself surrounded by a greater mass which was contracting on it, must have vertically elongated, and in doing this it separated into a series of vertical columns, the free graphite plates forming gliding planes at their junctions.

As cooling was continued and the outer mass ceased to contract or to contract slowly, the central portion being the last to cool must at one stage have exerted tensional pull on the metal surrounding it, but not being able to pull it inwards it partially separated along the original planes of flow, into loosely attached vertical columns, leaving porous passages between them. The material in the furnace above the hearth when still warm and exposed to rain which was free to fall upon it, evaporated the water as it percolated downwards, and this would pass into the central mass along the contraction passages, not only oxidising the surfaces of the columns but actually decarburising the iron. It is difficult to offer any other explanation to account for the oxide of iron which more or less completely covered the surface of the columns themselves. How long 600 tons of metal took to cool down none can tell, it would probably be more than three months.

Mr. Hutchinson has expressed his willingness to supply colleges and museums and other institutions with specimens of the central portions of the "bear," a courtesy which should be taken advantage of by all who are interested in the constitution of foundry irons.

Summary.

1. The constitution of the alloys of iron and phosphorus have been described in chemical terms. The more important of these are the binary eutectic containing 4·18 per cent. phosphide of iron in solid solution in iron and 61·4 per cent. free phosphide of iron, and the solid solutions of iron and phosphide of iron saturated, when 10·8 per cent. of the latter and 89·2 per cent. of the former are associated. These solid solutions increase in hardness with the increase of dissolved phosphide of iron. Each 0·01 per cent. phosphorus added to pure iron increases the hardness by about 1·3 Brinell degrees.

The resistance to corrosion appears to be proportional to the phosphide in solid solution, but more work is required in this specific direction.

2. The eutectic of iron and carbon contains about 50 per cent. free carbide of iron and 50 per cent. iron saturated with carbide of iron at 1130° C. Some of the carbide crystallises out of the solid solution in cooling and at about 700° C. the eutectic contains 59 per cent. free carbide of iron and 41 per cent. iron saturated with carbide.

3. On subjecting phosphorettic iron to great pressure when it is in nearly a solid condition, practically pure ternary eutectic of iron-carbon-phosphorus is expressed which has the composition of iron 91·19 per cent., carbon 1·92 per cent., phosphorus 6·89 per cent. This eutectic solidifies at about 945° C. and the arrest found by Carpenter when cooling both grey and white phosphorettic iron at 945° C. is that due to the solidification of the eutectic which is the last portion to freeze in pig irons containing phosphorus. The analysis of the ternary eutectic, expressed constitutionally, is:—

	Per cent.
Free iron phosphide	41·5
Iron saturated with phosphide	29·1
Iron carbide	29·4

4. The ternary eutectic in very grey iron decompose on cooling into the binary eutectic and pearlite or iron.

5. In Part II. a few of the triple alloys are describe and the changes which occur during solidification, reheati and slow cooling. When the phosphorus is high—abou 2 per cent.—and the carbon low, the first crystallites grow are free from carbon. The carbon and some of t phosphorus and iron form a eutectic which is found in t cold alloy between the branches of the primary crystallit and surrounding the crystals. On slow cooling, the carbi diffuses out of the eutectic and forms a pearlite fringe rou the eutectic, but in diffusing into the surrounding sol solution of phosphorus and iron, the carbide throws so of the phosphide out of the solid and this appears as f laminæ in juxtaposition to the pearlite carbide. A frin is thus formed consisting of three constituents iron carbide—phosphide.

On carburising this alloy by cementation, as the carbon enters at 1100° C. it displaces the phosphide, and a fusible eutectic is formed which liquates entirely out of the metal to such an extent that only half of the original phosphorus remains in the outer layers.

6. On melting an alloy containing 1·2 per cent. phosphorus and 0·12 per cent. carbon and cooling rapidly, eutectic envelopes surround the crystals in the cold alloy, but if cooled slowly the phosphorus diffuses into the centre of the primary crystallites and no eutectic is visible, the carbon remaining as pearlite in patches.

On gradually increasing the carbon, more and more eutectic is found in the cold alloy and when about 1 per cent. carbon is present practically the whole of the phosphorus is concentrated in the eutectic envelopes.

On further increasing the carbon the excess appears as plates of free carbide cutting through the body of the primary crystallites and when 4 per cent. is present graphite appears in the cold alloy, which is grey in fracture.

7. When an alloy with only 0·5 per cent. phosphorus and 0·3 per cent. carbon is melted, on slow cooling the greater amount of phosphide is found entirely in solid solution in rich segregations surrounding the primary crystallites, but they are quite free from carbon. On forging, these concentrations are drawn out into lenticular shaped bodies and are free from carbon. They resemble the "ghost lines" in large forgings, which it is shown have their origin in segregations of phosphorus. If steel must be free from these, it is necessary to have as little phosphorus in the steel as possible.

8. The order of crystallisation, when white and grey phosphoretted pig-irons solidify and cool down, has been traced, and it has been shown that the fir-tree type of crystallites are the first to form; following this the carbide or the silicocarbide of iron crystallises, while the ternary eutectic of iron-carbon-phosphorus is imprisoned in the spaces between the pre-formed solid crystallites, and is the last to solidify at 945° C.

In white iron the carbide or silicocarbide crystals remain as such in the cold alloy. In grey irons, however, the carbides decompose into graphite and austenite almost immediately they have become solid. When cold in the case when the carbides are completely decomposed the decomposition product consists of about one-fifth of graphite and four-fifths of iron by volume and the iron is almost always deposited on each side of the graphite plates. The broad bands of phosphorus-free material on each side of the graphite plates in grey pig-iron are a proof that the carbides crystallise and are solid and afterwards are decomposed and not, as some have suggested, that the graphite simply falls out of liquid solution, for, if this were so, the graphite plates would be heterogeneously arranged and not in the positions they are found surrounded by phosphorus-free layers of pearlite or ferrite.

9. An interesting mass of metal found in the hearth of a blast furnace at Skinningrove has been described, which, owing to the enormous amount of circumferential pressure during the time it was solidifying, had practically the whole of the ternary eutectic squeezed out of it, leaving the cold metal arranged in columnar form resembling the basaltic formation of the Giant's Causeway and early free from phosphorus.

In conclusion, I must acknowledge the valuable co-opera-on of Mr. J. L. Potts and his steel melter—Mr. Duckin-ld; of Messrs. J. H. Andrew and Co., Ltd., Sheffield; essrs. Hobson, Houghton and Co., Ltd., Sheffield; essrs. Wm. Shaw and Co., Ltd., Middlesbrough; Messrs. hos. Sorby and Sons, Sheffield; Messrs. Bolckow Vaughan ad Co., Ltd., Middlesbrough, and Mr. F. Outhwaite, their sistant furnace manager; Mr. T. C. Hutchinson, of essrs. The Skinningrove Iron Co., Ltd., Carlin How; d my own assistants—Messrs. E. W. Jackson, A. Scholes, H. Bellwood, and T. E. Towers.

APPENDIX I.

tectics.

A eutectic is a definite mixture of two or more con-uents which melt and solidify at a fixed point, a point ch is lower than the average melting or freezing points the component substances.

A eutectiferous alloy is a mixture of two or more metals or non-metals which are capable of forming a eutectic and which may or may not be in definite eutectic proportion. During solidification, when not in such proportion, the excess of one or the other of the substances first crystallises out leaving a liquid of definite eutectic proportion. This last portion, when liquid, resembles a "mother liquor," and, after solidification, is sometimes called a "solidified mother liquor." Guthrie coined the term eutectic.

Certain substances when mixed together have the peculiar physical effect of making very fusible mixtures. For instance, a mixture of iron saturated with phosphide which freezes at 1400° C. and iron phosphide which freezes at 1100° C. when melted together in the proportion of 61 per cent. phosphide and 39 per cent. iron does not solidify at the average temperature of these two substances, 1230° C. but at 1000° C., or 230° C. below the average.

Salt, which solidifies at 800° C. and water freezing at 0° C., when mixed together in the proportion of 23 per cent. salt and 77 per cent. water freeze at minus 22° C., or 422° C. below the average. Both these mixtures are eutectics.

The fusible alloys consisting of mixtures of two or more metals are essentially eutectics.

Eutectics are not definite chemical compounds. On solidification they usually split up into their constituents and are found in the solid binary alloys as honeycombed masses containing cells filled with one of the substances, and in the ternary alloys independent portions of three constituents.

In many cases the mixtures on freezing do not separate into the pure simple substances. The iron phosphide eutectic is an example, for a portion of the phosphide is retained in solid solution in the iron and it is this which separates at 1000° C. along with and at the same time as the iron phosphide.

Solid solution.—Glass and obsidian are types of non-crystalline solid solutions; they contain several substances homogeneously solidified together. On heating them, however, to certain temperatures some of the substances crystallise out and they become opaque and then are no longer simple solid solutions.

Many substances crystallise together into homogeneous crystals, and only one substance can be detected under the highest power of the microscope; they have all the properties of simple crystals as indicated by crystalline cleavage, crystalline orientation and crystalline habit. For instance, iron crystallises in the cubic system, and in freezing assumes the form of octahedral crystallites and the complete crystals cleave readily in three directions at right angles corresponding to the cleavages of the cube. Iron alloyed with traces up to about 10·9 per cent. phosphide of iron crystallises in exactly the same way, and the crystals have the same cubic cleavages as pure iron; the two substances are in solid solution. On heating the homogeneous alloys of iron and phosphide under certain temperature conditions a portion of the phosphide separates from solid solution and appears as ill-formed plates in the cleavage planes of the crystals.

The conception of solid solution, however, cannot be considered as beyond doubt excepting in the cases where they are non-crystalline. Some authorities hold the view that what are called solutions are mixtures crystallised together in chemical molecular groupings. Until, however, chemical combinations are proved the solution theory may be tentatively accepted.

APPENDIX II.

Method for the separation of free phosphide of iron from alloys.

In 1900 I described a crude method for approximately determining the free phosphide of iron in pig irons, etc. It was based on the relative insolubility in cold nitric acid, 1·20 sp. gr. Many approximate results were given, but no claim for accuracy was possible. Further study of the subject has led to the conclusion that analytical methods must fail on account of the complex character of the eutectics and the fact that the cell substance in them is enclosed more or less completely with solid Fe_3P

which prevents the more soluble part of the eutectics being attacked by chemical solvents. One is therefore obliged to study the structure and base one's conclusions on that and on other evidence obtained by systematic experiment, such as has been described in this paper.

APPENDIX III.

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Meeting held at Armstrong College, on Wednesday, January 21st, 1914.

MR. E. F. HOOPER IN THE CHAIR.

EXTRACTION APPARATUS, SPECIALLY DESIGNED FOR SOLVENTS OF HIGH SPECIFIC GRAVITY.

BY DR. C. BUDDE.

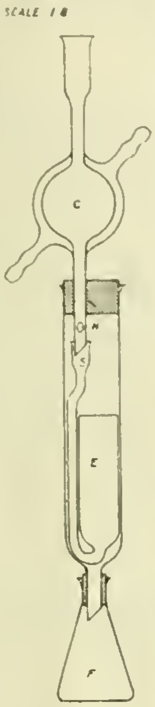
When a couple of years ago I had to make a larg number of extractions of wax from some vegetable sub stances I failed to find an apparatus specially suite for my purpose, in spite of the large number of suc apparatus already in existence.

As a solvent I had to use chloroform or carbon tetra chloride, as these were apparently the only solvent in which the wax in question was completely soluble—and that only at the boiling point of the solvent.

The point I wish to draw special attention to is this When an ordinary fat or wax is dissolved in one of thes heavy solvents, then the solution has a lower specif gravity than the pure solvent itself—in contradistinctio to what occurs when ether or benzine or any other solve of low specific gravity is used. The obvious consequen is that in my case the solution had a tendency to ri to the surface, and should be removed from there, whi fresh solvent should be supplied from the bottom, speedy and efficient extraction should be attained.

It seemed to me that previous designers of extracti apparatus had had no occasion to consider the importan of this fact, so I constructed the apparatus shown the drawing with this point in view and also keeping mind that the extraction should be performed all t time at the boiling point of the solvent.

The drawing hardly needs any explanation. T material to be extracted is placed in the extractor, either loose (with a plug of cotton wool on top prevent small particles from getting down in the fla or in a thimble or otherwise, according to the natur substance. The vapours of the solvent the pass out the extractor, E (keeping this at the boiling temperature), through the hole, H, in the condenser tube into the condenser, from where the condensed solvent flows through the side tube, S, into the bottom of the extractor. The solution of wax or fat overflows from the top of the extractor down into the flask, F. After the extraction is finished the extractor may be taken out, dried and weighed to corroborate the result obtained by weighing the flask.



I found that I was able to do the extractions not only more quickly but also more completely with this apparatus than than with an ordinary Soxhlet. It may, perhaps, also be mentioned that very little more solvent is required than is needed to fill the extractor, E, and that the bulk of it remains there when the extraction is finished.

In my case I gained yet another point by this apparatus, because I had to perform the extraction in the presence of water. This, of course, rose gradually to the surface of the solvent in the extractor and trickled down into the flask below, while in a Soxhlet it had a tendency to remain behind when the solvent emptied itself out through the syphon tube. The *modus operandi* in such cases was generally to put some water into the flask from the beginning together with the solvent. After the extraction was finished the rest of the solvent was removed by boiling the water, and on then cooling it was fairly easy to take out quantitatively the hard cake of wax floating on the surface of the water, dry it and weigh it.

It is obvious that the length of the side tube, S, should suit the purpose in view, if more than one volatile liquid be involved in the process. Supposing, for instance, that water is present and the specific gravity of the solvent is 1·5, then, if the height of the side tube be less than 1·5 times that of the extractor, the condensed water coming down from the condenser will overflow from the side tube and never enter the extractor, while if the height of the side tube be more than 1·5 times that of the extractor, the water will force its way through the solvent and overflow from the extractor.

Possibly the apparatus may be found useful for other purposes than the one mentioned. I have been able to use it with advantage for the extraction of liquids such as aqueous solutions or emulsions with solvents of lower specific gravity such as ether. It goes without saying that in such cases the side tube, S, must be high enough to allow the ether to force its way through the water into the extractor.

My apparatus have been made by Messrs. Brady and Martin, Northumberland Road, Newcastle-on-Tyne.

Yorkshire Section.

Meeting held at The University, Leeds, on Monday, January 26th, 1914.

MR. GEORGE WARD IN THE CHAIR.

FIELD METHOD FOR DETERMINING DISSOLVED OXYGEN IN WATER.

BY JAMES MILLER, F.I.C.

As the pollution of a water by organic matter increases. e amount of oxygen held in solution decreases until a int may be reached where the latter is nil.

Given free contact with air a polluted water will absorb oxygen and eventually become purified so far as readily oxidisable matter is concerned. Therefore a determination of the amount of dissolved oxygen becomes an important factor in judging the character say, of a stream into which effluent of a polluting character is discharged. This is borne out by the prominence which is given to dissolved oxygen in the Eighth Report of the Royal Commission on Sewage Disposal. Many methods have been suggested for determining dissolved oxygen in water but these have been designed mainly for laboratory use. A field method was proposed by Ramsay and Homfray (this J., 1901, 1072); this, however, requires special apparatus. Also the results are said to be modified by the presence of nitrites.

Mackey and Middleton published a method based on the use of pyrogallol and caustic potash (this J., 1898, 1127), and, working in Mr. Mackey's laboratory, my attention was drawn to the method with a view to adapting it to field work. It was found that the colour produced by the action of alkaline pyrogallate on the dissolved oxygen changed rather quickly and at times erratically, also that the colour produced was not exactly proportional to the quantity of oxygen present.

Pyrogallol with ammonia was tried but found useless. Various substances analogous to pyrogallol were tried in conjunction with caustic potash, *i.e.*, gallic acid, resorcinol, catechol, and quinol (hydroquinone), but none of these was of use.

It occurred to me that advantage might be taken of the colour produced by the action of potassium thiocyanate on ferric salts. Ferrous sulphate and caustic soda were added to a water under a layer of toluol, then acidified with hydrochloric acid and potassium thiocyanate added. The colour produced was matched with a standard ferric chloride solution. Good results were obtained when the oxygen was under 5 c.c. per litre, but over that amount the colour became too deep to match accurately. Also nitrites had a disturbing effect. The method was therefore discarded.

To overcome the detrimental effect of nitrites it seemed that the most likely line to work on would be one in which the ferrous iron could react, and any excess be detected, in an alkaline solution. Potassium ferrocyanide, the usual reagent for ferrous iron, is of no use in alkaline solutions, so another indicator was sought for without success until I saw a paper by Linossier (this J., 1891, 726) in which phenosafranine is used as an indicator for ferrous iron in presence of alkaline tartrate for the determination of dissolved oxygen in water. So the method I have now to describe becomes Linossier's adapted to field conditions.

Linossier's original process is essentially for the laboratory, involving the use of 400 c.c. of mercury, the water under examination being completely isolated from contact with the air, and is designed to give accurate results. I have found though that with very little apparatus it gives sufficiently accurate results, and, as a field method, may be used so as to give a determination in a minute or two, thus enabling one to make a large number of determinations and decide as to the condition, say, of a stream at different points, and to follow up at once any clue as to pollution.

The method I adopt is as follows:—

To 50 c.c. of the water contained in a 100 c.c. Nessler cylinder are added 5 c.c. of alkaline tartrate such as is used for Fehling's solution and one drop of phenosafranine solution (1 in 2000 of water), then from a 10 c.c. graduated pipette a solution of ferrous sulphate (0·22 grm. of pure $FeSO_4$ and 1 c.c. of conc. sulphuric acid in 100 c.c.) is run in just below the surface of the liquid stirring gently with the pipette until the colour is discharged, looking through the cylinder horizontally. The ferrous sulphate is added 1 c.c. at a time until the colour begins to fade then in additions of 0·5 c.c. to the end. There is a slight colouration at the surface of the liquid, but if the stirring is not too vigorous this does not interfere. The outlet hole of the pipette should not be more than 1 mm. in diameter to minimise diffusion.

The pipette reading gives the cubic centimetres of oxygen per litre. Theoretically 1 c.c. ferrous sulphate of above strength does not equal 1 c.c. oxygen per litre working on 50 c.c. of sample (0·25 per cent. $FeSO_4$ is theoretical strength) but under the conditions stated I have found that the above strength gives correct results.

Each experimenter should standardise his ferrous sulphate against water of known oxygen content, say distilled water shaken with air until saturated, taking the temperature and referring to Roscoe and Lunt's table (Sutton's Volumetric Analysis, page 260) for the amount of dissolved oxygen present.

In the following table are given some results by this (the field) method, compared with results obtained by the Winkler method :—

	Winkler.	Field method.
	c.c.	c.c.
Leeds supply	7·8	8·0
River Aire	7·0	7·5
River Aire	4·9	5·2
Effluent	2·0	2·5

Normal, 2-normal, and 3-normal solutions of sodium chloride contain, according to Winkler (this J., 1911, 382 and 644) at 16° C., 4·7 c.c., 3·4 c.c., and 2·4 c.c. of oxygen per litre respectively. By the field method, 5·0 c.c., 3·5 c.c., and 2·5 c.c. were obtained.

The ferrous sulphate keeps well. After keeping in a bottle repeatedly opened, and nearly empty, for four weeks, only 0·67 per cent. of the total iron had become oxidised. Experiments on samples containing up to 60 parts of sodium nitrite per 100,000 showed that nitrites had no effect on the method.

As dissolved oxygen plays an important part in the extraction of gold from gold ores by cyanide solutions, the method was tried on a 0·5 per cent. solution of potassium cyanide, but no end reaction could be obtained ; evidently the ferrous sulphate combines with the cyanide.

Discussion.

Mr. W. McD. Mackey wrote that he had used the method for practical work in the field, for determining the extent and persistence of pollution of a stream from a known source. He had found the manipulation was easy, and the time required for a test to be only about two minutes.

Dr. H. T. Calvert said that he had worked the process on the River Calder, and he could bear out all that Mr. Miller said. The methods at present in use would be divided into two classes, those suitable for very clean waters, and those suitable for dirty ones. Ramsay's method was only of use for very clean waters. Winkler's method was of almost universal application. The method advocated by Mr. Miller generally gave results rather lower than Winkler's method. They had adopted Winkler's method because it was accurate and easily carried out. The apparatus only weighed five or six pounds, and in order to simplify the operations in the field, they could proceed as far as the precipitation of the manganese hydroxide, and then finish the estimation in the laboratory.

Mr. Ward asked how the colour of the water would affect the results.

Mr. Miller replied that a pale colour of the water had no effect whatever on the results. Any water could be tested so long as it was not pink. He had determined the dissolved oxygen in an effluent which had a distinct pale blue colour, and the end point was quite sharp.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

English.—8*d*. each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s*. each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows : Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.) ; Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT ; MACHINERY.

Patents.

Extraction of liquids or solids held in suspension or combined in gases or fumes. J. Armstrong, London. Eng. Pat. 569, Jan. 8, 1913. Addition to Eng. Pat. 821, Jan. 10, 1912 (this J., 1913, 184).

The apparatus described in the principal patent is improved in that the compressed gases are passed in succession through a number of nozzles immersed in different liquids, each adapted to separate out a particular impurity ; the nozzles are carried on frameworks fixed to detachable lids, so that they can be removed for cleaning ; the chambers may be of cylindrical form with radial or tangential nozzles for the gas and conical collecting chambers for the impurities beneath.—H. H.

Distillation of liquids ; Process for the ——. Naamlooze Vennootschap Maatschappij Destillator. Fr. Pat. 461,822, June 25, 1913. Under Int. Conv., June 26, 1912.

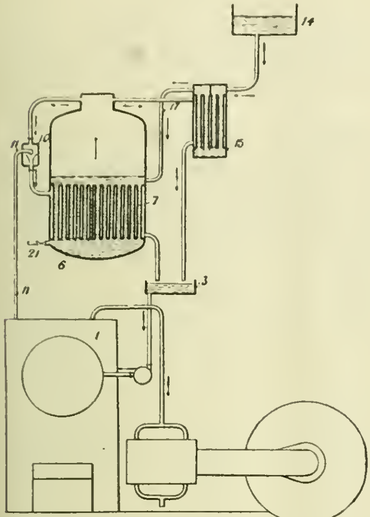
Heated water from engine or other condensers is fed into an evaporator in a finely divided condition and is exposed to a vacuum so that part of the water is evaporated by its own heat, the vapour passing to a condenser also under vacuum.—W. H. C.

Measuring the flow of fluid through a conduit ; Instruments for ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, New York, U.S.A. Eng. Pat. 2417, Jan. 29, 1913.

The pressure difference in a Venturi tube, Pitot tube, or similar measuring device is indicated by means of a mercury gauge supporting a short column of an " opaque substance such as carbon tetrachloride " contained in a narrow glass tube. The upper end of this tube is connected with the low-pressure side of the Venturi tube, while the lower end, which is enlarged, dips into a vessel of mercury connected with the high-pressure side. A permanent record of the pressure differences is made by a marking point carried by a lever attached to a U-shaped magnet, which encloses the vessel of mercury and moves in conjunction with a magnetic body floating on the surface thereof.—H. H.

Distilling feed water for boilers ; Process and apparatus for ——. Soc. d'Exploitation des Procédés Evaporatoires, Systéme Prache et Bouillon, Paris. Eng. Pat. 1583, Jan. 20, 1913. Under Int. Conv., Jan. 19, 1912.

Steam from the boiler, 1, enters the injector, 10, by the pipe, 11, and withdraws steam from the evaporator, 6, compresses it and injects it into the heating arrangement, 7, of the evaporator ; the steam is condensed and the condensed water flows into the tank, 3. The impure water flows from the tank, 14, through the heater, 15, where it is heated by a portion of the steam from the evaporator, 6, which is also condensed and flows into the tank, 3.



The heated water enters the evaporator, 6, by the pipe, 17, and is evaporated. The boiler is fed with the pure condensed water from the tank, 3, which has a temperature of about 100° C. and as only a small portion of the steam produced is required to actuate the compressor, 10, and the remainder can be utilised in any desired way, only a small increased fuel consumption is required to enable the boiler to be fed with pure hot condensed water. The impurities become concentrated in the evaporator, 6, and are got rid of by blowing off at intervals a portion of the liquor in the evaporator through the cock, 21.—W. H. C.

Air; Method of heating a current of ——. A. G. Bloxam, London. From Bergmann Elektricitäts-Werke A.-G., Berlin. Eng. Pat. 11,874, May 21, 1913.

An electrical heating apparatus is inserted in the suction pipe or receiving chamber of a dust suction plant or a vacuum cleaner.—W. H. C.

Dryers with rotary agitators. F. E. Otto and Phönixwerk G. m. b H., Meerane, Germany. Eng. Pat. 14,502, June 23, 1913.

The material is carried slowly through a drum by a set of rotary spiral heating coils arranged in the manner of a screw conveyer, the pitch of the spirals decreasing from the intake side of the dryer to the discharge side in order to make allowance for the decreasing bulk of the material as it becomes dry. Agitator blades mounted outside the spirals scrape material from the lower walls of the drum, lift it above the heating coils, and drop it thereon as the rotation proceeds. An additional heating coil may also be arranged in close proximity to the wall of the drum. —H. H.

Drying installations for all kinds of materials. A. Huillard. Fr. Pat. 461,611, July 31, 1913.

An improvement in the apparatus described in Fr. Pat. 318,562 of 1902 (see Eng. Pat. 17,663 of 1902; this J. 1902, 1386), whereby the material is passed over a sieve before it enters the drying tower. The coarser particles are fed into the upper part of the tower and the finer material enters lower down along with a supplementary supply of air which also assists in the sifting.—W. H. C.

Dryers; Stage ——. A. Huillard. Fr. Pat. 461,612, July 31, 1913.

The material is fed into the top of a tower provided with a number of horizontal perforated shelves. It is swept from the periphery to the centre of each shelf by agitators driven from a central shaft and is dried by a current of hot air which passes up the tower. When the material reaches the centre of each shelf it falls into a box provided with sliding baffles which allow the material to pass downwards but prevent the air passing upward so that the latter is forced to pass through the perforations in the shelves. The material falls from the box on to a conical spreader which guides it to the periphery of the shelf below.—W. H. C.

Filter [for slimes]. H. Alinder, Milwaukee, Wis., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,084,383, Jan. 13, 1914.

A number of wedge-shaped filter cells are arranged round a horizontal shaft which is rotated above a tank so that the cells are partially immersed in the tank. The cells have openings on the outer side for the supply of the "slimes" and inward openings for the discharge of the cake over the edge of the tank.—W. H. C.

Filters; Vacuum drum —— for the concentration of precious metals and other applications. G. Spence. Fr. Pat. 461,346, Aug. 12, 1913. Under Int. Conv., Aug. 31, 1912.

The periphery of the drum is divided by projecting ⊥-shaped bars into sections, in each of which is fixed a removable arc-shaped filter-element consisting of a shallow metal box covered with suitable filtering material supported on metallic gauze or on a perforated plate. The periphery of the drum is supported from the axis by a double series of radial tubes; one of each series is attached to each filter element and serves to connect it, through sleeves on the axis, in the one case with a vacuum pump and in the other with a supply of compressed air. The drum is rotated, partly immersed in a tank containing the liquid or mud to be filtered and the elements immersed are in connection with the vacuum pump. As each element comes to the discharge position, the vacuum is automatically cut off and compressed air is admitted which forces the cake off the surface. It is claimed that the action of the vacuum and compressed air is localised where it is required and that the filter elements can be easily and quickly replaced or repaired.—W. H. C.

Filter; Rotary drum ——. C. C. Bohm. Ger. Pat. 268,620, Jan. 30, 1913.

A curved, non-perforated, fixed plate extends across the lower part of the perforated drum which dips into the liquid to be filtered, and is provided with two pipes which extend upwards and then axially through the drum to opposite ends thereof. One pipe serves for suction of the liquid through the filter-drum, whilst the other serves for passing air either by suction or pressure through the filter-cake on the outer surface of the drum in order to dry it. —A. S.

Filtering material of high efficiency; Process of obtaining a ——. F. Pott. Fr. Pat. 461,386, Aug. 14, 1913.

Porous minerals are impregnated with an albuminous substance (blood, etc.) dissolved in alkali solution, then dried, and heated to redness out of contact with air. The carbonised mass is washed to remove soluble salts, and, if desired, may then be impregnated with iron, aluminium, manganese, nickel or cobalt hydroxides mixed with calcium carbonate.—W. P. S.

Evaporation of liquids, particularly saccharine juices; Process and apparatus for the ——. J. C. Grière. Fr. Pat. 461,208, Aug. 8, 1913. Under Int. Conv., Aug. 23, 1912.

The evaporator is divided, except in the vapour space above the liquid, into a number of separate compartments (*e.g.*, six) each comprising an upper and a lower chamber connected by a bundle of vertical tubes. In each compartment the heated liquid rises from the lower to the upper chamber and then passes from this to the lower chamber of the next compartment by a tube which is not heated and which may be external to the apparatus or may pass down a central duct. The liquid thus passes through each of the compartments in turn; its rate of flow, and therewith the degree of concentration attained, may be regulated by valves in the inlet pipe.—J. H. L.

Evaporating apparatus for all kinds of liquids. E. A. Barbet. Fr. Pat. 461,890, Nov. 8, 1912.

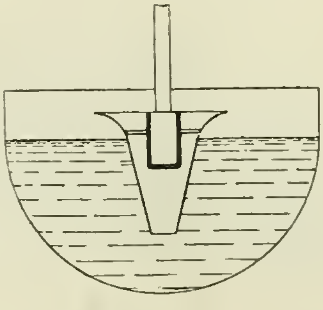
The tubes of a vacuum evaporator are arranged in two sets at an angle to each other, the liquid passing first through the lower set to a junction-box and back through the upper set to the main chamber of the apparatus where separation into vapour and liquid takes place. In this way the tubes may be short, easily cleaned, and yet at the same time afford a long distance through which the liquid must travel.—W. H. C.

Chemical reactions and thermal processes; Process and apparatus for the execution of —— *the materials treated being in a finely divided condition in solution or suspension.* A. Pollak. Fr. Pat. 461,446, Aug. 18, 1913. Under Int. Conv., Oct. 18, 1912.

The material (*e.g.*, a solution to be evaporated) is introduced in a finely-divided condition into the narrow upper part of a chamber along with a supply of heated air or gas and they pass downwards into the larger conical part of the chamber which is provided with baffles to assist the separation of solid particles produced by evaporation of the liquid. The gas is withdrawn from the top of the lower part of the chamber and is caused to pass through two condensers placed in series. In the first the separation of the solid particles is completed and in the second the vapour is condensed. The gas next passes through a fan which maintains a slight vacuum in the chamber and thence through a heater back to the main chamber to be used over again.—W. H. C.

Spraying liquids and intimately mixing them with gases or vapours; Device for ——. Salzbergwerk Neustassfurt und Teilnehmer. Ger. Pat. 267,939, March 12, 1912.

The device (see fig.) is hollow and is rapidly rotated whilst partly immersed in the liquid. Owing to the conical shape of the device, the liquid is drawn in at the lower edge, then forced upwards and delivered from the upper edge in the form of a fine spray.—A. S.



Purification, clarification and decolourisation of liquids and gases; Process for the ——. R. Marcus. Ger. Pat. 268,057, March 26, 1912.

The liquid or gas is treated with finely divided, artificial silicic acid, which has been freed from foreign adsorbed substances, and is subsequently filtered; the impurities are retained on the filter by the silicic acid.—A. S.

Crystals; Apparatus for separating large —— *from hot solutions by artificial cooling.* Gewerkschaft Carlsfund. Ger. Pat. 268,328, March 16, 1911.

Cooling is effected in a number of separate receptacles, through which the cooling medium is led successively, in such wise that the difference in temperature between the hot solution and the cooling medium is kept as small as possible. The cooling tubes may be helical and the cooling medium may be led in one direction through one tube or group of tubes and in the opposite direction through others.—A. S.

Crystallisation in motion; Apparatus for ——. F. A. Bühler. Ger. Pat. 268,409, Aug. 17, 1912.

Crystallisation is preferably effected in a double-walled tubular vessel, the jacket being formed as a helical channel. The agitator is rotated alternately to the right and left, and the agitating arms are so mounted that during rotation in one direction they glide over the material, whilst during rotation in the other direction they lift the material and move it forwards.—A. S.

Drying machines; Application of liquids to cylindrical ——. F. F. W. Stieler, Berlin. Eng. Pat. 4085, Feb. 17, 1913.

See Fr. Pat. 454,468 of 1913; this J., 1913, 858.—T. F. B.

Drying granular substances: Process and apparatus for ——. J. A. Topf und Söhne. Fr. Pat. 461,679, Aug. 21, 1913.

See Eng. Pat. 29,835 of 1912; this J., 1913, 1147.—T. F. B.

Drying solid substances held in suspension or solution; Method and apparatus for ——. F. E. Beeton. Fr. Pat. 462,212, Sept. 5, 1913.

See Eng. Pat. 13,505 of 1912; this J., 1913, 968.—T. F. B.

Extraction of various materials by means of volatile liquids; Apparatus for the ——. L. C. Bonneau, Paris. Eng. Pat. 12,138, May 24, 1913. Under Int. Conv., May 24, 1912.

See Fr. Pat. 457,905 of 1913; this J., 1913, 999.—T. F. B.

Filter-press. G. Pistor, J. Dion, and H. Reitz, Griesheim, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 1,084,659, Jan. 20, 1914.

See Ger. Pat. 252,577 of 1911; this J., 1913, 75.—T. F. B.

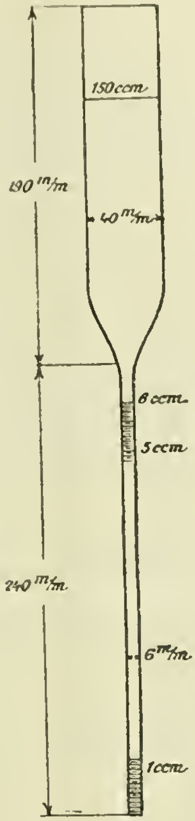
IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke ovens; Different methods of measuring the energy consumed by regenerative ——. *A new method for the exact determination of this quantity of heat.* E. Lecocq and J. Pieters. Rev. Mét., 1914, 11, 95—126.

The methods depending on the measurement in gasometers of the excess gas not utilised for heating the ovens and on measurement of the gas supplied to the ovens by means of Pitot tubes, are subjected to a detailed criticism. The method proposed is to calculate the volume of gas supplied, after obtaining by direct measurement the volume, temperature and pressure of the air supplied to the ovens, the composition of the ga supplied, the composition of the burnt gases passing up the chimney. The volume of air may be measured by a Pitot tube or preferably by means of an anemometer The calorific value of the gas supplied having been deter mined, the heat supplied to the ovens can be calculated The method of making the necessary calculation is illus trated by an example. The methods of making th required measurements are discussed, and the actua operations described. The probable error is stated to b under 2 per cent. The method used by the authors t measure the total volume of distilled gas is also describe

—T. St.

Fuels; Determination of water in solid and liquid —— by distillation with xylene. P. Schläpfer. Z. angew. Chem., 1914, 27, 52—56.



The author describes in greater detail his method of determining water which has been outlined by Huntley and Coste (this J., 1913, 63). A suitable quantity (30—100 grms.) of the fuel is brought into an Erlenmeyer flask of 500 c.c. capacity with 200 c.c. of xylene. The flask is connected by means of a tube, 0·8 to 1 cm. diam., with a vertical condenser which leads to the measuring vessel, shown in the figure. The distillation is conducted slowly whilst the first 30 c.c. are being collected, and then more rapidly, the total 150 c.c. being obtained in about 30 mins. For larger quantities of water a tube of 12 mm. diameter in its narrowest part is used, the other dimensions being approximately the same. The cylinder is carefully cleaned by steam and chromic acid after each determination. The volume of water observed must be corrected for errors in the graduation of the tube, for change in the shape of the meniscus by the pressure of the xylene (about 0·02 c.c. for the narrow tube) and finally for water lost in the distillation which depends on the quantity present and the form of the apparatus. When once the last correction has been determined under known conditions, it is possible to make accurate corrections and to obtain results which are very reliable, except in the case of certain anthracites. For material such as briquettes with a volatile binding agent, this appears to be the only reliable method of determining moisture, and it is also very convenient and rapid compared with other methods for liquids such as tar and viscous mineral oils.
—W. H. P.

Vertical [gas] retorts; American ——. J. H. Taussig. J. Gas Lighting, 1914, **125**, 232—233.

In new plant in course of erection by the United Gas Improvement Co. of Philadelphia, the size of the retorts is greater than heretofore, the object being to obtain complete carbonisation simultaneously at all heights, uniform discharge and larger size of coke, and economy of labour. The new retorts are 18 × 30 in. at the bottom, 12 × 22 in. at the top and 18 ft. 6 in. high, holding 1650 lb. of coal, and the carbonising period is 12 hours. The hot coke is discharged into a cast-iron shoot and fed by an electrically-operated drum on to a conveyor which elevates and delivers it to a shaking screen. The hot coke passes either into a brick-lined hot-coke bin, or on to a shaking table where it is quenched. The hot coke is also used in the water-gas generators. The breeze is passed dry from the bin into the conveyor and elevated to overhead bins for use as stoppers. The primary and secondary air is supplied through meters by blowers.
—A. T. L.

Oil-field; The Taranaki ——. A. E. Watkins. Trans. Australasian Inst. Min. Eng., 1912, **16**, 197—209.

THE author describes the geological formation of the Taranaki oil-field, which is situated on the western side f the North Island of New Zealand, and enumerates the urface indications of petroleum as indicating the extent f oil-bearing rocks. At present there are two flowing ells producing 6720 gallons per week. The oil, which esembles Pennsylvanian petroleum very closely, contains only a very small proportion of unsaturated hydrocarbons, and is free from sulphur. It yields about 14 per cent. of motor spirit (sp. gr. 0·756), about 38 per cent. of burning oil, and 10 per cent. of refined wax. It would be possible to distil it so as to leave a large percentage of fuel oil.
—T. St.

Petroleum pitch; Detection of —— in asphaltum and "liquid bitumens." G. Halphen and J. Spiess. Les Matières Grasses, 1914, 7, 3369.

The method of detecting pitch in asphaltum (this J., 1913, 1096) may also be used for its detection in "liquid bitumens." About 10 grms. of the sample are dissolved in carbon bisulphide, and the solution filtered and concentrated *in vacuo*, to eliminate the solvent and more volatile constituents. The residue is then dissolved in carbon bisulphide and the solution allowed to evaporate spontaneously as described (*loc. cit.*). A viscous bitumen from the Ivory Coast contained:—Water, 10·61; "cracking" oils (of sp. gr. 0·896) 30·56; coke and sand, 54·64; and gas (H_2S, NH_3) and loss, 4·19 per cent. When tested as described a glossy black residue was obtained. On the other hand, a fluid petroleum pitch left a dull black residue with a corrugated centre similar to that given by ordinary petroleum pitch.—C. A. M.

Motor fuels, with special reference to alcohol. W. R. Ormandy. J. Roy. Soc. Arts, 1914, 62, 234—245.

After referring to the enormous increase in the consumption of motor spirit in the past few years, the author discusses in turn the different sources of supply of petrol and its substitutes (see this J., 1913, 416, 819; 1914, 66). With regard to the suggestion that if the illuminating power standard for coal gas were replaced entirely by a calorific power standard, it would be possible to recover 20,000,000 gallons of benzene from the gas per annum in the United Kingdom, it is pointed out that if such change of standard took place, in all probability gas of a different type would be produced by carbonisation at higher temperatures and increased use of water-gas, and that it would be necessary then to leave in all the benzene and paraffin-like substances for such lower-grade gas to attain the required standard of calorific power. Of the petrol substitutes which have been suggested, alcohol alone seems to offer satisfactory possibilities, and tests have shown that with two types of modern petrol engines, mixtures of alcohol and benzene (1 : 1 and 2 : 1) will yield as much power as can be obtained from the same engines running on petrol (see this J., 1913, 1096). According to official statements in certain British Colonies, raw materials for the manufacture of alcohol can be produced in practically limitless quantities at a price equivalent to 3d. per gallon for 95 per cent. alcohol.—A. S.

Tars and heavy oils. Their use as fuels. See III.

Patents.

Coke-oven. Dr. C. Otto und Co. Ges. m. b. H. Ger. Pat. 268,399, Nov. 24, 1911.

The oven is heated from below and in order that heating may be effected alternately with high-grade gas and with low-grade (producer) gas, one of the two chambers alongside the block carrying the burner nozzles is provided with a means of communication with the supply pipe for the low-grade gas. When high-grade gas is being used, both of these chambers are utilised for preheating the air, but when low-grade gas is used, one chamber serves for preheating the air and the other for preheating the gas.—A. S.

Coke; Apparatus for quenching and loading ——. F. Méguin und Co. A.-G. and W. Muller, Dillingen-Saar, Germany. Eng. Pat. 1430, Jan. 17, 1913.

The red-hot coke is discharged into an open, water-jacketed hopper supported by a travelling framework. Short open pipes pass through the bottom of the hopper and through the bottom jacket and may be closed or opened at their lower ends by a sliding perforated plate. The hopper containing the hot coke is moved above a water tank, the sliding plate drawn back and the hopper lowered vertically into the water, which rises through the tubes and quenches the coke. The hopper is then again raised and tilted sideways so that the coke slides over the sloping side into a truck or store.—W. H. C.

Gas producers. C. Whitfield, London. Eng. Pat. 1117, Jan. 15, 1913.

In a suction gas producer, intended for light fuels of a bituminous or tarry nature, the gas is caused to pass through a restricted orifice formed by a conical nozzle, at any point between the producer and the tar extractor, in order to reduce the pulsations in the producer caused by the suction of the engine piston. The producer outlet converges inwards towards a junction box, whence the gas passes downwards through the conical nozzle which is arranged in a vertical pipe sealed in water. A branch near the lower end of this pipe leads to the scrubber and tar extractor, the latter preferably of the kind described in Eng. Pat. 1118 of 1913 (see following abstract). Water is admitted tangentially into the downpipe above the nozzle in order to keep the surfaces free from tar and dust. —A. T. L.

Gas washers or tar extractors. C. Whitfield, London. Eng. Pat. 1118, Jan. 15, 1913.

In a centrifugal tar extractor suitable for use with gas producers the rotating element comprises a central disc having radial blades on both sides, and annular discs attached to the outer edges of the blades. Additional blades are provided on the outer side of one of these discs, in the outlet compartment of the casing, in order to draw gas through the scrubber. The gas passes radially outwards between one set of blades to an annular channel in the casing, and thence radially inwards between the blades on the other side of the central disc and finally radially outwards in the outlet compartment. Water may be sprayed into the scrubber, and a settling tank may be provided.—A. T. L.

Producer gas; Cooling ——, and simultaneously manufacturing salt by the evaporation of brine. A. Burrows, Urmston, and J. Charlton, Heaton Moor, Lancs. Eng. Pat. 2728, Feb. 3, 1913.

An evaporating pan for brine has the central portion of the bottom raised throughout the length of the pan so as to form a flue beneath for the hot gases leaving a producer. In this way, the gases are cooled, and the raised part of the pan provides a large heating surface covered by a shallow depth of brine, whilst leaving the full depth of the pan near each side, where the brine is fed in and the salt accumulates.—A. T. L.

Wood gas and by-products; Apparatus for and mode of manufacturing ——. R. M. Poole, Mount Gambier, S. Australia. Eng. Pat. 13,929, June 16, 1913. Under Int. Conv., July 9, 1912.

Waste wood is carbonised in a horizontal retort set in a furnace and after separating the heavy tar which settles in the gas main the gas is passed through a water-cooled condenser where heavy and light liquids are condensed. The gas (poor gas or gas "y") then passes on through a train of purifying apparatus into a holder. The heavy liquid is withdrawn from the condenser and the light liquid which floats on the surface flows back through a store tank into a horizontal still placed above the retort and heated by the waste heat from the furnace. The liquid is distilled, the lighter portions pass through a condenser into a storage tank and the heavy residual oil is withdrawn from time to time. The light condensed liquid flows first into a vaporiser and thence into one or more retorts which are maintained at a high temperature to convert the vapours into permanent gas. This rich gas or gas "z," is passed through a separate train of purifying apparatus into a separate holder. The two gases are then mixed in suitable proportions in a third holder. The mixed gas burns with a blue flame and is said to give with an incandescence burner a light very similar in its properties to daylight.—W. H. C.

Gas-producers; Steam generators for ——. O. G. Pierson and La Soc. J. and O. G. Pierson, Paris. Eng. Pat. 21,553, Sept. 24, 1913. Under Int. Conv., Sept. 24, 1912. Addition to Eng. Pat. 14,531, June 24, 1907.

The cylindrical portion of the boiler described in the chief patent is made integral with the body of the producer and the inner cylinder is made of steel or other material more highly resistant than cast iron.—W. H. C.

Gas; Manufacture of lighting or heating ——, or hydrogen, by decomposition of the vapours of oil, tar, or liquid hydrocarbons. Berlin Anhaltische Maschinenbau A.-G. Ger. Pat. 267,944, Jan. 28, 1913.

The oil or the like is vaporised in a chamber packed with refractory material, so disposed that its permeability increases from the bottom of the chamber upwards. The vapours are then passed through a column of incandescent coke in a producer chamber, whereby carbon is deposited and a gas suitable for heating or lighting, or, under suitable conditions, hydrogen, is produced. After a certain period the oil supply is cut off, and the producer is "blown" with air, the exit-gases being led into the vaporising chamber, where they are mixed with air and burnt, and thus serve to heat the refractory packing preparatory to the vaporisation of a further quantity of oil. The oil vapours are preferably passed through the producer alternately in an upward and a downward direction.—A. S.

Methane or other inflammable gases in the air; Apparatus for measuring the content of ——. Akkumulatorenfabrik A.-G. Ger. Pat. 268,844, April 16, 1913.

Several heated conducting wires (*e.g.*, of platinum) capable of acting catalytically are introduced into the air to be tested. According to the content of inflammable gases a smaller or larger number of the wires is brought to incandescence.—A. S.

Methane or other inflammable gases in the air; Process and apparatus for detecting ——. Akkumulatorenfabrik A.-G. Ger. Pat. 268,845, April 16, 1913.

The apparatus is of the type in which an electrically heated wire, capable of acting as a catalyst, is brought to incandescence when the air contains inflammable gases. A variable resistance is inserted in the heating current circuit, and the content of inflammable gases in the air is estimated from the intensity of the current (varied by means of the resistance) needed to heat the wire to a degree sufficient for it to exert and maintain its catalytic activity. The apparatus is calibrated by means of gaseous mixtures of known composition.—A. S.

Inflammable gases in the air; Apparatus for detecting and measuring the content of ——. W. Kraushaar. Ger. Pat. 268,898, Jan. 14, 1913.

An electrically heated wire, preferably in the form of a spiral, is enclosed in a casing of incombustible, opaque material, having an opening below or at the side for the introduction of the air to be tested, and an opening above at which a flame with an aureole or cap appears in presence of a certain quantity of inflammable gases. The device can be applied to existing electric mine lamps.—A. S.

Petroleum; Apparatus for distilling ——. C. R. Ewing, Baltimore, Md., Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 1,083,998, Jan. 13, 1914.

The petroleum vapours pass upwards through a tower containing baffles or mixing devices at the bottom, a reflux condenser at the top, and an adjustable intercepting device in the middle adapted either to collect all the condensed liquid falling from the condenser and lead it to a liquid outlet, or to allow a free passage for the condensed liquid to fall on to the mixing device beneath. In either position of the intercepting device, there is a free passag for the upward flow of the vapours. A liquid outlet is provided at the bottom of the tower, and the vapours pass from the top into a condenser.—H. H.

Petroleum ; Distilling ——. W. C. Koehler and L. Link, Elizabeth, N.J., Assignors to Standard Oil Co., Bayonne, N.J. U.S. Pat. 1,084,016, Jan. 13, 1914.

The fraction of crude petroleum containing the wax and lubricating oils is heated to 650° F. (332° C.) and the vapours evolved are conducted at this temperature into a tower containing a large number of tubes acting as reflux condensers, whereby the gummy or asphaltic portions are removed while the lubricant and wax yielding hydrocarbons pass over and are separately condensed.—H. H.

Oil refining mechanism. G. H. Gillons, Assignor to Richfield Oil Co., Los Angeles, Cal. U.S. Pat. 1,084,080, Jan. 13, 1914.

The oil is pumped under uniform pressure through a series of alternate heating coils and vapour-separating devices, from which the vapours are led to condensers. Each separating device comprises a chamber having a number of nozzles and baffle-plates for thoroughly breaking up the oil, and a perforated plate adapted to distribute the oil and permit vapours to escape therefrom, suitable overflow pipes being provided to maintain a constant depth of oil in the separator.—H. H.

Petroleum soluble [emulsifiable] in water ; Manufacture of ——. P. H. Crochepeyre. Fr. Pat. 461,538, May 10, 1913.

Petroleum, 2 parts, is stirred into molten rosin, 1 part, and soda lye, 1 part, is then mixed in. The product will make an emulsion with water without any oil coming to the surface.—A. T. L.

Esters of fatty acids ; Utilisation of —— *[for carburetting, etc.].* Soc. d'Etude du Carburol. Fr. Pat. 461,520, Aug. 20, 1913.

The following esters are used, with or without the corresponding alcohols, for carburetting, for heating, and for lighting, in place of mineral oils :—the acetic, propionic, butyric, valeric and caproic esters of methyl, ethyl, propyl, butyl and amyl alcohols.—A. T. L.

Aliphatic hydrocarbons from polymethylenes or mixtures containing polymethylenes [petroleum products] ; Process for preparing ——. Steaua Romana Petroleum-Ges. m. b. H. Fr. Pat. 462,073, Sept. 2, 1913. Under Int. Conv., Sept. 24, 1912.

Polymethylenes or mixtures containing polymethylenes, especially petroleum residuum or mineral oils of high boiling point, are subjected to destructive distillation, and the products are converted into saturated hydrocarbons by treatment with hydrogen. For example, 10 kilos. of a mineral oil fraction of sp. gr. 0·850 are subjected to destructive distillation, at a temperature not exceeding 230° C. ; in addition to the coke and gas, to 9·5 kilos. of distillate of sp. gr. 0·750—0·780 are obtained ; this is now saturated with hydrogen in presence of a suitable catalytic agent, until a sample treated with oncentrated sulphuric acid diminishes in volume by less han 2 per cent. The product consists of 9·2 to 9·8 kilos. f saturated hydrocarbons of sp. gr. 0·740 to 0·770. The esulting liquids may be used as motor fuels.—T. F. B.

riquetting fuel by adding dry paper pulp flakes ; Process of ——. F. Reinold, Charlottenburg, Germany. Eng. Pat. 15,439, July 4, 1913.

EE Ger. Pat. 266,457 of 1912 ; this J., 1913, 1149.—T. F. B.

riquettes ; Process for making ——. C. Fohr and E. Kleinschmidt. Fr. Pat. 461,281, July 26, 1913. Under Int. Conv., Aug. 2, 1912.

EE Ger. Pat. 263,158 of 1912 ; this J., 1913, 901.—T. F. B.

Liquefied lighting gas ; Manufacture of —— *and plants for producing the same.* A. V. Lipinski, Zürich, Switzerland. Eng. Pat. 1325, Jan. 16, 1913. Under Int. Conv., Jan. 17, 1912.

See Fr. Pat. 453,370 of 1913 ; this J., 1913, 781.—T. F. B.

Gasification of fuels containing volatile constituents ; Process and apparatus for the ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 3672, Feb. 12, 1913. Under Int. Conv., Feb. 22, 1912.

See Fr. Pat. 454,655 of 1913 ; this J., 1913, 860.—T. F. B.

Coal gas ; Process for extracting or recovering certain substances from ——. G. H. Hultman. Fr. Pat. 461,294, July 30, 1913.

See U.S. Pat. 1,073,605 of 1913 ; this J., 1913, 971.—T. F. B.

Fuel ; Liquid ——. J. de Cosmo and H. Quinaux, Liège, Belgium. Eng. Pat. 11,167, May 13, 1913. Under Int. Conv., March 20, 1913.

See Fr. Pat. 459,857 of 1913 ; this J., 1913, 1150.—T. F. B.

Bituminous composition [for roads]. Eng. Pat. 1458. *See* IX.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Coal ; Distillation of —— *in a vacuum.* M. J. Burgess and R. V. Wheeler. Chem. Soc. Trans., 1914, **105**, 131—140.

The apparatus, after introduction of the coal (200 grms. of fine dust) was rapidly exhausted by means of a Geryk oil pump, and the last traces of air removed by a mercury pump fitted with two Sprengel tubes. In order to prevent reflux condensation and consequent decomposition of liquid distillation products, the neck of the glass retort was directed vertically downwards into the first condenser. When all occluded gases capable of being extracted at the ordinary temperature had been removed, the temperature was raised to 100° C., and exhaustion continued at that temperature until no more gases could be pumped off. The temperature was then raised gradually in successive stages of 50° or 100° C., and the gases removed at each stage. The pressure at no time exceeeded 20 mm. Small quantities of occluded gases (mainly carbon dioxide and monoxide) were obtained at the ordinary temperature from coal dust which had been dried in the air at 107° C. At about 200° C. there was a copious evolution of water, and water was also evolved at successive stages up to 450° C. ; during the period of most rapid evolution of water, the gases contained a high percentage of oxides of carbon. Decomposition of some sulphur-containing substance occurred at 270°—300° C. A thin reddish-brown oil began to distil at 310° C., but there was no marked evolution of gas at this temperature. At 350° C. there was a rapid evolution of gas and much viscid oil distilled over, and from this point decomposition continued with increasing rapidity as the temperature was raised (up to 450° C.). The gases were probably free from benzene (neither this compound nor its homologues were present in the liquid distillation products) but contained ethylene and higher olefines, and paraffin hydrocarbons up to and including pentane. For giving some indication of the nature of mixtures of paraffin hydrocarbons, instead of the commonly used ratio C/A (contraction on explosion : absorption by potassium hydroxide, or carbon dioxide formed), the authors recommend regarding the mixture of paraffins as consisting of *m* CH_4 groups and *n* CH_2 groups and determining the ratio n/V (number of CH_2 groups per unit volume of the paraffins). This ratio $\frac{n}{V} = \frac{2(2A—C)}{2C—A}$ is 0 for methane, 1 for ethane, 2 for propane, and so on. The composition and volume (per 100 grms. of Silkstone bituminous coal) of the gases evolved at different temperatures are shown in the following table :—

	100° C.	200° C.	300° C.	350° C.	400° C.
Volume	34 c.c.	65·5 c.c.	58·5 c.c.	985 c.c.	4 litres
Composition:	per cent.	per cent.	per cent.	per cent.	per cent.
CO_2	6·70	8·85	35·35	20·95	2·85
H_2S	—	—		1·70	0·70
O_2	1·65	0·70	—	—	—
C_2H_2	—	—	0·55	0·15	trace
C_2H_4	0·85	0·85	1·05	1·90	2·35
$C_nH_{2n}(n>2)$ ..	1·30	2·90	18·85	17·90	6·15
CO	1·40	2·60	10·50	3·40	3·40
H_2	1·90	2·75	13·35	15·35	36·90
C_nH_{2n+2}	84·55	81·00	18·85	37·22	46·55
n/V for paraffins	2·21	1·84	1·43	0·311	0·302

—A. S.

Coal ; Composition of ——. [*Tar obtained by distillation in a vacuum at low temperatures.*] D. T. Jones and R. V. Wheeler. Chem. Soc. Trans., 1914, **105**, 140—151.

Two bituminous coals (one from Scotland and one from Durham) were employed in the experiments, the crushed coal being sifted through a 10-mesh and on a 65-mesh sieve, and then dried at 105° C. for 1 hour. The temperature of the glass retort was raised gradually to 430° C. and distillation continued at this temperature at a pressure of 5—40 mm. It has been shown previously (this J., 1910, 1291; 1911, 606) that at temperatures below 500° C. only the "resinous substances" in bituminous coals are decomposed to any great extent. Besides gaseous products (see preceding abstract) and water, the coals yielded about 6·5 per cent. of their weight of a thin, brown, pleasant smelling tar (sp. gr. 0·999 at 15°/15° C.) covered with a layer of paraffins. The tar was distilled up to 300° C., leaving as residue about half its weight of pitch. The oils boiling below 300° C. contained 40—45 per cent. of unsaturated (ethylenic) hydrocarbons (mostly richer in carbon than the mono-olefines, C_nH_{2n}), about 40 per cent. of naphthenes (C_nH_{2n}), and liquid paraffins, the former greatly predominating, 12—15 per cent. of phenols, chiefly cresols and xylenols, about 7 per cent. of aromatic compounds, apparently homologues of naphthalene, a small quantity of a solid paraffin of m. pt. 52·5°—54° C. and mol. wt. 373·7 (intermediate between $C_{26}H_{54}$ and $C_{27}H_{56}$), and traces of pyridine bases. Benzene, naphthalene, anthracene, carbon bisulphide, and solid aromatic hydrocarbons were absent, as also were toluene and other homologues of benzene, except possibly in traces. The aqueous distillate from the coal contained hydrochloric acid and traces of ammonium chloride. The authors' results differ in many respects from those of Pictet and Bouvier (this J., 1913, 1098; 1914, 70), notably in the absence of phenols and solid paraffins from the tar obtained by the French authors. In the authors' experiments the mouth of the retort projected vertically downwards into the first condenser, so as to avoid thermal decomposition of the distillation products, and distillation was effected slowly during about 5 weeks, whereas Pictet and Bouvier completed a distillation in 5 hours. The authors have isolated paraffin wax (m. pt. 55°—59° C.) from several British coals by treating the extract obtained by the solvent action of pyridine and chloroform (this J., 1913, 969) with pentane. The possible ways in which the various distillation products are formed from the "resinous substances" of the coals are discussed.—A. S.

Lighting gas from coke ovens (*Westphalia*). L. D. Ford. North of England Institute of Mining and Mechanical Eng. Through Times Eng. Suppl., 1914, Feb. 18.

The plant erected in 1909, in addition to its other duties, such as feeding the boilers and gas-engines and making the usual by-products, supplies a Westphalian town of about 146,000 inhabitants with illuminating gas. A feature of interest is that the gas and ammonia are extracted from the gases whilst these are, comparatively speaking, still hot, by means of the Otto "direct" process. The coke ovens consist of two batteries of 50 ovens each, of the Otto-Hilgenstock under-burning regenerative type. The charge per oven is eight tons of uncompressed small coal. For heating the ovens the gas from the by-product plant is conveyed through a central main running underneath the entire battery, two small branch pipes being taken off the main directly under the walls of each oven and connected to nine Bunsen burners, which burn in vertical flues in each wall. The time taken for coking varies from 28 to 29 hours, each oven giving a 75 per cent. yield, or six tons of coke. Of the 50 ovens in each battery, 42 are discharged in 24 hours, and give an output of about 500 tons of coke per day. The yield of gas may be reckoned as 11,300 cb. ft. per ton of dry coke, or some 5,651,000 cb. ft. per 24 hours. Of the total gas, 50 per cent. is burned under the coke ovens, the surplus being divided in the following rough proportion :—Illuminating gas, 12 to 20 per cent.; power gas, 12 to 18 per cent.; and gas for heating boilers, 15 to 25 per cent. The town gas is supplied from one battery only, and in order to ensure good quality the following arrangement has been adopted :—When an oven has been filled, it is first coupled to the working-gas collecting main, which takes the products of distillation until the end of the second or third hour, after which the gas is switched over into the town gas collecting main, which draws the gas until the end of the 22nd or 23rd hour, when it is again taken by the working-gas collecting main until the coking is complete. Generally speaking, there are 20 to 25 ovens giving town gas at one time. With the present arrangement the largest number of ovens capable of yielding illuminating gas at one time, would be 30. The gas from the second battery is used entirely for working purposes—that is, for the by-product plant—for burning under the ovens and in the boilers, and for driving gas-engines, and needs only one collecting main. The town gas and working gas are thus entirely separate and require separate apparatus.

Patents.

Grape marc from the manufacture of wine ; Dry distillation of ——. M. Daza. Fr. Pat. 461,443, Aug. 18, 1913.

The marc is distilled in a closed vessel in order to obtain useful products such as charcoal, oils, ammonia and alcohol.—A. T. L.

Coal or other products ; Dry distillation of ——. B. Ludwig. Fr. Pat. 462,024, Aug. 30, 1913. Under Int. Conv., Sept. 2, 1912.

The coal is heated in small inclined retorts in thin layers which are renewed at frequent intervals. The coal is fed in through a vertical conduit near the upper end of the retort. After carbonisation, the coke is moved down the retort by a ram to a zone which is cooled by the circulation of air in flues around it, this air serving afterwards for combustion. From the cooling zone, the coke is discharged over a sill into a chamber common to a series of retorts, whence it can be removed in bulk. Gas outlets are provided both at the lower end and at the upper end of the distillation zone. The upper wall of the retort adjacent to the distillation zone is removable.—A. T. L.

Charcoal of great absorptive power ; Manufacture of active ——. J. von Kruszewski. Ger. Pat. 267,346, Oct. 13, 1912.

Wet peat is subjected for a long time to the action of alkaline substances (hydroxides or carbonates of potassium or sodium, or lime or baryta), and the mass, after further drying, is heated, with exclusion of air, until evolution of gas ceases. The resulting finely divided black powder is stated to be specially suitable for purifying and deodourising liquids and gases.—A. S.

Electric lamp filament containing cobalt ; Process of manufacturing an ——. C. Kanazawa, Tokyo, Japan. Eng Pat. 16,481, July 17, 1913. Under Int. Conv., July 17 1912.

See Fr. Pat. 460,093 of 1913 ; this J., 1914, 69.—T. F. B.

Zirconium lamp-filament. C. A. Hansen, Schenectady, N.Y., Assgnor to General Electric Co., New York. U.S. Pat. 1,084,629, Jan. 20, 1914.

See Eng. Pat. 5415 of 1908 ; this J., 1909, 83.—T. F. B.

Manufacturing wood gas and by-products. Eng. Pat. 13,929. *See* IIa.

Utilisation of esters of fatty acids [for carburetting, heating, lighting]. Fr. Pat. 461,520. *See* IIa.

Manufacture of active powdered charcoal [from refuse] for purifying and filtering purposes. Ger. Pat. 267,443. *See* XIXb.

III.—TAR AND TAR PRODUCTS.

Tars and heavy oils. Their use as fuels. Times Eng. Suppl., Feb. 4, 1914.

With the gradually increasing use of tar and the like as fuels, the necessary apparatus has been improved and burners can now be obtained capable of dealing not only with ordinary gas tar but also with lower-grade products such as Mond gas tar and carburetted water-gas tar. The burners work on the "air jet" or "steam jet" principle, the air or steam being delivered under pressure, whilst the fuel is subjected only to the hydrostatic pressure corresponding to the height of the overhead supply tank. When burners of the air jet type are used, the tar is preheated by means of a steam coil fitted to the supply tank and small steam pipes placed in the fuel services: any water which separates from the heated tar is run off. In an installation in a Liverpool gasworks in which three 500 h.p. boilers are fired by means of tar from air jet burners, the flow of tar is controlled by an ordinary wheel valve, and preheating is effected by a superheater in the waste-gas flue. The air, supplied at a pressure of about 3 lb. per sq. in., is divided into two currents. The primary air meets the preheated tar as it issues through the main control valve, and the two pass together down the central passage and around a helix which ensures thorough admixture and atomisation. The secondary air circulates through an annular chamber around the central passage and is discharged at the point where combustion takes place, whilst there is a third supply of air through the fire-bars or the hollow front of the furnace. The air supply is adjusted at the different points by sleeves operated by a rack and pinion. The air compressor is said to absorb no more than 3 per cent. of the steam raised. In the trials it is stated that the evaporative power of the tar was 14·65 lb. of water from and at 212° F. (100° C.), 84 per cent. of the heat being utilised. In burners of the steam jet type, the tar is superheated by the steam, and there is only one air supply, corresponding to the secondary air in the air-jet burners. The proper quantity of air can be easily judged from the "roar" of the fire and the character of the flame: the latter should be almost transparent and of an intense white colour ; with light oils the colour should approach a vivid pink. With the newer types of liquid-fuel burners, a change to ordinary coal firing can be carried out in a few minutes, with little or no loss in steam pressure, practically no alteration of the original grate being necessary. The chief difficulty in connection with Mond gas tar and carburetted water-gas tar is the high percentage of water they contain (60—70 per cent. in the case of Mond gas tar) : it may be overcome to some extent by burning the tar over a coke or coal fire sed for raising the steam in the first instance.—A. S.

Dimethyl-o-toluidine ; Preparation of pure ——. J. v. Braun and E. Aust. Ber., 1914, 47, 260—262.

MPURITIES which cannot be removed from dimethyl-o-toluidine by distillation are very easily got rid of by eating with formaldehyde and hydrochloric acid on he water-bath, making alkaline, washing, and fractionating *vacuo.* The dimethyl-*o*-toluidine is almost entirely unacted upon, whereas the para-isomeride is converted into a benzyl alcohol derivative and a carboxylic acid, the other impurities—dimethyl-*m*-toluidine and dimethylaniline—being converted into the corresponding benzyl alcohol or diphenylmethane derivatives, all products of very high boiling points.—J. B.

Composition of coal. [Tar obtained by distillation in a vacuum at low temperatures.] Jones and Wheeler. *See* IIb.

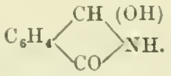
Patents.

Nitro compounds ; Process for the continuous reduction of ——. Chem. Fabr. vorm. Weiler-ter Meer. Fr. Pat. 462,006, Aug. 29, 1913. Under Int. Conv., Sept. 23, 1912.

Ferrous oxide and magnetic iron oxide are found to be excellent hydrogen-carriers when applied to the reduction of nitro-compounds, especially nitrobenzene. The process in question consists in mixing the nitro-compound in a state of vapour with hydrogen or a gas containing hydrogen, and passing the mixture over finely divided and heated ferrous oxide or magnetic oxide ; it is advisable to mix the iron oxide with an indifferent substance, such as asbestos or kieselguhr. The iron oxides are not reduced during the process.—T. F. B.

Phthalimide ; Process for preparing reduction products of ——. Kalle und Co. A.-G. Ger. Pat. 267,596, May 31, 1912.

Reduction of phthalimide by means of zinc dust and alkali hydroxide solution at the ordinary temperature gives rise to hydroxyphthalimidine,


$$C_6H_4\langle\begin{matrix}CH(OH)\\CO\end{matrix}\rangle NH.$$

When heat is applied to the reaction, the imino group is replaced by oxygen and the hydroxyl group by hydrogen, phthalide being produced.—T. F. B.

Polynitrocarbazoles and their N-alkyl derivatives ; Process for preparing ——. L. Cassella und Co. Ger. Pat. 268,173, Dec. 15, 1912.

Carbazole or an N-alkylcarbazole is sulphonated until products soluble in water are obtained ; the resulting polysulphonic acids are then treated with vigorous nitrating agents, whereupon the sulphonic groups are replaced by nitro groups. The products are suitable for use in the preparation of developers and of dyestuffs. —T. F. B.

Dianthraquinonylaminecarboxylic acids ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 268,219, Oct. 31, 1912.

A halogen-anthraquinonecarboxylic acid is heated with an aminoanthraquinone or an aminoanthraquinone-carboxylic acid with a halogen-anthraquinone in a solvent of high boiling-point, in presence of copper or a copper compound, or similar catalyst : an oxide or salt of an alkaline-earth metal is also added to combine with the hydrohalogen acid.—T. F. B.

Nitrogenous condensation products of the anthraquinone series ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 268,454, April 23, 1912.

1-Monoanthraquinonylamino-8-aminonaphthalene or one of its derivatives substituted in the anthraquinonyl nucleus, is heated either alone or in a high-boiling solvent. Similar products are obtained by heating 1-chloro-anthraquinone or its derivatives with 1.8-diaminonaphthalene in presence of a copper compound and a substance which combines with acid, in a high-boiling solvent.—T. F. B.

1.4-*Diaminoanthraquinone and its nucleus substitution products; Process for preparing sulphuric acid compounds of* ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,592, Oct. 3, 1912.

1.4-Diaminoanthraquinone or a nucleus-substitution product thereof is treated with fuming sulphuric acid until compounds insoluble in water but soluble in alkali are produced. The products are neither sulphates nor sulphonic acids, but have the characteristics of an acidyl derivative. They are probably of the formula, $C_{14}H_6O_2(N:SO_2)_2$. On heating with aqueous sulphuric acid the original diaminoanthraquinone is formed, whilst treatment with nitric acid and saponification gives 5-nitro-1.4-diaminoanthraquinone, and heating with caustic soda solution produces 4-amino-1.2-dihydroxyanthraquinone. —T. F. B.

2-*Dimethylamino-5-methylbenzyl alcohol; Process for preparing* ——. L. Cassella und Co. Ger. Pat. 268,486, Aug. 21, 1912.

Dimethyl-*p*-toluidine is converted into 2-dimethylamino-5-methylbenzyl alcohol by treatment with a considerable excess of formaldehyde in presence of a mineral acid. The product can be condensed to diphenylmethane derivatives by heating with a further quantity of dimethyl-*p*-toluidine or other tertiary aromatic base, to a high temperature in presence of zinc chloride.—T. F. B.

Sulphochlorides of phenolcarboxylic acids and of their derivatives; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,430, Aug. 13, 1913. Under Int. Conv., Aug. 13, 1912.

See Ger. Pat. 264,786 of 1912; this J., 1913, 1003.—T.F.B.

IV.—COLOURING MATTERS AND DYES.

p-Nitroso-N-phenylglycin and p-nitroso-N-phenylglycin-o-carboxylic acid. J. Houben. Ber., 1913, **46**, 3984—4000.

The author has obtained an 80 per cent. yield of nitrosophenylglycin by acting on phenylglycin directly with fuming hydrochloric acid and sodium nitrite. The *p*-nitrosophenylglycin forms a sparingly soluble brown powder, unstable, exploding when heated. The ammonium salt is green and more stable than the free acid. Condensation products (dyestuffs) are formed with α-naphthol (red-violet), *m*-toluylenediamine (blue), gallic acid (red violet), etc. By the new method N-methylphenylglycin gives no nitroso compound, nor does dimethylanthranilic ester; phenylglycin-*o*-carboxylic acid and its esters, however, give good yields. *p*-Nitrosophenylglycin-*o*-carboxylic acid is green; it gives a blue indophenol with β-naphthol and a blue-violet azine with *m*-toluylenediamine. (Compare Eng. Pat. 22,694 of 1913; this J., 1914, 70.)—J. B.

Methylethylaniline and p-nitrosomethylethylaniline and colouring matters therefrom. J. C. Cain and A. Coulthard. J. Soc. Dyers and Col., 1914, **30**, 48—50.

p-Nitrosomethylethylaniline behaves just like *p*-nitrosodimethylaniline in the synthesis of colouring matters. The analogues of Methyl Orange, Malachite Green, Crystal Violet, Auramine, Toluylene Blue, Neutral Red, α-Naphthol Blue, Gallocyanine, Meldola's Blue, Methylene Blue and Methylene Grey have been prepared. They approximate in shade to the ordinary products from dimethylaniline but generally the shade is moved nearer to the red end of the spectrum (*i.e.* the blues are greener, the oranges redder).—J. B.

Naphthoflavones and naphthothioflavones. S. Ruhemann. Ber., 1914, **47**, 119—125.

The naphthols and thionaphthols, in the form of their sodium compounds, react with phenylpropiolic ester to form cinnamic esters, just as do the phenols and thiophenols, although not so easily. These esters are very readily converted into the corresponding flavones and thioflavones. The naphthoflavones give fluorescent solutions in sulphuric acid like the benzene homologues; the naphthothioflavones also give weakly fluorescent solutions, a property which is lacking in the thioflavones of the benzene series.—J. B.

Patents.

Colouring matters of the benzanthrone series; Manufacture of —— *and dyeing and printing therewith.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 5248, March 1, 1913. Addition to Eng. Pat. 26,551, Nov. 19, 1912 (see this J., 1913, 1004).

The introduction of aldehyde groups into aminodibenzanthrones can be effected by treating a leuco compound of the aminodibenzanthrone with the aldehyde, or by the action of the aldehyde on an amino- or nitro-dibenzanthrone in presence of a reducing agent. Aldehyde hydrosulphites or sulphoxylates are especially suitable for use in this process, and if alkali is used during the reaction, the solution or mixture produced can be used directly in dyeing and printing. The process can also be carried out on nitro- or amino-dibenzanthrone compounds which have already been applied to the fibre. Fast maroon dyestuffs are obtained from nitrodibenzanthrone and sodium formaldehyde-sulphoxylate.—T. F. B.

Colouring matters of the anthracene series; Manufacture of compounds and ——. Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 22,836, Oct. 9. 1913. Under Int. Conv., Nov. 1, 1912.

Carbazole, or a homologue or a halogen derivative thereof, is treated with phthalic anhydride or a halogen derivative thereof in the presence of sulphuric acid. A mono- or diphthaloylcarbazole is probably formed. If a sulphonic acid group is present the product is an acid dyestuff; if no acid groups are present a vat dye. The shades obtained are generally yellow. (Compare this J., 1911, 738).—J. B.

Indigo and thioindigo dyestuffs in the colloidal condition. Badische Anilin und Soda Fabrik. Fr. Pat. 462,079, Sept. 2, 1913. Under Int. Conv., Nov. 2, 1912, and March 28, 1913.

See Ger. Pat. 265,536 of 1912; this J., 1913, 1101. Instead of the sulphite-cellulose lyes, there may be used aromatic sulphonic or carboxylic acids, especially benzylamine-sulphonic acids, or phenolsulphonic acids or their condensation products with formaldehyde, etc., or amorphous non-hydroxylated aromatic sulphonic acids soluble in water.—T. F. B.

3.6-*Diaminoacridine and its alkyl derivatives; Process for producing* ——. L. Cassella und Co. G. m. b. H First Addition, dated July 10, 1913, to Fr. Pat. 433,079, Oct. 18, 1910.

This addition is for the purpose of indicating severa typographical errors in the chief patent (see this J., 1912 120).—T. F. B.

Half-wool and half-silk dyestuffs; Manufacture of —— O. Imray, London. From Farbwerke vorm. Meiste Lucius, und Brüning, Hoechst a/M., Germany. Eng Pat. 13,236, June 7, 1913.

A tetrazo compound from *p*-phenylenediamine, benzidin tolidine or dianisidine, or a derivative or homolog thereof, is combined with 1 mol. of a mono- or di-sulphon acid of a naphthol, aminonaphthol or dihydroxynaphth lene, and with 1 mol. of an acidyl derivative of 1.5. or 2.5.7-aminonaphtholsulphonic acid. The dyestuffs a generally blue and dye only the cotton in mixed fabri —J. B.

o-Hydroxymonoazo dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Third Addition, dated July 25, 1913, to Fr. Pat. 361,649, July 26, 1905. Under Int. Conv., Oct. 16, 1912 (see U.S. Pat. 827,468 of 1906; this J., 1906, 922).

THE diazo derivative of picramic acid (2-amino-4.6-dinitrophenol) is combined with a monoalkyl ester of 1.8-dihydroxynaphthalene-4-sulphonic acid. The products dye unmordanted wool, in presence of bichromate and an acid, green shades fast to fulling and to light (see also Second Addition to this Patent; this J., 1913, 650).—T. F. B.

[Indigo] dyestuffs for wool; Process for preparing yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 267,384, Feb. 26, 1911.

THE yellow compounds obtained from indigo or 5.5′-dimethylindigo by treatment with benzoyl chloride, benzyl chloride, or benzotrichloride, are converted into yellow acid wool dyestuffs by heating with fuming sulphuric acid.—T. F. B.

Vat dyestuffs of the anthracene series; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 267,522, Aug. 23, 1912.

o-HALOGEN-DIANTHRIMIDES are converted into vat dyestuffs by treating with substances which eliminate hydrohalogen acids. For example, 2-bromo-1.1′-dianthrimide (obtained by boiling 2-bromo-1′-aminoanthraquinone with 1-chloroanthraquinone in amyl alcohol in presence of copper acetate and calcium acetate) gives an orange-yellow vat dyestuff.—T. F. B.

Vat dyestuff of the anthracene series; Process for preparing a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 267,833, Sept. 26, 1912.

1.1′-DIAMINO-2.2′-dianthraquinonyl is treated with an acid or neutral condensing agent. The product appears to be identical with that obtained from bromo-1.1′-dianthrimide according to Ger. Pat. 267,522 (see preceding abstract).—T. F. B.

Dyestuff of the anthracene series; Process for preparing a yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 267,546, Nov. 3, 1909.

A YELLOW vat dyestuff, which is applied in the same way as Flavanthrene, but dyes richer shades, is obtained by heating an ω-dihalogen-2-methylanthraquinone with copper.—T. F. B.

Disazo dyestuffs especially suitable for making lakes; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 461,644, Aug. 13, 1913. Under Int. Conv., Jan. 9, 1913.

THE tetrazo derivative of tetrachlorobenzidine $NH_2 : Cl : Cl = 1 : 2 : 5$) is combined with two mols. of 1-aryl-3-methyl-5-pyrazolone. The dyestuffs produce ellow to orange lakes, fast to light and insoluble in oil, nd yellower than those obtained from *o*-dichlorobenzidine. —T. F. B.

riphenylmethane dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 461,810, Aug. 26, 1913. Under Int. Conv., Aug. 30, 1912.

SULPHONIC acid of alkylated or arylated *m*-toluidine, or mixture of such sulphonic acids, is condensed with an omatic aldehyde which does not contain an alkylamino oup in the *p*-position to the aldehydic group, and the ico compounds are oxidised. Similarly, the unsulphoted amines may be condensed with the aldehydes, and products sulphonated before or after oxidation. llowish-green dyestuffs are produced which are much ter to fulling and to alkalis than the corresponding stuff from ethylbenzylanilinesulphonic acid.—T. F. B.

Disazo dyestuffs for wool; Process for preparing red ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,067, July 20, 1912.

A TETRAZO compound is combined on the one hand with one mol. of a monoalkyl-1.8-dihydroxynaphthalene-3.6-disulphonic acid, and on the other hand with a derivative of a β-ketone-aldehyde in which the aldehyde-hydrogen is replaced by an alkyl, aryl, alkoxy, or arylamino group, or with methylketol or its sulphonic acids, or with phenylmethylpyrazolone or its sulphonic, carboxylic, halogen, or nitro derivatives. The products dye red shades on wool fast to sulphuring.—T. F. B.

[Azo] dyestuffs capable of being developed; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,792, Dec. 28, 1912.

A DIAZO or diazo-azo compound is combined with 1.5-aminonaphthol or with its 6- or 7-sulphonic acid, and the product is diazotised and combined with a derivative of 2·5-aminonaphthol-7-sulphonic acid or its 1-substitution products which contain a diazotisable amino-group in a heteronuclear side-chain; as examples of these derivatives may be mentioned aminobenzoyl-2-amino-5-naphthol-7-sulphonic acid, aminophenyl-1.2 naphthiminazole-5-hydroxy-7-sulphonic acid, aminophenyl-1·2-naphthothiazole-5-hydroxy-7-sulphonic acid, etc. The products dye cotton blue-black to greenish-black shades, and can be diazotised on the fibre and developed with phenylmethylpyrazolone, acetoacetanilide, etc., to produce pure green shades very fast to light.—T. F. B.

Vat dyestuffs of the anthracene series; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,505, Jan. 22, 1913.

THE indazoles, obtained by eliminating the elements of water from *o*-diazo-methylanthraquinones, are treated with halogens or mixtures which evolve halogens. Vat dyestuffs are produced.—T. F. B.

Leucogallocyanines; Process for preparing blue to green ——. Farbwerke vorm. Durand, Huguenin und Co. Ger. Pat. 266,599, March 23, 1913. Addition to Ger. Pat. 167,805.

LEUCO-COMPOUNDS of gallocyanine dyestuffs are condensed with aromatic aldehydes to produce substances which dye blue to green shades on a chrome mordant.—T. F. B.

Vat [anthracene] dyestuffs; Process for preparing red-brown to brown ——. L. Cassella und Co. Ger. Pat. 267,416, Aug. 15, 1912. Addition to Ger. Pat. 267,414.

1.5-DIAMINOANTHRAQUINONE is condensed with benzoquinone and the product is treated with α- or β-chloroanthraquinone. The red-brown to brown dyestuffs thus produced give very fast, full shades in dyeing.—T. F. B.

[Azo] colouring matters capable of being further developed; Process of producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,386, July 16, 1913. Under Int. Conv., Dec. 27, 1912.

SEE Ger. Pat. 268,792 of 1912; preceding.—T. F. B.

Disazo dyestuffs for cotton; Manufacture of yellow ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 17,878, Aug. 5, 1913.

SEE Fr. Pat. 461,039 of 1913; this J., 1914, 19.—T. F. B.

Disazo dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 18,096, Aug. 8, 1913. Addition to Eng. Pat. 1730, Jan. 23, 1911.

SEE Fr. Pat. 461,644 of 1913; preceding.—T. F. B.

Monoazo dyestuffs especially suitable for making lakes [and for producing ice-colours]; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. First Addition, dated July 28, 1913, to Fr. Pat. 441,333, March 13, 1912. Under Int. Conv., March 10, 1913.

See Eng. Pat. 17,279 of 1913; this J., 1914, 73.—T. F. B.

Production of fast shades on vegetable fibres and dyestuffs therefor. Eng. Pat. 1436. *See* VI.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Manufacture of ethyl alcohol from sawdust. Junien. *See* XVIII.

Manufacture of nitrocellulose for collodion. Viscosity of collodions. Chandelon. *See* XXII.

Patents.

Cellulose; Bleaching of ——. F. W. Dobson, Tamworth, Staffs. Eng. Pat. 3801, Feb. 14, 1913. Addition to Eng. Pat. 3181, Feb. 8, 1911 (this J., 1912, 225).

In bleaching cellulose by the method of rotating it with concentrated bleach liquor in a closed vessel, the action may be accelerated by introducing air, chlorine or other suitable gas so that a pressure of about 10 lb. per sq. in. is attained. When chlorine gas is used the water placed in the vessel to saturate the pulp may be made alkaline and caused to absorb chlorine gas prior to bleaching under a pressure of gas.—J. F. B.

Artificial silk and the like thread; Machines for manufacturing ——. Soc. Anon. des Celluloses Planchon, Lyons, France. Eng. Pat. 13,360, June 9, 1913. Under Int. Conv., May 2, 1913.

Two sets of bobbins on parallel shafts are driven by means of friction wheels rotating on a sleeve of a central shaft; means are provided through tappets, cams and levers, whereby the central shaft is caused to rotate through an angle of 180° when the set of bobbins receiving the thread is filled up. Thus the set of empty bobbins on the other shaft takes the place of the previous one automatically and the guide levers are so arranged that the thread is gathered up by adhesion to the empty bobbins and broken off the full ones without the attention of the operator.—J. F. B.

Cellulose esters; Manufacture of products having a basis of ——. H. Dreyfus. Fr. Pat. 461,544, June 2, 1913. Under Int. Conv., May 27, 1913.

Nitrocellulose or esters of cellulose with fatty acids are combined in solution with glyceryl esters of aromatic carboxylic acids and the products are employed for all purposes where plastic cellulose derivatives are required. Example: Glyceryl monobenzoate is dissolved in acetone, tetrachloroethane or other suitable solvent of cellulose esters, together with an equal weight of cellulose acetate, and pliable films or coatings are obtained on evaporation of the solution. More rigid products are prepared by using smaller proportions of the glyceryl benzoate.—J. F. B.

Cellulose xanthate [viscose]; Manufacture of derivatives of ——. F. Petit. Fr. Pat. 461,900, Nov. 8, 1912.

For the preparation of brilliant products from viscose a coagulating bath is employed consisting of a concentrated saline solution, together with a quantity of acid regulated so as to produce at first a thread consisting of yellow xanthate, still soluble in water, which is gradually converted into cellulose by the action of the acid liquid. Examples: a solution containing 30 per cent. of sodium sulphate and 12 per cent. of commercial hydrochloric acid or a saturated solution of common salt containing 10 per cent. of acetic or formic acid.—J. F. B.

Viscose solution from wood cellulose; Manufacture of a [purified] ——. A. Bernstein. Fr. Pat. 462,147, Sept. 3, 1913. Under Int. Conv., Sept. 3, 1912.

The alkali-cellulose prepared from wood pulp is subjected to the action of carbon bisulphide in the usual manner. The product is then discharged into a vertical vessel with agitators and a conical bottom, the latter being provided with a grid and discharge-cock. In this vessel the crude xanthate is washed for a few minutes with water or with water slightly acidulated with acetic acid, and the liquid which absorbs the saline by-products and excess of carbon bisulphide, is discharged. The purified residue is then dissolved by the addition of an alkali.—J. F. B.

Cellulose formate solutions; Process for preparing ——. Internationale Celluloseester-Ges. m. b. H. Ger. Pats. 266,600 and 267,577, July 5, 1912, and Feb. 26, 1913.

(1) Solutions of the following compounds are used as solvents of cellulose formate:—Alkali iodides and bromides, calcium chloride, ammonium nitrate, alkaline-earth and metallic nitrates, cupric chloride, alkali xanthates, aniline salts, and alkali salts of aromatic mono- and polysulphonic acids. The solutions set to a jelly when cool, but become liquid again on warming. The cellulose formate can be separated from them by suitable precipitants. (2) Solutions of soluble bichromates are used as solvents; thus, 20 kilos. of cellulose formate can be completely dissolved in a solution of 30 kilos. of ammonium bichromate in 100 litres of water, preferably by aid of gentle heat. —T. F. B.

Plastic composition [from yeast and spent hops]. A. S. Quick, Assignor to M. Bartholomew, London. U.S. Pat. 1,084,900, Jan. 20, 1914.

A mass containing yeast in a condensed or semi-solid condition is thoroughly mixed with a smaller quantity of a textile fibre; the mixture is heated and the product shaped while hot. Ground spent hops may be added to the mixture; the fibres used should be sufficiently long to produce a felted mass.—J. F. B.

[Paper] Pulp; Method of preparing ——. C. Bache-Wüg, Berlin, N.H., Assignor to H. J. Chisholm, New York. U.S. Pat. 1,084,244, Jan. 13, 1914.

A stock suitable as a substitute for ground wood pulp is prepared from cellulose material such as straw or corn (maize) stalks by placing the material in a digester, withdrawing the air from it, forcing in a bleaching gas such as sulphur dioxide, then injecting a pulp-forming liquor such as sodium chloride solution and cooking the mass. —J. B.

Fibrous matter; Process for separating —— from admixtures. J. J. Werst, Delft, P. M. H. L. Collée, an J. M. Egmond, Rotterdam. U.S. Pat. 1,083,204 Dec. 30, 1913.

See Fr. Pat. 449,059 of 1912; this J., 1913, 482.—T. F. B

Cellulose and other substances of which it forms the essenti part; Process and apparatus for the electrical treatme of ——. A. L. C. Nodon, Bordeaux, France. Eng Pat. 6668, March 18, 1913. Under Int. Conv., March 2 1912.

See Fr. Pat. 453,111 of 1912; this J., 1913, 785.—T. F.

Celluloid, acetylcellulose, and analogous substances; Proce for cleaning or renovating objects of ——. A. Püsch Fr. Pat. 461,121, Aug. 5, 1913.

See Eng. Pat. 18,105 of 1913; this J., 1914, 20.—T. F.

Production of solvents [of nitrocellulose] by means of halog compounds. U.S. Pat. 1,082,543. *See* XX.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Dyeing ; The theory of ——. I. W. D. Bancroft. J. Phys. Chem., 1914, 18, 1—25.

The author discusses the experimental data available and concludes that it is sufficient to establish the outlines of a satisfactory theory of dyeing if the single postulate be accepted that a fibre tends to adsorb everything in the dye solution in amounts varying with the nature, concentration, and temperature of the solution and with the nature of the fibre. In the present paper the data available in regard to dyeing with acid dyes are discussed in relation to this postulate, and it is shown that in the case of acid dyes it may be deduced that the dye will be most readily taken up in an acid solution, but may be taken up in a neutral or alkaline solution ; also that a readily adsorbed anion will decrease and a readily adsorbed cation increase the amount of dye taken up. The paper of Hallitt on "The Theory of the Acid Dye-bath" (this J., 1899, 368) is discussed in detail in relation to the adsorption theory. —A. S.

Basic dyestuffs ; The fixation of —— by means of naphthols. J. Niagavi. Rev. Gén. Mat. Col., 1914, 18, 33.

The process consists in fixing a naphthol or naphtholsulphonic acid on vegetable fibres by steaming, a compound being produced which has a chemical affinity for basic dyestuffs like that of tannin, and which also has the property of fixing dyestuffs mechanically like albumin, casein, etc. The presence of a catalyst is necessary for the formation of the lake, a wide variety of inorganic compounds being suitable. The shades are brighter than those produced on a tannin-antimony mordant.—J. B.

Colour measurement and nomenclature ; The industrial applicability of the various systems of ——. P. Krais. Z. angew. Chem., 1914, 27, 25—37.

The author examines the possibility of establishing a standard system of colour value nomenclature, and comes to the conclusion that only a compromise can be achieved on account of such difficulties as the practical impossibility of obtaining pure spectrum standards, the variations in light from different sources, the difficulty of comparing a lithographed colour scale with textile materials, for example, if it is necessary to judge the appearance of a shade "overhand," etc. The various schemes that have been devised (by Radde, Langhein, K. Mayer, Kallab, Arons, Klemperer, Lovibond, Baumann and Rosenstiehl) are described and criticised, and the author discusses his experiences with the three main types of apparatus—the pigment colour scale, the light-filter apparatus and the rotating disc apparatus. Yellow, on account of the difficulty in measuring its strength, is always an obstacle. Baumann's scale is finally recommended as a practical basis for the measurement of colour values, in spite of its complicated nomenclature and the difficulty of securing absolute regularity in commercial pigments.—J. B.

Patents.

Lixiviating, acidifying and washing wool ; Pump worked by compressed air for machines for ——. F. Bernhardt Maschinenfabrik und Eisengiesserei. Fr. Pat. 462,166, Sept. 3, 1913. Under Int. Conv., June 11, 1913.

A reciprocating current of compressed air is used for orcing liquids from a lower to a higher level in wool washng, etc., machines, whereby metallic corrosion usually sociated with rotary and other pumps, is avoided.—J. B.

leaching, dyeing, washing, etc., hanks ; Apparatus for ——. Courtaulds Ltd., and J. Clayton, Coventry. Eng. Pat. 9067, April 17, 1913.

HE yarn rods are supported on rails which are alternately ised, moved forward, lowered and moved back to their rmer position. The yarn rods are also caused to revolve, st in one direction, then in the other, by rollers on which they rest. The working parts of the machine are enclosed in casings inside of which a pressure of air is maintained in order to prevent the entrance of the bleaching or other corrosive liquor.—J. B.

Fast shades on vegetable fibres ; Production of —— and dyestuffs therefor. H. Levinstein, J. Baddiley and Levinstein, Ltd., Manchester. Eng. Pat. 1436, Jan. 17, 1913.

Dyestuffs of the general formula, $R.N_2.D.N_2.M.N_2.R$, in which R represents resorcinol, D the residue of a diamino capable of giving substantive dyestuffs, and M the residue of an aminonaphtholsulphonic acid containing an extra-nuclear diazotisable amino-group, are claimed. Bright shades are produced on vegetable fibres which on after-treating with formaldehyde become fast to boiling soap. For example, the tetrazo-compound from *m*-azoxytoluidine combined with one mol. of *m*-aminobenzoyl-1-amino-8-naphthol-3-6-disulphonic acid, re-diazotised and combined with two mols. of resorcinol gives a red.—J. B.

Dyeing machines. W. Furness, Greetland. Eng. Pat. 1688, Jan. 21, 1913.

In order to allow of their ready removal, the rollers in hawking machines, such as are used for indigo vats, are mounted in the frame in open slots, the stripper-blades being mounted on beams parallel to the rollers and so disposed as not to prevent the removal of the latter.—J. B.

Dyeing and otherwise treating textile fibres or fabrics ; Apparatus for ——. W. and J. A. Cock, Huddersfield. Eng. Pat. 22,185, Oct. 2, 1913.

The dye-vat has a false bottom and a vertical circulating pipe, open at both ends. The circulation is effected by means of steam which enters through a pipe brought down inside the circulating pipe. On emerging from this pipe the steam impinges on a dish having a central mound, whence it is reflected up through a horizontal grating into the circulating pipe. The top of the circulating pipe is fitted with a dome-shaped deflecting plate.—J. B.

Charges for dye-vats ; Apparatus for forming and preparing ——. J. T. Psarski, Cleveland, Ohio. U.S. Pat. 1,083,410, Jan. 6, 1914.

The material is compressed by means of a weighted lid and the admission of steam in a cylinder which telescopes into the mouth of a cylindrical dye-vat, and which has for a temporary bottom the false bottom of the dye-vat. —J. B.

Dyeing on bobbins ; Apparatus for ——. Textilmaschinenfabrik B. Cohnen. Fr. Pat. 461,251, Aug. 11, 1913.

The blocks of wood on which the small bobbins are wound are displaced by perforated dyeing tubes, each tube being slightly enlarged at its lower end. The bobbins are then slipped on to the longer perforated spindles of the dyeing machine, one above another, each tube fitting into the enlarged portion of the one above it.—J. B.

Naphthazarin derivatives ; Dyeing or printing with ——. O. Imray, London. From Soc. of Chem. Industry in Basle, Switzerland. Eng. Pat. 12,790, June 2, 1913.

Certain condensation products of naphthazarin are dyed or printed on vegetable fibres in the form of their leuco-compounds, after the manner of vat dyestuffs. Greys, browns and various shades of black are produced, which are improved in fastness on after-treating with metallic salts. Suitable condensation products are obtained (1) by condensing naphthazarin or its derivatives with substances containing one or more primary, secondary or tertiary amino-groups ; or (2) by heating naphthazarin or its derivatives or the products obtained as described under (1) in solution or suspension in a diluent with or without the addition of alkali, a sulphide or the like.—J. B.

Solutions for bleaching and other like purposes; Electrolytic apparatus for making ——. C. A. M. Buckley. Fr. Pat. 461,666, Aug. 21, 1913.

See Eng. Pat. 18,600 of 1912; this J., 1913, 1007.—T. F. B.

Dyeing skins, hairs, feathers, and the like; Process for ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 10,293, May 1, 1913. Under Int. Conv., Oct. 19, 1912. Addition to Eng. Pat. 20,926, March 19, 1912.

See Ger. Pat. 262,692 of 1912; this J., 1913, 941.—T. F. B.

Fast dyeings on the fibre; Process for producing ——. L. Cassella und Co. G.m.b.H. Fr. Pat. 461,747, Nov. 5, 1912.

See Eng. Pat. 25,897 of 1912; this J., 1913, 1007.—T. F. B.

Dyeing machine. The Psarski Dyeing Machine Co. Fr. Pat. 461,857, Aug. 8, 1913.

See Eng. Pat. 18,303 of 1913; this J., 1914, 73.—T. F. B.

Manufacture of colouring matters of the benzanthrone series and dyeing and printing therewith. Eng. Pat. 5248. *See* IV.

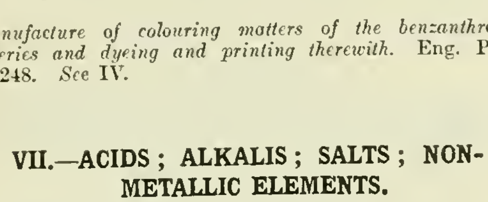
VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid free from nitric acid and oxides of nitrogen; Preparation of ——. A. Grégoire. Bull. Soc. Chim. Belg., 1914, **28**, 32—33.

The sulphuric acid to be purified is diluted in a Kjeldahl flask with its own volume of water and concentrated by boiling. If traces of nitrous compounds still remain, the process is repeated.—O. E. M.

Electrolytic chlorine at Mount Morgan, Queensland. B. Du Faur. Trans. Australasian Inst. Min. Eng., 1911, **15**, 375—389.

The installation comprises 20 cells, each of which (see fig.) is divided into three compartments by means of two perforated sheets of iron (*b*) bolted to the bottom and ends; the two asbestos diaphragms (c), upon the inside walls, extend to the bottom of the cell, the anode compartment thus formed being covered at the bottom and each end with cement 1 in. thick. The diaphragms extend upwards to (*d*) and are held in position by the earthenware cover (*e*) of the cell, the space between them and the latter being filled with cement. The upper part (*f*) of the cover is removable for the purpose of renewing the anodes, but while the cell is in use is rendered gas-tight by means of pitch. The anodes (*a*) are of Acheson graphite, the holders being composed of an alloy of Pb 80 and Sb 20 per cent. For the purpose of indicating the level of the solution in the anode compartment, the latter is connected with the glazed earthenware pot (*g*) by means of the ebonite pipe (*k*). The electrolyte is a solution of common salt from which lime and magnesia have been separated by precipitation with a mixture of sodium carbonate and hydroxide (in calculated quantities) followed by settling, decantation of the clear solution, and filtration of the sludge. The purified solution from the storage tank drips into the anode compartment of each cell, through a funnel, the chlorine evolved being drawn off by suitable means and the anode liquor returned to the dissolving tank; the cathode solution, the sodium hydroxide content of which is not allowed to exceed 8 per cent., is periodically withdrawn and either run to waste or evaporated for the recovery of sodium chloride. The cells are connected in series and a current of 350 amp. is employed, the voltage necessary being 88 when the anodes are new and 98 when fresh ones are required (6 months later). The chlorine production over a period of 6 months was 312·48 lb. per 24 hours; and the consumption of sodium chloride 3 lb., or 1·67 lb., per lb. of chlorine obtained, according as the sodium chloride was extracted from the cathode liquors or not. The mean power consumption by the cells was 2·5 electrical-horse-power-hours per lb. of chlorine produced, the electrical current efficiency being 63·72 per cent. and the energy efficiency 49·24 per cent. On the basis of salt consumption per lb. of chlorine produced, the efficiency of the plant was 55 or 98 per cent. according to the disposition of the cathode liquors.—W. E. F. P.



Polysulphides of the alkali metals. I. Polysulphides of sodium. A. Rule and J. S. Thomas. Chem. Soc. Trans., 1914, **105**, 177—189.

Sulphur reacts readily with sodium hydrosulphide in alcoholic solution with the evolution of hydrogen sulphide and formation of polysulphides. The authors have used quantities of sulphur corresponding to di-, tri-, tetra-, penta-, and hexa-sulphides, and concentrated the solution in each case to obtain a solid product. Only in the case of the tetrasulphide proportion was the product homogeneous, when it was pure anhydrous tetrasulphide crystallising in cubes and having a yellowish colour. The crystals melted at about 267° C. and were readily soluble in water, but the solution soon became cloudy. The other proportions gave mixtures of tetrasulphide with unchanged hydrosulphide or with sulphur, although there was some indication of the formation of a higher sulphide when much sulphur was used. The course of the reaction was followed in each case by measuring the amount of hydrogen sulphide evolved, which also gave an idea of the nature of the substances in solution. By reducing solutions of the tetrasulphide with metallic sodium the anhydrous disulphide was obtained as a bright yellow crystalline powder, not so soluble in alcohol as the tetrasulphide.—W. H. P.

Persulphates; Action of —— *on acetates.* M. A. Gordon. J. Phys. Chem., 1914, **18**, 55—66.

Acetic acid is decomposed in two ways by persulphate, being, on the one hand, oxidised, with formation of ethane, olefines, carbon dioxide, water, and other products, and on the other hand, decomposed into methane and carbon dioxide, the persulphate acting catalytically. That persulphate itself is the catalyst in this second mode of decomposition is shown by the facts that probable impuritie when tested had no such action and that the action ceased when the persulphate was destroyed. The oxidation of th acetic acid is promoted by conditions favouring th decomposition of persulphate (*e.g.*, high concentratio of persulphate, high temperature, moderate acidity presence of manganous sulphate or platinum foil), provide they are not carried to excess: in presence of an excessiv quantity of sulphuric acid, the persulphate is decompose at high temperatures with liberation of oxygen, and oxida tion of the acetic acid is diminished. The catalyt decomposition of acetic acid into methane and carbo dioxide is promoted by high concentration of acetic aci low acidity (obtained by addition of sodium acetate reduce the dissociation of the acetic acid) and low co centration of persulphate.—A. S.

Peroxides. S. Tanatar. Ber., 1914, **47**, 87—89.

The author controverts some results obtained by Tuba and Riedel (this J., 1911, 1210). A solution of nic peroxide in dilute sulphuric acid contains hydrogen peroxi and not merely persulphuric acid. Nickel peroxi dissolved in hydrocyanic acid in presence of potassi cyanide yields larger quantities of hydrogen peroxide, but other nickel compounds, if free from cobalt, do not give the reaction.—J. R.

Silicic acid gel; Action of hydrogen peroxide on ——. A. Komarowsky. Chem.-Zeit., 1914, **38**, 121—122.

By evaporating silicic acid gel with a slight excess of 30 per cent. hydrogen peroxide to dryness on the water-bath, or over sulphuric acid, a glassy amorphous mass is obtained containing 12·6 per cent. of active oxygen, 50·6 per cent. SiO_2 and 36·8 per cent. H_2O. On keeping it gradually loses oxygen in the form of ozone and also water. It liberates chlorine from hydrochloric acid and iodine from potassium iodide, decolourises permanganate, evolves ozone on treatment with concentrated sulphuric acid; and must be regarded as either a persilicic acid or a perhydrogel of silicic acid in which part of the water has been replaced by hydrogen peroxide.—A. S.

Cupric oxide jellies. L. S. Finch. J. Phys. Chem., 1914, **18**, 26—33.

The author confirms Foerster's statement (Ber., 1892, 25, 3416) that copper ammonium acetate, on treatment with water, yields a blue jelly, which, however, is not permanent. Similar jellies, some of which were of a more permanent character, were prepared in various ways, the best results being obtained by adding 4 drops of concentrated sulphuric acid to 50 c.c. of a saturated solution of copper acetate and then adding 3—4 c.c. of dilute ammonia (1 : 1). The jelly dried to a powder when exposed to the air, but on shaking with water a solution was obtained which again set to a jelly, and this sequence of operations could apparently be repeated indefinitely. Good results were also obtained by using potassium sulphate in place of sulphuric acid.—A. S.

Magnesium chloride as mineraliser, and a contribution to the spectrochemistry of the rare earths. K. A. Hofmann and K. Höschele. Ber., 1914, **47**, 238—247.

Anhydrous magnesium chloride melts at 708° C. to a mobile liquid which is stated to be an excellent solvent and crystallising medium for many metallic oxides. In some cases it reacts with the oxides, and especially with sulphates, with formation of volatile chlorides, *e.g.* of beryllium, zinc, iron, and tin. In other cases spinel-like magnesium compounds are formed, probably as the result of decomposition of the magnesium chloride by water vapour from the heating flame or by atmospheric oxygen. Such decomposition must always be taken into consideration, as large octahedra of magnesia are formed which remain admixed with the reaction product; and the crucible may be attacked by hydrochloric acid or chlorine. For example on melting magnesium chloride in an open platinum crucible, aggregates of hexagonal platinum crystals are gradually formed; in a gold crucible, regular crystals of gold; in silver, crystals of silver chloride, and in copper, crystals of cuprite (Cu_2O) are produced. There is, however, little action on porcelain crucibles or on covered platinum crucibles. By heating iron filings, anhydrous ferrous sulphate, or ferric oxide with fused magnesium chloride, according to the conditions crystalline products ranging from magnesium ferrite, $(FeO_2)_2Mg$, to ferrosoferric oxide $(FeO_2)_4Fe$, may be obtained, all of which are strongly magnetic. Other compounds which may be prepared in this way in the form of crystals are magnesium orthoborate from hydrated boric acid, magnesium uranate from uranic acid, cerium dioxide, praseodymium oxide and zirconium dioxide from the corresponding sulphates, and the oxychlorides of erbium neodymium, praseodymium, and samarium from the corresponding sulphates.—A. S.

Uranyl nitrate; Question of the liability of —— to explode. W. Eichhorn. Chem.-Zeit., 1914, **38**, 139.

A sample of Merck's uranyl nitrate, $UO_2(NO_3)_2.6H_2O$, showed triboluminescence phenomena, but gave no indications of exploding when shaken in a flask, as in the case of the samples examined by Iwanow (this J., 1912, 362) and by Andrews (Chem.-Zeit., 1912, 1463). By extracting a concentrated aqueous solution of the salt with ether a product was obtained containing 53·92 per cent. UO_2 and 24·83 per cent. NO_3. On exposing the product to the air rapid absorption of water took place, and it is probable that this is a factor in causing explosion phenomena.—C. A. M.

Carbon dioxide and monoxide dissolved under pressure; Electrolytic reduction of ——. F. Fischer and O. Prziza. Ber., 1914, **47**, 256—260.

Experiments were made with an apparatus similar to that used previously (this J., 1913, 362) for the electrolytic reduction of dissolved oxygen. Using solutions of potassium, sodium, or lithium sulphate saturated with carbon dioxide as electrolyte, and copper coated with zinc and then amalgamated as electrodes, the carbon dioxide was reduced to formic acid even at comparatively high current densities (10—15 ampères per sq. dcm.). For short periods (10 mins.) the current yield was almost quantitative, but high concentrations could not be obtained, owing to migration of the formic anion to the anode. The maximum concentration of formic acid attained was 17·6 grms. of potassium formate in 100 c.c., the current density being 6 ampères per sq. dcm., the current yield 49 per cent., and the pressure nearly 50 atmospheres. Carbon monoxide dissolved under pressure was reduced, in very small quantities, to methyl alcohol, when low current densities were used; no methane was formed.—A. S.

Reactions in non-aqueous solutions. VI. In acetonitrile. A. Naumann. Ber., 1914, **47**, 247—256. (See also this J., 1909, 1195; 1910, 349.)

The solvent was prepared by leaving commercial acetonitrile (contaminated by acetamide) in contact with phosphorus pentoxide in a closed vessel for 3—4 weeks, then distilling, and collecting the fraction boiling at 81·6° C. At 18° C. 1 grm. of acetonitrile dissolved 0·0161 grm. $CuCl_2$, 0·2443 grm. $CuBr_2$, about 0·1333 grm. Cu_2Cl_2, about 0·0386 grm. Cu_2Br_2, 0·0352 grm. Cu_2I_2, 0·1131 grm. KSCN, 0·0752 grm. NH_4SCN, 0·0408 grm. $CoCl_2$, at least 2·9 grms. $AgNO_3$, and 0·0958 grm. $Hg(CN)_2$ respectively. In addition to the salts mentioned, ammonium bromide and calcium nitrate were very sparingly soluble, ammonium nitrate, mercuric and bismuth iodides were slightly soluble, sodium and potassium iodides, sodium thiocyanate, potassium permanganate, aluminium, cadmium and tin chlorides, cobalt, mercuric, cadmium and bismuth bromides were soluble, and lithium, ferric and ferrous bromides, zinc, ferric, ferrous, mercuric and bismuth chlorides, cadmium iodide, chlorine, bromine, iodine, hydrochloric, hydrobromic and hydriodic acids, ammonia, hydrogen sulphide, and sulphur dioxide were easily soluble in acetonitrile. Many of the salts formed addition compounds with the solvent. The reactions of the dissolved substances were studied and are described in detail.—A. S.

The system, sulphur dioxide-camphor. Bellucci and Grassi. *See* XX.

Carbon bisulphide as a laboratory solvent. Vlies. *See* XXIII.

Patents.

Water spray or steam injected into sulphuric acid chambers: Device for regulating, according to the density of the acid in the chambers, the ——. L. Santa. Fr. Pat. 461,641, Aug. 13, 1913. Under Int. Conv., Feb. 7, 1913.

Part of the acid condensing on the walls of the chamber is led into a gutter and thence into a receptacle mounted on one end of a counterpoised lever, connected with clockwork mechanism, by which the movement of the valve controlling the supply of water to the spraying devices is operated. When the density of the acid falls below a certain limit, the acid in the receptacle is not sufficiently heavy to operate the lever, the clockwork is prevented from working, and the supply of water is cut off.—A. S.

Lead chamber for sulphuric acid manufacture. H. Ising. Ger. Pat. 267,513, Feb. 7, 1913.

The walls of the chamber are provided with superposed ledges of such form and width that the acid drops from them directly on to the floor of the chamber. In this way the area of the walls coming directly into contact with the liquid acid is diminished.—A. S.

Nitric acid; Manufacture of —— from nitrates and sulphuric acid. C. Uebel. Fr. Pat. 461,452, Aug. 18, 1913. Under Int. Conv., March 11, 1913.

Sulphuric acid and half the usual charge of nitrate are introduced gradually into a retort which is heated to about 140° C., whereby nitric acid vapour of high concentration is evolved. When the nitrate is completely decomposed, the temperature is raised to 160°—170° C., and the other half of the charge of nitrate is introduced gradually; the acid vapours liberated during this stage of the process are still of a high degree of concentration, though yielding a weaker acid than those from the first stage. The residue is next transferred to another retort in which it is heated to about 250° C. to expel water and the last traces of nitric acid.—A. S.

Nitrous gases; Process for the absorption of ——. Dynamit-A.-G. vorm. A. Nobel und Co. Ger. Pat. 267,874, Nov. 27, 1912.

The claim is for the use of fatty acid esters of alcohols, *e.g.*, amyl acetate, as absorbents. At the ordinary temperature amyl acetate will absorb about 20 per cent. of its weight of nitrogen oxides, and these can be subsequently recovered by passing a current of air or other gas through the liquid and warming or by treatment with water.—A. S.

Phosphoric acid; Process of manufacturing ——. F. Brunschwig, Brooklyn, N.Y. U.S. Pat. 1,083,429, Jan. 6, 1914.

Ground material containing calcium phosphate is treated with sufficient sulphuric acid to render the mass fluid whilst in a state of agitation, and the reaction is stopped before impurities go into solution, the quantity of acid used being such as to allow the calcium phosphate to remain in excess up to 20 per cent.—O. R.

Formates and the like; Process of producing ——. J. E. Bucher, Coventry, R.I. U.S. Pat. 1,083,589, Jan. 6, 1914.

A cyanogen compound of a light metal, especially the cyanide, is vigorously hydrolysed in the presence of the hydroxide of the same metal, at the boiling point of the mixture, with the rapid formation of a carboxylate, especially the corresponding formate.—O. R.

Lead solutions; Process of producing ——, from lead ore. Process of producing lead nitrate solutions. S. W. Anderson and G. C. Kaar, Spokane, Wash. U.S. Pats. 1,083,910 and 1,083,911, Jan. 13, 1914.

Crude lead sulphide is digested with dilute nitric acid (7 per cent. strength) containing an alkali nitrate, and the solution purified by the addition of successive small quantities of an alkali. Iron is eliminated from the solution by first heating the latter with sufficient sodium carbonate to precipitate the greater part of this impurity, and then with that necessary to precipitate the remainder. —W. E. F. P.

Sodium bisulphite; Process of making solid ——. H. Howard, Boston, Mass. U.S. Pat. 1,084,436, Jan. 13, 1914.

Sodium bisulphite solution is exactly neutralised with sodium carbonate, so as to obtain solid sodium sulphite suspended in a solution of the same; by the action of sulphur dioxide, both the suspended and the dissolved sulphite are converted into bisulphite, the solid bisulphite is separated, the residual liquor is neutralised, and the procedure is repeated.—O. R.

Sodium fluoride and aluminium fluoride; Manufacture of a double compound of ——. Humann und Teisler. Fr. Pat. 461,181, Aug. 7, 1913.

The double compound, $6NaF,2Al_2F_6$, is obtained by the interaction of 3 mols. of sodium silicofluoride and 2 mols. of alumina. 2·8 kilos. of sodium silicofluoride suspended in 1—1·5 litres of water is heated to 40° C. and 1·6 kilos. of aluminium hydroxide suspended in 1·5 litres of water and also heated to 40° C., is added with vigorous agitation. The product, although it contains about 20 per cent. of silica, is readily fusible and may be used directly as a clouding agent for enamels and opal glass. (See also Fr. Pat. 458,750; this J., 1913, 1067.)—A. S.

Basic insoluble carbonates [basic magnesium carbonate and white lead]; Manufacture of —— and of their transformation products. Chem. Fabr. Rähnitz Ges. m. b. H. Fr. Pat. 461,397, Aug. 14, 1913. Under Int. Conv., Aug. 15, 1912.

Basic carbonates, especially those of magnesium and lead, are prepared by precipitating a solution of a soluble salt of the metal, with a mixture of a carbonate and a soluble hydroxide. More or less voluminous precipitates are obtained according to the relative proportions of carbonate and hydroxide used and the temperature of precipitation.—A. S.

Tartaric acid; Treatment of materials containing —— for the extraction of calcium and potassium tartrates. T. Gladysz. Fr. Pat. 461,901, Nov. 8, 1912.

Wine lees from which calcium and potassium tartrates cannot readily be extracted ("gummy lees") are first heated in suitable vessels and subjected to the action of almost anhydrous hydrochloric acid gas at about 130° C. This treatment greatly facilitates the subsequent extraction of the tartrates.—J. H. L.

Chlorate solutions; Process for activating ——. K. Hofmann. Ger. Pat. 267,906, Nov. 20, 1912.

Osmium or a compound of the same, especially osmium tetroxide, is added to a neutral or acid solution of the chlorate. (See also this J., 1913, 46, 697, 977.)—A. S.

Cyanogen or hydrogen cyanide; Production of gases containing —— from gaseous mixtures containing carbon, hydrogen, and nitrogen, in the electric arc. Konsortium für Elektrochemische Industrie Ges. m. b. H. Ger. Pat. 268,277, July 1, 1911. Addition to Ger. Pat. 263,692 (this J., 1913, 1067).

The yield is increased by introducing into the arc the vapours of metals or metallic compounds (*e.g.* copper or iron or their salts), capable of exercising a favourable catalytic effect on the reaction.—A. S.

Hydrogen peroxide; Process of producing ——. A. Pietzsch and G. Adolph, Hoellriegelskreuth, Germany U.S. Pat. 1,083,888, Jan. 6, 1914.

A mixture of a persulphate and sulphuric acid is subjecte to the action of steam, with the formation of hydroge peroxide vapour.—O. R.

Graphitising carbon; Apparatus for ——. P. L. Héroult, New York, Assignor to Electrode Co. America, Niagara Falls, N.Y. U.S Pat. 1,084,27 Jan. 13, 1914.

A vertical, tubular graphitising chamber is construct of a series of horizontal, removable, brickwork rings, that the height of the chamber can be regulated at wi Electrodes are disposed at the top and near the botto of the chamber, and the latter is surmounted by a tubul heating chamber, the lower end of which forms a dire extension of the graphitising chamber, the gases from t latter thus passing through the mass of material descending from the heating to the graphitising chamber. —O. R.

Ores of manganese and of iron and manganese ; Use of natural —— in contact processes [e.g., for the production of hydrogen]. A. Messerschmitt. Fr. Pat. 461,480. Aug. 19, 1913. Under Int. Conv., Jan. 10, 1913.

Natural ores of manganese or of manganese and iron are used as contact materials for the production of hydrogen by the alternate action thereon of reducing gases and steam. It is stated that hydrogen is obtained in good yields at 700°—800° C., about 200° C. lower than the temperatures required when spongy iron is used as contact material.—A. S.

Reducing agents ; Manufacture of stable —— from rapidly oxidising substances, such as sodium, potassium, calcium, phosphorus, and the like. P. Goldstein. Ger. Pat. 268,657, Dec. 24, 1912.

Easily oxidisable substances, such as those mentioned in the title, are incorporated with porous materials. Metallic sodium, for example, in long filaments, is incorporated with kieselguhr and heated to about 100° C. with exclusion of air or in an atmosphere of nitrogen. The product, it is stated, is not affected by exposure to air. Metallic oxides which are to be reduced, or metals to be protected from oxidation, may also be incorporated with the porous material.—A. S.

Nitrous gases or vapours ; Process for the absorption of ——. A. T. Schloesing, Paris. Eng. Pat. 22,119 Oct. 1, 1913. Under Int. Conv., Oct. 2, 1912.

See Fr. Pat. 460,328 of 1912 ; this J., 1914, 23.—T. F. B.

Nitric acid ; Process for concentrating aqueous ——. H. Pauling. Fr. Pat. 461,326. Aug. 11, 1913. Under Int. Conv., Aug. 24, 1912.

See U.S. Pat. 1,074,287 of 1913 ; this J., 1913, 1009.—T. F. B.

Sulphuric acid ; Process for concentrating —— by preliminary and final concentrations. A. Zanner. Fr. Pat. 462,016, Aug. 30, 1913. Under Int. Conv., Aug. 30, 1912.

See Ger. Pat. 260,655 of 1912 ; this J., 1913, 751.—T. F. B.

Hydrogen : Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 461,621, Aug. 4, 1913. Under Int. Conv., Sept. 7, 1912.

See Eng. Pat. 2096 of 1913 ; this J., 1913, 1156.—T. F. B.

Cooling producer gas and simultaneously manufacturing salt by the evaporation of brine. Eng. Pat. 2728. *See* IIa.

Preparing metals and metal oxides in a minutely divided form. Eng. Pat. 5212. *See* X.

Electrolytic processes and apparatus, particularly applicable to the production of alkali compounds. Eng. Pat. 1935. *See* XI.

VIII.—GLASS ; CERAMICS.

elenium as colouring agent in soda-lime silicate glasses. P. Fenaroli. Chem.-Zeit., 1914, **38**, 177—180.

was shown previously (this J., 1912, 1033) that in estnut-brown selenium glasses the colour is due to lyselenides. Ultramicroscopic examination has now own that in pink glasses, which always contain some tash, the colour is due to elementary colloidal selenium. e colour is affected by a more protracted cooling, uch causes some opacity through the formation of lenites and selenides ; opalescent selenium glasses are oduced in this way. Red colloidal selenium particles have a magnitude less than 40 $\mu\mu$. The colloidal solution has the same properties as other selenium-sols. These glasses exhibit great analogy to boron-selenium ultramarine. The absorption spectrum of colloidal selenium solutions varies from red to yellow according to the size of the sub-microns.—H. H. S.

China clay ; Temperature at which the combined water in —— is expelled. W. Thomson. J. Soc. Dyers and Col., 1914, **30**, 45—46.

Ordinary China clay contains usually about 10 to 16 per cent. H_2O which can be expelled at steam-oven temperature (about 104° C.). On heating to redness a further loss takes place of about 12 per cent. on the dry clay ; this water is held very tenaciously for none of it is given up during an hour's heating at 560° F. (293° C.). The character of the substance is entirely changed by the loss of this combined water.—J. B.

Patent.

Manufacture of a double compound of sodium fluoride and aluminium fluoride. Fr. Pat. 461,181. *See* VII.

IX.—BUILDING MATERIALS.

Portland cement ; Plant and method of manufacture of —— at Limestone Island. F. N. Rhodes. Trans. Australasian Inst. Min. Eng., 1912, **16**, 275—287.

The cement rock of Limestone Island, New Zealand, requires only the addition of a certain amount of high-carbonate limestone to yield a mixture with a composition suitable for making Portland cement. The raw materials are crushed, dried in a rotary dryer, ground, and passed through the kilns, the clinker being burnt fairly hard. The hot clinker is quenched by a stream of water, mixed with 1 per cent. of gypsum, and mixture ground.—T. St.

Patents.

Bituminous compositions [for roads]. J. J. Ingham, Bradford. Eng. Pat. 1458, March 18, 1913.

Bitumen sheeting, *i.e.*, canvas coated with bitumen, is interposed between two layers of a composition formed by boiling together 4 parts of pitch, 1 part of creosote oil, 14 parts of sand, 7 parts of Trinidad bitumen, and 7 parts of petrol pitch.—O. R.

Slime and the like [Portland cement slurry] ; Process of separating and purifying ——. M. Kohn, Brünn, Austria. Eng. Pat. 8129, April 7, 1913.

Thick mud, especially cement slurry, containing large and rough particles, is passed into a closed reservoir, from which it is forced by means of compressed air through an inclined sieve into an outlet pipe or reservoir, the compressed air also serving to remove the residue remaining in the first reservoir by way of a second pipe.—O. R.

Lumber ; Process of treating ——. [*Tinting wood.*] R. L. Gilliam, New York. U.S. Pat. 1,084,266, Jan. 13, 1914.

A pinkish colour is imparted to the sap wood of the sweet gum tree by subjecting the wood in a closed chamber to the action of steam at about 100° C. until the sap is substantially removed, and continuing the treatment in the presence of the exuded sap and of iron, until the desired shade is obtained.—O. R.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ore output of the world. C. K. Leith. Times Eng. Suppl., Feb. 4, 1913.

The annual output of iron ore in the chief producing countries during the latest period (average of 1909, 1910, and 1911) for which figures are available was: United States, 50 million tons; Germany, 27; United Kingdom, 15; France, 14; Spain, 8, and Sweden 5 million tons. Continued heavy production may be expected of the Lake Superior ores, the ores of the Franco-German boundary, the Bilbao ores of Spain, the Cleveland ores of England, and the high-grade magnetites of N. Sweden; whilst increasing quantities of ores may be expected from Sweden and Cuba, and the use of Clinton hæmatites and Adirondack magnetites in the United States will also probably increase. In the near future there will probably become available the Brazilian high-grade hæmatites, Chilean ores, and ore deposits of Western United States, Western Canada, India, and China.—A. S.

Steel refining; Metallurgy of —— in an acid electric furnace. A. Müller. Stahl u. Eisen, 1914, **34**, 89—95.

The most important reaction is the passage of silicon into the steel from the lining and the silica-rich slag. This silicon has a considerable deoxidising action, and makes additions for deoxidising purposes unnecessary. No final desulphurisation or dephosphorisation takes place. A certain amount of desulphurisation is effected probably by the formation of volatile silicon sulphide at the arc temperature, but this only balances the sulphur contained in the coke, etc. The most suitable slags contain CaO about 15, MgO 2 to 5, MnO 10 to 15, FeO about 4, and SiO_2 55 to 60 per cent. Whilst the working of an acid electric furnace requires care and experience, the author considers that where suitable material is available, it has the advantages over the basic furnace, for the production of medium quality steel, of smaller current consumption through a shorter refining period, a saving of deoxidising additions, cheaper first cost and upkeep of the lining, and cheaper fluxes.—T. St.

[Gold and silver.] Treatment of the complex East Gippsland (Victoria) ores. K. A. Mickle. Trans. Australasian Inst. Min. Eng., 1911, **15**, 583—603.

The ore contains iron pyrites, mispickel, pyrrhotine, blende and galena, with smaller amounts of copper pyrites, covellite, stibnite and jamesonite—these minerals occurring as an intimate mixture (totalling about 40 per cent.) in which the first two predominate—and also varying quantities of calcite, magnesium silicate and felspar; the country rock is a greenish-coloured schist, which, in the neighbourhood of a lode, is also usually impregnated with fine-grained sulphides. The ore, containing about 27 dwt. Au and 20 dwt. Ag per ton, is wet-stamped and passed over amalgamated copper plates to cone hydraulic classifiers, whence the sized products are transferred to different Wilfley tables upon each of which a "strip" of sulphides is obtained. The upper part of this strip ("galena concentrate") is roasted and smelted separately, the remainder ("ordinary concentrate") being roasted and chlorinated; the sands and slimes are treated, separately, by cyaniding. The "ordinary concentrate" contains from 55 to 80 dwt. Au per ton, only about 85 per cent. of which is extracted by the present method. Experiments showed that the gold is intimately mixed with the sulphide portion of the ore, much of it being exceedingly fine and probably not "free" even after fine grinding; that during roasting, some of the gold particles become more or less enclosed by reason of the fritting which occurs and thus protected from attack by the chlorine; and that by mixing the raw, with an equal weight of roasted, concentrate (previously chlorinated) and roasting the mixture, a product is obtained which is more amenable to cyanide or chlorination treatment than the ordinary roasted concentrate. (In a large-scale test the residue from the chlorination of the former contained 6 dwt. Au per ton and that from the latter 10—14 dwt.) In the cyanide process, the best results were obtained by first treating the raw concentrate with the solution, then roasting the material slowly and at a low temperature, and finally treating it a second time with cyanide. A higher extraction, however, was obtained by roasting and chlorination than by any other method of treatment with solvents.—W. E. F. P.

Sulpho-telluride gold ore; Roasting —— at the Kalgurli Gold Mines, Ltd. F. G. Brinsden. Trans. Australasian Inst. Min. Eng., 1911, **15**, 71—90.

A description, with drawings, of plant which has a daily output of 360 tons is given. The crushed ore is roasted in Simplex Edwards roasters, and on being discharged is conveyed direct to the agitators, where it is mixed with cyanide solution. It enters the agitators at about 454° C. The aim in roasting is to obtain a product having the minimum quantity of oxygen-absorbing salts, and tests are made by titrating a sodium hydroxide extract of the roasted ore with $N/100$ iodine solution. The roasting enables an average extraction of slightly over 94 per cent. of the gold to be maintained.—T. St.

[Gold and silver.] Cyaniding; Use of lime in ——. A. M. Merton. Min. and Eng. World, 1914, **40**, 58.

The functions of lime in cyaniding practice and its use in the various stages of the ore treatment are discussed. The following method is advocated by the Mines Trials Committee of S. Africa for determining "available" lime in the commercial product:—50 grms. of crystallised sugar and 800 c.c. of water are added to 2 grms. of the sample (60-mesh), the mixture is shaken thoroughly, allowed to stand for a few hours with occasional shaking, and diluted to 1000 c.c. 50 or 100 c.c. of the liquid are withdrawn immediately after shaking and titrated with standard oxalic acid (22·5 grms. per litre: 1 c.c.=0·01 grm. CaO) using phenolphthalein as indicator.—W. E. F. P.

Gold and silver; Precipitation of —— in cyanide solutions by carbon. R. K. Cowles. Trans. Australasian Inst. Min. Eng., 1912, **16**, 58—61.

In treating tailings, which also contained half-burnt coal, etc., from power plants, by fine grinding in a weak cyanide solution for the recovery of gold and silver, it was found that the coal caused first the selective precipitation of the gold, and later of the silver. Experiments showed that ground clinker, half-burnt coal, and charcoal were all effective, but that unconsumed coal-dust had no action. The action appeared to be more rapid with fresh carbon than with carbon that had become saturated with water. The trouble was overcome by passing the tailings over vanners to remove the carbon.—T. St.

Auriferous and argentiferous copper; The electrolytic refining of —— at Lithgow, in New South Wales. G. H. Blakemore. Trans. Australasian Inst. Min. Eng., 1911, **15**, 36—70.

The anodes consist of blister copper containing 99·4 to 99·6 per cent. Cu, with Au from 2 to 4 oz., and Ag from 15 to 20 oz.; and weigh originally 200 lb. each. The electrolyte contains approximately 12 per cent. of free sulphuric acid, and 14 per cent. of crystallised copper sulphate; the temperature is maintained at about 120° to 130° F. (48°—54·5° C.)., and the solution is agitated by jets of compressed air at a pressure of 5 lb. per sq. in. The current density is 12 to 14 amps. per sq. ft. of cathode surface, and the space between the face of each starting sheet and the anode is about 2¼ in. The electrolyte flows from one tank to another, and is finally filtered through sand and returned to the feeding tank. As it gradually becomes richer in copper, it is electrolysed from time to time in special tanks with insoluble lead anodes. The cathodes obtained are melted in a reverberatory furnace used solely for this purpose, and the molten metal, after being brought to "pitch," is ladled into ingots. This copper, which contains about 99·95 pe cent. Cu, is used chiefly for wire making. The mud from the tanks is sifted, washed, heated to a dull red heat, and boiled with concentrated sulphuric acid. The residue i then washed, dried, and fused with sodium carbonate i a small cupel furnace to gold bullion, which usuall assys about 12 to 16 per cent. Au and 82 to 86 per cent Ag. This bullion is parted electrolytically in an electrolyt of silver nitrate solution, a silver plate forming the cathode The gold is caught as a mud in calico bags, and after bein heated with nitric acid, is fused, giving a fineness usually from 990 to 998. The silver is removed by moving wooden arms from the cathodes as fast as it is deposited. The knocked-off crystals are finally collected and fused, the fineness being not less than 996.—T. St.

Copper-welding; New process for ——. W. Schieber.
Chem.-Zeit., 1914, **38**, 188.

THE two pieces of copper, placed in position, are heated at the appropriate point by means of the oxy-hydrogen blowpipe until the requisite degree of softening is attained. Complete reduction is then effected in a flame of specially purified hydrogen, and the welding is accomplished by hammering. It is claimed that the joint is invisible and that the area of juncture is homogeneous in every way with the remainder of the metal.—J. R.

Copper; Action of sulphuric acid on ——. J. T. Cundall.
Chem. Soc. Trans., 1914, **105**, 60—63.

UNDER certain conditions sulphuric acid which has been acting on copper, when poured from the metal into water, yields a reddish-brown precipitate of metallic copper, which appears to be produced by the decomposition of cuprous sulphate. The original acid must be below 94 per cent. strength, and the maximum effect is given by an 87 per cent. acid. If the same acid liquid is heated it deposits either cuprous or cupric sulphide, according to the degree of heating: and these deposits redissolve with evolution of sulphur dioxide on heating still further. Cuprous sulphate is thus regarded as the primary product of the reaction:—

$$(a)\ 8Cu + 4H_2SO_4 = 3Cu_2SO_4 + Cu_2S + 4H_2O,$$
$$(b)\ 2Cu + 2H_2SO_4 = Cu_2SO_4 + 2H_2O + SO_2.$$

Equation (*a*) probably represents a low-temperature reaction. The formation of the secondary products is represented as below:—

$$(c)\ 5Cu_2SO_4 + 4H_2SO_4 = Cu_2S + 8CuSO_4 + 4H_2O,$$
$$(d)\ Cu_2S + 2H_2SO_4 = CuS + CuSO_4 + 2H_2O + SO_2,$$
$$(e)\ CuS + 4H_2SO_4 = CuSO_4 + 4SO_2 + 4H_2O.$$

See also Pickering (Chem. Soc. Trans., 1878, **33**, 112).—J. R.

Mixed sulphides [of lead and zinc]; Treatment of —— by the "Horwood" process. E. J. Horwood. Trans. Australasian Inst. Min. Eng., 1912, **16**, 228—241.

CONCENTRATES containing sulphides of lead and zinc, with possibly the sulphides of iron and copper, are roasted for a short time at 300° to 400° C. The particles of lead sulphide thus become coated with a layer of sulphate, whilst the zinc sulphide is unaffected, and the two may then be separated by an acid oil flotation (see also this J., 1909, 942, and 1911, 342). The best results obtained from Tasmanian complex sulphides were. zinc concentrates with 58·6 Zn, 3·5 Pb; lead residues with 5·8 Zn, 20·0 Pb per cent. Silver and gold were present. The former could be largely recovered in the leady residues. Details are given of crushing, roasting, and flotation, as carried out in an experimental plant.—T. St.

Zinc; The recrystallisation of worked ——. G. Timoféeff.
Rev. Mét., 1914, **11**, 127—132.

THE structure of zinc crushed in a vice becomes homogeneous, no crystals being visible under very high magnifications. The hardness increases considerably. Recrystallisation takes place however extremely readily on annealing the metal, and in time at the ordinary temperature. The growth of the crystals is more rapid the higher the temperature of annealing, and the greater the deformation the zinc has undergone. Under slight shock the large individual crystals composing cast zinc become striated, this effect being produced even by removing the ingots from moulds, if special care is not taken. The best etching reagent for zinc sections, of many tried by the author, is that of a few drops of a mixture of nitric acid 94 and chromic acid 6 per cent., to 100 c.c. of water.—T. St.

Aluminium; Improving the properties of ——. [Aluminium-cobalt alloys.] A. Neuburger. Elektrochem. Zeits., 1914, **20**, 295.

ALLOYING with 9—12 per cent. Co improves aluminium, but it is still deficient in mechanical strength owing to the coarse crystalline structure. This defect can be overcome by addition of a small proportion of tungsten or molybdenum, yielding alloys having a tensile strength three times that of pure aluminium. The best results are obtained with: W 0·8—1·2 and Co 8—10 per cent., or Mo 0·6—1, Co 9—10 per cent. The forging and rolling qualities diminish and the tensile strength increases with increasing content of tungsten (or molybdenum) and cobalt. The alloys containing tungsten are somewhat harder than those containing molybdenum.—A. S.

Cerium and its alloys; Preparation of ——. M. Moldenhauer. Chem.-Zeit., 1914, **38**, 147.

CERIUM fluoride is more suitable than the other halides or the oxide for the preparation of cerium alloys by reduction. An alloy containing per cent. about 86 Ce and 12 Ca was obtained from a mixture of cerium fluoride and calcium (10 per cent. more of the latter than the amount required for reduction). The yield was improved by covering the compressed mixture with a layer of calcium fluoride; a glass tube, passing through this layer served for the introduction of the ignition mixture and magnesium ribbon. Alloys of Ce-Fe, free from calcium, were obtained from mixtures of cerium fluoride, ferric oxide, and calcium. By substituting aluminium for calcium in this mixture, a 60 per cent. yield of an alloy containing per cent. 25·3 Ce, 62·5 Fe, 10·2 Al, and 1·2 Si, was obtained. This product showed similar properties to those of the commercial iron alloys.—L. E.

Foundry plant and machinery. [Die-castings.] J. Horner. Engineering, 1914, **97**, 144—145.

DIE-CASTING or casting under pressure in steel moulds, is adopted for making intricate parts which would be expensive to cast in sand, to stamp in dies or to machine. The accuracy of castings having holes, screw-threads, teeth, etc., is as great as with ordinary machined parts. Only white-metal alloys are suitable. These may contain Zn 50—80, Sn 5—30, Cu 2—20, Al 2—6, and Sb 1—5 per cent. A considerable range of alloys is thus available These alloys are not as strong as bronze or cast iron, but parts made of the latter can be cast in. In the following example, Nos. 1 and 2 are suitable for ordinary work in place of brass, No. 3 is harder and No. 4 harder still.

	No. 1.	No. 2.	No. 3.	No. 4.
	per cent.	per cent.	per cent.	per cent.
Zinc	73·75	72·7	73·8	46·2
Tin	14·75	19·0	12·0	30·8
Copper	5·25	5·0	10·6	20·4
Aluminium	6·25	1·0	3·4	2·6
Lead	—	2·0	—	—
Antimony	—	0·3	—	—

Gas furnaces may be used for melting the metal, the pot being covered to prevent oxidation, and the metal forced through a tube and nozzle into the moulds. A pressure of 80—120 lb. per sq. in. is applied by means of a hand-lever.—A. T. L.

Combustion-analysis by means of tellurium dioxide. Glauser. *See* XXIII.

Patents.

Steel or iron; Process for manufacturing ——. G. Tischenko and H. Paulson, St. Petersburg. Eng. Pat. 27,147, Nov. 26, 1912.

Pure gaseous or vaporised hydrocarbons are passed, by suction or pressure, into electrolytically-refined iron until the metal is carburised to the required degree, the operation being preferably effected in a closed, electric furnace.—W. E. F. P.

[*Iron and steel.*] *Wire; Annealing* ——. M. Woods, Warrington. Eng. Pat. 10,215, April 30, 1913.

In an apparatus of the kind having a seal of sand or other powdery material at one or both ends, provision is made whereby the sand, etc., carried away from the seal by the moving wire is collected in a sealed trap and conveyed back to its original position.—W. E. F. P.

Steel; Method of treating ——. A. J. Rossi, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,084,036, Jan. 13, 1914.

After addition of sufficient carbon to impart the required degree of hardness, titanium and manganese are added to prevent undesirable brittleness. The finished steel contains Ti less than 0·50 and Mn less than 0·60 per cent.—W. E. F. P.

Steel; Method of refining ——. E. Humbert. Fr. Pat 461,459, Aug. 18, 1913.

The refining is effected in two stages; in the second stage, slag (containing lime, carbon, silica and a little fluorspar) is used, and when the metal is tapped, the whole or a part of this slag is left in the furnace. Iron oxide or other oxidising agent is added to oxidise the calcium carbide which has been formed and the heat of this reaction serves to improve the fluidity of the slag. The steel from the Bessemer converter, or the like, is now introduced on top of the slag, whereby energetic dephosphorisation is effected whilst the metal is descending through the molten slag. After about 10 mins. dephosphorisation is practically complete; the slag is removed and fresh slag introduced for the second stage of the refining.—A. S.

Steel alloy for electric dynamos. W. Rübel. Fr. Pat. 461,704, Aug. 22, 1913. Under Int. Conv., Aug. 27, 1912.

The alloy, of high electric resistance, is composed of iron and metals of specific gravity less than iron, such as aluminium and magnesium.—B. N.

Iron, free from carbon; Method and means for the production of —— direct from ores, even of a refractory nature. R. P. Pictet. Fr. Pat. 461,895, Nov. 8, 1912.

A blast furnace of the usual type working with hot blast, is provided with a second lower set of tuyères, through some of which carbon monoxide is supplied, and through the others air enriched with oxygen. The carbon supplied to the furnace with the ore is regulated either to be only sufficient just to reduce the iron oxide, or to give the iron a desired carbon content. The mass which enters the zone between the two sets of tuyères thus contains only a predetermined amount of carbon. In this zone the iron and the slag are melted by the heat of combustion of the carbon monoxide supplied through the lower set of tuyères, the proportions of carbon monoxide and oxygen being regulated according to the refractory nature of the gangue. The molten metal and slag are run off by different apertures from the crucible situated below the lower set of tuyères. The iron in the crucible may be further refined by blowing air through it, or suitable additions, such as chromium, vanadium, nickel, etc., may be made before the metal is run off.—T. St.

[*Steel.*] *Armour plate.* Soc. Anon. des Aciéries et Forges de Firminy. Fr. Pat. 462,087, Nov. 13, 1912.

The steel preferably contains:—C 0·450 to 0·750, Mn under 0·700, Cr 1·60 to 2·80, Ni 2 to 4 per cent. There may be also less than 2·5 per cent. Mo, W and V. After forging, the plate is heated to 775°—900° C., and quenched; heated to 550°—675° C., and quenched; heated so that the temperature falls uniformly from about 850° C. at the face, to below 700° C. at the back, and quenched; reheated to below 500° C. The face may be very superficially hardened by covering it with potassium ferrocyanide during the heating operations.—T. St.

[*Steel.*] *Armour plate; Face-hardened* ——. Soc. Anon. des Aciéries et Forges de Firminy. Fr. Pat. 462,201, Nov. 16, 1912.

The steel employed contains:—C 0·150 to 0·250, Cr 0·900 to 2·500, Ni 4·50 to 6·50, Mn under 0·600 per cent. All or part of the chromium may be replaced by tungsten, molybdenum, and vanadium. Hardening of the face to a depth of more than 15 mm. is brought about during the heat treatment by means of potassium ferrocyanide. On heating the plate before the last quenching, the back of the plate is heated to a slightly lower temperature than the face. As a final operation the plate may be reheated to a temperature below 500° C.—T. St.

Ferro-chromium and pure chromium: Electrometallurgical manufacture of —— and other metals, from metallurgical slags free from iron. C. A. Keller. Fr. Pat. 461,098, Oct. 21, 1912.

Ferro-chromium or ferro-manganese alloys are produced by keeping the amount of reducing agent at a low amount, so that an oxidising slag is obtained in which iron is practically absent, and a slag rich in chromium or manganese oxide is formed. By the reduction of these slags, the pure metals may be obtained, or by the addition of the slags to the original ore, alloys rich in chromium or manganese may be produced.—B. N.

Ores; Treatment of ——. Minerals Separation, Ltd. London. From A. H. Higgins, New York. Eng. Pat 27,323, Nov. 27, 1912.

The recovery of metalliferous material from ores is effecte partly by froth-flotation and partly by treatment wit solvents. The two processes are applied successively simultaneously, the solvent, in the latter case, being th medium in which the mineral-bearing froth is produce In either case the ore or concentrate may be roasted otherwise treated to render any desired portion solubl In the application of the process to lead-bearing ores (*e.g* lead-zinc sulphides) claim is made for the use of ferr chloride (in hot solution) for dissolving the lead co stituents.—W. E. F. P.

Ore concentration [froth-flotation]; Apparatus for — W. Broadbridge and A. C. Howard, Assignors to Miner Separation, Ltd., London. U.S. Pat. 1,084,196, Jan. 1914.

A series of agitating- and aerating-vessels arranged sections and operated in conjunction with a series spitzkasten. Each agitation section has a high-le outlet (provided with pulp-directing baffles) to adjacent spitzkasten; and each of the latter a low-le outlet to the first agitating-vessel of the next section. —W. E. F.

Tungsten; Manufacture of ——. C. Gladitz, Lon Eng. Pat. 27,859, Dec. 3, 1912.

Claim is made for a "fluffy" variety of tungsten prep d as follows:—Tungsten ore, freed from sulphur, arsenic, by roasting, is finely ground and "dissolved in a known manner in ammonia." The solution of ammonium tungstate is filtered and sufficient distilled water added to reduce the sp. gr. to between 1·06 and 1·03 (preferably 1·05), after which the liquid is allowed to flow, from a capillary burette, at the rate of 1000 c.c. in 780—900 (preferably 840) seconds, into twice its volume of boiling hydrochloric acid (8·7° B., sp. gr. 1·065), which is kept agitated by means of superheated steam. The tungsten trioxide so produced (which is stated to be flaky and free from colloidal and granular forms) is dried, sifted through a fine sieve and reduced, by means of hydrogen, in nickel trays which are propelled through a long nickel tube subjected to a progressively increasing temperature (20° to 850° C.) for about 3 m. of its length and not heated for the remaining 2 m.; the arrangement is such that the charge attains its maximum temperature in about 4½ hours and cools during about 3 hours, a sudden fall in temperature occurring immediately after the maximum has been passed.—W. E. F. P.

Tungsten ; Process for fusing ——. Siemens Brothers and Co., Ltd., London. From Siemens und Halske A.-G., Berlin. Eng. Pat. 10,369, May 2, 1913.

The metal is fused in an atmosphere of inert gas in an electric arc furnace the crucible of which is lined with compressed powdered tungsten, the molten metal forming the anode. The tendency of tungsten to form bubbles is prevented by the addition of about 1·7 per cent. of thorium oxide.—W. R. S.

Metallic sheets ; Process of and means for galvanising or coating ——. H. Folland, T. A. Morris, and W. Griffiths, Glanamman, Carmarthen. Eng. Pat. 29,801, Dec. 27, 1912.

The (thin) metal sheet is passed, at one operation and in one bath, through a flux, any desired metal, and molten zinc, in succession; the flux and the zinc are floated upon the "desired metal" at opposite ends of the bath and are retained in position by partitions extending from the upper part of the apparatus to different levels in the bath. (Reference is directed to Eng. Pats. 7332 of 1892, 2509 of 1903 and 5608 of 1910; this J., 1893, 360; 1910, 1392).
—W. E. F. P.

Manganese-brass, manganese-bronze, and similar alloys ; Manufacture of ——. F. Heusler, Dillenburg, Germany, and The British Mining and Metal Co., Ltd., London. Eng. Pat. 1092, Jan. 14, 1913.

The manganese is added in the form of a Mn-Al-Cu alloy (Mn 15—30, Al 5—15 per cent.), which is incorporated with the copper before the addition of the zinc.—W. R. S.

Metals and metal oxides ; Process for preparing ——, *in a minutely divided state.* H. Kast, Berlin. Eng. Pat. 5212, March 1, 1913. Addition to Eng Pat. 19,006, Aug. 19, 1912 (see Ger. Pats. 256,962 and 263,648: this J., 1913, 426, 1011).

Claim is made for the employment of metallic salts of aromatic nitro-carboxylic acids, in place of those of nitrophenols originally specified; and for the admixture, with either, of a volatile, inorganic salt (*e.g.* of ammonium) to modify the fierceness of the combustion.—W. E. F. P.

Electroplating ; Apparatus for ——. G. P. M. Lee and W. A. Brame, London. Eng. Pat. 13,747 of 1912, date of appl., Jan. 13, 1913.

The conveyor, for transporting the material by means of cross rods, is arranged to run on opposite sides of the vat, and an inclined supplementary conveyor is provided for ransportation of material from one vat to another, this latter conveyor, operated by insulated chain wheels, being made to travel faster than the former. The supplementary conveyor has carriers furnished with displaceable stops to allow the carriers to pick up the cross rods, the stops then resuming a normal position and keeping the cross rods in place. The latter are carried on the main conveyor by brackets or cradles. The vat is provided with agitating, heating and filtering means, and an arrangement for imparting partial or complete rotary motion to the work. Several rows of anodes may be employed, with means for applying a higher voltage to the first than to the remainder of a set.—B. N.

Copper ; Process of electrolytic production of ——. N. V. Hybinette, Christiania, Norway. U.S. Pat. 1,084,150, Jan. 13, 1914.

The metal is deposited from a solution containing both copper and iron salts, by adding an electrolyte containing large quantities of ferric salts to the cathode compartment of an electrolytic cell and circulating the solution through a filter from cathode to anode.—W. E. F. P.

Copper ; Process for welding ——. H. Suzuki. Fr. Pat. 461,688, Aug. 21, 1913. Under Int. Conv., Feb. 15, 1913.

The surfaces to be welded are cleaned, polished and placed in contact, and then placed, with or without an anti-oxidising material, such as ammonium carbonate or chloride, on a layer of wood charcoal in a closed vessel, which is heated externally. When they have reached the desired temperature, the pieces are withdrawn and hammered or rolled in the usual way.—A. S.

Copper and nickel ; Process for soldering ——. Autogenwerk Sirius Ges. m. b. H. Fr. Pat. 461,942, Aug. 27, 1913. Under Int. Conv., Sept. 28, 1912.

In joining together pieces, especially wires, of copper or nickel, the metal wire used to facilitate the soldering, contains besides the phosphorus usually employed, also up to 5 per cent. of silver, cadmium, or bismuth, or mixtures of these metals.—A. S.

Ores ; Process for treating ——. C. J. Best, Oakland, Cal. U.S. Pat. 1,084,600, Jan. 20, 1914.

The finely subdivided ore is treated with a "preparing solution" containing potassium nitrate, nitric acid, potassium permanganate, common salt, and sulphuric acid; it is then roasted, and leached successively with solutions of: common salt, sulphuric acid, and manganese peroxide; or potassium nitrate, sal ammoniac (ammonium chloride), nitric acid, common salt, and sulphuric acid.—W. R. S.

Furnace for refining metals. E. C. Wills, Frederick, Md. U.S. Pat. 1,084,991, Jan. 20, 1914.

A horizontal rotatable cylinder (resembling a copper converter), provided at each end with an oil jet and an adjacent flue: each flue has an air inlet and can be used for injecting blast or drawing off the products of combustion.—W. R. S.

Zinc ; Method of preventing the formation of "zinc powder" during the condensation of ——. J. B. M. E. Vuigner. Fr. Pat. 461,893, Nov. 8, 1912.

To free zinc vapours from oxygen and so prevent the formation of "zinc powder," lumps of calcium carbide or carborundum are placed either in the condensers, or in a chamber between the furnace and the condensers.—T. St.

Zinc ; Manufacture of pure ——. H. Speckter. Fr. Pat. 461,905, Aug. 26, 1913. Under Int. Conv., Sept. 7, 1912.

Impurities in the ore are separated before the zinc itself is liberated. By gradually heating the ore mixed with reducing agents in a suitable furnace, such as a rotary furnace, cadmium and lead are volatilised between 950° and 1000° C., and when, at about 1050° C., zinc begins to volatilise, the charge is transferred to the zinc furnace proper. Zinciferous material containing zinc chloride may be leached with water, or the zinc chloride, with other volatile chlorides, may be volatilised by a preliminary heating. In this case the condensed zinc chloride is dissolved in water and the zinc precipitated as hydroxide. —T. St.

Metals; Method for the extraction of useful —— contained in metallurgical slags. J. B. M. E. Vuigner. Fr. Pat. 462,194, Nov. 15, 1912.

The molten slags are subjected to the action of reducing agents formed at temperatures much higher than those possessed by the slags on their discharge from furnaces. Reducing agents of special value are ferrosilicon and calcium carbide. Slags containing copper or nickel are treated, as they leave the furnace, with ferrosilicon and sulphur (free or combined) in order to form a matte. Slags containing zinc are stirred with ferrosilicon under a layer of carbon. Poor or complex ores of zinc may be similarly treated after being brought into a state of fusion. The reducing agent may also be formed *in situ* by running the molten slag into an electric furnace, and adding carbon and, if desired, a little lime.—T. St.

Condensation of vapours of volatile metals, especially of zinc vapour; Process and apparatus for the ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 1701, Jan. 21, 1913. Under Int. Conv., Feb. 20, 1912.

See Fr. Pat. 454,495 of 1913; this J., 1913, 871.—T. F. B.

Tunnel kilns or furnaces for tempering, cementation, and like processes. G. Richter, Stettin, Germany. Eng. Pat. 11,632, May 19, 1913. Under Int. Conv., Feb. 25, 1913.

See Ger. Pat. 265,761 of 1913; this J., 1913, 1161.—T.F.B.

Alloys resistant to the action of concentrated acids; Process for making ——. W. and R. Borchers. Fr. Pat. 461,242, Aug. 9, 1913.

See Ger. Pats. 265,076 and 265,328 of 1913; this J., 1913. 1160.—T. F. B.

Ores; Process for reducing —— to metals. J. A. McLarty. Fr. Pat. 461,399, Aug. 14, 1913.

See U.S. Pat. 1,079,788 of 1913; this J., 1914, 31.—T.F.B

Electroplating apparatus. G. P. M. Lee and W. A. Brame. Fr. Pat. 461,565, July 12, 1913.

See Eng. Pat. 13,746 of 1912; this J., 1913, 831.—T.F.B.

Filter [for slimes]. U.S. Pat. 1,084,383. *See* I.

Vacuum drum filters for the concentration of precious metals and other applications. Fr. Pat. 461,346. *See* I.

XI.—ELECTRO-CHEMISTRY.

Electrolytic chlorine at Mount Morgan, Queensland. Du Faur. *See* VII.

Electrolytic reduction of carbon dioxide and monoxide dissolved under pressure. Fischer and Prziza. *See* VII.

Patents.

Alkali compounds; Electrolytic processes and apparatus, particularly applicable to the production of ——. C. White, London. Eng. Pat. 1935, Jan. 23, 1913.

The process is applicable to the electrolysis of sodium or potassium chloride or nitrate in non-diaphragm cells, in which the anode tubes each dip into a pocket or well in the cell, the pockets being preferably formed of or lined with non-conducting material. Heat is applied locally by means of heating coils to portions of the electrolyte near to the anodes, and this part of the electrolyte is kept above the level of the electrolyte in the cell by the action of an exhaust pump. The portion of the electrolyte below the anodes may be cooled by cold liquid flowing through a coil, or the cold electrolyte may be admitted at a point below the heating coils.—B. N.

Electro-osmotic processes; Method of and apparatus for ——. Ges. für Elektro-Osmose m. b. H., Frankfurt a/Main, Germany. Eng. Pat. 26,061, Nov. 13, 1913. Under Int. Conv., July 21, 1913.

In its passage to the anode, the liquid holding solid matter in suspension is caused to wash against as large a cathode surface as possible, this end being attained by employing cathodes composed of laminæ spaced apart so as to divide the liquid into a number of streams.—W. E. F. P.

Metallic objects; Electrolytic cleansing of ——. A. Lévy. Fr. Pat. 461,285, Oct. 24, 1912.

The alkali cyanide commonly used is replaced by potassium ferrocyanide, and lime is added to the bath, the action of the electrolyte on the metal of the anodes being thus prevented.—B. N.

Separation of particles in suspension from gaseous bodies; Utilisation of high tension electricity for the ——. E. Möller. Fr. Pat. 461,370, Aug. 13, 1913. Under Int. Conv., Aug. 13, 1912.

The ionising non-metallic electrodes are arranged alternately with the non-ionising intermediate electrodes, and the gas to be treated is passed between them. The former electrodes consist of narrow strips of mica with serrated edges supported between conducting pieces, and forming a rod-like electrode, with its length at right angles to the direction of the gas, and so that the latter impinges on the serrated edges. The intermediate electrodes consist of smooth sheets, with their longitudinal dimensions transverse to but with their planes parallel to the direction in which the gas is moving. The ionising electrodes are mounted on an insulated rod passing through a tube closed by an insulating disc, and the gas which circulates in the tube is maintained electrically pure by passing it over an auxiliary ionising electrode in the form of a ring mounted on the rod.—B. N.

Furnaces; Electric ——. W. N. Crafts. Fr. Pat. 461,847 Aug. 8, 1913.

See U.S. Pats. 1,069,923 and 1,069,924 of 1913; this J., 1913, 915.—T. F. B.

Electrically insulating sheets, plates, etc., from mica waste Process for making ——. F. Bölling. Fr. Pat. 462,000 Aug. 29, 1913. Under Int. Conv., Sept. 4 and 20, 1912

See Eng. Pat. 21,445 of 1912; this J., 1913, 290.—T. F. B

Electrolytic apparatus for the clarification of sugar solutions U.S. Pat. 1,084,556. *See* XVII.

XII.—FATS; OILS; WAXES.

Hydrogenated fats. J. Leimdörfer. Seifensieder-Zeit 1913, **40**, 1317—1318. Chem. Zentr., 1914, **1**, 304—30

Experiments with pure hydrogenated fats, from whic the catalyst had been completely removed, indicat that whilst the stearic acid present therein was identical chemically with that contained in natural fats, the stearin of the hydrogenated fats differed in crystalline character, behaviour on exposure to light and heat, and other physical properties from the stearin of natural fats. Hydrogenated fats change in odour and colour when preserved even in a vacuum. Soaps prepared from them have an unpleasant odour and inferior lathering properties. The speed of saponification of hydrogenated fats is greater than that of an analogous natural fat (tallow) under similar conditions. It is concluded that the stearin produced by hydrogenation is an allotropic modification of ordinary stearin, of greater reactivity.—A. S.

Glycerol; Determination of —— in commercial glycerins and soap-lyes. M. Tortelli and A. Ceccherelli. Chem.-Zeit., 1913, **37**, 1505—1506, 1573—1574; 1914, **38**, 3—5, 28—31, 46—48.

The results of the authors' experiments upon the estimation of glycerol in commercial glycerins lead them to the conclusion that the acetin method prescribed in the International Standard Methods 1911 (this J., 1911, 556—558) gives low results and they advocate the adoption of the following modification of the Hehner bichromate process as being more accurate and more rapidly carried out. The following reagents are required: 1. *Pure potassium bichromate*, small crystals. 2. *Potassium bichromate solution.* 74·564 grms. per litre. 3. *Dilute bichromate solution.* Solution 2 diluted with water to ten times its volume. 4. *Ferrous ammonium sulphate*, chemically pure, in small crystals: 2 grms. titrated with solution 3 should require 33·5—33·6 c.c. 5. *Ferrous ammonium sulphate solution.* 200 grms. are dissolved in water which has been made slightly acid with sulphuric acid and the solution made up to 1 litre: 10 c.c. should require 33·5—33·6 c.c. of the dilute bichromate solution. 6. *Silver carbonate.* Prepared as required by mixing 4·9 c.c. of $N/1$ sodium carbonate with 150 c.c. of a 0·5 per cent. solution of silver sulphate. The precipitated silver carbonate is washed once by decantation and is then ready for use. 7. *Basic lead acetate.* A 10 per cent. solution of lead acetate is boiled with an excess of litharge for 5 hours, the volume being kept constant, and is then filtered hot. 8. *Sodium sulphate solution.* 10 per cent. 9. *Potassium ferricyanide solution.* A 0·1 per cent. solution which has been filtered through glass wool. 10. *Sulphuric acid.* The concentrated acid diluted with its own volume of water. A. *Estimation of glycerol in crude glycerin. a. Preliminary test to determine approximately the glycerol content.* About 5 grms. of the sample are mixed with 10 c.c. of distilled water and 5 c.c. of basic lead acetate solution in a 100 c.c. glass-stoppered flask, the mixture being well shaken and allowed to stand for a few minutes. 10 c.c. of sodium sulphate solution are then added, the volume of the solution made up to 100 c.c. with water and, after being well shaken and allowed to stand for a short time, the liquid is filtered through a dry filter paper. 10 c.c. of the filtrate are placed in a flask of 250—300 c.c. capacity, mixed with a few drops of dilute sulphuric acid and then 50 c.c. of bichromate solution (reagent 2) and 50 c.c. of sulphuric acid (reagent 10) are added. The mixture is boiled gently for fifteen minutes over a direct flame and, after being cooled, he excess of bichromate is titrated with the ferrous iron olution. *b. Final estimation of glycerol.* A quantity of he sample which will be approximately equal to 5 grms. of glycerol, is diluted with water to 250 c.c. in a graduated lask. 25 c.c. of this solution are treated with the precribed quantity of silver carbonate in a glass-stoppered 00 c.c. flask, and well shaken for 5—10 minutes. Therefter 5 c.c. of basic lead acetate are added, the mixture ell shaken and allowed to stand for 2—3 minutes. 5 c.c. f sodium sulphate solution are then added and, after haking, the volume is made up to 100 c.c. and the liquid ltered through a dry filter, the first 10 c.c. being rejected. 5 c.c. of the filtrate are placed in the same flask as was sed for the oxidation in the preliminary test, the liquid eing made acid with 3 or 4 drops of sulphuric acid (1 : 5), nd then 4 grms. of potassium bichromate (reagent 1) and 25 c.c. of water are added. After the bichromate is dissolved, 50 c.c. of sulphuric acid (reagent 10) are added and the mixture gently boiled over a free flame for 15 minutes. 4 grms. of ferrous ammonium sulphate are added to the contents of the flask after these have cooled to room temperature and the excess of iron salt is titrated back with dilute bichromate solution (reagent 3). If the preliminary test has been properly carried out the titration should require between 25 and 30 c.c. of this solution. B. *Estimation of glycerol in soap lyes.* The amount of the sample taken is increased so as to give approximately corresponding amounts of glycerol in the test solution, and the lye is neutralised with acetic acid before adding the clarifying reagents. Extensive tables are given, the use of which avoids the tedious calculations which otherwise have to be made.—J. A.

Emulsions; Experiments on ——. F. R. Newman. J. Phys. Chem., 1914, **18**, 34—54.

The emulsions were prepared by shaking together the components, in most cases in a shaking machine in which the containing bottle was shaken up and down in a vertical plane at the rate of about 360 oscillations (amplitude about 2 ins.) per minute. For ascertaining the nature of the emulsion, drops were placed on a glass plate and each stirred with a drop of one of the components; the drop of emulsion spread when the added drop was of the same nature as the external phase of the emulsion. In emulsions of benzene and water prepared with sodium oleate, water was always the external phase. Homogeneous emulsions were prepared containing respectively up to 0·5 per cent. and 80—90 per cent. of benzene by volume; at intermediate concentrations the emulsions separated into a creamy upper layer and a watery lower layer. Homogeneous emulsions of high concentration could only be obtained by adding the benzene gradually. With 0·05 grm. of sodium oleate to 1 c.c. of water a stiff jelly could be obtained with 99 c.c. of benzene; with 0·02 grm. of sodium oleate only 98 c.c. of benzene could be incorporated. Using soap, sodium oleate, or caustic soda as emulsifying agents, olive oil and water always gave emulsions of oil in water; the supposed emulsion of water in oil obtained by Robertson (this J., 1910, 888) was probably a "cracked" emulsion in which the appearance of the oil was changed by the presence of suspended solid sodium oleate, etc. For making emulsions of water in benzene, magnesium oleate gave the best results, especially in presence of a small quantity of sodium oleate; homogeneous emulsions were prepared containing 75—96 per cent. of water by volume. With magnesium oleate and sodium oleate, also, an emulsion of water in carbon bisulphide, containing over 94 per cent. of water by volume, was prepared, but was not so stable as the emulsion of water in benzene, "cracking" after 3 days. In mixed paints water was found to be the internal and oil the external phase. A homogeneous, stable emulsion of water in oil was obtained by shaking together 20 c.c. of raw linseed oil and 20 c.c. of water. The oil contained rosin, and it is concluded that rosin is usually the emulsifying agent in the case of mixed paints, since Pickering's work on insoluble emulsifiers (this J., 1908, 88) indicates that the pigments would tend to produce emulsions of oil in water so far as they had any emulsifying action.—A. S.

Lipoids of [milk] separator slime and their importance for the formation of milk fat. Laxa and Konecny. *See* XIXa.

Patents.

Catalytic reactions [hydrogenation of oils]; Process of effecting ——. O. C. Hagemann, Yonkers, and C. Baskerville, New York. U.S. Pat. 1,083,930, Jan. 13, 1914.

The interacting materials (*e.g.* hydrogen and a fatty body) are brought into contact in the presence of thin leaves of nickel or other catalytic metal.—C. A. M.

Catalysers [for hydrogenating oils]; Process of preparing —— and apparatus therefor. C. Ellis, Montclair, N.J. U.S. Pat. 1,084.202, Jan. 13, 1914.

The material is reduced in a cylindrical chamber provided with conveyors, with means for the introduction of heated hydrogen under pressure, for collecting and returning dust to the chamber, and for cooling the reduced substance and conveying it, without contact with the air, to the oil to be treated.—C. A. M.

Catalyser [for hydrogenating oils] and process of making catalytic material. C. Ellis, Montclair, N.J. U.S. Pat. 1,084,258, Jan. 13, 1914.

A catalytic agent for hydrogenating oils, etc., is prepared by attaching nickel or other metallic catalytic substance to the exterior of a non-porous pulverulent body (*e.g.* carbon), which may also be catalytically active.—C. A. M.

Oily material: Processes of hydrogenating ——. C. Ellis, Montclair, N.J., U.S.A. Eng. Pat. 16,782, July 22, 1913. Under Int. Conv., July 23, 1912.

See U.S. Pat. 1,040,532 of 1912; this J., 1912, 1085.—T.F.B.

Oily substances; Process for hydrogenating ——. C. Ellis. Fr. Pat. 461,578, July 18, 1913. Under Int. Conv., July 23, 1912.

See U.S. Pat. 1,040,532 of 1912; this J., 1912, 1085.—T.F.B.

Hydrogenated fat; Edible ——, C. Ellis. Fr. Pat. 461,647, Aug. 13, 1913. Under Int. Conv., Aug. 15, 1912.

See U.S. Pat. 1,058,738 of 1913; this J., 1913, 543.—T.F.B.

Manufacture of petroleum soluble [emulsifiable] in water. Fr. Pat. 461,538. *See* IIa.

Producing glycerol-halogen-hydrins and poly-oxy fatty acid esters. Eng. Pat. 14,767. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Rosin driers and other metallic resinates. M. Ragg. Farbenzeit., 1913, **19**, 309—311, 364—365, 420—422. Chem. Zentr., 1914, 1, 433—434.

If a "neutral resinate" prepared by fusing colophony with the requisite quantity of calcium hydroxide (calculated from the acid value of the colophony), be analysed by Fahrion's method (treatment with a mixture of alcohol and petroleum ether and titration with alkali), a considerable quantity of free resin acid is frequently found and a basic resinate is precipitated. Experiments showed that besides the known normal metallic resinates, well-defined basic resinates exist, which can be obtained either directly by fusing together the components or by the action of alkali on the normal resinates. Mixed basic resinates can also be obtained. The following have been prepared (Ac=the resin acid residue, $C_{19}H_{29}{\cdot}CO_2$): $2Ac_2Ca,CaO$; Ac_2Pb,PbO; Ac_2Zn,ZnO; $2Ac_2Zn,3ZnO$; $Ac_2Zn,3ZnO$; $Ac_2Zn,10ZnO$; $Ac_2Mn,4MnO,5AcNa$; $6Ac_2Mn,2MnO,4AcNa$; $2Ac_3Mn,MnO$; Ac_3Mn,MnO; $Ac_3Mn,2MnO$, $Ac_3Mn,2Mn_3O_4$, $2MnO$; $Ac_2Pb,PbO,2Ac_2Mn$; $Ac_2Pb,4PbO,Ac_2Mn$. The metallic salts of higher fatty acids, especially of the acids of linseed oil, behave in an analogous manner to the metallic resinates.—A. S.

Experiments on emulsions. Newman. *See* XII.

Patents.

Paints, enamels and the like; Method of making ——. A. S. Ramage, Assignor to International Colour and Chemical Co., Buffalo, N.Y. U.S. Pat. 1,084,361, Jan. 13, 1914.

A pigment is mixed with less than 5 per cent. of its weight of a water-soluble metallic stearate soap, in the presence of water, a suitable paint-vehicle then added, and the mixture heated until water separates, after which the residual paste may be dehydrated by further heating. Or the soap may be precipitated by a reagent, the mass heated, and the water displaced by a suitable paint vehicle.—C. A. M.

Paint; Rust-preventing ——. H. Howard. Fr. Pat. 462,148, Sept. 3, 1913.

So-called "red mud," the insoluble residue left when bauxite, preferably red French bauxite, is treated with alkali for the manufacture of sodium aluminate, and containing as essential constituent, an insoluble double silicate of sodium and aluminium, is mixed with a suitable oil to form a paint, which is stated to prevent the rusting of iron and steel.—A. S.

Gum resins, especially kauri gum; Process and apparatus for the treatment of ——. F. V. Raymond. Fr. Pat. 462,125, Aug. 27, 1913.

For removing the outer crust of low-grade gum from lumps of kauri gum or other gum-resins, the material is conveyed on an endless band through a receptacle, in which it is subjected to the action of sand blasts delivered through movable divergent nozzles. Jets of air, steam, etc., may be used in addition to the sand blasts. The apparatus for carrying out the treatment is described and illustrated in detail.—A. S.

Paint [rust-preventing]. H. Howard, Boston. U.S. Pat. 1,084,884, Jan. 20, 1914.

See Fr. Pat. 462,148 of 1913; preceding.—T. F. B.

Disazo dyestuffs especially suitable for making lakes. Fr. Pat. 461,644. *See* IV.

Manufacture of basic insoluble carbonates [basic magnesium carbonate and white lead]. Fr. Pat. 461,397. *See* VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Determination of the total sulphur in ——. Utz Gummi-Zeit., 1914, **28**, 631—632.

A review of some of the methods which have been proposed for the determination of total sulphur in vulcanise rubber. Carius' method gives the best results but require special apparatus. The rapid method of Kaye and Shar (India-Rubber J., Dec. 7, 1912, 5) when tested wit different kinds of vulcanised rubber gave results in fa agreement with those obtained by the more tedio method of Frank and Marckwald (method b, Lunge-Ber Chem.-techn. Untersuchungsmethoden, 6 Aufl., III. Bd S. 858), and the author recommends it for technic purposes. It is carried out as follows:—0·25—0·5 gr of the finely-divided sample is intimately mixed wi 5 parts by weight of pure zinc oxide and 4 parts of pota sium nitrate in a porcelain crucible, a thin layer of zi oxide is distributed over the mixture, and the cover crucible is carefully heated. When the reaction begi the flame is removed for a time, and subsequently t crucible is heated with the full flame for 5 mins. Aft cooling, the contents of the crucible are dissolved in dil hydrochloric acid, and the sulphur precipitated as bari sulphate.—A. S.

Patents.

Indiarubber; Coagulating and curing of ——. E. J. Byrne, London. Eng. Pat. 849, Jan. 11, 1913.

The latex is delivered on to a rotating drum, endless band, or the like, from a trough above. One side of the trough is separate and adjustable in end guides, thus forming a slot of variable width and of a length equal or nearly equal to the width of the drum, and opening on its outer side on to an inclined shoot with end flanges, from the end of which the latex drops on to the drum. The latex may be forced through the slot by air pressure, and to prevent it overflowing from the top edge of the trough, the latter may be provided with a suitable overflow pipe. The shoot may be hinged so as to allow its free edge to rise as the thickness of the rubber on the drum increases. On the rear side of the drum, a heat radiator is provided for delivering hot air under pressure on to the coagulated latex, thus effecting partial drying before it again reaches the delivery shoot.—B. N.

Rubber; Process of purifying ——. C. E. Anquetil. Fr. Pat. 462,156, Nov. 14, 1912.

The crude rubber is dissolved in a chloro-derivative of ethylene or of ethane, and the comparatively fluid solution, after removal of the insoluble impurities, is run into a vessel containing alcohol, or is evaporated, in order to separate the dissolved rubber. The most suitable solvent is trichloroethylene: other compounds mentioned are di- and per-chloroethylene and tetra- and penta-chloroethane.—A. S.

Caoutchouc substance and process of making same. F. Hofmann, C. Coutelle, K. Meisenburg, and K. Delbrück, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,082,522, Dec. 30, 1913.

An alkyl derivative of erythrene, which has at least one substituent containing more than one atom of carbon (*e.g.*, an ethyl-erythrene), is polymerised until a product is formed which is insoluble in alcohol but soluble in benzene.—T. F. B.

Caoutchouc; Manufacture of synthetic ——. A. Heinemann. Fr. Pat. 461,232, Aug. 9, 1913. Under Int. Conv., Aug. 12, 1912.

See Eng. Pat. 18,506 of 1912; this J., 1913, 1022.—T.F.B.

XV.—LEATHER; BONE; HORN; GLUE.

Leather analysis; Change in methods. (Glucose determination.) J. Amer. Leather Chem. Assoc., 1914, 9, 2—3.

The revised method for the estimation of glucose in leather extracts adopted by the Amer. Leather Chemists Association. 200 c.c. of leather extract are mixed with 25 c.c. of a saturated solution of normal lead acetate in a 500 c.c. flask, shaken frequently during 5—10 mins., and filtered. Excess of solid potassium oxalate is added to the filtrate which is again filtered after 15 mins. 150 c.c. of the filtrate are boiled in a 600 c.c. Erlenmeyer flask with 5 c.c. of concentrated hydrochloric acid under a reflux condenser for 2 hours. After cooling and neutralising with anhydrous sodium carbonate, the solution is made up to 200 c.c., and filtered till clear. 25 c.c. of copper sulphate solution (34·639 grms. of the crystallised salt per 500 c.c., filtered through asbestos) and 25 c.c. of alkaline tartrate solution (173 grms. of Rochelle salt and 50 grms. of caustic soda per 500 c.c., filtered through asbestos after standing for 2 days) are placed in a 400 c.c. beaker and 50 c.c. of the clear neutral solution added, heated to boiling in exactly 4 mins. and boiled for 2 mins The precipitate is collected immediately on asbestos, without diluting, washed with hot water, alcohol, and ether, and weighed as cuprous oxide after drying for 30 mins. in the water oven. The quantity of glucose is ascertained from Munson and Walker's table (Bull. 107, Rev., U.S. Bureau of Chem., 243; also this J., 1906, 656).—D. J. L.

Patents.

Tanning; New method of ——*and production of new tanning agents.* Badische Anilin und Soda Fabrik. First Addition, dated July 31, 1913 (under Int. Conv., May 17, 1913), to Fr. Pat. 443,730, May 11, 1912 (this J., 1912, 1045).

The products obtained by the interaction of formaldehyde and aromatic hydroxy compounds specified in the chief patent may be replaced by other aromatic hydroxy-compounds, soluble in water, of a non-crystalline character and capable of precipitating gelatin solutions. They are characterised by the presence, in the molecule, of two or more aromatic nuclei containing at most one hydroxy group each and united by one or more plurivalent atoms or atomic groups. They must also contain one or more salt-forming acid groups in addition to the hydroxy groups. *Example* 1. The limed and prepared skin is suspended in a 2·5 per cent. aqueous solution of sulphonated dimethyldihydroxysulphobenzide neutralised until only moderately acid. The solution is gradually strengthened and the skin is tanned in about 10 days. Sodium chloride may also be added to the liquors and tanning may be carried out in the drum. After tanning, the leather is neutralised and is of a white colour. The tanning agent is prepared by stirring 50 kilos. of dimethyldihydroxysulphobenzide, obtained by heating *o*-cresol with sulphuric acid, with 200 kilos. of fuming sulphuric acid (23 per cent. SO_3) until the product becomes soluble in water. The mixture is then poured on 200 kilos. of ice and excess of sulphuric acid removed by lime or baryta. The solution thus obtained is used either at once or after concentration. *Example* 2. The product obtained by the action of sulphur chloride on the sulphonated product of crude cresol is partly neutralised with caustic soda and water is added to make a 5 per cent. solution which constitutes a tanning liquor and is used according to the usual methods. *Example* 3. 100 kilos. of thionaphtholsulphonic acid B, obtained according to Ger. Pat. 50,077, is dissolved to make a 5 per cent. solution and used as a tanning liquor according to the above methods.
—D. J. L.

Colloids; Method of rendering —— *insoluble.* P. Mercier. Fr. Pat. 461,287, Oct. 24, 1912.

Colloids such as gelatin, casein, albumin or blood serum are rendered insoluble, apart from any action of light, by adding to them together or separately the following substances. Chromates or bichromates with a reducing agent used as a photographic developer such as metol, quinol, pyrocatechol, ferrous salts (acidified or mixed with alkali sulphites to restrain their reducing properties), resorcinol or an alkali sulphite or bisulphite. The reduction is carried out so slowly that the colloid may be used for moulding or other purposes. Trioxymethylene may also be used if an alkali sulphite or metabisulphite is added to accelerate its transformation into formaldehyde which will render the colloid insoluble.—D. J. L.

Leather; Process for treating iron-tanned ——. J. Bystron and K. von Vietinghoff. Fr. Pat. 461,103, Oct. 21, 1912.

See Ger. Pat. 256,350 of 1911 and Eng. Pat. 21,175 of 1912; this J., 1913, 438, 618.—T. F. B.

Tanning preparations; Soluble ——. Badische Anilin und Soda Fabrik. Fr. Pat. 461,746, Nov. 5, 1912.

See Eng. Pat. 24,982 of 1912; this J., 1913, 919.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Nitrate contents of arable soils : Nature and amount of the fluctuations of the ——. E. J. Russell. J. Agric. Sci., 1914, **6**, 18—57.

The amount of nitrate in arable soil fluctuates regularly, but in the author's experiments it rarely exceeded 6 parts per million (28 lb. per acre for a depth of 18 ins.) for sand, 23 parts per million (115 lb. per acre) for loam, and 14 parts per million (60 lb. per acre) for clay. These figures do not refer to heavily dunged land, where it rose to 37 parts per million on loam. The principal accumulation of nitrate appeared usually to take place in late spring or early summer. After this there was very frequently a loss, but in hot dry autumns (*e.g.* 1911) the accumulation sometimes continued till September. During winter loss of nitrate took place, which was more marked in wet than in dry winters. The fluctuations in nitrate content were most pronounced on loams. Clays lost less in winter but gained more in summer, while sandy soils lost a fairly large amount in winter without accumulating a great deal in summer. The main cause of loss in winter appeared to be leaching and not denitrification. On comparing cropped with fallow land, it was found that the fallow was richer in nitrate during the late summer, even after allowing for that taken up by the crop, in fact there was no evidence that any nitrate formation took place during the period of growth of the crop, even though it might be in rapid progress on adjacent fallow land. The data to hand did not, however, enable any definite conclusions to be drawn as to the influence of the growth of crop on the rate of nitrate production. The rapid rise in nitrate content in the spring lagged for some time behind the arrival of the warm weather, and there were indications of greater bacterial activity in early summer than later on, which was in accordance with the author's views on the soil population (see this J., 1913, 1136). In general it was found that as the supply of nitrate was an important factor in crop growth, those factors which determine the accumulation of nitrate played a great part in determining crop production. Heavy winter rainfall tended to reduce crops, while hot dry summers followed by dry winters were favourable to growth.—W. H. P.

Acid and alkaline peats ; The humus of ——. J. A. Hanley. J. Agric. Sci., 1914, **6**, 63—76.

The author has attempted to devise a method for distinguishing chemically between normal or alkaline peats, and acid peats. The former are usually fertile, while the latter are usually non-fertile peats from bogs, moors, etc. In ordinary soil analysis the total humus is estimated by decomposing the humates with dilute hydrochloric acid and then extracting the "humic acid" with ammonia. A great deal of the humus even from alkaline peat, is however capable of being extracted by ammonia without previous acid treatment and the proportion of the whole does not give any idea of the nature of the soil. It was found on analysis that all soils containing no calcium carbonate were acid to litmus and no soil containing calcium carbonate gave an acid reaction. Determination of the amount of nitrogen extracted from the peat by ammonia before and after treatment with acid did not lead to any more reliable information as to the nature of the soil, but the use of caustic soda instead gave more significant results. The readily available proteins as measured by the yield of ammonia on hydrolysis with 20 per cent. hydrochloric acid were very low in normal peats and practically nil in acid peats, so that this method would not serve to give a clear differentiation. The most valuable method tested by the author, and the one most in agreement with the known fertility of the soils tested, was the determination of the amount of sugar inverted on boiling a 1·25 per cent. solution (100 c.c.) of sucrose with a suitable quantity (2—10 grms.) of the soil for 2 hours. The alkaline soils always gave much less cuprous oxide than the acid soils, and treatment with acid invariably led to an increase in the inverting power of a soil, even after most careful washing.—W. H. P.

Iron pan ; The solution and precipitation of iron in the formation of ——. C. G. T. Morison and D. B. Sothers. J. Agric. Sci., 1914, **6**, 84—96.

"Iron pans" may vary from 10 to 60 cm. in thickness; they consist mainly of ferric and aluminium hydroxides with silica and varying amounts of organic matter; it is yellowish brown to black in colour. The authors attribute them to the formation of colloidal humus compounds of iron and aluminium which are carried down into the soil and there precipitated by soluble salts, by loss of water or by change of bases. Experiments which show that peat though a strong reducing agent is not capable of reducing ferric to ferrous oxide, or to form from ferric oxide a solution of ferrous humate. In the presence of water, however, peat will remove considerable quantities of minerals, especially ferric oxide, aluminium oxide and lime, as colloidal suspensions, which are not very sensitive to changes in concentration. Evaporation to dryness destroys to some extent their capacity for suspension. The order in which the minerals are removed from the upper layer of what ultimately becomes bleached sand is lime, alumina, ferric oxide.—W. H. P.

Soils ; Ferrous iron in ——. C. G. T. Morison and H. C. Doyne. J. Agric. Sci., 1914, **6**, 97—101.

In the extraction of soil with acid the organic matter present is capable of reducing the ferric salt formed by the action of the acid on insoluble ferric compounds in the soil. Such a method of treatment will therefore lead to incorrect results in determining ferrous iron in soils, and it is in fact improbable that ferrous iron exists in normal soils to any extent. It is also very improbable that ferric iron is present in the normal soil solution, since 100 grms. of soil will remove all the iron from 200 c.c. of $N/200$ ferric chloride.—W. H. P.

Soils ; Selective adsorption by ——. E. G. Parker. J. Agric. Research, 1913, **1**, 179—188.

Soils adsorb dissolved salts from solution and also remove one ion to a greater extent than the other. The presence of soil bases (lime, magnesia, etc.) in solution after passing a neutral salt (of potassium for example) through a soil is attributed to selective adsorption of the cation. Chlorine ions are much less rapidly adsorbed from solution by soils than potassium ions, and the selective adsorption of potassium from potassium chloride increases with the concentration of the salt solution up to a certain point and then remains constant. The percentage of the potassium removed from a potassium chloride solution increases asymptotically as the concentration of the chloride is diminished, adsorption being practically complete at low concentrations. In general, the selective adsorption of potassium is greater the smaller the soil particles. The presence of sodium nitrate increases the adsorption of potassium from potassium chloride when there is over 37·5 grms. per litre present, but decreases at lower concentrations. Monobasic calcium phosphate has practically no effect.—W. H. P.

Surface of soils ; Determination of ——. J. A. Hanley. J. Agric. Sci., 1914, **6**, 58—62.

The author compares the total surface of different soils by measuring the amounts of adsorbed methyl violet on 5 grms. of each soil, which are in equilibrium with the same methyl violet solution. The equilibrium solution should contain about 0·05 per cent. of the dye, and this involves testing each soil with a range of about four solutions whose initial known strength is greater in the case of clays than in the case of loams, and again smaller in the case of sands. From comparisons (accurately made with Nessler glasses) of the two equilibrium solutions nearest to the standard with the standard (0·05 per cent.) itself, it is easy to deduce the amount of adsorbed dyestuff which would be in equilibrium with the standard solution.—W. H. P.

Experiments on emulsions. Newman. *See* XII.

Effect of different manures on the time of ripening of sugar cane. Taylor. *See* XVII.

Excessive leaf growth of the beet. Vivien. *See* XVII.

Purification of vinasse from beetroot distilleries. Müntz and Lainé. *See* XVIII.

Patent.

Manure from vinasse; Process for obtaining a non-hygroscopic ——. H. Stoltzenberg, Breslau, Germany. Eng. Pat. 14,884, June 27, 1913.

See Fr. Pat. 459,872 of 1913; this J., 1913, 1165.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; Experiments with —— at Sabour (India) I. Character and quantity of fibre in different varieties. II. Effect of different manures on the time of ripening of cane. C. S. Taylor. Agric. Research Inst., Pusa. Bull. No. 37, 1913. Pp. 17.

I. The fibre-content of 36 varieties of cane was found to range from 8·59 to 16·6 per cent. without any well-marked break, and hence could not serve to classify the varieties into distinct groups. The fibre-content of the corresponding megasses, however, fell in three groups comprised between the limits: 34·3 ± 1·7, 40·9 ± 2·3, and 46·9 ± 2·7 respectively. These distinctions indicate differences in the structure of the fibre, and though there is a tendency to grow canes of higher fibre-content owing to their greater resistance to disease, a cane giving as dry a megass as possible is obviously advantageous. The *Khari* variety containing 16·41 per cent. of fibre and yielding a megass with 46·3 per cent., gave slightly more juice than the *Mango* variety containing 13·16 per cent. of fibre and yielding a megass with 34·2 per cent. It is suggested that the absorptive power of the megass may depend on some hereditary character of the cane variety.

II. Experiments in which canes were grown on untreated soil and on soil manured with ammonium sulphate or superphosphate, or with both, showed that these fertilisers delay the ripening of the cane by about a fortnight but do not appreciably affect the ultimate sugar-content or composition of the juice.—L. E.

Beet; Excessive leaf growth of the ——. A. Vivien. Bull. Assoc. Chim. Sucr., 1914, **31**, 501—505.

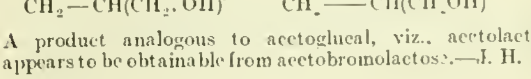
Comparative investigations of beets grown on soils treated with (1) abundance of organic nitrogenous manure, (2) little or no manure, showed that in the former case the leaf growth was excessive and the roots contained a lower percentage of sugar. The results do not bear out the view that the sugar is elaborated only in the leaves. —L. E.

Dextrose; New reduction-products of ——: glucal and hydroglucal. E. Fischer. Ber., 1914, **47**, 196—210.

Tetra-acetobromoglucose is reduced by zinc dust and acetic acid at 0° C., and a compound $C_{12}H_{16}O_7$ is produced, thus,

$$C_{14}H_{19}O_9Br+2H=C_{12}H_{16}O_7+C_2H_4O_2+HBr.$$

The new compound contains three acetyl groups· it is lævorotatory and crystallises well (m. pt. 55° C.). When boiled for a short time with water it loses one mol. of acetic acid and yields a diacetyl derivative. Dissolved in chloroform it readily takes up two atoms of hydrogen, and is saponified by cold alkalis with production of a thick syrup, very soluble in water and alcohol. This syrup shows the reactions of aldehydes but does not yield an osazone. It readily decolourises aqueous solutions of bromine and is converted into a dark amorphous mass by mineral acids. In presence of hydrochloric acid it colours pine shavings an intense green. Its formula appears to be $C_6H_{10}O_4$, for in aqueous solutions it readily absorbs two atoms of hydrogen in presence of platinum, and yields a crystalline compound $C_6H_{12}O_4$, which is also obtained by reducing and saponifying the triacetyl compound (m.pt. 55° C.) mentioned above. The syrupy compound, $C_6H_{10}O_4$, is termed "glucal." It is the representative of a class of substances hitherto unknown. Hydro-glucal, $C_6H_{12}O_4$, formed by reduction of glucal, is saturated and shows none of the reactions of aldehydes. The following formulæ are suggested for glucal and hydro-glucal respectively :—

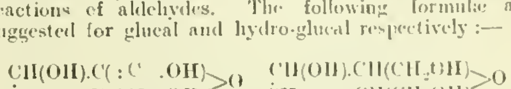


$$\left.\begin{matrix}\text{CH(OH).C(:C\ \ .OH)}\\ \dot{\text{C}}\text{H}_2\text{—CH(CH}_2\text{.OH)}\end{matrix}\right>\text{O} \qquad \left.\begin{matrix}\text{CH(OH).CH(CH}_2\text{.OH)}\\ \dot{\text{C}}\text{H}_2\text{——CH(CH}_2\text{.OH)}\end{matrix}\right>\text{O}$$

A product analogous to acetoglucal, viz., acetolactal appears to be obtainable from acetobromolactose.—J. H. L.

Methylpentoses; Constitution of the ——. I. Synthesis of an i-methyl tetrose and an i-methyl tetritol. R. Gilmour. Chem. Soc. Trans., 1914, **105**, 73—81.

Dihydroxyvalerolactone (obtained by oxidation of Δ^{α}-angelicalactone by potassium permanganate), reduced with sodium amalgam, gave rise to about 6 per cent. of a reducing sugar, from which a methyltetrosazone (m. pt. 140°—142° C.) and a methyltetrosephenylbenzylhydrazone (m. pt. 99°—100° C.) were prepared. The aqueous solution from the preparation of the hydrazone yielded a methyltetritol as a yellow syrup, which on benzoylation gave rise to a tetrabenzoyl derivative (m. pt. 136°—137° C.). The methyltetrose, obtained in the free state by decomposition of the phenylbenzylhydrazone with formaldehyde, proved to be a pale yellow strongly reducing syrup. Its constitution must be represented by one of the following formulæ :—



$$\text{CHO}\cdot\underset{\text{H}}{\overset{\text{OH}}{\text{C}}}\cdot\underset{\text{H}}{\overset{\text{OH}}{\text{C}}}\cdot\underset{\text{OH}}{\overset{\text{H}}{\text{C}}}\cdot\text{CH}_3 \quad \text{or} \quad \text{CHO}\cdot\underset{\text{OH}}{\overset{\text{H}}{\text{C}}}\cdot\underset{\text{OH}}{\overset{\text{H}}{\text{C}}}\,.\,\underset{\text{OH}}{\overset{\text{H}}{\text{C}}}\cdot\text{CH}_3$$

—J. H. L.

Patents.

Sugar from cane; Process of making ——. F. G. P. Leao, New York. U.S. Pat. 1,083,545, Jan. 6, 1914.

Sugar cane is finely divided, dried at a temperature below 158° F. (70° C.), and then saturated with water. The liquid portion is next separated by pressure, evaporated, and the residue obtained is subjected to refining processes.—W. P. S.

Sugar solutions; Electrolytic apparatus for the clarification of ——. H. McCubbin, Lahaina, Hawaii. U.S. Pat. 1,084,556, Jan. 13, 1914.

A closed horizontal tank is provided with a sludge sump and tap and with a number of adjustable electrodes. The sugar solution is admitted at the lower part of the tank near one end and leaves at the top near the other end. The electrodes are mounted on insulating supports moving on longitudinal guide-ways.—W. P. S.

Sugar; Manufacturing refined ——. M. Weinrich, Yonkers, N.Y. U.S. Pat. 1,084,771, Jan. 20, 1914.

Cold raw cane juice is mixed with raw cane sugar to a magma or syrup. The latter is charged with finely powdered caustic lime, and before the lime is completely slaked, the whole is mixed with more raw cane juice. The mixture is carbonatated, heated and filtered, the evaporated filtrate being worked up for refined sugar.—L. E.

Sugar ; Process of defecating raw cane —— or cane sugar syrup. M. Weinrich. Yonkers, N.Y. U.S. Pat. 1,084,772, Jan. 20, 1914.

Cold raw cane sugar or syrup is intimately mixed with a small percentage of finely powdered caustic lime and then slowly run into raw cane juice or water (at a temperature of about 30° C.) which at the same time is carbonatated and stirred. Carbonatation is stopped before any precipitated impurities begin to re-dissolve, the liquid then being fully neutralised by a suitable acid (whereby a second carbonatation and filtration are avoided) and finally heated and filtered.—L. E.

Sugar ; Decolourising ——. I. Larrondo C. Fr. Pat. 461,628, Aug. 6, 1913.

The sugar in the solid state is treated for a few minutes at the ordinary temperature with oxidising agents such as nascent oxygen, potassium permanganate, chlorine or iodine, and afterwards with a solution of sulphurous acid in alcohol or some other liquid in which sugar is insoluble. —J. H. L.

Sugar beets ; Preparation of —— for the extraction of juice. M. Lindner. Ger. Pat. 268,530, Dec. 12, 1912.

The beet slices or pulp, before extraction of the juice, are treated with aluminium hydroxide, whereby, it is claimed, pure light-coloured syrups are obtained, which can be worked up directly to raw sugar of low mineral content or to marketable white sugar. (See also this J., 1914, 96.) —A. S.

Evaporation of liquids, particularly saccharine juices. Fr. Pat. 461,208. *See* I.

XVIII.—FERMENTATION INDUSTRIES.

Mash filters. L. Briant, H. Harman and C. Vaux. J. Inst. Brew., 1914, **20**, 1—15.

The construction and method of working of a modern mash filter (Weigel type, holding 17½ quarters of malt) are described. The malt is ground more finely than for the ordinary mash tun but the husk should be as whole as possible. The stirring machinery is kept running during the whole of the mashing operations, say 10 mins., and the mash is then allowed to stand until shortly before it is transferred to the filter. The normal mashing period may be reduced from two hours to one hour, without any loss of extract. When this period has elapsed the rakes are set in motion and the mash is heated to about 158° F. (70° C.) and stirred continuously until the whole has been transferred to the filter. The filling of the filter occupies about 30 mins. and immediately afterwards washing is commenced and continued without interruption. The final runnings may be brought to a gravity of 1001 with a relatively small quantity of water as compared with mash-tun sparging. The possible saving of extract by use of the filter-press is estimated at 1·5—2 lb. per quarter of malt. The spent grains contain less starch, digestible fibre, etc., than those from mash-tun practice (*e.g.*, 36·8 compared with 44·7 per cent. of the dried grains), and the proportions of the other constituents are correspondingly increased. The use of the filter-press does not in any way impair the stability or brilliance of the beer or the character of the yeast, and its only effect on the flavour of the beer is to produce a marked softening, accompanied by increased palate-fulness. The beer also carries a much more lasting head when poured out, than corresponding beer prepared by the normal mash-tun process.—J. H. L.

Yeast ; Formation of higher alcohols from aldehydes by ——. II. Conversion of valeric aldehyde into amyl alcohol, and the enzymic nature of the reaction. C. Neuberg and H. Steenbock. Biochem. Zeits., 1914, **59**, 188—192. (See also this J., 1913, 803.)

Attempts to obtain a better yield than that obtained previously (*loc. cit.*), in the conversion of valeric aldehyde into amyl alcohol by living yeast in absence of sugar, were unsuccessful. That these transformations are enzymic is proved by the fact that yeast maceration juice, prepared by von Lebedeff's method (this J., 1911, 1081) and treated with sugar, was found capable of converting added valeric aldehyde into amyl alcohol with a yield of at least 12 per cent.—J. H. L.

Beer ; Concentration of hydrogen ions in —— and in brewing processes. F. Emslander. Z. ges. Brauw., 1914, **37**, 2—5, 16—19, 27—30, 37—41.

The question of acidity in relation to brewing processes and products is treated from the point of view of the concentration of hydrogen ions, as distinguished from the acidity determined by titration. The subjects thus considered are brewing water, malt, brewing processes, beer and gluten turbidity. An apparatus is described by means of which the concentration of hydrogen ions in malt liquors can be determined from the potential difference between the liquids and a "hydrogen electrode" of platinum immersed in them.—J. H. L.

Malt-wines and their relation to the (German) law. P. Kulisch. Z. Unters. Nähr. Genussm., 1913, **26**, 705—726.

Within recent years a new industry has developed in Germany, particularly in Alsace, *viz.*, the production of malt-wines, containing very little sugar, and much lighter in character than "Malton-wines" (see List, this J., 1897, 347). The new products are strongly acid and resemble, in their content of alcohol and extract, the light German wines, with the cheaper kinds of which they enter into keen competition, for in some parts of Alsace they are sold at 35 Pf. per litre (2d. per pint). The annual production at present is estimated at 150,000 hl (3,300,000 galls.). The composition of the product is subject to rather wide variations, and probably the process of manufacture is not well controlled. The outline of the process appears to be as follows :—The ground malt is extracted several times with hot water, opportunity being given for saccharification, but the yield of extract is not very satisfactory. The united extracts are treated with sugar and fermented. The character of the product seems to depend much more on its acidity and on the ratio of alcohol to extract, than on the type of yeast employed, and probably beer- or distillery-yeast could be used. The acidity develops spontaneously and doubtless depends on the rate of fermentation. The subsequent treatment of the fermented wort is very similar to that of grape wines. The quantities of materials used are estimated at 6—8 kilos. of malt and 8—15 kilos. of sugar per 100 litres of malt-wine. The following figures represent the limits of composition of sixteen samples from Alsace :—sp. gr. 0·9931—1·0076, alcohol 4·71—7·66 grms., extract 1·22—4·65 grms., sugar-free extract, 1·13—3·15 grms., ash 0·056—0·190 grm., total acidity (calculated as tartaric acid) 0·27—0·61 grm., volatile acidity (calculated as acetic acid) 0·01—0·15 grm. lactic acid 0·23—0·37 grm., reducing sugar 0·10—1·67 grm., and glycerol 0·3—0·5 grm. per 100 c.c. Neither tartaric nor citric acid was present. The optical rotation (in 200 mm. tube) ranged from +0·6 to +2·3 sugar degrees, and remained distinctly dextro-rotatory after fermentation. According to the author it is possible to detect the presence of only 10 per cent. of malt-wine in dry grape wines by polarising after suitable concentration.—J. H. L.

Wines ; Presence of citric acid in ——. Blarez, Denigès and Gayon. Ann. Falsif., 1914, **7**, 9—11.

Analyses of 38 authentic wines from the Sauterne Montbazillac, Anjou, and Rhine districts show that citr acid is a natural constituent of these wines, the amount found varying from a trace to 0·45 grm. per litre. The juices from 16 samples of black and white grapes, before and after fermentation, contained from 0·08 to 0·70 grm. of citric acid per litre.—W. P. S.

White wines ; Presence of oxalic acid in ——. H. Fonzes-Diacon. Ann. Falsif., 1914, **7**, 22—28.

White wines are liable to become opalescent or turbid and to give a white sediment, and to prevent this defect ("*casse blanche*") the practice has arisen of treating the wine with from 18 to 20 grms. of oxalic acid per hectolitre, with the object of precipitating the calcium salts present, as the turbidity is attributed to these compounds. The calcium oxalate formed is not, however, precipitated completely from the wine, a certain proportion, in quantity depending on the acidity of the wine and the presence of sulphurous acid, remaining in solution. A wine free from oxalic acid when treated similarly will remain clear for about 3 days, after which, crystals of calcium tartrate are deposited. The author has separated as much as 0·06 grm. of oxalic acid from a litre of white wine.—W. P. S.

Tannin : Determination of —— *in cider.* C. W. Spiers. J. Agric. Sci., 1914, **6**, 77—83.

The author criticises the various methods in use for the determination of tannin, and finally recommends the use of fat-free casein as a detannising agent, the amount of tannin removed being determined by the loss in permanganate value on titration, since casein removes nothing but tannin from solution (see this J., 1911, 126). Detannising is accomplished by shaking 50 c.c. with 1 grm. of casein for 15 min. The permanganate was standardised by means of various pure commercial tannins and the figure adopted is 1 grm. of ammonium oxalate=0·4648 grm. of tannin.—W. H. P.

Alcohol ; Manufacture of ethyl —— *from sawdust.* Junien. Bull. Assoc. Chim. Sucr., 1914, **31**, 500—501.

Foth (Bull. Assoc. Chim. Sucr., 1913, **31**, 463) has stated that it is unnecessary to use lead-lined vessels in saccharifying sawdust with sulphurous acid in presence of a small quantity of water, steel being sufficiently resistant under these conditions. The author's experience does not confirm this. Thus, it has been found that on heating mixtures of 1500 kilos. of sawdust (containing 30—35 per cent. of water), 81 kilos. of sulphurous anhydride, and 400 litres of water, in apparatus made of unprotected steel, the metal is rapidly attacked ; in the course of 200 operations, the thickness of the steel sheeting was diminished from 22 to 15 mm. Further, the iron sulphate thus introduced into the saccharification product, seriously retarded the subsequent fermentation.—L. E.

Vinasse from beetroot distilleries : Methods of purification of ——. A. Müntz and E. Lainé. Bull. Soc. d'Encour., 1913, **120**, 535—563.

After a description of various methods proposed for the purification and disposal of vinasse from distilleries in which beetroots are employed, the author presents details of experiments on a new biological process. The vinasse is allowed to flow very slowly over a series of shallow trays whilst aerobic organisms, such as mycoderma yeasts or moulds are cultivated on its surface. In one series of experiments described, ten trays (each 38 cm. by 57 cm.) were disposed one above another, and the liquid passed over each in turn in a layer 0·5 cm. deep, and at such a rate that 9—13 litres were treated per day. All the trays were inoculated with spores of *Sterigmatocystis nigra*, and the crops produced were collected every 3—4 days, but from only 5 trays at a time so that there were always at least 5 trays covered with well-developed cultures. The following table shows the composition of the vinasse before and after treatment, expressed in grms. per litre :—

	Before.	After.
Ammoniacal nitrogen ..	0·023	0·073
Soluble organic nitrogen	0·394	0·146
Insoluble organic nitrogen	0·269	0·034
Soluble organic matter	10·43	2·53
Insoluble organic matter	3·18	0·28

The vinasse underwent considerable concentration by evaporation, and about one-half of its total organic matter was oxidised to carbon dioxide and water by the mould. The acidity was also greatly reduced. The use of pure cultures of *Sterigmatocystis nigra* was found to prevent serious invasion of the trays by mycoderma yeasts, which are undesirable as they are not so readily separate from the liquid, and do not trap suspended matters to the same extent as the felted mould growths. The mould crops, containing about 50 per cent. of the nitrogen and 30 per cent. of the phosphorus of the vinasse, can be very readily removed from the liquid, and after being dried and powdered, they constitute a valuable manure containing : N about 8·27, P_2O_5 3·51 and K_2O 2·68 per cent. The yield of dried mould is about 3·5 kilos. per cb. m. of vinasse. After treatment by the process described above, and neutralisation of the residual acidity, the vinasse is amenable to further purification on nitrifying bacterial beds (see this J., 1911, 506, 707, 1403), whereby it can be rendered free from ammonia and almost free from organic nitrogen and organic matter. Thus purified the liquid is perfectly limpid and inodorous although coloured yellowish brown : it contains : P_2O_5 about 0·2, K_2O 1·6 and CaO 0·4 per cent., and is well suited for watering growing plants.—J. H. L.

Patents.

Diastatic preparations ; Manufacture of ——. C. F. Cross and R. F. L. Turner, London, and H. F. Fuller, Burnham, Bucks. Eng. Pat. 737, Jan. 9, 1913.

A concentrated diastatic extract is incorporated with such a quantity of previously dried starch or starchy material that a solid and apparently dry product is obtained.—L. E.

Yeast ; Transformation of beer —— *into bakers' yeast.* E. A. Barbet. Fr. Pat. 461,742, Nov. 5, 1912.

Pressed beer yeast is first liquefied by admixture with a suitable salt (*e.g.*, 2 per cent. of common salt). The cell juices, containing bitter substances, are thus drawn out of the cells, and may be separated from them by filtration, but this is not necessary. The liquefied yeast is regenerated by growth in a dilute, filtered, saccharified wort similar to those employed in the manufacture of yeast by the aeration process.—J. H. L.

Yeast ; Collection of —— *from fermentation vats.* R. Reik. Fr. Pat. 462,207, Sept. 4, 1913. Under Int. Conv., Sept. 6, 1912.

The yeast head is drawn off from the top of fermented wort, into the mouthpiece of a flexible pipe and is carried along the pipe to closed receivers which are in communication with an exhaust pump.—J. H. L.

Amylaceous materials : Process for the liquefaction, saccharification and fermentation of ——. A. Boidin and J. Effront. Fr. Pat. 461,853, Nov. 7, 1912.

The material is preferably first steeped in water at about 70° C. and ground in the moist state. The starch is liquefied by the action of *Bac. subtilis* or *Bac. mesentericus* in an alkaline medium, saccharified by malt diastase or suitable moulds in a neutral or acid medium, and fermented by yeast.—J. H. L.

Malt ; Process of manufacturing ——. J. von der Kammer, Berlin. Assignor to B. von der Kammer, Chicago. U.S. Pat. 1,084,943, Jan. 20, 1914.

See Fr. Pat. 454,534 of 1913 ; this J., 1913, 880.—T. F. B.

Diastase; Process for obtaining pure ——. S. Fränkel. Fr. Pat. 461,385, Aug. 13, 1913.

See Eng. Pat. 18,427 of 1913; this J., 1913, 1166.—T.F.B.

Non-alcoholic beverages; Manufacture of ——. C. R. Wagner, Sonnenberg, Germany. U.S. Pat. 1,084,833, Jan. 20, 1914.

See Eng. Pat. 16,707 of 1910; this J., 1911, 916.—T. F. B.

Crystallised liquids: Process for preparing ——. U. Wegener. Fr. Pat. 461,392, Aug. 14, 1913.

See Eng. Pat. 20,061 of 1913; this J., 1914, 157.—T. F. B.

Distillery and like residues; Impts. in and apparatus for recovering valuable products from ——. C. E. Geiger, W. E. Koop, and G. W. Fiske, Louisville, Ky., U.S.A. Eng. Pat. 4052, Feb. 17, 1913.

See U.S. Pat. 1,057,142 of 1913; this J., 1913, 444.—T.F.B.

Dry distillation of grape marc. Fr. Pat. 461,443. *See* IIb.

Plastic composition [from yeast and spent hops]. U.S. Pat. 1,084,900. *See* V.

Treatment of materials containing tartaric acid for the extraction of calcium and potassium tartrates. Fr. Pat. 461,901. *See* VII.

Preparation of yeast for the manufacture of extracts. Fr. Pat. 462,198. *See* XIXa.

XIXa.—FOODS.

Flour containing barium carbonate; Cases of poisoning caused by ——. L. Hugounenq. Ann. Falsif., 1914, **7**, 54—56.

Numerous cases of more or less acute poisoning investigated by the author were found to be caused by the presence of barium carbonate in the flour which had been consumed by the patients. Analysis of the flour showed that it contained from 5 to 21 per cent. of barium carbonate, whilst bread made from the flour contained from 2 to 7·5 per cent. (calculated on the dry substance). No definite evidence was obtained as to how the barium carbonate came to be mixed with the flour.—W. P. S.

Milk; Detection of added water in —— by a simplified molecular concentration constant. L. Mathieu and L. Ferré. Ann. Falsif., 1914, **7**, 12—21.

The simplified molecular concentration constant denotes the sum of the weight of crystallised lactose and of the sodium chloride expressed as the isotonic equivalent of lactose. For instance, a milk containing 54·5 grms. of lactose and 1·4 grm. of sodium chloride per litre would give a constant of $54{\cdot}5+(1{\cdot}4\times11{\cdot}9)=71{\cdot}2$, since 1 grm. of sodium chloride is the isotonic equivalent of 11·9 grms. of lactose. The constant must be corrected for the volume of the fat and casein; the volume of the calcium phosphate may be neglected. This correction, taking extreme cases, varies from 1·03 to 1·10 and in the majority of milks it is 1·07, that is to say, the constant found as above must be multiplied by 1·07 to give the true value. With most milks the value of the constant lies between 74 and 79 and will fall below 73 when the milk contains from 5 to 8 per cent. of added water.—W. P. S.

[*Milk.*] *Separator-slime; The lipoids of —— and their importance for the formation of milk fat.* O. Laxa and A. Konecny. Milchwirtschaftl. Zentr., 1913, **42**, 663—671, 691—697. Chem. Zentr., 1914, **1**, 281—282.

The separator-slime examined was derived mostly from milk which had been pasteurised at 85° C. It contained 53·32—60·78 (average 56·52) per cent. of water, 28·56—55·12 (32·12) of protein, 0·61—4·25 (2·32) of fat, and 4·40—6·08 (5·23) per cent. of ash. The dried slime contained 0·103—0·107 per cent. P_2O_5 soluble in alcohol and 0·21 per cent. of cholesterol. Slime from raw milk contained 71·86—75·32 per cent. of water, 16·73—21·91 of protein, and 2·85—3·07 of fat; and the dry substance contained 0·157 per cent. P_2O_5 soluble in alcohol. The fat extracted by ether was separated into a liquid portion (greatly preponderating) and a solid portion. The residue left after extracting the slime with ether yielded to alcohol a further quantity of pale green fat rich in chlorophyll. The characters of the different specimens of fat are shown in the following table:—

	Fat extracted by ether.			Fat extracted by alcohol.
	Whole fat.	Liquid fat.	Solid fat.	
Solidif. pt...........	—	+6° C.	28·3° C.	—
Melting point	—	18°—28° C.	38°—39° C.	—
Saponif. value	192·2—192·9	191·9—192·8	180·1—180·3	210—210·8
Acid value	119	69·3	—	—
Reichert-Meissl value	12·8	17·2—17·6	12·7	8·5
Polenske value......	4·3	3·2	3·6	1·8
Refractometer reading (40° C.)	47	—	46·5	—
Iodine value	40·8—43·6	45·5—45·9	34·6—35·2	38·1—38·6
Hehner value	—	88·2—88·8	91·5	—
Mol. wt. of insol. acids	—	315	309	291

The fatty acids of the liquid fat contained: erucic acid, 49·56; oleic acid, 21·24; palmitic, stearic, myristic and lauric acids, 17·70; soluble volatile acids, 4·90 per cent.—A. S.

Butter; Preservation of —— by means of sodium bicarbonate and sodium nitrate. F. Bordas. Ann. Falsif., 1914, **7**, 45—49.

The results of an investigation, in which quantities of 100 grms. of butter were mixed with 0·857 grm. of sodium bicarbonate or with this quantity of bicarbonate and 0·143 grm. of sodium nitrate, and then kept for 14 days, showed that, although the alkali prevented the acidity of the butter from increasing, it modified the colour and taste; the addition of the sodium nitrate was without effect. —W. P. S.

Cottonseed hulls; Determination of —— in cottonseed meal. C. Grimme. Chem.-Zeit., 1914, **38**, 137—139.

The difficulties of manipulation in Fraps' method (this J., 1909, 590) are obviated by basing the calculation upon the results of hydrolysis with 1 per cent. hydrochloric acid. The amounts of residues thus obtained with the seed kernels of N. American, Brazilian, Egyptian and Caucasian cotton ranged from 10·32 to 11·58 per cent., whilst the hulls gave 69·64 to 70·07 per cent. Only in the case of cottonseed grown in Togo was there any pronounced variation from these results, the residues then ranging from 10·45 to 11·54 (kernels) and from 59·10 to 65·0 (hulls). As the exports of Togo cottonseed are relatively negligible the values of 70 for the hulls and of 11 for the kernels was adopted for the calculation. 2 grms. of the finely-powdered meal (freed from fat) are digested fo 30 mins. (from the time of boiling) beneath a reflux condenser with 200 c.c. of 1 per cent. hydrochloric acid, and th liquid then diluted to 1000 c.c. with hot water, and filtered through asbestos. The residue is washed with hot water then three times with alcohol and once with ether, an dried at 105°—110° C. until constant in weight, afte which it is ignited and the amount of ash deducted fro the first weight. The percentage of hulls is calculated by the formula $x = \frac{(y-11)\,100}{59}$, where y represents the amount of ash-free residue. The results agreed closely with those obtained by the method of Fraps, the difference lying between −0·3 and +0·8 per cent.—C. A. M.

Patents.

Meat; Process of preserving ——. A. Danilevsky, St Petersburg. Eng. Pat. 14,784, June 26, 1913.

Immediately after the animal has been slaughtered an incision is made in the heart, and a solution consisting of water, 100 parts, sodium chloride, 1 to 3, and hydrogen peroxide, 0·005 to 0·5 part, is introduced into the artery and forced through the blood vessels under a pressure not exceeding 0·33 atmosphere. When the solution has replaced all the blood in the vessels, as is shown by the solution flowing in a colourless condition from the right ventricle, the carcase is eviscerated, skinned, immersed in a tank filled with the solution, and then wrapped in linen saturated with the solution.—W. P. S.

Protein compounds from fish; Process for the preparation of soluble ——. Naamlooze Vennootschap Algemeene Exploitatie Maatschappij, Amsterdam. Eng. Pat. 22,462, Oct. 6, 1913. Addition to Eng. Pat. 7700 of 1913, dated Nov. 6, 1912 (this J., 1913, 957).

In order to avoid the use of carbon dioxide for carbonating the excess of calcium hydroxide employed in the process described in the former patent (*loc. cit.*), the mixture obtained on digesting fish with calcium hydroxide is diluted with water, and filtered. The insoluble portion of the calcium hydroxide is thus removed, and the filtrate is then carbonated and the proteins separated.—W. P. S.

Milk; Process for curdling ——. J. Brensike, Hustisford, Wis. U.S. Pat. 1,083,659, Jan. 6, 1914.

Stomachs and intestines of fish are freed from their contents, soaked in water, and heated for 1 hour, or more. The liquid portion is then separated, filtered, a suitable proportion of rennet is added to the filtrate, and this mixture is added to milk.—W. P. S.

Milk; Machine for drying ——. P. M. Thardy. Fr. Pat. 461,584, July 23, 1913.

Circular glass or polished metal plates are mounted vertically on a rotating shaft; each plate is surrounded by a steam-jacket which covers three-fourths of the surface, and means are provided for exhausting the air from the space between the jacket and the plate. The milk is delivered on to both sides of the plates by oppositely rotating rollers, the lower parts of which dip into a vessel containing the milk; a pair of rollers is provided for each plate. The film of dried milk is removed from the plates by scrapers.—W. P. S.

Artificial milk and a process and apparatus for its manufacture. G. von Rigler. Fr. Pat. 461,131, Aug. 5, 1913. Under Int. Conv., Oct. 29, 1912.

Crude gluten (150 grms.) is dissolved in 1 litre of a solution containing 0·01 to 0·015 per cent. of potassium hydroxide and 0·5 per cent. of alcohol; suitable quantities of sodium chloride, lime-water, phosphoric acid, and sugar, are then added (care being taken that the solution still remains alkaline in reaction), and the solution, while being gradually heated from 70°—100° C., is emulsified with 3·5 per cent. of its weight of a vegetable oil such as cocoanut oil. The mixture is maintained at 100° C. for 30 mins., then filtered, cooled, and transferred to sterilised bottles. The different parts of the apparatus are all in connection with each other so that, during the various operations, the mixture may be kept out of contact with the atmosphere.—W. P. S.

Margarine and analogous substances; Manufacture of —— *using cooling surfaces for cooling the liquid fats or emulsions.* E. Schou. First Addition, dated July 30, 1913, to Fr. Pat. 454,640, Feb. 20, 1913 (this J., 1913, 880). Under Int. Conv., Oct 21, 1912.

The thin films of fat removed by the scrapers are heated rapidly so as to yield a homogeneous mass.—W. P. S.

Pectinous alimentary products; Process of extracting —— *from fruits and legumes.* R. Douglas. Fr. Pat. 462,044, Sept. 1, 1913.

Fruit (apple) pulp, after the removal of the natural juices and sugar, is extracted with hot water containing a small quantity of an acid. The aqueous solution is evaporated, preferably under reduced pressure, to a syrupy consistence. Leguminous substances may also be used as the source of the pectin.—W. P. S.

Alimentary products [jellies, jams, etc.], and process of manufacturing them. R. Douglas. Fr. Pat. 462,045, Sept. 1, 1913.

Crushed fruit, or fruit juice, is mixed with sugar and an amount of concentrated pectin solution sufficient to convert the whole into a jelly without concentration. The mixture is then sterilised by heating, and cooled.—W. P. S.

Yeast; Preparation of —— *for the manufacture of extracts.* "Visca" Nahrungsmittel-Ges. m. b. H. Fr. Pat. 462,198, Nov. 16, 1912.

For the preparation of yeast-extracts analogous to extracts of meat, the yeast is first washed to remove bitter substances and other impurities, and then allowed to ferment an aqueous solution of sugar. It is killed when fermentation is in full vigour, and the quantity of sugar employed is so chosen that a small excess remains in the yeast.—J. H. L.

Flour; Process and machine for treating ——. C. Herendeen. Fr. Pat. 461,138, Aug. 6, 1913.

See U.S. Pats. 1,073,985 and 1,073,986 of 1913; this J., 1913, 987.—T. F. B.

Transformation of beer yeast into bakers' yeast. Fr. Pat. 461,742. *See* XVIII.

XIXb.—WATER PURIFICATION; SANITATION.

Experiments on emulsions. Newman. *See* XII.

Patents.

Water; Apparatus for the treatment [softening] of —— *and for similar purposes.* W. R. Ormandy, Manchester. Eng. Pat. 25,261, Nov. 4, 1912.

A rotating horizontal cylinder is divided into compartments by perforated partitions; zeolites are placed in these compartments and are brought into intimate contact with the water passing through the cylinder by means of curved blades attached to the inner walls. A filter is provided at each end of the cylinder. The water may be passed in either direction, alternately, through the cylinder, and a regenerating solution may be admitted when required, or the zeolites may be removed and treated with the solution in a separate vessel. In a modification of the apparatus, the cylinder is fixed and contains a central rotating shaft fitted with blades.
—W. P. S.

Water; Method of and apparatus for heating and purifying ——. N. Tikhomiroff, Moscow. Eng. Pat. 131, Jan. 2, 1913.

Waste furnace gases are passed upwards through three or more superposed chambers, and the water mixed with a suitable reagent (aluminium sulphate, calcium hydroxide, sodium carbonate) is sprayed through an atomiser into the upper chamber, then collected from the latter and sprayed into the next lower chamber, and so on. A tank, divided into compartments, is provided for collecting separately the water flowing from the different chambers, and the hot water from the last chamber may be passed through a filter before it is conducted to the boiler. —W. P. S.

Water; Method and means for softening ——. H. J. Wheaton, Spondon, Derbyshire. Eng. Pat. 4188, Feb. 18, 1913.

In an apparatus where the water to be softened is passed downwards through a bed of softening material such as zeolites and then through a layer of sand, the zeolites are regenerated by leading a solution of sodium chloride from a tank (situated above the softening chamber) to a space below the zeolite bed and allowing it to flow upwards through the same. Water is then admitted to the upper part of the chamber in order to wash the zeolites. The sodium chloride solution is prepared in a tank at the ground level and then pumped into the upper tank. —W. P. S.

Refuse destructors. Comp. d'Incinération Industrielle, Paris. Eng. Pat. 12,668, May 30, 1913. Under Int. Conv., June 28, 1912.

The destructor consists of a number of furnaces, each having a preliminary drying chamber with an inclined arch on which the fresh refuse is dried and distilled before it falls on to the grate; the distillation gases pass into a combustion chamber heated by a coke furnace, the latter being supplied with a current of heated air from the refuse chamber or from the front of the furnace. The gases from the combustion chamber are then conducted under a boiler and through a preheater and dust collector before being allowed to escape into the atmosphere. Means are provided for removing clinker from the furnaces. —W. P. S.

Charcoal Manufacture of active powdered —— *[from refuse] for purifying and filtering purposes.* L. Pilaski. Ger. Pat. 267,443, Aug. 16, 1912.

House refuse and road sweepings are sifted to remove the fine material; from the coarser portion, stones, cinders, etc. are removed, and the residue is treated with quicklime and subjected to destructive distillation.—A. S.

Sterilisation of liquids: Apparatus for the ——. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris. Eng. Pat. 28,660, Dec. 12, 1912. Under Int. Conv., Dec. 21, 1911.

See Addition of Dec. 21, 1911, to Fr. Pat. 424,369 of 1910; this J., 1913, 504.—T. F. B.

Charcoal for purification and filtration; Process for making powdered ——. L. Pilaski. Fr. Pat. 461,599, July 30, 1913.

See Ger. Pat. 267,443 of 1912; preceding.—T. F. B.

Sewage; Apparatus for purifying ——. P. Bunzel, Fr. Pat. 461,622, Aug. 4, 1913.

See U.S. Pat. 1,079,391 of 1913; this J., 1914, 39.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Strophanthin in seeds and tincture; Determination of ——. J. B. Lampart and A. Müller. Arch. Pharm., 1913, **251**, 609—632.

Comparisons have been made of a number of methods for the determination of strophanthin in strophanthus seeds or tincture. The most satisfactory is that described by Fromme in 1910 (Geschäfts-Ber., Cæsar and Loretz, 1910, 118; 1911, 142). 7·0 grms. of the finely-crushed seeds are boiled in a reflux apparatus for an hour with 70·0 grms. of absolute alcohol. When cold, the whole is made up to the original weight with absolute alcohol, and 50·5 grms. filtered into a porcelain basin. The alcohol is evaporated and the residue washed with light petroleum which is poured through a filter. The insoluble residue in the filter and basin are boiled with 5—8 grms. of water, treated with 5 drops of lead acetate solution and about 0·2 grm. of kieselguhr, well mixed and filtered into a 100 c.c. flask. The insoluble portion is washed till the runnings no longer have a bitter taste. The filtrate is treated with 5 drops of hydrochloric acid and boiled gently for 2 hours, the volume being kept between 10—20 c.c. by the addition of distilled water. When cold, the liquid is extracted twice with 10 c.c. of chloroform which is filtered into a tared flask. The aqueous portion is again boiled for half-an-hour, cooled and extracted three times with 10 c.c. of chloroform. If the aqueous portion after warming still tastes bitter, the boiling and extraction with chloroform are repeated. The chloroform is distilled off, the residue dried in a desiccator and then weighed. It consists of strophanthidin, one part of which corresponds to 2·187 parts of pure strophanthin. For the tincture 51 grms. (equivalent to 5·0 grms. of the seeds) are heated on the water bath to remove the alcohol, the residue taken up with 20 grms. of hot water, treated with 15 drops of lead acetate solution and 0·2 grm. of kieselguhr. It is then treated by the method described above for the seeds.—F. Shdn.

Harmine and harmaline. O. Fischer. Ber., 1914, **47**, 99—107. (See also this J., 1912, 659.)

After discussing the formulæ that have been proposed for harmine and harmaline, including those of Perkin and Robinson (*loc. cit.*), further formulæ are put forward for harmine which are better in accordance with the behaviour of this substance. Methylharmaline hydrochloride crystallised from hot water and melted at 265° C. with decomposition. It was reduced by boiling with sodium and amyl alcohol to methyldihydroharmaline $C_{14}H_{18}N_2O$, which was crystallised from benzene and formed nearly colourless leaflets, m. pt. 173°—174° C. The latter substance gave a methiodide, m. pt. 203° C., which was converted into a pseudo-base with the composition of a quaternary dimethylharmaline ammonium hydroxide, $C_{15}H_{22}N_2O_2$, m. pt. 129° C., on boiling with potassium hydroxide and methyl alcohol. When dimethylharmaline iodide was boiled with aqueous potassium hydroxide trimethylamine was split off. Harmaline was condense with hydroxylamine by boiling an alcoholic solution o the two substances, with the formation of a product $C_{13}H_{17}N_3O_2$, m. pt. 180° C. after crystallising from alcohol Harmine and dihydroharmaline could not be condensed i this way. Dihydroharmaline and benzaldehyde wer boiled in concentrated solution and the product precipitate by the addition of hydrochloric acid. After washing wit ether, nearly colourless crystals of a condensation produc were obtained with the composition, $C_{33}H_{38}N_4O_2Cl$ Harminic acid was oxidised by heating 1—1·5 grm. wit 2 c.c. of nitric acid (sp.gr. 1·4) and 6 c.c. of water to 180°-200° C., when isonicotinic acid, $C_6H_5NO_2$, m. pt. 307°-308° C., was obtained.—F. Shdn.

Digitoxin and gitalin. H. Kiliani. Arch. Pharm.. 191 **251**, 562—587.

Gitalin is not readily converted into anhydrogitalin boiling with water or treatment with solvents as w stated by Kraft (Arch. Pharm., 1912, **250**, 118 ; compare also this J., 1912, 256). A method for analysing digitalis preparations is proposed, based on the fact that when a solution of digitoxin, gitalin and anhydrogitalin in a mixture of equal volumes of chloroform and methyl alcohol is treated with ether, digitoxin and anhydrogitalin are precipitated, whilst gitalin remains in the solution. Good yields of digitoxigenin can be obtained by boiling 1 part of digitoxin with about 10 parts of a mixture of 100 parts of 50 per cent. alcohol and 1 part of concentrated hydrochloric acid for 15 minutes. Digitoxose, produced together with digitoxigenin by the hydrolysis of digitoxin, is readily decomposed by boiling with dilute aqueous hydrochloric acid. This sugar behaves quite differently to *l*-arabinose and does not yield furfural on distillation with hydrochloric acid. It has the composition, $C_6H_{12}O_4$. When digitoxinic acid lactone is boiled with an aqueous alcoholic solution of quinine, a quinine salt of the acid is formed melting at 164° C. The brucine salt formed in the same way melts at 124° C.—F. Shdn.

Purine bases ; Synthetic glucosides of the ——. E. Fischer and B. Helferich. Ber., 1914, **47**, 210—235.

By interaction of acetobromoglucose or its derivatives, and salts of the purine bases with heavy metals (especially silver salts), in water-free solvents, the authors succeeded in preparing glucosides of these bases. Thus, by heating together the silver salt of theophylline and acetobromoglucose, in boiling xylene, a tetra-acetyl derivative of theophylline-*d*-glucoside was obtained, which when hydrolysed by alcoholic ammonia yielded theophylline-*d*-glucoside. This compound (which probably contains the dextrose residue attached to one of the nitrogen atoms of the imidazole ring) was very readily hydrolysed by hot dilute acids, but not by emulsin or yeast enzymes. It is probably a β-glucoside like all those hitherto prepared from acetobromoglucose. Glucosides of theobromine and hydroxycaffeine were prepared in a similar manner ; the former underwent slow hydrolysis in cold aqueous solutions. Dichloro-adenine served for the preparation of several of these glucosides. Thus, by careful reduction of dichloro-adenine-glucoside with hydriodic acid and phosphonium iodide, adenine-*d*-glucoside was obtained and this was converted into hypoxanthine-glucoside by the action of nitrous acid ; both of these were similar to natural ribosides of adenine and hypoxanthine. Dichloro-adenine-glucoside was also converted into the monochloro compound by heating with water and zinc dust at 140° C. ; the amino group was removed by means of nitrous acid and, by subsequent treatment of the product with alcoholic ammonia at 150° C. a crystallisable substance, probably guanine-glucoside, was obtained. The nucleic acids and the closely related, but more simply constituted nucleotides, contain not only bases and sugars but also phosphoric acid, and the latter appears to be combined with the sugar residue. By combining theophylline-*d*-glucoside with phosphoric acid by the procedure of Neuberg and Pollak (this J., 1910, 291, 967) products were obtained which, though they resembled the nucleotides in many respects, were only monobasic and they were not obtained crystalline.—J. H. L.

Sarsaparilla root ; Chemical examination of ——. F. B. Power and A. H. Salway. Chem. Soc. Trans., 1914, **105**, 201—219.

OMMERCIAL grey Jamaica sarsaparilla root (*Smilax ornata*, Hooker, fil.) was found to contain a small quantity of an nzyme which slowly hydrolysed amygdalin. 22·1 kilos. f the ground root were extracted by continuous percolaion with hot alcohol, and after removal of the greater art of the solvent, the viscid dark-coloured extract 2·95 kilos.) was distilled with steam. The distillate ontained 2·6 grms. of a pale yellow essential oil, which ad the sp. gr. 0·977 at 15°/15° C., was not completely luble in 70 per cent. alcohol, and distilled between 70° nd 200° C. at 15 mm. The following compounds were olated from the alcoholic extract :—A crystalline glucoside, sarsasaponin, $C_{44}H_{76}O_{20},7H_2O$ (m. pt. 248° C., $[\alpha]_D=-48{\cdot}5°$ in aqueous solution), a phytosterolin (sitosterol-*d*-glucoside), $C_{33}H_{56}O_6$, m. pt. 280—285 C., with decomposition, sitosterol, $C_{27}H_{46}O$, m. pt. 135°—136° C., $[\alpha]_D=-27{\cdot}3$ in chloroform, stigmasterol, $C_{30}H_{50}O$, a new, crystalline dicarboxylic acid, *sarsapic acid*, $C_4H_2O_2(CO_2H)_2$, m. pt. 305° C., dextrose, and a mixture of palmitic, stearic, behenic, oleic, and linolic acids. There were also present a considerable quantity of potassium nitrate and a small quantity of a substance having the characters of cetyl-*d*-glucoside. The total quantity of resinous material extracted by alcohol was equivalent to about 1·25 per cent. of the weight of the root. Sarsasaponin, on hydrolysis, yielded 1 mol. of sarsasapogenin, $C_{26}H_{42}O_3$, m. pt. 183° C., $[\alpha]_D=-60{\cdot}3°$ in methyl alcohol, and 3 mols. of dextrose. Jamaica sarsaparilla root thus contains only one definite saponin-glucoside, namely sarsasaponin, but it also contains a phystosterol-glucoside or phytosterolin (sitosterol-*d*-glucoside), and it is probable that the parillin of earlier investigators consisted of a mixture of sarsasaponin and a phytosterolin. Commercial smilacin, the smilasaponin of v. Schulz (Pharm. J., 1892, **52**, 6 ; Arb. des pharmakol. Inst. zu Dorpat, 1896, **14**, 14), was found to consist of a relatively small proportion of sarsasaponin together with indefinite amorphous products.—A. S.

Sulphur dioxide-camphor ; The system ——. I. Bellucci and L. Grassi. Atti R. Accad. dei Lincei Roma, 1913, **22**, II., 676—680.

A careful study of mixtures of camphor and sulphur dioxide by the method of thermal analysis showed that two compounds are formed, viz., $C_{10}H_{16}O,2SO_2$, m. pt. —45° C., and $C_{10}H_{16}O,SO_2$, m. pt. —24° C. It is probable that the action of camphor in facilitating the union of sulphur dioxide and chlorine to sulphuryl chloride is connected with the formation of these compounds. This view is borne out by the statement in Ger. Pat. 138,531 (U.S. Pat. 716,248 of 1902 ; this J., 1903, 110) that good yields of sulphuryl chloride can be obtained by adding liquid chlorine to a previously prepared, cooled liquid mixture of sulphur dioxide and camphor, *i.e.*, under conditions specially favourable to the formation of the compounds mentioned.—A. S.

Salicylic acid chloride ; Preparation of ——. E. Kopetschni and L. Karczag. Ber., 1914, **47**, 235—237.

Sodium salicylate was added slowly to thionyl chloride cooled with ice. Sulphur dioxide was evolved and the mixture turned into a gelatinous mass which became more or less transparent on standing. This consisted of a mixture of salicylic acid chloride, $C_6H_4(OH)COCl$, and sodium chloride. The excess of thionyl chloride was removed by warming gently in a vacuum. The mass was then heated and the salicylic acid chloride distilled off at 90°—115° C. at 12 mm. It then formed a clear, highly refractive, stable liquid with a characteristic odour. When cooled on ice it solidified and then melted again at 17·5°—18·0° C. A better yield was obtained by extracting the mass with light petroleum, but the product was found to be liable to spontaneous decomposition.—F. Shdn.

Aldehydes and ketones ; Reduction of the carbonyl group in —— *to the methylene group.* E. Clemmensen. Ber., 1914, **47**, 51—63.

A general and practically quantitative reduction is effected by amalgamated zinc and hydrochloric acid (which is usually of 1 : 1 or 1 : 2 strength), and the products are of high purity. The reactions are represented thus ;

$$R.CO.Ar(OH)+2H_2=R.CH_2.Ar(OH)+H_2O \text{ and}$$
$$Ar(OH).CHO+2H_2=Ar(OH).CH_3+H_2O.$$

For ketones the complete mixture is heated for several hours ; but, owing to the resinification of certain aldehydes by acid, the aldehyde is usually added in portions to the reducing mixture. The following phenols have thus been prepared from the corresponding hydroxy-ketones: *p*-ethylphenol, *p*-propylphenol, *m*-ethyl-*o*-cresol, ethylresorcinol, ethylquinol, ethylcatechol, ethylpyrogallol and diethylpyrogallol. The phenols obtained by the reduction of aromatic hydroxy-aldehydes include the three cresols and *p*-methylthymol. As a typical case, the preparation of *o*-cresol from salicylaldehyde may be quoted. Good commercial granulated zinc is left for a few hours in a 5 per cent. solution of corrosive sublimate. The liquid is poured off and the zinc (150 grms.) transferred directly to a flask provided with a reflux condenser. Concentrated hydrochloric acid (200 c.c.) is added, the mixture is warmed till reaction sets well in, and salicylaldehyde (25 grms.) run in gradually from a dropping funnel. The completed mixture is boiled for an hour; further small quantities of acid being introduced from time to time during the whole course of the reaction. Finally, the *o*-cresol is distilled with steam, separated by the addition of common salt, dried and re-distilled. The yield is about 70 per cent. The colour reactions of the extremely pure cresols so obtained, are described, and the author attributes the unpleasant smell of commercial phenol to the presence of *p*-cresol and *p*-ethylphenol.—J. R.

Alkoxy groups; The action of Grignard's reagent on ——. H. Simonis and P. Remmert. Ber., 1914, **47**, 269—271.

The alkoxy group is only indifferent to Grignard's reagent (alkyl magnesium iodide) at comparatively low temperatures, thus anisol is not acted upon at 100° C., but at its boiling point (155° C.) is completely decomposed: $C_6H_5.OCH_3+CH_3.MgI=C_6H_5.OMgI+C_2H_6$. Phenetol similarly gives phenol and propane. Dimethoxy-compounds behave in the same way, quinol-dimethylether giving a good yield of quinol together with a little of the mono-ether when the reaction is carried out at 250° C. in petroleum solution.—J. B.

Sodium alkyl thiosulphates; Action of hydrogen peroxide on the ——. D. F. Twiss. Chem. Soc. Trans., 1914, **105**, 36—39.

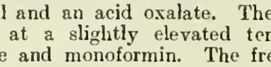
In slightly acid solution the sodium alkyl thiosulphates are readily oxidised by hydrogen peroxide, forming disulphides,

e.g., $2C_6H_5.CH_2.S_2O_3Na+H_2O_2=(C_6H_5.CH_2)_2S_2+2NaHSO_4$.

The disulphides of the benzyl, *o*-nitrobenzyl, *p*-nitrobenzyl and allyl radicles have been prepared in this manner. *o*-Nitrobenzyl-selenosulphate has similarly been oxidised to yield di-*o*-nitrobenzyl diselenide. The method has the advantage of not giving rise to by-products of unpleasant smell. Dibenzyl diselenide suspended in glacial acetic acid is oxidised almost quantitatively by hydrogen peroxide to selenious acid and benzyl alcohol.—J. R.

Glycerol and oxalic acid, Interaction of ——. F. D. Chattaway. Chem. Soc. Trans., 1914, **105**, 151—156.

The explanation of this action usually given in the text-books is incorrect. Oxalic acid forms with glycerol both a normal and an acid oxalate. The latter decomposes readily at a slightly elevated temperature into carbon dioxide and monoformin. The fresh oxalic acid displaces formic acid from the monoformin, and the cycle of operations is repeated. This is shown by the fact that on adding ammonia or aniline to the reaction mixture, oxamic or oxanilic acids can be obtained, demonstrating the existence of the acid glyceryloxalate in the melt. Using ethyl alcohol instead of glycerol the whole series of reactions can be carried out and the products isolated at every stage. The allyl alcohol obtained when the reaction mixture is rapidly heated to a higher temperature results from the decomposition of the normal glyceryl ester, dioxalin,



$$\begin{array}{l}CH_2\text{———}CH{\cdot}CH_2{\cdot}OH.\\ \;| \qquad\qquad\quad |\\ O\text{—}CO\text{—}CO\text{—}O\end{array}$$

This can be shown to be present in such a reaction mixture by the formation of oxamide or oxanilide, and on heating it decomposes into allyl alcohol and carbon dioxide.

—W. H. P.

Patents.

Preparations containing formic aldehyde [*and sugars*]. H. Sefton-Jones, London. From J. A. von Wülfing, Berlin. Eng. Pat. 17,616, Aug. 2, 1911.

See U.S. Pat. 1,062,501 of 1913; this J. 1913, 672. Similar products are obtained from one mol. of a biose or two mols. of a monose and one, two, three, or four mols. of formaldehyde.—T. F. B.

Formaldehyde; Process for the manufacture of crystalline polymerisation products of ——. F. Pollak, Berlin. Eng. Pat. 25,830, Nov. 11, 1913. Under Int. Conv., Dec. 13, 1912.

The various crystalline polymerisation products of formaldehyde (polyoxymethylenes) can be obtained by dissolving amorphous paraformaldehyde in solutions of acids or acid salts by heating, or by treating it with such solutions heated to a temperature below that required for complete solution; on cooling the polymerisation products separate from the liquid. For example, 500 parts of dry amorphous paraformaldehyde are dissolved in 680 parts by weight of sulphuric acid (22·8 vols. per cent.) at 90°—95° C., the solution is filtered and allowed to cool slowly: the product consists of pure α-polyoxymethylene, which is soluble in aqueous sodium sulphite solution and does not react exothermically with phenols without contact media. When stronger acid is used, and in greater quantity, the β- and γ-polymers, which are reactive with phenols, and are soluble and insoluble, respectively, in sodium sulphite solution, are obtained.

—T. F. B.

Pharmaceutical compounds [*fatty acids containing arsenic and phosphorus*]; *Manufacture of* ——. F. Heinemann, Berlin. Eng. Pat. 10,378, May 2, 1913. Addition to Eng. Pat. 18,732 of 1912, dated Nov. 29, 1911 (see this J., 1913, 109).

Fatty acids of the acetylene series containing arsenic can be obtained by treating the acids with arsenic trioxide and hydrohalogen acids in presence of dehydrating agents. Other mixtures yielding trihalogen derivatives of arsenic or phosphorus may be used to produce acids containing arsenic or phosphorus, respectively.—T. F. B.

Organic arsenic compounds; Process for preparing ——. H. Bart. Ger. Pat. 268,172, Sept. 20, 1912. Addition to Ger. Pat. 250,264 (see Eng. Pat. 568 of 1911; this J., 1911, 1087).

An aromatic diazo compound is treated in alkaline solution with arsenious acid or its salts or compounds which contain either of the groupings, $.As(OK)_2$ or $.As:O$, in presence of a catalyst, such as metallic copper, silver, nickel, or cobalt, or their compounds. By this process, amino-5-hydroxy-2-phenylurethane is converted into hydroxy-4-carboxyethylamino-3-phenylarsinic acid and *p*-aminophenol into *p*-hydroxyphenylarsinic acid.—T. F. B

Arseno-precious metal compounds; Process for preparin ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 268,220 and 268,221, July 21 and Sept. 27 1912.

An aqueous solution of a salt of 3.3′-diamino-4.4′-dihydroxy arsenobenzene or of its formaldehyde-sulphoxylate compound is treated with a salt of gold or of a metal of th platinum group, and the products are separated fror the solutions by evaporation or by addition of an organi solvent. The complex compounds thus obtained may b used in medicine on account of their bactericidal pr perties.—T. F. B.

Aromatic stibino-compounds, aromatic stibinoxides and their derivatives; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 268,451, Dec. 28, 1911.

When monoarylstibinic acids or their derivatives are treated with reducing agents, stibino-compounds or stibinoxides or their derivatives are produced, according to the conditions of the reaction.—T. F. B.

Glycerol-halogen-hydrins and poly-oxy-fatty acid esters; Process for directly producing ——. H. Fairbrother, London. From E. Zollinger, Zürich, Switzerland. Eng. Pat. 14,767, June 26, 1913.

Triglycerides (fats and oils) are converted into glycerol-halogen-hydrins by treatment with the calculated quantity or with an excess of hydro-halogen acid under pressure, either in the form of a gas or in solution in methyl or ethyl alcohol: the fat or oil may be used undiluted or in solution. Usually a further reaction takes place, owing to the dehydrating action of the hydrohalogen acid on the fatty acid liberated. Thus, in the case of castor oil, the principal products of the reaction are mono- and di-halogen-hydrins and the esters of polyricinoleic acid, together with small quantities of glycerol and free di- and tri-ricinoleic acid. The yield of chlorhydrins obtained from castor oil and hydrochloric acid gas dissolved in ethyl alcohol, is said to be from 90 to 98 per cent. of the theoretical yield.
—T. F. B.

Emetine: Manufacture of ——. H. S. Wellcome, London, and F. H. Carr and F. L. Pyman, Dartford. Eng. Pat. 17,483, July 30, 1913. Addition to Eng. Pat. 14,677, June 25, 1913 (see this J., 1914, 102).

Yields of emetine much greater than those produced as described in the principal patent, are obtained by boiling cephaeline with sodium amylate and anhydrous sodium methyl sulphate in anhydrous fusel oil, subsequently extracting the emetine from the mixture by means of dilute acid.—T. F. B.

Aldol and crotonic aldehyde; Manufacture of ——. Consortium f. Elektrochem. Industrie G. m. b. H., Nürnberg, Germany. Eng. Pat. 19,463, Aug. 28, 1913. Under Int. Conv., Sept. 3, 1912.

Acetaldehyde is converted into aldol by treating it, in absence of water, with a small quantity of an alkali-metal or alkaline-earth metal, or one of their alloys or compounds soluble in aldehyde: the amount of condensing agent required is not more than 5 per cent., and is preferably much less. It is possible, by using a very small quantity of the condensing agent, to prevent almost entirely the formation of higher condensation products and resinous substances, so that the aldol may be distilled *in vacuo* directly from the reaction product. Further, the crude reaction product may be worked up directly to crotonic aldehyde, *e.g.*, by slow distillation under ordinary pressure. In the examples given, the amounts of condensing agent used are 70 parts of 2 per cent. calcium amalgam or 2 parts of potassium cyanide to 1000 parts of acetaldehyde.—T. F. B.

Pipitzahoic acid; Extraction of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,692, Oct. 30, 1913. Under Int. Conv., Nov. 14, 1912.

Extraction of the root of *Perezia adnata* (*syn. Dumerilia humboldtiana, Trixis pipitzahuac, Compos. Mexico*) with hot alcohol gives a maximum yield of 3·7 per cent. of pipitzahoic acid, owing to partial decomposition and ntramolecular change of the product occurring, with ormation of an isomeric compound, of m. pt. 136° C., hich does not possess the therapeutic properties of pipitzahoic acid. It is now found that the decomposition an be almost entirely prevented, with the consequent production of higher yields of the pure product (m. pt. 04—106° C.) if the root be extracted at the ordinary emperature with an organic solvent, such as benzene.
—T. F. B.

Low-freezing liquid. M. A. Hunter, Troy, N.Y. U.S. Pat. 1,082,528, Dec. 30, 1913.

A mixture of carbon tetrachloride and carbon dichloride ($C_2H_2Cl_2$ dieline) with or without addition of another liquid, is claimed as a "low-freezing mixture."—T. F. B.

Solvents [of nitrocellulose]; Production of —— by means of halogen compounds. W. E. Masland, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,082,513, Dec. 30, 1913.

An unsaturated chlorohydrocarbon is used to render miscible a series of normally immiscible liquids, *e.g.*, wood alcohol and benzine. The product may be used as a solvent of nitrocellulose.—T. F. B.

Esters and ethers of ethylidene glycol and of vinyl alcohol; Manufacture of ——. F. Klatte, Schwanheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,084,581, Jan. 13, 1914.

Acetylene can be made to react with various organic hydroxy-compounds in presence of a mercury salt (*e.g.*, mercuric sulphate), to form ethers and esters of ethylidene-glycol and of vinyl alcohol.—T. F. B.

p-Nitrophenylcarbamyl chloride [and diarylureas]; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated July 11, 1913, to Fr. Pat. 459,885, June 12, 1913. Under Int. Conv., July 25, 1912.

The *p*-nitrophenylcarbamyl chloride described in the principal patent (see this J., 1913, 1129) is treated with a primary or secondary base or a substitution product thereof (sulphonic acids, hydroxysulphonic acids, etc.), with or without adding a substance to neutralise the hydrochloric acid. When *p*-nitraniline is used as the base, *pp′*-dinitrodiphenylurea is produced. The products can be obtained in one operation by treating with phosgene two mols. of the same base or one mol. each of two different bases.—T. F. B.

Sulphocarboxylic anhydrides and their alkali and alkaline-earth salts: Process for producing ——. Naamlooze Vennootschap Fabriek van Chemische Producten Fr. Pat. 461,539, May 16, 1913.

The conversion of monocarboxylic acids or their anhydrides into the sulphacids by the action of sulphuric anhydride or fuming sulphuric acid, respectively, is found to take place in two stages, the first stage being the formation of a sulphocarboxylic anhydride, *e.g.*, $CH_3.CO.OSO_3H$, which is rapidly converted into the sulphacid (sulphacetic acid) at the ordinary temperatures. This second stage is very slow, however, at temperatures below 0° C., so that the sulphocarboxylic anhydrides can be prepared by carrying out the reaction at low temperatures. For example, a quantitative yield of acetylsulphuric acid is obtained by adding gradually 80 kilos. of sulphuric anhydride to 60 kilos. of acetic acid at a temperature below 0° C. The anhydrides thus formed can be converted into their alkali or alkaline-earth salts by mixing them with a suitable anhydrous alkali or alkaline-earth salt at a temperature below 0° C.—T. F. B.

Anhydrides of monobasic organic carboxylic acids: Process for producing ——. Naamlooze Vennootschap Fabriek van Chemische Producten. Fr. Pat. 461,540, May 16, 1913.

The alkali or alkaline-earth salts of sulphocarboxylic anhydrides of organic acids (see Fr. Pat. 461,539; preceding) are converted into the corresponding carboxylic anhydrides by heating alone or in presence of an indifferent liquid, such as acetic acid. Simple or mixed anhydrides are also obtained by heating alkali or alkaline-earth salts of sulphocarboxylic anhydrides with alkali or alkaline-earth salts of monocarboxylic acids. The preparation o acetic anhydride from sodium sulphacetate and sodium acetate is described in detail.—T. F. B.

Calcium salt of acetylsalicylic acid; Process for making the ——. Soc. Chimique des Usines du Rhône. Fr. Pat. 462,161. Sept. 3, 1913. Under Int. Conv., Oct. 4, 1912.

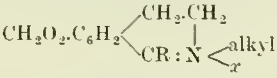
Quantitative yields of calcuim acetylsalicylate are stated to be obtained by introducing ammonia into a solution of salicylic acid and calcium chloride in methyl or ethyl alcohol.—T. F. B.

Hydrastinine from dihydrohydrastinine; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 267,272, Jan. 19, 1913.

Dihydrohydrastinine is converted into hydrastinime by treatment with iodine dissolved in an organic solvent, preferably in presence of a substance which will combine with the hydrohalogen acid. If alcohol has been used as a solvent, the insoluble hydriodide of hydrastininc separates out, and may be converted into the free base, of m. pt. 115°—116° C.—T. F. B.

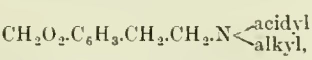
Salts of hydrastinine and its homologues; Process for preparing ——. H. Decker. Ger. Pat. 267,699, Feb. 2, 1912. Addition to Ger. Pat. 234,850 (this J., 1911, 923).

Salts of hydrastinine and its homologues of the general formula,



$$CH_2O_2.C_6H_2\left\langle\begin{matrix}CH_2.CH_2\\ \qquad\quad|\\ CR:N\left\langle\begin{matrix}\text{alkyl}\\ x\end{matrix}\right.\end{matrix}\right.$$

(where R represents hydrogen, alkyl, aralkyl, or aryl, and x an acid residue), are obtained by treating with a condensing agent the N-acidyl derivatives of homopiperonylamine,



$$CH_2O_2.C_6H_3.CH_2.CH_2.N\left\langle\begin{matrix}\text{acidyl}\\ \text{alkyl},\end{matrix}\right.$$

and converting the dihydro-isoquinoline compound into its salts by the usual methods (see also Ger. Pats. 245,095 and 249,723; this J., 1912, 483, 953).—T. F. B.

N-Monoalkyl derivatives of homopiperonylamine; Process for preparing ——. H. Decker. Ger. Pat. 267,700, Feb. 2, 1912.

The condensation products of homopiperonylamine and aldehydes, obtained aocording to Ger. Pat. 257,138 (see this *J.*, 1913, 507), are treated with alkylating agents in absence of water, and the quaternary ammonium compounds thus formed are decomposed by the usual methods to produce the free base.—T. F. B.

Guanidine salts; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 267,380, Aug. 18, 1912.

Dicyanodiamide or its equivalent is treated with an acid substance, without application of pressure, the reaction being stopped as soon as the dicyanodiamidine has been decomposed.—T. F. B.

Mercury substituted amino-compounds; Process for preparing ——. Dr. Bayer und Co. Ger. Pats. 267,411 and 267,412, July 2 and Dec. 20, 1912.

Tyrosine is heated in aqueous solution with mercuric oxide or a mercuric salt, such as mercuric acetate. The products are stated to be non-irritant and to possess powerful bactericidal properties.—T. F. B.

Saponin; Process for preparing decomposition products of ——. F. Hoffmann-La Roche und Co. Ger. Pat. 267,815, June 24, 1911.

Solutions of saponin in dilute mineral acids are allowed to remain for a long time at temperatures not exceeding blood heat. The pentosides separate in the form of a fine snow-white, non-crystalline mass, which can be purified by dissolving in a small quantity of alcohol and pouring into water. The product does not possess the hæmolytic properties of saponin. Further hydrolysis with acids results in the formation of sapogenin and pentoses which are soluble in water.—T. F. B.

Hydrogen peroxide and hexamethylenetetramine; Preparation of a compound containing —— *in solid, stable form.* Diamalt A.-G. Ger. Pat. 267,816, March 5, 1912. Addition to Ger. Pat. 264,111 (see Eng. Pat. 29,373 of 1912; this J., 1913, 672).

The stability of the product mentioned in the principal patent is increased by addition of a small quantity of an acid anhydride or of an acetyl compound of an aromatic hydroxy-acid and an albuminoid compound or a polysaccharide. These additions serve to absorb the small quantities of ammonia and formaldehyde which are evolved.—T. F. B.

C-Allylphenols and their analogues; Process for preparing ——. L. Claisen. Ger. Pat. 268,099, Nov. 3, 1912.

O-Allylphenols (allylphenyl ethers), or their analogues or nucleus-substitution products, can be converted into the corresponding C-allylphenols by prolonged heating at high temperatures. The allyl group takes up a position *ortho* or *para* to the hydroxyl group.—T. F. B.

Lecithin salts; Process for preparing ——. P. Bergell. Ger. Pat. 268,103, Nov. 2, 1912.

One mol. of citric acid is mixed with a solution of one, two, or three mols. of lecithin, or one mol. of glycerophosphoric acid is added to a solution of one or two mols. of lecithin, and the salts are separated from the solutions by evaporation or precipitation. Alternatively, citric acid or glycerophosphoric acid is added in excess to a solution of lecithin in a solvent which is not miscible with water, the solution is extracted with water or very dilute alcohol, and the lecithin salt solution evaporated to dryness *in vacuo*. —T. F. B.

p-Aminophenyl ester of salicylic acid; Preparation of derivatives of —— *containing sulphur.* I. Abelin, E. Bürgi, and M. Perelstein. Ger. Pat. 268,174, Feb. 18, 1913.

Salicylic acid *p*-aminophenyl ester is treated with an alkali salt or an ammonium salt of ω-methylsulphonic acid. The products are soluble in water, and may be used for therapeutic purposes.—T. F. B.

Curative agents for tuberculosis, smallpox, and foot-and-mouth disease; Preparation of ——. W. Ponndorf. Ger. Pat. 268,293, Nov. 14, 1911. Addition to Ger. Pat. 265,207.

The skin of animals treated as described in the principal patent and in Ger. Pat. 265,208 (see this J., 1913, 1129) is not dried, but is frozen by means of liquid air, liquid carbon dioxide, etc., finely powdered, sterilised, and further treated as described in the prior patents.—T. F. B

Allyl halides; Process for preparing ——. Chem. Fab auf Actien, vorm. E. Schering. Ger. Pat. 268,34 Dec. 14, 1912.

Esters of allyl alcohol are converted into allyl halides b treatment with gaseous hydrogen halides, preferably i presence of aqueous hydrohalogen acids. The proce may be carried out under increased pressure. Esters allyl alcohol may also be treated with gaseous hydroge halides in presence of catalysts. The yields of allyl halid are said to be almost quantitative.—T. F. B.

Carbonic esters [of polyhydric alcohols, etc]; Process for preparing —— A. Hochstetter. Ger. Pat. 268,452, June 13, 1912.

Polyhydric alcohols other than glycerol, or hydroxyaldehydes or hydroxyketones of the carbohydrate series, are heated with phenol carbonate to a temperature about 130° C.; mono- or polyhydric phenols may be added as solvents. The resulting carbonic esters are generally sparingly soluble in the usual solvents; hot glacial acetic acid, methyl oxalate, and formamide are the best solvents Dextrose carbonate, which can be crystallised from these solvents, is also soluble in hot water. All the carbonates are decomposed after prolonged boiling with water, carbon dioxide being evolved.—T. F. B

Nicotine from tobacco waste; Process for preparing —— W. Halle. Ger. Pat. 268,453, April 12, 1913 Addition to Ger. Pat. 262,453 (see Eng. Pat. 11,758 of 1911; this J., 1912, 1147).

The dry tobacco is extracted with an organic solvent, the solvent is separated from the extract, and the residue is fractionated in a vacuum.—T. F. B.

Ointment-like or gelatinous masses for medicinal or cosmetic purposes; Preparation of ——. A. Eichengrün. Ger. Pat. 268,489, Nov 24, 1911

Aqueous-alcoholic solutions of cellulose hydro-acetates or cellulose sulphacetates are mixed with medicinal substances, perfumes, or sweetening or flavouring agents which are themselves solvents of acetylcellulose, or if they are not soluble, they are dissolved in indifferent solvents or brought in contact with solvents during the process. —T. F. B

Alkaloids of opium free from morphine; Production of a preparation containing all the —— soluble in water. F. Hoffmann-La Roche und Co. Ger Pat. 268,555, Aug. 13, 1911.

Opium is extracted with a dilute mineral acid, preferably sulphuric acid, the solution is neutralised with alkali, extracted with chloroform, made alkaline by addition of an alkali carbonate (preferably a bicarbonate) and shaken out with chloroform. The latter chloroform solution, which contains all the alkaloids except morphine, is washed with dilute caustic soda solution and evaporated to dryness, and the residue is converted into soluble salts. It is stated that the mixture of these alkaloids, in the proportions in which they exist in opium, is a highly effective soporific agent.—T. F. B.

Esters of aromatic carboxylic acids; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 268,621, Nov. 14, 1912.

Salts of aromatic carboxylic acids are treated with halogenides of alcohols in presence of organic bases.—T. F. B.

Diaminodiphenylurea: Process for preparing a [chloro] substituted ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 268,658, Sept. 14, 1912.

2.6-Dichloro-*p*-phenylenediamine or one of its salts is treated with phosgene to form tetrachloro-diamino-diphenylurea.—T. F. B.

Solvents for the difficultly soluble compounds formed in organismal concretions; Method of producing ——. C. Luckow, Cologne, Germany. Eng. Pat. 1427, Jan. 17, 1913.

EE Fr. Pat. 454,183 of 1913: this J., 1913. 884.—T. F. B.

-Allylphenols and their analogues; Process for producing ——. L. Claisen, Godesberg on Rhine, Germany. Eng. Pat. 24,932, Nov. 1, 1913. Under Int. Conv., Nov. 2, 1912.

EE Ger. Pat. 268,099 of 1912; preceding.—T. F. B.

Ether-salts and ether-oxides of ethylideneglycol and of vinyl alcohol; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 461,223 Aug. 8, 1913.

See U.S. Pat. 1,084,581 of 1914; preceding.—T. F. B.

Sulphochlorides of phenol-o-carboxylic acids and of their derivatives; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 461,320, Aug. 11, 1913. Under Int. Conv., Aug. 13, 1912.

See Ger. Pat. 264,786 of 1912; this J., 1913, 1003.—T.F.B

Aldol from acetaldehyde; Process for preparing ——. Consortium f. Elektrochem. Industrie G. m. b. H. Fr. Pat. 461,734, Aug. 23, 1913.

See Eng. Pat. 19,163 of 1913; preceding.—T. F. B.

Butadiene and its homologues; Manufacture of ——. W. H. Perkin and F. E. Matthews. Fr. Pat. 461,829, July 21, 1913. Under Int. Conv., July 24, 1912.

See Eng. Pat. 17,235 of 1912; this J, 1913, 884.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photomicrography; Media of high refractive power for ——. C. Jones. Photogr. J., 1914, **54**. 14—26.

The media are considered chiefly for use in the examination of skeleton diatoms (refractive index, 1·43). Some details of the keeping, optical, and other properties of styrax (1·58), liquidambar, monobromonaphthalene (1·66), piperine (1·68), piperine with Canada balsam (between 1·52 and 1·68) and with bromide of arsenic or antimony, are given, with notes on their preparation. Canada balsam, styrax, and piperine give the full advantage of homogeneous immersion, with maximum resolving power, but as a dry mount they are inferior to air, while realgar, As_2S_2 (2·45) is superior. The chief published methods for using substances containing arsenic and sulphur, loosely called "realgar," are reviewed; the author finds that cleanliness is the chief condition: the materials should be twice distilled before use; 7 parts of arsenic to 22½—30 sulphur are satisfactory proportions. To secure mounts free from air-bubbles, the medium must be worked at a low temperature: this is made possible by supporting the cover with a slip, so that more pressure than usual may be applied. The addition of arsenious bromide lowers the melting-point, but is to be avoided. Selenium and sulphur, and selenium and realgar, give media of high refractive index, but of deep red colour.—O. E. M.

Patents.

Photographic printing paper and transfer processes. F. W. Kent, Clapham. Eng. Pat. 29,616, Dec. 23, 1912.

Paper saturated with paraffin wax or other wax is employed as the basis for photographic prints or transfers: this ensures permanence of dimensions of the basis, and easy separation of the film when the transfer is made. The emulsion consists preferably of a gelatin emulsion containing pyroxylin, which adheres satisfactorily to the waxed base.—T. F. B.

Photographic sensitive plates and the like. R. E. Crowther, Carlisle. Eng. Pat. 29,919, Dec. 30, 1912.

Photographic emulsions which will not produce reversal of the image as a result of excessive over-exposure, can be produced by treating an ordinary silver salt emulsion with *p*-phenylenediamine or with a methyl derivative thereof, or with a salt of either of these. For example, a sensitive plate is immersed for from 30 secs. to 2 mins. in a solution of one part of *p*-toluylenediamine hydrochloride and one part of sodium sulphite crystals in 75 parts (by weight) of water, to which one-third of the volume of alcohol has been added. The sulphite and alcohol are used as preservatives, and are not essential. If it is desired to treat the emulsion prior to coating, the above solution is added in the proportion of 120 c.c. to each 20 grms. of silver in the emulsion. Plates or papers prepared in this way are stated to give equally good results whether used with short exposure and subsequent development or by "printing-out." Developers which act slowly should be used with these emulsions (compare Eng. Pat. 14,744 of 1911; this J., 1912, 747).—T. F. B.

Colour photography. M. F. Ungerer, Offenbach on Maine, Germany. Eng. Pat. 17,979, Aug. 7, 1913.

Three part negatives are made from Lumière autochrome plates or other colour-sensitive coated plates, employing the usual three subtractive colour filters, but without the use of lineal, cross, or similar lining frames. The copying is done by contact on panchromatic plates, and the three part negatives are printed successively on the same printing surface, which is suitably stained after each printing.—T. F. B.

Coloured reliefs for use in preparing cinematograph films or other photographic transparencies; Process for producing ——. F. W. Kent. Fr. Pat. 461,920, Aug. 27, 1913. Under Int. Conv., Sept. 9, 1912.

See Eng. Pat. 20,555 of 1912; this J., 1913, 990.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Nitrocellulose for collodion; Manufacture of ——. T. Chandelon. Bull. Soc. Chim. Belg., 1914, **28**, 13—23.

Lunge has shown (this J., 1901, 1021; 1907, 33) that although the complete solubility of a nitrocellulose depends upon the water-content of the nitrating bath, the quantity of ether-alcohol required for solution varies with the conditions of nitration. To determine whether increase of solubility in this sense is set off by decreased yield or other disadvantage, nitrations were carried out with baths containing 15, 20, and 25 per cent. of nitric acid, 67, 62, and 57 per cent. of sulphuric acid, and 18 per cent. of water, at 35° or 40° C. for 1 to 4 hours. Three samples of cotton were used. It was found that solubility, as measured by the fluidity of the resulting collodion, was increased by the use of a bath containing 15 to 20 per cent. of nitric acid, but that with the lower limit the loss was 11 per cent. for 2 hours' nitration at 40° C., and in some cases reached 18 per cent. Although the loss was also dependent on the nature of the cotton, it could not be predicted with accuracy from a low copper number (Schwalbe, this J., 1907, 548; 1910, 689).—O. E. M.

Collodions; Viscosity of ——. T. Chandelon. Bull. Soc. Chim. Belg., 1914, **28**, 24—32.

The viscosities of 4·5 per cent. collodions having been observed to differ according to whether the nitrating mixture contained 15 or 20 per cent. of nitric acid, this difference was investigated for higher concentrations of the collodions. The material was specially prepared, and the Cochius' viscometer used for the determinations. It was found that a 5 per cent. collodion made with nitrocellulose from the 20 per cent. bath gave a viscosity equal to that of a 5·74 per cent. collodion from the 15 per cent. bath, and that this ratio (1·33), called the coefficient of viscosity, was maintained up to about an 8 per cent. collodion. Mixtures of 1 to 2 and of 3 to 2 alcohol-ether gave collodions of about equal viscosity from equal percentages of a nitrocellulose. A commercial nitrocellulose was found to have a coefficient of 0·62. From the coefficient the quantity of solvent to give a required viscosity may be calculated. For collodions so viscous as to be above the range of the viscometer, an instrument was constructed by means of which the extensibility (viscosity) was measured as the distance at which a film of the collodion drawn out between two discs was just ruptured. From experiments on solutions containing from 12·82 to 19·3 per cent. of nitrocellulose, the coefficient was found to be 1·41. Hence, although the use of a nitrating mixture containing 15 per cent. nitric acid involves a loss of 11 per cent. in yield, the resulting nitrocellulose requires only 1 part of solvent where a nitrocellulose made with a 20 per cent. mixture, without loss, would require from 1·33 to 1·41 parts.

—O. E. M.

Patents.

Explosives; Manufacture of —— *of the Sprengel type.* T. Hawkins. Fr. Pat. 461,332, Aug. 12, 1913. Under Int. Conv., Sept. 23, 1912.

A cartridge of potassium chlorate contained in a porous envelope is dipped in a liquid prepared as described below, and then allowed to drain. To prepare the liquid, about 85 grms. of powdered Australian Grasstree gum are covered to a depth of not less than 15 cm. by about 4½ litres of petrol containing 1 per cent. each of acetone and turpentine, and about 170 grms. of fuming nitric acid (sp. gr. 1·5) are then added drop by drop.—T. St.

Nitrocellulose; Process for purifying ——. J. Duclaux. Fr. Pat. 461,785, Aug. 25, 1913.

The purification of nitrocellulose, whether of new manufacture or deteriorated with age, is effected by solution and then reprecipitating in a finely divided form by a liquid which is a solvent of the impurities to be eliminated but not of nitrocellulose. For dissolving the nitrocellulose, acetone is a suitable solvent. This solution may be purified by dialysis through a cellulose membrane under a pressure sufficient to determine osmosis outwards instead of inwards. Alternatively the solution may be precipitated by water, which removes acid impurities, or by benzene or other suitable organic medium, which removes resinous impurities. Preferably the two modes of precipitation may be combined by adding a quantity of benzene insufficient to determine precipitation and then emulsifying the mixture by the gradual addition of water.—J. F. B.

Explosive charges for mining and military purposes; Manufacture of ——. C. Claessen, Berlin. Eng. Pat. 13,086, June 5, 1913.

See Fr. Pat. 459,979 of 1913; this J., 1913, 1171.—T. F. B.

Nitrating cotton in vacuo; Process and apparatus for ——. L. Dumons, Landerneau, France. Eng. Pat. 14,003, June 17, 1913. Under Int. Conv., July 6, 1912.

See Fr. Pat. 445,833 of 1912; this J., 1912, 1203.—T. F. B.

Production of solvents [of nitrocellulose] by means of halogen compounds. U.S. Pat. 1,082,543. *See* XX.

XXIII.—ANALYTICAL PROCESSES.

Carbon bisulphide as a laboratory solvent. L. E. Vlies J. Soc. Dyers and Col., 1914, **30**, 46—48.

Carbon bisulphide has been stated to increase the sulphu content of wool (Pearson, J. Soc. Dyers and Col., 1906, 65 The author finds that carbon bisulphide very carefully pur fied by treatment with bromine permanganate and fumi nitric acid, left a deposit when boiled for a long time in Soxblet apparatus. This residue (probably a polymeric of carbon bisulphide) had a brown colour, was soluble in carbon bisulphide but not in sodium sulphide, and varied in amount between 0·003 and 0·0076 per cent., a fact which the author considers might be due to the varying intensity of the light at the time the experiments were made. The experiments show the necessity of a blank test in exact analytical work.—J. B.

Carbon; Determination of —— by the wet method. Simultaneous determination of halogens. F. H. Thies. Chem.-Zeit., 1914, **38**, 115—116.

An extension of Messinger's method (this J., 1890, 1069) in combination with that of Baubigny and Chavanne (this J., 1903, 761; 1904, 136), whereby without special apparatus, carbon and halogens (and nitrogen) can be determined simultaneously in organic compounds; explosive organo-metallic compounds, such as silver carbide, silver-allylene, etc., can be safely analysed by the method. The material is oxidised by a mixture of sulphuric acid and potassium bichromate, with addition of silver nitrate in the case of iodo-compounds (compare Baubigny and Chavanne, *loc. cit.*); a larger quantity of the oxidising mixture than that recommended by Baubigny and Chavanne is required to ensure the complete oxidation of the carbon to carbon dioxide, and the concentration must be sufficiently high to allow of a temperature of 200° C. being attained. The gases are passed through a layer of ignited lime (Brügelmann, Z. anal. Chem., 1876, **15**, 1, 175; 1877, **16**, 1, 24), about 15 cm. by 6 mm., between two asbestos plugs in a tube of potash glass, 30 cm. long, and then through two soda-lime tubes; the lime is heated during the process. Iodine is retained in the oxidation flask as silver iodide; carbon dioxide, chlorine, and bromine are absorbed by the lime, the two latter quantitatively, whilst any traces of carbon dioxide which pass are retained by the first soda-lime tube. The lime (plus carbonate and halogen compounds) is subsequently decomposed by nitric acid free from halogens, the carbon dioxide determined from the loss in weight, and the halogens in the solution determined with silver nitrate.—A. S.

Combustion-analysis by means of tellurium dioxide. R. Glauser. Chem.-Zeit., 1914, **38**, 187.

The general use of tellurium dioxide is no longer prohibited by the excessive price of tellurium, from which it is prepared. At a red heat the molten substance readily oxidises many otherwise refractory substances; and in the case of carbides, cyanamides, and similar products the quantitative absorption or collection of the resulting gases presents no difficulties. Thus, nitrogen has been determined in aluminium nitride, carbon and nitrogen in calcium cyanamide, and carbon in several specimens of hard steel: the last-named were readily dissolved by the molten dioxide, even in the form of coarse lumps. The method is expeditious; the results, after practice, are said to be very reliable; and the tellurium is readily recovered. The method is being investigated with respect to the determination of sulphur in ores.—J. R.

Determination of water in solid and liquid fuels by distillation with xylene. Schläpfer. *See* IIa.

Detection of petroleum pitch in asphaltum and "liquid bitumens." Halphen and Spiess. *See* IIa.

Determination of zinc [in ores] by ferrocyanide in acid solutions. Williams. *See* X.

ssay of zinc by ferrocyanide methods. Report of Assay Sub-Committee of Australasian Inst. Min. Eng. *See* X.

Determination of glycerol in commercial glycerins and soap lyes. Tortelli and Ceccherelli. *See* XII.

Determination of total sulphur in rubber. Utz. *See* XIV.

Leather analysis. Change in methods. (Glucose determination.) Amer. Leather Chem. Assoc. *See* XV.

Determination of surface of soils. Hanley. *See* XVI.

Determination of tannin in cider. Spiers. *See* XVIII.

Detection of added water in milk by a simplified molecular concentration constant. Mathieu and Ferré. *See* XIXa.

Determination of cottonseed hulls in cottonseed meal. Grimme. *See* XIXa.

Determination of strophanthin in seeds and tincture. Lampart and Müller. *See* XX.

Patents.

Viscosimeter. J. Axer. Ger. Pat. 267,917, May 7, 1913.

The apparatus consists of an upright cylinder to contain the material to be tested, and a second cylinder, which fits closely within the first but not in contact with it: the inner cylinder is perforated, so that the material to be tested flows inside it as it sinks in the outer cylinder. The inner cylinder may be provided with straight or spirally-curved guide-bars, to give it a direct or spiral motion.—T. F. B.

Reactions; Apparatus for carrying out and observing ——. B. and E. Sági. Ger. Pat. 268,897, Feb. 15, 1913.

By means of suitable gearing connected with a common shaft, measured quantities of the substance under examination and of the necessary reagents are introduced (*e.g.*, from tilting receptacles) into the transparent reaction vessel, a source of heat is brought into operation, and after a predetermined time, the reaction vessel is emptied, this and the other vessels are rinsed, and the different parts are all restored to their original positions ready for another test, these operations being performed automatically and in the order mentioned.—A. S.

Instruments for measuring the flow of fluid through a conduit. Eng. Pat. 2417. *See* I.

Apparatus for measuring the content of methane or other inflammable gases in the air. Ger. Pat. 268,844. *See* IIa.

Detecting methane or other inflammable gases in the air. Ger. Pat. 268,845. *See* IIa.

Apparatus for detecting and measuring the content of inflammable gases in the air. Ger. Pat. 268,898. *See* IIa.

XXIV.—MISCELLANEOUS ABSTRACTS.

Carbon sulpho-telluride. A. Stock and P. Praetorius. Ber., 1914, **47**, 131—144.

An arc-discharge between electrodes of a pure tellurium-graphite mixture beneath carbon bisulphide results in the production of two volatile products, namely, carbon subsulphide, C_3S_2, and carbon sulpho-telluride, CSTe. These are very unstable, and the isolation of the latter, which melts at —54° C. and decomposes spontaneously, is extremely difficult. (See also following abstracts.)—J. R.

Carbon sulpho-selenide. A. Stock and E. Willfroth. Ber., 1914, **47**, 144—154.

This substance, CSSe, prepared in a similar manner to the corresponding tellurium compound (see above), is a yellow liquid boiling at 84° C. and is comparatively stable towards many reagents, although it decomposes slowly on keeping.—J. R.

Volatile substances ; Manipulation of small quantities of ——. A. Stock. Ber., 1914, **47**, 154—156.

The author recommends distillation in a closed apparatus below the ordinary temperature by the use of a high-vacuum pump. The several parts of the apparatus are cooled in suitable baths : such as ice, ice and salt (—20° C.), liquid ammonia (—30° to —50° C.), carbon dioxide and acetone (—80° C.), melting carbon bisulphide (—112° C.), melting ether (—124° C.), and liquid air (—190° C.). The homogeneity and purity of the fraction may in most cases be readily and very accurately determined by measuring the tension of the vapour from the 0° C. bath. The fractionation is extremely effective ; and the process, besides being very economical, facilitates the handling of unstable substances. In general, it may be applied to substances boiling not higher than 200° C. at ordinary pressures.—J. R.

Formaldehyde and acetaldehyde ; Formation by oxidising agents. L. Rosenthaler. Arch. Pharm., 1913, **251**, 587—595.

According to von Baeyer's hypothesis, carbon dioxide is reduced in plants to formaldehyde which is further transformed into carbohydrates. This theory has been supported by proof of the occurrence of formaldehyde in leaves (see this J., 1912, 706). The author has found that a number of substances oxidised with permanganate and dilute sulphuric acid, and distilled, give distillates in which formaldehyde can be readily detected. Substances which yield formaldehyde in this way contain a methoxy-, methylenedioxy-, or methylimido-grouping. The higher aliphatic alcohols such as glycerol and most carbohydrates behave in the same way. Rhamnose and certain other substances containing an ethoxy- or ethylimido-grouping yield acetaldehyde on oxidation. Formaldehyde may therefore be an intermediate product in the breakdown of carbohydrates.—F. Shdn.

Books Received.

Taschenbuch für die anorganisch-chemische Grossindustrie. Herausgegeben von Prof. Dr. G. Lunge und Dr. E. Berl. Fünfte, umgearbeitete Auflage. Julius Springer's Verlag., Luikstr. 23—24. Berlin W. 9. 1914. Price M. 8.

This, the fifth edition of the "Pocket Book" (6¾ by 4⅜ ins.), contains 297 pages of subject matter and tables (against 288 pages in the 4th edition), and 8 pages of alphabetical index, with 24 blank pages for written notes and addenda. The text is illustrated with 15 engravings. The subject matter is arranged under the following heads : General Data and Tabulated Matter. Special. I. Fuels, etc. Steam boilers. Feed water for boilers. II. Sulphuric acid manufacture. III. Salt cake and hydrochloric acid manufacture. IV. Bleaching powder, etc. V. Alkali manufacture. VI. Sulphur recovery from the Leblanc alkali waste. VII. Nitric acid manufacture. VIII. Potash industry. IX. Ammonia industry. X. Illuminating gas manufacture. XI. Calcium carbide and acetylene. XII. Investigation of the raw materials and products of the manure manufacture. XIII. Alumina preparations. XIV. Cement industry. XV. Preparation of normal volumetric solutions. XVI. Preparation of average samples. XVII. Comparison of the various hydrometer scales.

Evaporation in the Cane and the Beet Sugar Factory. A theoretical and practical treatise. By Edward Koppeschaar. Formerly Technical Manager of the Vierverlaten Sugar Factory, Holland. Norman Rodger. St. Dunstan's Hill, London, E.C. 1914. Price 7s. 6d. net.

This volume (10 by 6⅜ ins.), contains 116 pages of subject matter, with nine plates and 31 illustrations in the text. The subject matter is classified as follows :—I. Introduction. Necessity for evaporation, etc. II. The study of steam. Its application to evaporation, and to multiple effect evaporation in particular. III. Historical development of evaporation in the cane and beet sugar factory, including the introduction of multiple evaporation. IV. Comparative study of evaporation. V. Multiple effect apparatus. VI. Fundamental parts and accessories of evaporating apparatus. VII. Control of evaporating apparatus. VIII. Special designs. IX. Evaporation and crystallisation in vacuum pans.

Principles and Practice of Agricultural Analysis. A Manual for the Study of Soils, Fertilizers, and Agricultural Products. For the Use of Analysts, Teachers, and Students of Agricultural Chemistry Second edition, revised and enlarged. Volume III. Agricultural Products. By Harvey W. Wiley, A.M., Ph.D. The Chemical Publishing Co., Easton, Pa., U.S.A. 1914. Price $6.00. Williams and Norgate, 14. Henrietta Street, Covent Garden, W.C.

This volume (9⅛ by 6¼ ins.), contains 807 pages of subject matter, with 127 illustrations, and alphabetical indexes of authors and subjects. The subject matter is classified as follows :—I. Sampling, drying, incineration and extraction, etc. II. Sugars and starches. Analysis by density of solution. Determination of sugar with polarized light. Preparation of pure sucrose, and its use. Chemical methods of estimating sugar, etc. III. Processes for detecting and determining sugars and starches and other carbohydrates in crude or manufactured agricultural products, etc. IV. Fats and oils. Their physical and chemical properties. V. Separation and estimation of bodies containing nitrogen. Qualitative tests for nitrogenous bodies. Estimation in agricultural products. Separation of protein bodies in vegetable and in animal products. VI. Dairy products. VII. Miscellaneous agricultural products, such as cereals and cereal foods : fodders, grasses and ensilage; flesh products, etc. tannins and allied bodies ; tobaccos, etc. Fermente beverages, etc.

Quantitative Analysis. By Edward G. Mahin, Ph.D Assoc. Professor in Purdue University. McGraw-Hi Book Company, Inc., 239, West 39th Street, New Yor 6, Bouverie Street, London, E.C. 1914. Price 12s. 6 net.

This volume (8⅜ by 5⅞ ins.), contains 493 pages of subje matter, and an alphabetical index of subjects. The are 120 illustrations. The classification of the subjec matter is as follows :—I. General principles. II. Grav metric analysis. III. Experimental gravimetric analys IV. Electro-analysis. V. Volumetric analysis. VI. Colo change of indicators. VII. Standardisation. VII Experimental volumetric analysis. IX. Oxidation a reduction. X. Titrations involving the formation precipitates. XI. Analysis of industrial products a raw materials.

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New York Section.

Meeting held at Rumford Hall, New York, on Friday, January 23rd, 1914.

MR. G. W. THOMPSON IN THE CHAIR.

PRESENTATION OF THE PERKIN MEDAL TO MR. JOHN WESLEY HYATT.

The Chairman opened the proceedings with an address, in which he said :—

At this meeting of the New York Section of the Society of Chemical Industry, it is our pleasant duty to award the Perkin medal to the person selected as most worthy for valuable work done in applied chemistry. In the past it has generally been considered that this work should be in the nature of original or inventive work which has proved of great public value. The question I would propound to you to-night is: What is the mental faculty which has made the recipients of the Perkin medal what they are? In what respect do these men differ from their fellow chemists, so as to render them especially successful in the application of chemistry to the arts? I have given considerable thought to this question, and I wish to submit my conclusions for your consideration, believing that they may be of some suggestive value.

In 1870, Tyndall delivered his famous discourse on the "Scientific Use of the Imagination." In this discourse, he showed the value of the imagination properly made use of in solving some of the most difficult problems of physics. Thousands of instances could be given showing that practically all of the progress made in the science of chemistry has been due to this proper use of the imagination; but considering the work done in applied chemistry, we see clearly that it was imagination that enabled Herreshoff to develop the metallurgy of copper, that inspired Behr in his work on the separation of the oil contained in the germs of corn, and Acheson, who argued that, if flocculating agents existed, there were probably also *de*-flocculating agents, and Hall, who believed that somewhere there was a solvent for alumina, from which aluminium could be obtained electrolytically, and Frasch, to whom the oil and salt wells suggested the possibility of recovering sulphur from the bowels of the earth, and Gayley, who saw the possibility of the dry blast in increasing the output and decreasing the cost of the blast furnace; and now, in the case of Hyatt, who saw in the drop of dried collodion the possibility of producing a plastic mass, which was finally obtained in celluloid.

We must not think, however, of imagination as being the sole factor, although it is probably the principal factor, in the production of valuable works. There must be energy, concentration, and persistence. Nevertheless, the imagination is the most important factor.

We see this imaginative faculty in all degrees of development, and I would ask those who are educators, in whose hands are being moulded the minds of future chemists, whether the work which they are doing tends to develop this imaginative faculty, or whether it is indeed possible for them to sow in the minds of their students the seeds of imagination if they do not already exist there? It seems to me that there is no better place, no better occasion, than this place and this occasion, when we are honouring, by the presentation of the Perkin medal, a man in whom the imaginative faculty is highly developed, to put before you the need of the imaginative faculty in as emphatic a manner as possible and to urge that in our educational institutions this faculty should be developed to the highest degree, for, if we are honouring Mr. Hyatt on account of his possession of this faculty, should we not also seek to increase the number of those who possess the faculty in a high degree? Is not the real purpose of the Perkin medal something more than the honouring of its recipients—great as that purpose is—is it not for the purpose of encouraging those faculties on which the presentation of this medal rests?

Prof. Chas. F. Chandler spoke as follows :—

It is my very pleasant privilege as the Senior Past-President of the Society of Chemical Industry, residing in this country, to present to John Wesley Hyatt the eighth impression of the Perkin gold medal, in recognition of his most valuable work in applied chemistry.

Mr. Hyatt was born at Starkey, Yates County, New York, in November, 1837. He was educated in the public school and later in the Eddytown Seminary, where he excelled in mathematics.

In his early boyhood he acquired a strong taste for mechanical affairs in his father's blacksmith shop. In his sixteenth year he went to Illinois and learned the printing business, working at this trade for the following ten years. During this period he made his first invention, which was a family knife sharpener and which included a new method for making solid emery wheels.

He then went to Albany and worked as a journeyman printer for about two years. Seeing a $10,000 offer for a substitute for ivory for billiard balls by Phelan and Collander of New York, he began experimenting nights and Sundays in the hope of gaining the reward. He made a number of useful plastic compositions, none of them however good enough for billiard balls, but he started to make checkers and dominos of pressed wood, and with his two brothers established what is now the Embossing Company of Albany, New York, which has been a highly successful concern for more than 40 years, under the mechanical management of Mr. Hyatt's younger brother, C. M. Hyatt.

In 1870 he invented and patented a machine for turning billiard balls, by which an unskilled workman can do as much as a dozen skilled workmen could accomplish by former methods, securing at the same time perfect accuracy.

His attention having been called to the character of the solid nitrocellulose left by the evaporation of liquid collodion, or artificial skin, as it was called when collodion was first put upon the market for covering cuts and other wounds, he turned his attention to the subject of nitrocellulose as a suitable material for producing plastics. It should be remembered that guncotton or nitrocellulose was first discovered by Schoenbein in 1845. In 1847, Maynard announced the discovery that while nitrocellulose is not soluble either in alcohol or ether alone, it is soluble in a mixture of the two, and he gave the name collodion to the solution, which has since found its way very extensively into medical use. It also served to solve the problem of producing photographic pictures, either positives or negatives, upon glass, practically sounding a death knell for the beautiful though expensive daguerrotype process. The wet collodion process was introduced by Scott Archer in 1851.

Hyatt was entirely ignorant of the various efforts which had been made by Parkes, Spill, and others to utilise soluble nitrocellulose or pyroxylin for the manufacture of plastic materials, and consequently he started out without any hints or suggestions as to how he should proceed. His first success resulted in the manufacture of billiard balls by first making a solid core of another plastic material and covering the same with nitrocellulose dissolved usually in ether and alcohol. The process was so successful that a good business was established in 1870 which continued for several years.

In the meantime Hyatt invented celluloid and began the manufacture of celluloid and bone dust billiard and pool balls. At this time his brother, Isaiah S. Hyatt, joined him, and they worked together until the brother died in March, 1885.

I do not propose to give a detailed history of the progress made by Mr. Hyatt and his brother in establishing the celluloid industry. I will merely remark that Hyatt's Patent 88,633, dated April 6, 1869, was for a moulding composition to imitate ivory and other substances, composed of fibrous material and gum shellac or other solid fusible adhesive gum.

His patent No. 88,634, dated April 6, 1869, was for an improved method of coating billiard balls, consisting in dipping the billiard balls made of some suitable composition into a solution of collodion which might be given any desired colour beforehand.

His patent 89,582, dated May 4, 1869, was for a composition consisting of ivory dust or its equivalent mixed with collodion and subjected to pressure during the evaporation of the solvent.

Patent 91,341, dated June 15, 1869, taken out by the two brothers jointly, was for manufacturing solid collodion with very small quantities of the solvent and dissolving the pyroxylin under heavy pressure, thus securing great economy of solvents and a saving of time.

Their patent 105,338, dated July 12, 1870, shows the fundamental invention of celluloid. It is entitled "Improvement in treating and molding pyroxyline." The three claims of the original patent are: 1. Grinding pyroxylin into a pulp, as and for the purpose described. 2. The use of finely comminuted camphor-gum mixed with pyroxylin pulp, and rendered a solvent thereof by the application of heat, substantially as described. 3. In conjunction with such use of camphor-gum, the employment of pressure, and continuing the same until the mold and contents are cooled, substantially as described.

This patent was reissued three times in order to avoid ambiguities. The claims of the last reissue are as follows:

1. The use of finely-comminuted camphor-gum mixed with pyroxylin pulp, and rendered a solvent thereof by the application of heat, substantially as described.

2. In conjunction with such use of camphor-gum, the employment of pressure, and continuing the same until the mold and contents are cooled, substantially as described.

The specification fixes the proportions at about 1 part of camphor to 2 parts of pyroxylin. Modifications of this process were embodied later in U.S. Patents 156,352 and 156,353.

From this time on celluloid became a most important plastic, superior in almost every respect to any other plastic hitherto proposed, for the manufacture of the greatest variety of articles useful and ornamental.

Seventy-five different patents were taken out either by John Wesley Hyatt alone or in association with his brother, Isaiah S. Hyatt, and an enormous establishment grew up at Newark in the hands of the Celluloid Company.

Mr. Hyatt's activities were not limited to celluloid. Among his other inventions also of great importance, we find a sugar cane mill, very superior to any mill previously used in its efficiency both in increasing the percentage of juice extracted from the cane and greatly diminishing the time necessary to extract it, and giving a higher value to the refuse bagasse as fuel.

In the early 'eighties, Mr. Hyatt and his brother Isaiah took up the subject of water filtration and started a company called the Hyatt Pure Water Company. Isaiah Hyatt invented and patented a very important feature of the filtration process, February 19, 1884, patent 293,740. It marks the beginning of a new era in water purification. Coagulants had been previously used to purify water, but the difficulty was that the water was held in large tanks or cisterns. The coagulant was added to it, the whole was thoroughly agitated and then it was necessary to allow it to stand 12 to 24 hours for the coagulum to settle to the bottom. The Hyatts conceived the idea of employing a coagulant which could be added to the water while it is on the way to the filter, so that no large settling tanks or basins are required and no time is lost. The claim of this patent is as follows:—

"The method herein described of arresting and removing the impurities from water during an uninterrupted passage of the same from a supply pipe into a filtering apparatus, thence through a filter bed contained therein and out through a delivery pipe leading therefrom, which method consists in introducing into the water simultaneously with its passage to or into the filter a substance which will sufficiently coagulate or separate the impurities to facilitate their arrest and removal by the filter bed, thus obviating the necessity of employing settling basins."

I was connected with a litigation which followed the issue of this patent, and studied the process and apparatus at Somerville, N.J., Niagara Falls, and Elmira. The process was unusually successful. At Somerville the river water exhibited a milky opalescence caused by such fine particles of clay that no filter would clarify it. By a proper attachment of an alum box to the feed pipe to the filter, a minute quantity of alum was added to the stream of water on its way to the filter, less than one grain to the gallon, and in the few seconds that elapsed before the water reached the filter bed of the ingeniously constructed Hyatt filter, coagulation had taken place and the coagulum, including the alumina of the alum and the clay, bacteria and other suspended impurities of the water had been converted into such flocks as made it possible for the bed of sand in the filter to arrest it completely. These Hyatt filters are so constructed whether they are on a large scale or small scale, that they can be washed completely at any convenient moment by simply reversing the current through the filter. This churns up the sand and separates from it the accumulated coagulum.

Nearly all the paper mills and woollen mills in the country were and still are supplied with these filters as are also more than 100 cities and towns.

The validity of the patent was established through law suits which were brought against the City of Elmira and the City of Niagara Falls. These cities attempted to evade the Hyatt patents by constructing a chamber underneath the filter through which the water passed on its way to the filter, but we found by examination that while a portion of the coagulum accumulated in the chamber, one-third of it passed on and was separated by the filter.

Judgments in favour of the Hyatt patent were given by the Circuit Court of the United States Judge Shipman, presiding in 1894, by Circuit of Appeals Judge Wise, presiding in 1895; again by Judge Coxe in 1896, and again by Judges Wallace, Lacomb and Shipman in 1897.

In 1891–2, Mr. Hyatt took up the subject of antifriction roller bearings with great success.

I have really occupied far more time than I should have done, but I felt it a duty to take advantage of this opportunity to present the facts with regard to Mr. Hyatt's priority of invention in connection with the celluloid and water purification, which I was in a position to do owing to my experience and knowledge gained in the litigation which arose in both cases.

I think that the facts to which I have called your attention, although very briefly expressed, will satisfy you of the great achievements of Mr. Hyatt and will fully justify your Committee in placing Mr. Hyatt beside Sir William Henry Perkin and the six American chemists who have already received the Perkin Medal.

Presentation of the Medal.

It gives me great pleasure, as the representative of the Society of Chemical Industry, and the affiliated chemical and electrochemical societies, to place in your hands, Mr. Hyatt, this beautiful token of the appreciation and affection of your fellow chemists.

Mr. JOHN WESLEY HYATT acknowledged the receipt of the medal in the following words:—

I have never looked forward to any such honours as you have bestowed upon me, and I do not know how fittingly to express my gratitude. You have overlooked my lack of early training in the sciences with which you are all familiar, and only look to results which have been obtained mainly by persistent, and many times mistaken, experiments. Some successful experiments I might never have made if I had been familiar with the danger theories of some learned men.

From my earliest experiments in nitrocellulose, incited by accidentally finding a dried bit of collodion the size and thickness of my thumb nail, and by my very earnest efforts to find a substitute for ivory billiard balls, it was apparent that a semi-liquid solution of nitrocellulose, three-fourths of the bulk of which was a volatile liquid and that the final solid was less than one-fourth the mass of the original mixture, was far from being adapted to the manufacture of solid articles, and that I must initially produce a solid solution by mechanical means. The only useful solvent known to me at that time was a mixture of alcohol and sulphuric ether; with the old formula (about equal parts of ether and alcohol) I mixed in a closed mill a thick paste of soluble cotton, made by the old firm of Charles Cooper and Co. After mixing, the cover of the mill was removed and the mass evaporated down to a thick dough, which was then forced accurately around the ball (made of another substance), and allowed to dry. This resulted in a rather brittle coating, owing, as I found, to the unequal evaporation, leaving only the alcohol, a poor solvent by itself, at the final shrinkage. This was remedied by using only the least amount of alcohol (five parts ether to one alcohol) necessary as a solvent. Even this coating shrunk to less than half of its original thickness and required to be dried immersed in water under several hundred pounds' pressure per square inch to insure its solidity and freedom from bubbles. It became necessary to strain the mass by forcing it through a very fine sieve to exclude the unnitrated fibres. All these difficulties stood in the way of success, except in high-priced articles like billiard balls. Other seriously objectionable features became apparent. In order to secure strength and beauty only colouring pigments were added, and in the least quantity; consequently a lighted cigar applied would at once result in a serious flame, and occasionally the violent contact of the balls would produce a mild explosion like a percussion guncap. We had a letter from a billiard saloon proprietor in Colorado, mentioning this fact and saying he did not care so much about it, but that instantly every man in the room pulled a gun.

I next had a small beating engine made, to pulp the nitrocellulose. In one experiment I placed a small quantity of this dried pulp in a strong cylinder and forced quickly a minimum quantity of liquid solvent into it with high pressure. The result was a solid substance, as hard as sole-leather, which soon dried, leaving a fine hard disc about three-fourths of an inch in diameter and one-half an inch thick. While no explosion ever resulted from this, there was real danger to be feared, and the matter was dropped.

My brother, I. S. Hyatt, joined with me at that time, and finding it stated in some patents to which I was referred, that a little camphor added to the liquid solvent was beneficial, we conceived the idea that it might be possible to mix solvents mechanically with the pulp and colouring matter while wet, then absorbing the moisture by blotting papers under pressure, and finally submitting the mass to heat and pressure. To our surprise, we noticed a slightly solvent action of the precipitated and washed camphor upon the pulp, even before the heat and pressure, and without other solvent we succeeded in producing a transparent slab one-fourth of an inch thick, fine, and as hard as a piece of wood. My brother took some samples to the American Hard Rubber Company, with the view of interesting them. They employed the late Professor Charles A. Seeley, who had made collodion for the Government during the Civil War, to investigate the matter. He came to our place in Albany, N.Y., and we conducted the whole process for his inspection, very successfully. He remarked that he had come prepared to detect some chicanery, but could see no deception, and expressed himself as satisfied. He kindly advised us that if, accidentally or otherwise, we were to apply a little too high temperature, the quantity we were dealing with would inevitably destroy us with the building and adjacent property. While we did not accept this as true, it was disturbing. The following day between 12 and 1, when all were out, I rigged up a four-inch plank used as a vice-bench, braced it between the floor and ceiling, between the hydraulic press and the hand pump, intending it to shield me from possible harm. I then prepared the mould, heating it to about 500 degrees Fahrenheit, knowing it would certainly ignite the nitrocellulose and camphor, and would abide by the result. The gases hissed sharply out through the joints of the mould, filling the room with the pungent smoke. The mould, press, building and contents were there, including myself, very glad that I did not know as much as the Professor.

The next step was to make a small stuffing machine, consisting of a cylinder, four-inch bore, about a foot long, terminating in a tube three-fourths of an inch bore, ten inches long, immersed in an open oil-jacket, with a gas-burner and thermometer. A cap-nut with one and one-fourth inch screw forced a plunger upon the cakes of incipient celluloid, which were heated at the outlet end of the cylinder passing through the heated tube into moulds, and also through nozzles forming rods, tubes, etc. We found it advisable to lower the melting point of the camphor by adding a small quantity of alcohol or other solvent of camphor. A much larger hydraulic stuffing machine was then made. Dental plate blanks were the principal part of our early business.

My brother interested some New York capitalists—principally composed of General Marshall Lefferts, Joseph Laroeque and Tracey R. Edson—and we removed to Newark, N.J., in the winter of 1872–73 We had nearly all the appliances and machinery to design and build, which progressed with some halts and mistakes for two or three years, when a fire occurred in our four-storey and basement building, utterly destroying all our stock and machinery, and pushing out the whole front of the building (which was very weak), and severely injuring several of our men, who all finally recovered, although one—Mr. Charles S. Lockwood—was in great danger for a long time. We then started our present works, acquiring knowledge and experience, my brother starting a separate factory for making brushes, mirrors and combs. Early in 1878 my brother went to Paris and started the French Celluloid Company.

Before we left Albany we began the use of tissue paper in place of carded cotton or bleached flax, which finally resulted in getting tissue paper of definite thickness and materials, and breaking it up into small separate pieces by a machine I constructed, drying these separate pieces in a loose mass and nitrating them instead of the carded cotton.

In 1876 I was allowed to employ a chemist for determining our acids and to systematize our nitration, instead of merely using hydrometers and thermometers, and Mr. Frank Vanderpoel was selected by me. So far as I know, the analyses of mixed spent acids were not applied to practical work. Professor Seeley proposed that we separate the nitric and sulphuric acids by distillation, and then bring these to the proper strength before mixing; this was not adopted. Vanderpoel first removed the gelatinous flock by adding finely powdered natural barium sulphate and allowing the barium and flock to subside, which was a great success. I had previously tried filtration, which was impractical. After much labour Vanderpoel perfected a quick and accurate method of determination of the spent acids, and then added the required fresh acids. An elaborate and extensive battery of tanks was constructed, the acids being moved through copper pipes, where required, by means of air pressure. The tanks for mixing the comminuted tissue paper with the prepared acids were arranged on a turntable supporting a dozen or more tanks, each holding hundreds of pounds. A rotating stirrer was arranged to stir in the requisite amount of paper in one tank, the turntable being revolved to the next tank, and so on. At a distance embracing about half a dozen tanks from the stirrer was located a centrifugal machine, which separated out most of the acids. The nitrated paper was then thrown into a washing device, and the partly washed paper then fell into large tanks of fresh water and was thoroughly washed. A very considerable number of tons of paper per day were and are treated in this way.

The next procedure was to grind this nitrated paper in a beating engine. The water was then mainly removed by a centrifugal machine. The mixture of pigments, camphor and nitrocellulose was then made, according to the results required, and ground together in a mill, then pressed into slabs or cakes, and still further deprived of moisture by great pressure, and finally deprived entirely of moisture by blotting papers, repeatedly changed.

These cakes were then broken up and alcohol or other desired solvents added and allowed to soak in. The partly dissolved mass was next masticated in heated rolls, turned out into necessarily rough sheets, cut into strips and rolled up into cylinders, ready for the stuffing machine.

The great want was to furnish celluloid in solid perfect sheets, and this neither the rolls nor the stuffing machines could possibly do, with all our experience. I constructed a special nozzle for the stuffing machine, to form a slab about one and one-half inches thick, seven inches wide and several feet long, which was pressed between steam plates, one of them with underent grooves, to hold the slab. A machine was made with shaving knife and reciprocating bed, and by it the slab was shaved into sheets of the desired thickness. These slabs were necessarily imperfect, and were too small. After showing this result to the other directors, I proposed building a hydraulic pressure steam-heated mould, to make a slab or block about two feet by five, and three inches thick, in which to weld and press a pile of rough sheets from the masticating rolls. To those who knew the least about celluloid my suggestion looked pretty good, but to others came a great fear of possible danger and failure to weld up such a mass. At last they gave me authority to build the apparatus, limiting me to less than half its cost if fairly estimated. With this authority, which consisted more of the privilege of trying such an apparatus than in providing for its cost, I ordered the machine, agreeing to pay the machinist all above the appropriation if it failed to work. The machine was built and most carefully tried in the presence of only the new president, who knew little about celluloid, and Mr. Stevens and Mr. Lockwood among the employees. The mould was cooled and opened, and nice sheets were at once made, considering that only scrap material was used, though less than half the block was welded. This meant re-heating, which was at once done, and the whole was known to be a success.

I dwell upon this because of its vast importance to us. It multiplied the value of celluloid many times, making a much stronger and finer material than was produced by the former means.

About this time we were precluded from bleaching the iron out of the pulp, caused by the iron-beating knives, and it was necessary to remedy the serious difficulty. The mixture of nitrated paper, camphor, and pigments was placed in a large revolving drum of copper, through the axis of which was a shaft with beating arms rotating at a very high speed, and the whole was beaten to a pulp without the discoloration of the iron and water, and without the loss in washing and bleaching the fine pulp from the beating engine.

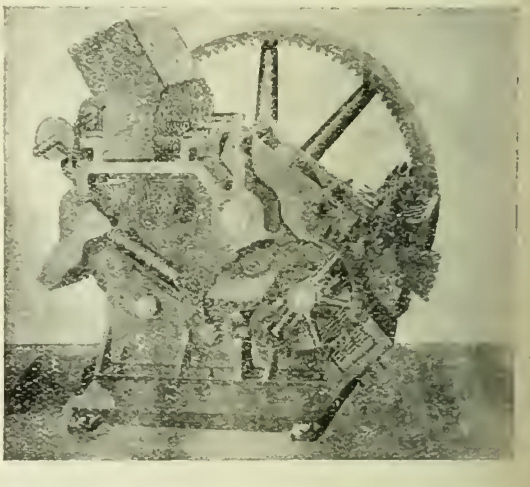
In order clearly to differentiate my work in celluloid from that of others in the nitrocellulose industry, I will summarize as briefly as I can. First, the idea of combining with the nitrocellulose only the exact or approximate amount of solvent required for a solid solution. This required a nearly perfect mechanical mixture before very much solvent action could take place. Second, completing the solution by means of heat and pressure. Third, eliminating the practically unnitrated fibres by pulping. Fourth, employing tissue paper in place of carded fibre. Fifth, avoiding the terrible danger of drying out the moisture by exposure in drying room. Many years ago I patented the process of first pressing out all the water possible and displacing the remainder by forcing alcohol through under pressure. This, I understand, is now used by other nitrocellulose workers, but we prefer the method herein described. Sixth, the stuffing machine process. Seventh, the sheeting process, most essential.

Mr. Stevens has been with me ever since he was fourteen years old, and has invented solvents and many other things of great importance in the art, and stands at the head of nitrocellulose workers at the present time.

Mr. Harrison, in his department, has invented the method of imitating the grain of ivory, of smoked pearl, of onyx, and of many other beautiful colours and effects. He has been with us nearly forty years. Others are entitled to much credit, but it is impossible to name them here.

Description of Sugar-Cane Mill.

In the old method of milling sugar cane the cane is passed between rolls which are generally 34 inches in diameter and 84 inches long. These rolls are grooved and roughened so as to draw all the cane in between them that is possible. Owing to the comparatively obtuse angle formed by the contact of two rolls, the quantity of cane is limited and they are very nearly together at the passage of the cane through the last pair of rolls. The last, say, 15 per cent. of the juice is forced out through five or six inches of highly compressed fibre in the opposite direction from which the cane is moving, so that in practice a considerable portion of the juice is carried through the rolls. For this reason it is repeatedly passed through rolls, each passage removing a small proportion more of the juice. It is found profitable in most cases to add water to the bagasse between each set of rolls so as to dilute the juice that necessarily remains in the bagasse. In order to get the desired quantity of work from the mill the rolls are of great length, from seven to seven and one-half feet. There is generally from 30 to 40 tons of pressure for each foot of face of the rolls. It is not practicable to get any greater pressure than this. I employ four or five times as much pressure per lineal foot.



With my apparatus and method the angle formed between the chain and the upper roll is far more acute and the cane is forced through rolls so that five times more cane goes through the rolls of a given face than is possible with the old mills. If this chain belt were impervious to the juice little or nothing would be gained by this method, but inasmuch as the chain forms a massive screen through which the juice may readily escape from the underside, the juice has only to pass downwards through the mass perhaps one and one-quarter inches at the most to escape, instead of five or six inches in the opposite direction to the progress of the cane, as in the old mill. It does not take any more powerful apparatus to press the cane fibre when it is one inch thick than it does to press fibre that is one-eighth of that thickness, and as I get quite as much cane through my rolls with 12-inch face as will pass through the old rolls of 84-inch face I can readily afford to put several times as much pressure upon each foot of face as is practicable with the old mills. I employ upwards of 150 tons on rolls with 12-inch face.

For the same amount of cane passing six times through the present rolls my mill will not require more than one-third as much power and instead of getting with the best milling a bagasse with 50 per cent. of moisture and 50 per cent. of fibre, I can easily produce a bagasse which has 60 per cent. of fibre and 40 per cent. of moisture. This bagasse is so dry that a quantity of it, either a handful or a bushel, placed upon the ground can be lighted with a match and will burn like carpenter's shavings. My mill is about one-eighth the weight of the present mills with the same capacity, and as the machine work is of the same character the machine will not cost one-quarter as much as the present mills.

In Cuba 71 per cent. of extraction without dilution is as good as can be obtained. With my mill without dilution I can easily get 78 per cent. extraction.

With Louisiana cane, which has less fibre, I can easily get 84 per cent. extraction without dilution. Of course, if the bagasse is passed through a second mill with 12 per cent. dilution, I can get 88 per cent. extraction.

The joints of my sprocket chain belt are self-cleaning and cannot clog; as shown in practice, each revolution of the chain rubs the screen surface together several times. All the links of the chain are alike, and are of drop-forged steel. The concave edges of these links absolutely fit the under roll. The smaller pressing roll is provided with annular grooves coinciding with the longitudinal joints of the chain so that even the last small percentage of juice has a perfectly free outlet.

There is no danger from irregular feeding, as the mass of bagasse between the rolls is about one and one-quarter inches thick, and no loose or open space can possibly exist. The springs yield or follow up, according to the feed. No crusher or shredder is necessary or desirable.

The speed of the surfaces of the rolls and chains is designed to be 30 feet per minute, although I did practically as good work on my previous machine at 40 feet per minute, and it will probably prove that this machine can do equally as good work at 40 feet per minute, but to be safe, I have calculated it for 30 feet per minute. The ordinary cane mills are run at anywhere from 16 to 25 feet per minute, according to the choice of the owner or engineer.

The increased value of the bagasse as fuel, and the avoidance of any peculiar kind of bagasse burner with forced draft, etc., is quite an item. Furthermore, as was shown by my machine at Adeline, Louisiana, the purity of the juice is considerably improved, as the cane is not ground up as in the ordinary mills, but merely flattened by the great pressure.

I have taken out 238 patents (a few of them being joint inventions with others), and several new industries have resulted. The one of next importance to celluloid is named The Hyatt Roller Bearing Co.

The proceedings concluded with an address by Dr. Frank Vanderpoel, in which he recalled some personal details of his association with Mr. Hyatt.

Sydney Section.

Meeting held at Sydney, on Wednesday, 19th November, 1913.

MR. LOXLEY MEGGITT IN THE CHAIR.

EXTRACTION OF RADIUM FROM THE OLARY ORES.

BY S. RADCLIFF.

In May of the year 1906 a prospector forwarded some pieces of a dense dark-coloured mineral, carrying small amounts of a yellow incrustation in the surface crevices, to Adelaide for examination. Mr. W. S. Chapman, the Government Assayer, identified the yellow substance as carnotite, a vanadate of uranium and potassium. He found the material to contain 60 per cent. of uranium oxide and a considerable amount of vanadic oxide.

The locality from which the ore was obtained was shortly afterwards visited by Mr. H. Y. L. Brown, then Government Geologist of South Australia. He stated: "The ore, occurs as yellow and greenish-yellow incrustations and powder on the faces, joints, and cavities of a lode formation, which consists of magnetic titaniferous iron, magnetite, etc., and quartz in association with black mica[1] (biotite).

Dr. Mawson subsequently published an account of a mineralogical examination of the lode-stuff and came to the conclusion that it contained several new minerals.[2]

Some years later a block of the ore, weighing about 16 lb., was forwarded to the Imperial Institute. A detailed mineralogical and chemical examination was there made of the material by Messrs. T. Crook and G. S. Blake.[3]

Some typical specimens of the ore were, I understand, forwarded to Madame Curie; she reported that the ore was only feebly radioactive and of little commercial value, radium at that time being comparatively cheap.

In 1909 a company known as the Radium Hill Company was formed in Sydney to exploit the deposit commercially, and a consignment of about 30 tons of picked ore was taken to England by Dr. Mawson, who brought it under the notice of a number of firms, both in England and on the Continent, interested in the extraction of radium from its ores. A few tons were also sent to America. The low uranium content and the high percentage of titanium present, which rendered treatment difficult, militated against the disposal of the ore, and no offers of any value were received for it.

While these negotiations were in progress, the author of this paper (who, some time prior to the Olary find, had discovered a radioactive copper ore at Moonta, S.A.) was asked to investigate the possibility of treating the ore locally; and after some twelve months' experimental work developed a process which gave promise of commercial success. The preliminary work was done at the Bairnsdale School of Mines, Victoria, which possesses a fairly extensive metallurgical plant, a total quantity of 30 tons being dealt with in the course of the experiments. From the data so obtained the plant now in successful operation at Woolwich on the Parramatta River, Sydney, was designed.

The present communication gives a preliminary account of the treatment process as it is worked at the present time.

The most complete account yet given of the extraction of radium from its ores is that by Haitinger and Ulrich.[4] They describe the methods adopted by them in treating 10 tons of residues derived from about 30 tons of pitchblende ore containing 54·2 per cent. of U_3O_8. The treatment of the ten tons occupied two years, and resulted in the recovery of three grams of radium chloride in a state approaching purity. No analyses are given in this paper and only very scanty details as to the plant used.

As these residues were derived from ore containing 270 milligrams of radium (calculated as bromide) per ton, and as the Olary ore, even when concentrated, contains only eight milligrams, it is obvious that any process to be commercially successful when applied to these latter ores must be comparatively simple in operation, and must allow of a considerable tonnage being put through annually. It may be noted that eight milligrams of bromide to the ton means one part in 125 million or one part of elementary radium in 214 million parts of concentrates.

As first observed by H. Y. L. Brown the amount of visible carnotite in the ore is negligible from an economic point of view, and for practical purposes the ore consists of a mixture of ilmenite, magnetite, and rutile, with small amounts of carnotite and a mineral stated by Crook and Blake to be probably tcheffkinite. Table I. gives:—

(*a*) Analysis of the ore complex excluding the carnotite, taken from Crook and Blake's paper.

(*b*) Analysis of the concentrates now being treated at Woolwich.

(*c*) Analysis of a typical Austrian pitchblende.[5]

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[1] Record of Mines of S. Australia, 4th Edition, Adelaide. 1908, p. 361.

[2] D. Mawson, Trans. Roy. Soc. S. Aust. 1906, Vol. xxx., p. 188.

[3] D. Crook, F.G.S., and G. S. Blake, D.Sc., Mineralogical Mag. March, 1910, Vol. xv., No. 77, pp. 271—284.

[4] Haitinger and Ulrich, Sitz. Ber. der Wiener Akad. IIa Bd. 117, 1908) pp. 619—630.

[5] Brearly, Analytical Chemistry of Uranium, p. 43.

Table I.

	a	*b*	*c*
Lime	0·25	0·55	2·55
Lead oxide	0·4	0·16	1·9
Ferric oxide	17·87	17·4	1·14
Ferrous oxide	17·37	16·9	—
Manganous oxide	0·24	trace	0·11
Thorium oxide	0·13		
Cerium oxide	1·26	3·27	
Lanthanum and didymium oxide	2·13		—
Yttrium oxide	1·16		
Chromium sesquioxide	1·6	0·85	—
Uranoso-uranic oxide	2·25	1·6	49·95
Vanadic oxide	0·93	0·86	0·02
Titanium dioxide	51·85	45·85	—
Silica	1·15	12·70	18·54
Zinc oxide	—	—	1·09
Phosphoric oxide	—	—	0·33
Sulphur	—	—	5·08
Arsenic	—	—	0·44
Bismuth	—	—	0·24
Copper	—	—	0·89
Iron	—	—	8·04
Carbon dioxide	—	—	5·02

The ore is dry crushed at the mine to pass a sieve of 20 holes to the linear inch, and is then concentrated magnetically, the concentrates, amounting to about 30 per cent. of the ore crushed, being forwarded to Sydney for treatment.

One of the most interesting points about analysis (*a*) is that the ratio of the uranium to the thorium is as 16·7 : 1; radium preparations worked up from this ore should therefore contain very little mesothorium. This conclusion has been confirmed in Rutherford's laboratory by Dr. Alexander Russell, who examined a specimen of the bromide and found it to contain as radio-active substances only radium and its decomposition products.

As the concentrates are insoluble in acids, a fusion process is necessary to effect the initial decomposition. The concentrates are mixed with three times their weight of salt cake (acid sulphate of soda) and fused in a reverberatory furnace of sufficient capacity to take 500 kilos. of concentrates and 1500 kilos. of salt cake in a single charge. Three charges can be put through in twenty-four hours. The fused product, crushed to pass a sieve of eight holes to the linear inch, is fed, in small amounts at a time, into wooden vats fitted with agitators. Cold water is fed continuously into the vats at the bottom and an overflow is provided near the top. By suitably adjusting the conditions, it is possible to separate out on the bottoms of the vats a considerable amount of comparatively coarse material which is almost free from radium and uranium. The turbid liquid overflowing carries in suspension the radium, lead, and barium as sulphates, together with a considerable amount of finely divided silica; while in solution we have the uranium rare earths, and part of the iron and acid earths contained in the ore.

The coarse residues are removed from the vats daily, re-washed to free them from any undissolved fused product and sent to the dump. The composition of these residues is given in Table III.

The overflow from the dissolving vats is pumped to large lead-lined settling tanks and allowed to stand all night. The "slimes" settle completely in twelve hours, and the clear liquid is drawn off daily and treated for the recovery of the uranium. The slimes, which amount when dried to approximately 10 per cent. of the weight of the concentrates, are collected weekly and treated for the recovery of the radium as described below.

The further steps in the treatment process may conveniently be described under two heads :—

(*a*) The recovery of the uranium.

(*b*) The recovery of the radium.

(*a*) *Recovery of the uranium.*

The clear solution containing the uranium and much of the iron and other bases in the concentrates, together with a large amount of sodium salts, is fed into a series of vats containing a measured excess of a mixture of carbonate and bicarbonate of soda, and heated and agitated by means of steam jets. The iron, with most of the other bases present is precipitated, while the uranium goes into solution together with some of the rare earths. The bulky iron precipitate is separated partly by settlement and partly by means of vacuum filters. It is difficult to handle and cannot be washed effectually, a portion of the uranium is therefore unavoidably discarded along with this precipitate. The uranium solution is made just acid with sulphuric acid, heated, and the carbon dioxide expelled by a brisk current of air. The uranium is then precipitated by the addition of ammonia. The ammonium uranate is thickened somewhat in conical settling tanks and then further thickened to a pulp in a hydro-extractor. This pulp is dried and dehydrated in large muffles. The dehydrated product is broken up and washed repeatedly with hot water. This treatment removes the bulk of the sodium salts, and a product is obtained which on drying contains about 75 per cent. of U_3O_8. An analysis of this, together with that of the iron precipitate, is given in Table II. Prior to analysis the iron hydroxide was twice dissolved and re-precipitated with ammonia to free it from the larga amount of sodium salts present. The washed precipitate was dried, ignited, and analysed.

Table II.

	Uranium product.	Iron precipitate.
Insoluble matter	3·0	—
Titanium dioxide	—	8·11
Ferric oxide	9·41	74·65
Uranoso-uranic oxide	76·6	2·7
Rare earths	1·57	7·36
Lead oxide	0·51	—
Vanadic oxide	—	1·2
Chromium oxide	—	5·81
Sodium salts	8·21	—

(*b*) *Recovery of the radium.*

The thickened insoluble residue or slime from the settling tank is mixed with half its dry weight of strong sulphuric acid and allowed to stand for several days. It is then washed, first by decantation and then on a vacuum filter, till the washings give only a very slight precipitate with barium chloride. The acid treatment and washing reduces the bulk of the slime considerably, removing large amounts of acid earths and iron salts. The washed slime, in quantities of about 200 kilos. dry weight, is then boiled in large steel boilers with an excess of a 20 per cent. solution of sodium carbonate for two days, the solution being replaced once during the boiling. This treatment dissolves a large amount of silica, and converts much of the lead, radium, and barium sulphates to carbonates. The slime is then washed till the wash water gives no reaction for sulphates; thi takes two days for each lot of 200 kilos. The washed slime is then fed into a warm dilute solution of hydrochloric acid, agitated for a couple of hours, and allowed to settle all night. The clear solution is siphoned off and the lead, barium, and radium precipitated as sulphates. After washing once by decantation, the slime is again treated as above described. Two treatments suffice to extract most of the radium, but the slime is reserved for a further treatment if necessary. The plant as at present arranged, can treat the slime from ten tons of concentrates per week. The weekly yield of crude sulphate is about 12 kilos.

During the past two years I have made a number of experiments, both in the laboratory and on the working scale, to see if the sulphates in the slime could be reduced by heating the material with carbonaceous substances, or else in a current of some reducing gas, but the results so far have not been encouraging.

The crude sulphate is fused with carbonate of soda in large graphite pots, and the product digested with hot water. The insoluble residue after picking out most of the metallic lead is thoroughly washed, and heated with hydrochloric acid, The solution is evaporated to dryness to dehydrate the silica, the residue moistened with acid and digested with hot water and the silica filtered off.

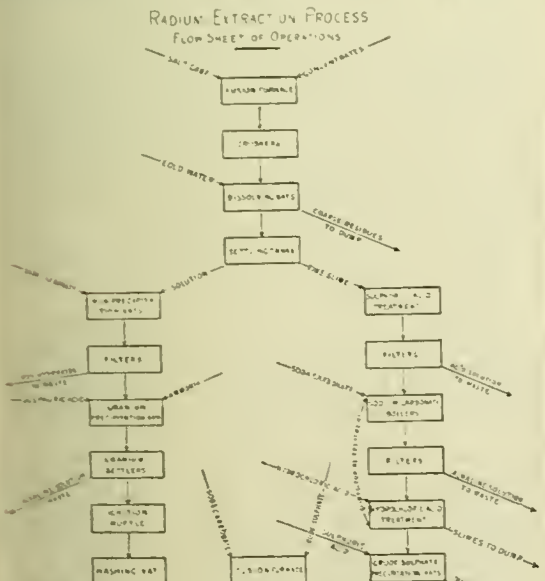
It was found that the method of converting the sulphates to carbonates by boiling with concentrated soda solution was altogether too slow, and the fusion method has the further advantage of removing most of the lead in the metallic state. This lead which is, of course, radio-active (Table IV.) is being stored for examination later. The hydrochloric acid solution, containing the radium and barium, together with large amounts of lead, iron, and acid earths, was formerly treated by the ordinary analytical methods for the removal of the impurities prior to precipitating the radium and barium as carbonates. Bulky precipitates, difficult to handle and wash were obtained; this procedure has been abandoned, and a method due to Soddy* is now used with very satisfactory results.

The chloride solution is saturated with hydrogen chloride and the barium and radium are thrown down nearly free from other elements. The crystalline precipitate is filtered off, freed by suction from most of the adhering liquid and dried. It is dissolved in water, the small amounts of lead, iron, etc., still remaining, removed, and the mixed carbonates of barium and radium finally dissolved in hydrobromic acid for fractionation. About 1500 grams of dry chloride, which when freed from radio-active substances other than radium has an equilibrium activity of from 40 to 50, is obtained weekly.

Table III. gives analysis of the slime, of the tailings or coarse residues, and of the crude sulphate. The whole series of operations is summarised in the accompanying flow sheet.

TABLE III.

	Crude sulphates.	Slimes.	Tailings.
Silica	10·82	51·42	22
Titanium dioxide	3·0	42·40	63·1
Ferric oxide	2·15	4·21	14·23
Rare earths	—	—	0·41
Uranoso-uranic oxide	—	—	—
Lead sulphate	69·24	1·85	trace
Barium sulphate	12·50	0·23	—



The composition of the tailings is of great interest, the high percentage of titanium dioxide being noteworthy. It is apparent that the initial fusion effects a selective decomposition of the ore complex, the uranium minerals are completely decomposed, and the tailings, which contain a large proportion of comparatively coarse grains, seem to consist largely of unaltered rutile.

Repeated assays of the tailings have failed to detect appreciable amounts of uranium. As will be seen too, from Table IV., the amount of radium left in the tailings must be very small.

The economic success of the process apparently depends on the fact that it is only necessary to decompose partly the ore mixture in the fusion furnace, and that therefore, comparatively small amounts of reagents are required. If it had been necessary to decompose the ore completely in order to extract the radium, treatment costs would I think, under local conditions, at least, have been prohibitive. As a matter of fact, about 50 per cent. of the concentrates consists of minerals almost free from radium and uranium, this being the proportion of the material fused sent to the dump each week.

An approximately ten-fold concentration of the radium is therefore effected by the two simple operations of fusing the concentrates and dissolving the fused product under proper conditions.

In Table IV. the relative activities per unit mass of the concentrates, tailings, and slimes are given.

TABLE IV.

	Activity per unit mass.
Uranium oxide	1·0
Tailings	0·007
Concentrates	0·06
Slimes	0·25
Crude sulphate	11·0

The radio-active lead separated out on smelting the sulphate has an activity approximately twice that of uranium oxide when three months old.

The whole of the radium in the concentrates must distribute itself between the tailings and the slimes. As the tailings amount to five times the weight of the slimes, it appears from the relative activities of the two products that 86 per cent. of the radium contents of the ore is concentrated in the slimes, 14 per cent. being rejected in the tailings.

So far I have done nothing in the separation of the other radio-active bodies in the ore. I hope, however, to examine very shortly a portion of the radio-active lead now being stored, as its activity appears too high to be wholly due to radium D and its products. Rutherford* states that "radium D is separated with the large amount of lead usually present in radioactive minerals. In the course of time, radium D produces radium F (polonium) and the ray activity of the lead becomes about equal to that of uranium."

As stated previously, the radio-lead separated on smelting the crude sulphide was about twice this activity. It is possible that this is due to small amounts of radium-barium sulphate included in the lead. The lead accumulated in the course of several years will ultimately form a convenient source for the working up of polonium preparations. As the amount of polonium in equilibrium with a mineral containing one gram of radium is only 0·19 milligram, the direct recovery of polonium from the working solution is obviously out of the question.

It should be possible, on the other hand, to work up fairly active ionium preparations from the rare earths without much difficulty.

While the chief technical problems in connection with this ore may be regarded as solved, much work of a scientific character remains to be done, and I hope to continue investigations on the three following lines:—

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* F. Soddy, Chemistry of Radio Elements, p. 45.

* E. Rutherford, "The Radio-active Substances," p. 511.

1. To make a complete spectrographic examination of the ore and the various products separated out during treatment.
2. To investigate the radio-active properties of these products.
3. To work up some kilos. of the rare earths in order to examine them in detail.

In conclusion I desire to thank Professor Pollock for his kindness in testing various radium preparations from time to time, and for the friendly interest he has taken in the work throughout.

Discussion.

In reply to questions by the chairman, the author stated that in the examination of radio-active bodies the gold leaf electroscope was 1,000 times as sensitive as the spectroscope. With regard to losses in extraction of the ore, about 13 per cent. of the radium was at present lost in the slimes, in addition to other losses. He hoped soon to diminish this, and to obtain 85 per cent. of the total radium contained in the ore.

Meeting held at Sydney on Wednesday, 10th December, 1913.

MR. LOXLEY MEGGITT IN THE CHAIR.

NOTES ON AUSTRALIAN PINE BARKS.

BY F. A. COOMBS AND A. H. DETTMANN.

In a recent publication entitled "A Research of the Pines of Australia," by R. T. Baker and H. G. Smith, attention is drawn to the tannin values of the barks of the various species of *Callitris* (see this J., 1911, 1353, 1358).

Samples of bark were supplied by Messrs. Baker and Smith to the Tanning Department of the Sydney Technical College. These have been tested quantitatively and qualitatively, and while there is still a considerable amount of work to be carried out in this direction, we wish to make known results which will probably enable interested persons to estimate approximately the true value of these barks as a tanning agent.

We have only dealt with two species, *Callitris calcarata* and *Callitris glauca*, as being worthy of commercial consideration at the present date. The *Callitris* barks appear to be like the hemlock bark of America, the ross being rough with deep fissures and carrying varying proportions of red tannins. The tannin values of *Callitris calcarata* are higher than hemlock or any of the conifer barks, which supports the theory that during the long processes of evolution the dry Australian climate has been a big factor in the growth of barks which contain such liberal supplies of tannin, unequalled in any part of the world. The Australian forests differ considerably from the forests of New Zealand. The former are dry with very little undergrowth and the bark of the trees is clean and practically free from lichens, etc., but the soil of the latter is always damp, the undergrowth is very thick, the sun cannot penetrate through the branches overhead, and the barks of large numbers of the living trees are covered with moss, ferns, and lichens, which will probably affect adversely the tannin values of barks that contain tannin in the ross, such as the black birch (South Island, New Zealand, 16 per cent. tannin). Samples of bark from these birch trees, received at the Sydney Technical College, show that the bark decays in patches on the living tree, a result probably brought about indirectly by the excessive moisture, which is not so pronounced in the Australian forests. The commercial side of the *Callitris* barks has not been thoroughly investigated. Our results show that these barks have not the same high tannin values as the best Australian wattles, but yield tannin values which compare favourably with the average woods and barks used for the manufacture of extracts. The Australian tanner has been very fortunate in having large local supplies of wattle bark (*Acacia pycnantha* and *decurrens*) which range in tannin values from 30 to 38 per cent. in commercial samples, and naturally any new tanning material is compared with these two species of *Acacia*.

We obtained an average tannin value of 20·87 per cent. for *Callitris calcarata* and 12·33 per cent. for *Callitris glauca*. Such results compared with the above-mentioned wattles are not likely to tempt the tanner to use pine bark for its tannin values. The Australian tanners obtain the majority of the tannin required, by leaching bark; the leaching plant is connected with the tannery, and by using the local wattle barks tannin is obtained in solution at a cheaper rate than from imported extracts of equal quality, and as the costs of stripping, freight, and leaching are all inversely proportional to the tannin value, we believe that *Callitris glauca* could never be successfully exploited as a bark for the tanners to leach. The bark of *Callitris calcarata* might find a ready sale if commercial samples return the same tannin values as the samples we have analysed. The average of a number of small samples of bark from trees of various sizes, returns a tannin value varying with the practical experience of the collector, usually higher than tannin values obtained from commercial samples.

A great change has been brought about in the tanning industry during the last twenty years by the introduction of semi-liquid and solid tannin extracts. The large tanning centres of Europe and the United States depend on supplies from abroad. The demand is so strong that barks and woods containing small percentages of tannin are used in the form of extracts.

Australian *Callitris* barks have a tannin value which brings them within the sphere of those substances which are suitable for manufacturing tannin extracts. Belonging to the catechol group, they can be compared with North American hemlock bark (8 to 10 per cent. tannin), South American quebracho wood (20 per cent. tannin), and mangrove bark (30 to 38 per cent. tannin). Both *Callitris calcarata* and *glauca* give a deep red colour to the leather and are therefore not so serviceable as wattle bark for those leather manufacturers who produce dyed leathers or basils, and this fault is shared by the three above-mentioned tannin materials, but when these red leather producing materials are blended with other tannin materials good results, varying with the skill of the tanner, can be obtained on all classes of leather. A primary tanning experiment was carried out with these barks. Liquors containing 3/5 pine bark tannin and 2/5 oakwood extract were used to tan several sections of hide, and the resulting 90 per cent. of leather compared with other results obtained from leather tanned under similar conditions with wattle instead of pine bark, shows that these barks do not prevent the production of good weight returns and a solid leather.

The future of the pine barks will depend on the successful manufacture of an extract, and we hope to carry out further experiments when the extract can be obtained in sufficient quantities.

The factors which brought about the manufacture of "hemlock extract" and a big demand for the bark in the United States, will throw light on the possibilities of exploiting Australian pine bark. The U.S.A. had the hides to tan, and the same can be said of Australia. The former had to depend on hemlock or imported tannin materials; the latter have always had large supplies of wattle bark, and therefore there has not been the same incentive to search for fresh tannin materials and to exploit the inferior pine bark. But at the present time Australia is importing large quantities of wattle bark from South Africa, which means a shortage of local supplies—a factor which shows the necessity of a more complete investigation of the practical value of these pine barks.

In America there were vast tracts of land covered with hemlock trees, and Messrs. Baker and Smith are quite confident that Australia also has large amounts of pine trees whose bark has a high tannin value, and if investigations show that sufficient bark can be obtained, the successful manufacture of extract will depend on the quality and the cost of production.

The United States and Canada are in a better position than Australia to collect the maximum value from their respective forests. The two former countries owe their great advancement and the wealth obtained from natural resources largely to private enterprise, but in Australia private enterprise differs from the same in North America because it does not include the right to build and control railways. The pioneers in America go out in large numbers to take up land, and private enterprise soon follows with a railway, and in some cases the railway goes before the farmer and squatter, enabling land owners to combine if necessary and deal with such items as bark, timber, etc., which would bring in money when the land is being prepared for cultivation, or railways can be laid through forest land to deal with timber, etc., and after the land is cleared the settlers will follow and replace the sawmills, etc., with cultivated land. In Australia and New Zealand the land has been taken up by scattered units who are too far apart to organise and unite their labour in an effort to convert the forests into money, which is only possible when the timber can be sent by rail or river to the various markets. These isolated settlers, who cannot place the products of the forests on the market within a reasonable time, are forced to burn the growing trees to enable them to cultivate the land, and these fires have brought about great losses to Australia of timber and bark. The utilisation of timber and its by-products depending almost entirely on private enterprise, which, under certain circumstances, is powerless without a railway, it would appear that State ownership of railways places some industries at a disadvantage. The railways are one of the most important factors in developing a young country, and it is quite possible that Australia would benefit considerably if, instead of prohibiting private individuals from controlling railways, the State were to lay down a system which would prevent the evils of monopolies, etc., and containing a clause allowing the State to resume and control after certain periods.

America appears to have been in a better position to treat hemlock than Australia is to treat the local pine barks, but at the present time the supplies of tannin materials are decreasing, and if an extract of good quality is manufactured from the local pine bark we have no doubt that a ready sale will be found for it.

Baker and Smith, in "The Pines of Australia," point out that there are considerable belts of rocky mountainous land supporting the growth of these trees, which would not be suitable for cultivation but which with care would give continual supplies of timber, sandarac, and bark.

Briefly the position may be summed up as follows:— The supplies of bark are apparently large; the tannin value is quite sufficient for the successful manufacture of extract, and the quality of the tannin is not inferior to that obtained from hemlock, quebracho and mangrove, but a commercial investigation is required to deal with the quantity available and cost of carriage to certain centres near a railway, and a more complete analysis of commercial samples, the latter to be taken from not less than 500 tons of bark. If this amount of bark were stripped, as suggested in a recent paper from this Department on "Australian Mangrove Bark" (Leather World, December, 1912), factors would be obtained which would go a long way towards solving the commercial value of *Callitris* barks.

The tannins from these pine barks are decidedly red. A imple method of decolourising their extracts would mprove the value considerably, but research workers in his direction should keep in view the action of the lecolourising agents on the process of tanning. Dumesny, n his book on "Wood Products," places the problem of lecolourisation in a very clear light. (He writes: "the ecolourisation of the future does not lie in the use of hemical products, nor in more or less complicated proesses; tanning is an industry far too complex to stand . It requires and will require before and above all, ure extracts of a well determined nature, with a high perentage of tannin soluble in cold water, and finally of as onstant and uniform a composition as possible.") There an be no objection to the use of albuminous substances remove suspensoids and the catechol tannins or reds, hich have almost reached the stage of suspended matter; ut while chemical substances such as the alkali sulphites ve been great factors in the production of cheap extracts, ey are not without drawbacks in the tannery.

Qualitative reactions.

The qualitative reactions of the tannins in *Callitris* barks were tested by the methods and reagents used by Stiasny and Wilkinson (see this J., 1911, 1172). The tannins in the barks of *C. calcarata* and *C. glauca* belong distinctly to the catechol group. Both species give a complete precipitate with the formaldehyde test, and no immediate precipitate with the ammonium sulphide test, but slight traces after standing overnight. With *Callitris calcarata* the filtrate from the acetic acid and lead acetate test, on the addition of iron alum, gives a slate blue precipitate by reflected light, and with *C. glauca* a greenish-brown. The other tests gave the following results in the case of both varieties:—*Bromine*, precipitate. *Normal or basic lead acetate filtrate and caustic soda*, colourless. *Copper sulphate and ammonia*, no. ppt. *Tartar emetic and ammonium acetate*, clear. The qualitative reactions of the tannins of *Callitris* barks do not give abnormal results when compared with other well-known pine barks. The fermentable sugars, noted by the amount of acid in the liquors, are slightly higher in *Callitris* barks than in wattle barks, but the acidity value, as far as our experiments have gone, is not nearly as high as in some European pine barks.

The deal shaving test gave a pink colour with *C. calcarata* and slight pink with *C. glauca*. Iron alum tests gave brownish-green and green, respectively.

The following table will show the tannin values of 11 samples of *C. calcarata* and 6 samples of *C. glauca*:—

Callitris Calcarata.

	Tannin.	Non-tannins.	Insolubles.	Water.
	per cent.	per cent.	per cent.	per cent.
No. 1	21·72	7·24	58·54	12·5
„ 2	23·69	5·99	57·91	12·5
„ 3	22·90	5·98	58·62	12·5
„ 4	20·37	6·09	61·04	12·5
„ 5	21·65	6·96	58·89	12·5
„ 6	16·68	6·80	64·02	12·5
„ 7	18·29	6·97	62·24	12·5
„ 8	15·24	6·77	65·49	12·5
„ 9	18·42	7·32	61·76	12·5
„ 10	23·33	5·66	58·51	12·5
„ 11	27·28	7·18	53·04	12·5
Average	20·87	6·63	60·00	12·5

Callitris Glauca.

	Tannin.	Non-tannins.	Insolubles.	Water.
	per cent.	per cent.	per cent.	per cent.
No. 1..	15·30	5·76	66·44	12·5
„ 2..	11·03	6·30	70·17	12·5
„ 3..	14·63	7·02	65·85	12·5
„ 4..	9·02	4·90	73·58	12·5
„ 5..	10·99	6·55	69·96	12·5
„ 6..	13·00	5·03	69·47	12·5
Average	12·33	5·93	69·24	12·5

	Ethyl acetate extract.	Alcohol precipitation figures.	Gallic acid value of 1 grm. of tannin.	Ratio of tannins to non-tannins,
Callitris Calcarata	per cent.			
No. 1	7·3	Nil	0·588	2·3—4 3
„ No. 2	3·98	1·0	0·593	
Callitris Glauca				
No. 1	9·96	3·54	0·573	1·7—2 6
„ No. 2	10·6	3·61	0·593	

Amyl acetate was used for ethyl acetate figure.

Discussion.

Mr. H. G. Smith said that the production of wattle bark in Australia was now unremunerative, the supply being drawn from Natal, but the cultivation of white pine would be very profitable. Large areas, useless for agriculture, were covered with white pine scrub, which could be cut down and quickly grown again. The supply was unlimited, and the bark was easily stripped.

THE ACTION OF CONCENTRATED SULPHURIC ACID ON IRON.

BY CHARLES E. FAWSITT AND CHARLES W. R. POWELL.

In commerce it is customary to carry concentrated sulphuric acid in iron drums and to store it in iron tanks. It appears to be generally supposed that the acid has no action on iron in the cold. A certain amount of action does go on, however, and the following investigation was undertaken to determine its nature and extent.

In several respects iron appears to stand out from other metals as peculiar. For one thing it is rendered passive very easily; and again, its behaviour in the matter of rusting and of corrosion generally is erratic.

Peculiarities noticed in regard to its passivity and corrosion are in many cases connected with the surface condition of the metal, and as a result of the present investigation it appears that certain irregularities observed with respect to the action of sulphuric acid may be due to special conditions of the surface of the metal. The Laboratory Experiments (Part I.) in this paper were performed by C. W. R. Powell (Science Research Scholar of the University of Sydney), while C. E. Fawsitt is responsible for the experiments conducted with a drum of acid (Part II.).

Part I.—Laboratory Experiments.

The effect of temperature, quality of acid, and quality of iron, on the products and rate of reaction were investigated. The temperatures varied from 25° to 200° C.

The experiments were conducted mainly with sulphuric acid "Pure for analysis" which contained 97·5 per cent. of sulphuric acid by analysis. Unless otherwise expressly stated, this is the acid used as "concentrated sulphuric acid." No attempt was made to obtain the acid quite free from water, as it was thought that more particular interest attached to experiments with commercial acid. Experiments were also carried out with commercial acid (94·6 per cent. by density) and with the ordinary acid diluted with water. The most dilute pure acid used contained 94·6 per cent. of H_2SO_4 (estimated from the density). The quality of the iron used also affects the reaction. In this work the following kinds of iron were employed.

A. Steel plate which gave the following analysis: carbon 0·35 (per cent.), manganese 0·61, phosphorus 0·06, silicon 0·01, sulphur 0·07.

B. Steel cut from a sulphuric acid drum. This, as well as steels A and C, was kindly analysed for us by Messrs. Eastaugh and Burrows, of the University of Sydney, and came out as follows: carbon 0·045 per cent., manganese 0·375 per cent. phosphorus 0·004 per cent., sulphur 0·015 per cent., silicon 0·007 per cent., nickel 0·46 per cent.

C. Steel wire analysed as follows: carbon 0·51 per cent., manganese 0·48 per cent., phosphorus 0·046 per cent., silicon 0·083 per cent., sulphur 0·058 per cent.

D. Wrought iron.

E. British pig iron, No. 1 Foundry (soft, gray).

F. White cast iron (British).

G. Cast iron from Lithgow, N.S.W. Cast in sand. Analysis kindly supplied to us by Mr. B. Smart, as follows: Carbon, graphite, 3·16 per cent.; carbon, combined, 0·57 per cent.; silicon, 3·27 per cent.; sulphur, 0·019 per cent.; phosphorus, 0·792 per cent.; manganese, 1·51 per cent.

H. Cast iron from Lithgow, N.S.W. (per Mr. B. Smart). Cast in chill. Analysis: carbon, graphite, 2·88 per cent.; carbon, combined, 0·53 per cent.; silicon, 3·46 per cent.; sulphur, 0·024 per cent.; phosphorus, 0·789 per cent.; manganese, 1·52 per cent.

I. Iron powder obtained by reduction of ferric oxide with hydrogen.

Nature of the action of sulphuric acid on iron.

When iron or steel is plunged into concentrated sulphuric acid there is an initial evolution of gas which usually falls off rapidly.

It lasts at most a few minutes and is probably due to the special condition of the surface of the iron. The gas given off is mostly hydrogen. There are doubtless usually traces of hydrocarbons present, but no sulphur dioxide could be detected in the gas. It is highly probable that the first evolution of gas is due to there being a small quantity of moisture on the surface of the iron as it comes from its condition of exposure to the atmosphere. After some time has elapsed a more or less steady current of gas is in most cases evolved from the iron. It is this action that we have more closely investigated.

It has already been pointed out by one of us (Powell, Proc. Roy. Soc. N.S.W., 1913, 47, 59) that cold concentrated sulphuric acid acts slowly on iron to produce ferrous sulphate and hydrogen. There is also a very small proportion, 1·3 per cent., of sulphur dioxide in the gas produced. The effect of temperature, acid, and metal on the reaction is next given.

Effect of temperature on the products.

As the temperature is increased the percentage of hydrogen decreases and that of the sulphur dioxide increases until at some particular temperature the gas evolved consists entirely of sulphur dioxide. This temperature was not the same for all the samples of iron worked on, and in some cases it was found that even if some hydrogen was being evolved at a particular high temperature, then after a few hours at that temperature the evolution of hydrogen had ceased and sulphur dioxide alone was being evolved.

Certain secondary reactions also seem to take place at high temperatures; sulphuretted hydrogen was detected by means of its reaction with lead acetate, although in most cases the gas reacted with the sulphur dioxide forming sulphur and water, before a test could be obtained: when the presence of sulphur in the reaction flask indicated that this was going on the surface of the mercury in the side tube leading to the measuring cylinder was invariably blackened owing, no doubt, to the formation of mercury sulphide.

In some cases (iron powder) sulphuretted hydrogen was evolved at 30° C. in sufficient quantity to be detected by the smell.

With steel wire (C) and concentrated sulphuric acid the following results were obtained:—

Table I.

Temperature.	Time from start of experiment till taking of sample.	H_2	SO_2
25°C.	8 days	96·8	3·2
30° C.	18 days	98·0	2·0
30° C.	54 days	95·1	4·9
35° C.	3 days	92·5	7·5
35° C.	6 days	92·0	8·0
35° C.	8 days	93·2	6·8
160° C.	½ hour	55·2	44·8
160° C.	2 hours	54·5	45·5
160° C.	4 hours	57·8	42·2
160° C.	7 hours	61·0	39·0
160° C.	16 hours	17·9	82·0
160° C.	30 hours	8·4	91·6
180° C.	1 hour	—	100·0
200° C.	1 hour	—	100·0

Effect of composition of metal on the nature of the reaction

The composition of the iron or steel employed considerably affects the analysis of gases evolved. Lithgow pi iron cast in chill (H) yielded gas containing 92 per cent of sulphur dioxide immediately on heating to 150° C whereas the steel wire of previous experiments required t be heated to 160° C. for 30 hours before the percentage sulphur dioxide was reached. The following table illustrates the nature of the reaction at 150° C. and 165° C.

TABLE II.

Temperature.	Time.	H_2	SO_2
150° C.	4 hours	7·7	92·3
150° C.	6 ,,	3·9	96·1
165° C.	1 ,,	—	100·0
165° C.	3 ,,	—	100·0

In this case at 165° C. the amount of hydrogen present, if any, had become too small to be detected by the ordinary methods of analysis. Nickel steel (B) yielded immediately on heating to 150° C. a mixture of gases containing 98 per cent. sulphur dioxide and 2 per cent. of hydrogen.

English No. 1. foundry iron behaved as follows :—

TABLE III.

Temperature.	Time in hours.	H_2	SO_2
100	5	35·0	65·0
150	3	—	100·0
165	3	—	100·0

The action of English white cast iron was very different, the percentage of sulphur dioxide being 100 at 100° C.

TABLE IV.

Temperature.	Time.	H_2	SO_2
30	12 days	35·0	65·0
50	24 hours	1·0	99·0
100	1 hour	—	100·0

Steel of composition (A) gave the following results :—

TABLE V.

Temperature.	Time.	H_2	SO_2
30	14 days	97·0	3·0
30	50 ,,	94·7	5·3

This is very similar to what was obtained with the steel wire already experimented on.

Influence of the acid on the action.

In the following table are shown the results obtained fter a week's run by the use of the ordinary "pure" acid 97·5 per cent.) and with this diluted with water to 94·6 er cent., and with commercial acid which contained 4·6 per cent. H_2SO_4.

TABLE VI.

Acid.	Temperature.	Iron used.	H_2	SO_2
per cent.				
97·5	30° C.	Steel wire	96·5	3·5
94·6	30° C.	,,	96·2	3·8
94·6 (commercial)	26° C.	B	98·8	1·2

The results of these experiments show that the products btained from the dilute acid do not differ greatly from ose with the most concentrated acid (97·5 per cent.). Further, the impurities present in the "commercial" id used were evidently of such a nature as not to disturb e reaction greatly.

Experiments on the rate of reaction.

Exact measurements on the rate of reaction between a etal surface and an acid are difficult to carry out, as the tent of the surface of the metal and its condition vary in te of all precautions.

Most of the experiments in this paper have been repeated two, and in some cases, three or four times : the results of these several experiments agreed fairly well.

Any general conclusions arrived at here in regard to temperature effect, effect of metal composition, and effect of acid are considered to be valid, inasmuch as other factors were kept constant while the one was varied, and because the results obtained could be repeated with very similar results.

The experiments were conducted in round bottom Jena distilling flasks. After introducing the iron and sulphuric acid the neck was sealed with a paraffined rubber stopper and the side tube led to a measuring cylinder inverted in a mercury trough. In some cases after filling the flask, the neck was fused and drawn out, thus avoiding the use of anything but glass in the apparatus. The volume of gas evolved was taken as a measure of the rate of the reaction. The volume was corrected for temperature and pressure, all volumes being calculated to 0° C. and 760 mm.

Experiment with steel (C).

Steel wire (19·4 grms.) having a surface of 143 square cms. and freshly polished with emery cloth, was immersed in 60 c.c. of concentrated sulphuric acid and placed in a thermostat maintained at a temperature of 30° C. (Table VII.). After 23 days the temperature was allowed to fall to room temperature for 10 days (generally about 25° C.). The rate of reaction after the first day at 25° C. had fallen from 0·14 c.c. per hour to 0·05 c.c. per hour. It then continued to fall until on the 10th day it had ceased altogether. On again raising the temperature to 30° C. the rate rose to a value slightly higher than its former value at 30° C. On again lowering the temperature to 25° C. the rate gradually decreased.

TABLE VII.

Time in days.	Temperature °C.	c.c. evolved per hour.
		p. sq. decimetre.
6	30	0·06
8	30	0·08
10	30	0·08
14	30	0·08
16	30	0·10
20	30	0·09
21	30	0·10
22	30	0·10
23	30	0·09
24	25	0·03
27	25	0·03
29	25	0·02
31	25	0·01
34	25	0·00
35	30	0·14
37	30	0·12
39	30	0·11
41	30	0·13
42	30	0·13
43	25	0·06
49	25	0·06
51	25	0·06
52	25	0·05
53	25	0·03
57	25	0·02
59	25	0·05
60	25	0·02
64	25	0·02
72	25	0·00

It was found that as the result of four experiments, the average rate of gas evolution at 30° C. from 20 grms. of steel wire during the first twenty days was 0·12 c.c. per hour. For each square decimetre of surface the rate was 0·08 c.c. per hour.

Variation of rate of reaction with iron used.

With steel (A) the rate remained constant for 10 weeks at 30° C. at 0·05 c.c. per hour per square decimetre. With steel (B) the average rate for twenty days was the same as for steel (A), but the action began more slowly. With cast iron (G) (Lithgow) an entirely different result was obtained. This sample of cast iron proved resistant to the action of sulphuric acid at 30° C. After four weeks at this temperature no gas had been evolved and even when the temperature was raised to 100° C. the iron still remained "passive." After removal from the acid the iron presented a very different appearance to that of the steels used in previous experiments. All the steels became coated with white anhydrous ferrous sulphate, which sometimes clung to the metal and sometimes fell to the bottom of the flask. In this case, however, the iron had a dull dark grey surface, which looked black while still immersed in the acid. This was probably due to a film of ferrous sulphide, the formation of which would also account for the darkening of the acid. (cf. Ditte, An. Ph. Ch., 1890, **19**, 68.)

Sample E. (*British foundry iron*).—This iron gave off no gas at 30° C. and indeed liberated no gas even after remaining at 50° C. for seven days.

Sample F. White cast iron (*British*).—The iron was too hard to cut into pieces without altering the temper. Turnings had therefore to be taken, and were used of such a size that they were retained by a mesh of 24 to one inch and passed through a mesh of 10 to one inch. 37 grms. were immersed in 120 c.c. of sulphuric acid. Gas was evolved in this case at a rate comparable with the rates found for steels, when equal surfaces are considered.

Sample D.—Wrought iron was cut into pieces having a surface area of 61·8 square cms.; 30 grms. were immersed in 120 c.c. of sulphuric acid. During the first seven days at 30° C. about 1·5 c.c. of gas were evolved, but after that no gas was evolved up to twenty-five days when the temperature was raised to 50° C.

The results of the various samples of iron are shown in the following table (Table VIII.).

TABLE VIII.

Average rate of gas evolution during the first twenty days at 30° C. (86° F.).

Iron used.	Weight of iron.	Surface of iron.	Quantity of acid.	c.c. per hour per sq. dcm.
	grms.	sq. cm.	c.c.	
A.	37	60	120	0·05
B.	40	60	120	0·05
C.	20	143	60	0·08
D.	30	62	120	0·005
E.	37	67	120	0
F.	37	170	120	0·035
G.	37	68	130	0
H.	38	67	120	0

The results for iron powder are given separately, as this is hardly comparable with the other more compact forms of iron.

I. *Iron powder.*—Obtained by reducing pure ferric oxide. On mixing 20 grms. of the powder with 50 c.c. of sulphuric acid a very vigorous action ensued. Hydrogen, sulphuretted hydrogen and sulphur dioxide were liberated with the evolution of much heat. This violent action gradually eased off, but even after ten days was still very much greater than with other samples. On first mixing, the rate of evolution was very high, but was not measured exactly. This settled down in half an hour to about the rate shown in Table IX.

TABLE IX.

Time.	Temperature.	Rate.
4 days	30° C.	9·5
5 ,,	30° C.	6·95
6 ,,	30° C.	2·78
8 ,,	30° C.	2·15
11 ,,	30° C.	1·46

Effect of temperature on rate.

While the rate of gas evolution at 25°, 30°, and 35° C. was found for each temperature to be fairly constant, this cannot be said for temperatures above 35° C. Above this temperature the rate may vary considerably according to the time that the experiments have been in progress. In comparing the results of one temperature with another it was considered desirable to use the maximum rates observed. Different results are also obtained when fresh iron and acid are used for each temperature from those with the same materials heated to the higher temperatures.

In Table X the "Time" given in the second column is the time that has elapsed since the iron has been in contact with the acid at the particular temperature.

TABLE X.

Iron used.	Time (days).	Temperature	Rate in c.c. per hour per sq. dcm.	Temperature coeff. for 10° C.
B.	35	30	0·08	—
B.	6	50	0·07	—
B.	1	100	0	—
B.	1	150	28	—
*C.	43	30	0·08	—
	8	35	0·26	9·5
	13	40	0·71	6·9
	1	55	2·6	2·5
	1	100	7·7	1·3
†C.	1	100	2·0	—
	0·2	150	59	2·0
	0·5	160	229	3·9
	0·1	180	1916	2·9
E.	20	30	0	—
	7	50	0	—
	1	100	2·4	—
	0·5	150	152	2·3
	0·5	165	270	1·5
F.	20	30	0·04	—
	1	50	1·0	3·3
	0·5	100	155	2·9
	0·5	150	5865	2·1
H.	30	30	—	—
	13	35	—	—
	6	40	—	—
	9	50	0·04	—
	1	100	1·40	2·0
	1	150	12·7	1·6
	1	165	128	4·0

* Same reacting substances heated first at 30° and temperature then raised.

† Fresh iron and acid used for high temperatures.

With the exception of B (nickel steel), which gave off no gas at 100° C. for one day, all the specimens showed increased rate of gas evolution with rise of temperature. This rise of temperature did not cause a steady rise in the velocity; the temperature coefficient for increase of velocity per 10° C. usually fell as the temperature was raised. The average value, however, as calculated from these numbers is 3·1, which is very similar to the usual value obtained for temperature on reaction velocities.

Effect of concentration on rate.

The dilution of the acid was not carried very far, the most dilute acid used having a content of 94·6 per cent. sulphuric acid.

The results of experiments are shown in the following table (Table XI.)

TABLE XI.

Used 20 grms. of steel (C) having a surface of 143 sq. cm. Temperature 30° C.

Acid used.	Time from first contact in days.	Rate in c.c. per hou per sq. dcm.
per cent. 97·5 by analysis	6	0·07
97·5 by analysis	12	0·08
96·0 by density	2	0·03
	3	0·16
	6	0·37
	10	0·37
94·6 by density	1	1·0
	8	1·5
	12	2·37

The effect of diluting the acid increased the rate co siderably, and this effect became more pronounced aft the first few days had elapsed.

Effect of impurities on the rate of reaction.

The effect of rust was found to be such that when the steel was already rusted at the time of introduction to the acid the rate was increased considerably for the first two or three days at 30° and then fell to its normal value.

Effect of shaking.

In certain of these experiments which had been evolving gas for some time, the reaction gradually fell away and in some cases ceased altogether. This was particularly so when the temperature was high. An experiment carried out at 40° C. will serve as an example.

Time.	Rate.
1	1·00
7	0·90
8	0·80
9	0·07

The reaction began at the rate of 1·00 c.c. of gas per hour and fell away until on the ninth day 0·07 c.c. per hour were being evolved. The flask was shaken and then allowed to remain undisturbed and in a few hours the rate had again risen to 0·80 c.c. per hour.

In such cases as this, shaking had an effect on the rate of reaction, but the effect could hardly be called an accelerative one, since the rate was only raised to a value it had reached earlier in the experiment. The retardation was obviously due to the coating of anhydrous ferrous sulphate, which at 40° C. and higher very quickly accumulated. In other cases, however, where no such coating had been received by the iron, shaking had little effect.

PART II.

Experiments with a steel drum containing concentrated commercial sulphuric acid.

The drum used was composed of Mannesman steel (B). It measured 42 inches in length and 25 inches in diameter. The ends were curved inwards considerably. We were told that similar drums had been found to resist a pressure of ninety pounds to the square inch before bursting.

The drum was not quite full, the level of the acid being three inches from the bung hole. The volume of the acid was approximately ten cubic feet, and the gas space one foot. The area of the steel in contact with the acid was aken as twenty-four square feet. The acid was dark in olour and contained 94·6 per cent. of sulphuric acid (by ensity determination).

The drum had been welded along the side. By special xperiment on a part cut from the weld it was shown that he rate of evolution of gas at this place was not greater than t other parts of the drum. The drum was left in a yard nder cover. The temperature inside the drum was not ecorded, but a thermometer was placed beside it, and ver long periods of time it may be assumed that the verage temperature was similar to that recorded by the hermometer.

A mercury pressure gauge was inserted in the bung ole in August, 1912, but the pressure recorded after allowg the drum to stand for several weeks was very small, eing scarcely more than that due to the direct effect of an teration in atmospheric pressure and temperature on the essure of the gas in the drum.

This result was surprising as the laboratory experiments d led us to expect considerable pressure. On Nov. 12th, 12, the drum was shaken by rocking and hammering. e pressure immediately rose, and in a few days was so eat that the mercury gauge had to be abandoned. On v. 16th, a new gauge was kindly placed at our disposal Mr. S. H. Barraclough, of the Engineering Department the University of Sydney, and this was securely fixed in e bung of the drum. The rocking was carried on for a tnight to the extent of one to two hours rocking per day en the pressure reached 14 lb. to the square inch. The m was then left alone but the pressure rose in another tnight to 37 lb. to the square inch. The accumulated gas was then allowed to escape. Once the gas evolution had started it never completely ceased throughout the year 1912–1913.

The rate appeared to be controlled almost entirely by the temperature, and was little, if any, affected by further shaking, once the first evolution of gas had been started. Further, the rate of evolution was not affected by the pressure of the gas already in the drum, as was indeed the result to be expected.

In the table given below is a record of the rate of evolution of gas, expressed as pressure of pounds to the square inch. The average temperatures are also given during the time.

Table XII.

Period.	Aver. temp.	Extra pressure in lb. to the sq. inch produced by one day's evolution of gas.
1912.		
Nov. 16th—Dec. 10th	20° C.	1·5
Dec. 10th—Jan. 2nd	21° C.	1·7
1913.		
Jan. 2nd—Jan. 31st	23° C.	2·1
Jan. 31st—Feb. 25th	24° C.	2·6
Feb. 25th—Mar. 25th	22° C.	2·4
Mar. 25th—April 25th	18° C.	1·9
April 25th—May 19th	14° C.	1·6
May 19th—July 8th	12° C.	0·44
July 8th—Aug. 14th	12° C.	0·49
Aug. 26th—Sept. 27th	15° C.	1·4
Sept. 27th—Oct. 24th	17° C.	2·1
Oct. 24th—Nov. 10th	18° C.	2·3

The last velocity is greater than the velocity at the same time a year previously, but it was not increased by agitation and so for practical purposes may be taken as being the maximum.

To increase the pressure by 2·3 lb. to the square inch at 18° C. means that 0·15 cb. ft. of gas was produced per day. This means that the production of gas in c.c. per hour per square decimetre is 0·8 at 18° C.

The laboratory experiments for 94·6 per cent. acid gave a value 2·4 c.c. at 30° C. for steel (C). Inasmuch as laboratory experiments showed that there was little difference as a rule between steel (B) and (C), and as the temperature coefficient is 3 for 10° C., the correspondence obtained is satisfactory.

The safety of the carriage of sulphuric acid in iron drums will depend on the quality of the acid, the size of the air space left when filling, the temperature, and the time that elapses before the pressure is released.

Summary.

1. Concentrated sulphuric acid acts at the ordinary temperature on steel and on some kinds of cast iron, the products being ferrous sulphate and hydrogen with a small quantity of sulphur dioxide.

2. The reaction proceeds more rapidly with rise of temperature, and the gaseous products at 180° C. are sulphur dioxide with occasional small quantities of sulphuretted hydrogen, but no hydrogen.

3. The rate is increased on the average about three times for each 10° C. rise of temperature.

4. The rate of reaction depends on the concentration of the acid, but for small dilutions the ratio of hydrogen to sulphur dioxide in the mixture of gases evolved remains almost unchanged.

5. Although the rate of reaction depends to a certain extent on the composition of the sample of iron, as indicated by the large difference between steel wire and pig iron, an important factor governing the reaction with any one sample appears to be the condition of the surface of the iron.

6. Laboratory experiments on the rate of reaction were found to give results similar to those obtained on the large scale.

7. For the carriage of iron drums containing sulphuric acid, it is possible to calculate the conditions for safe carriage in any particular instance.

Our thanks are due to the British Australian Oil Company for placing a drum of acid at our disposal.

DETERMINATION OF THE VISCOSITY OF REFINED SYRUPS AND MOLASSES.

BY CHARLES W. R. POWELL.

Many methods have from time to time been suggested for the determination of the viscosity coefficients of liquids, and for liquids of low viscosity this determination can be made with a very high degree of accuracy. For instance, the viscosity coefficient of pure water has been determined at various times to several places of decimals, and even in ordinary laboratory work the error in such determinations may be restricted to 1 in 1000 without any difficulty. When, however, it is necessary to deal with very viscous liquids, the same degree of accuracy could hardly be expected and is certainly not obtained.

For dilute aqueous solutions or liquids of low viscosity the most convenient method of determination of the viscosity coefficient is that which involves the use of Poiseuille's capillary tube; but this method does not seem to have been very largely employed for very viscous liquids such as heavy oils and syrups. The glass capillary has been used for the determination of the viscosity of fused salts[1] and a platinum capillary has been used for similar work at high temperatures.[2] Other methods that have been tried are those depending on the rate at which a platinum wire sinks in the liquid[3] and upon the rate at which a platinum cylinder falls in the liquid.[4]

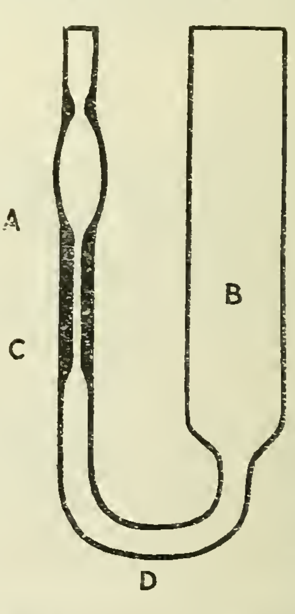
These last two methods were designed for very viscous liquids—liquids 1000 times more viscous than water—but similar methods applied to the class of liquids here experimented on, have been found to give unsatisfactory results. Fawsitt[5] has described a method by means of which the viscosity is calculated from the logarithmic decrement of a metal disc suspended in the liquid. This method, however, was designed for liquids that are not more than, say, 50 times as viscous as water, and would therefore be hardly suitable for heavy syrups which have a viscosity, in some cases, 1000 times greater than that of water. The viscosity of certain syrups has been determined by Pellet and Fribourg[6] by observing the time of flow of a definite volume of the syrup through an ordinary glass funnel, the stem of which was 10 cm. long and had an internal diameter of about 2 mm., the apparatus being maintained at a constant temperature by means of a water jacket. This method has the disadvantage of involving the use of a large amount of syrup, if good results are to be obtained, and this considerably increases the chance of error through variation of temperature, which has a large influence upon the viscosity.

The forms of apparatus in most general use for the determination of high viscosities are those of Redwood[7] and Engler.[8] These are fully described by Benedikt and Lewkowitsch.[9] Traube[10] condemns these viscosimeters because on theoretical grounds it is not permissible to compare directly the respective times of delivery of light and heavy oils, and still less the times of delivery of oils and water observed in one and the same apparatus (Engler's method involved the use of water as a liquid of standard viscosity, while Redwood employed refined rape oil for the same purpose). Traube thinks that the most satisfactory results can be achieved by approximating closely to Poiseuille's method, and considers the use of tubes of different diameters necessary for heavy and light oils if Hagenbach's correction to Poiseuille's formula is to become negligible.

More recently Dunstan and Strevens[11] have employed Ostwald's modification of Poiseuille's tube for the determination of the viscosity of lubricating oils and obtained good results. The dimensions of their apparatus were, capillary 6 cm. × 1 mm.; small bulb above capillary, 4 c.c.; bulb below capillary in other limb, 8 c.c.; length over all 15 cm. For the lubricating oils worked on these dimensions were very suitable, but for more viscous liquids such as syrups and molasses, it seemed to the author desirable to enlarge further the capillary and to decrease the size of the small bulb.

In the present paper the apparatus employed by the author is described, and the results obtained justify the use of such apparatus for the liquids dealt with. Furthermore it becomes unnecessary to adhere strictly to any particular dimensions in the construction of the viscosity tube, whereas with Redwood's viscosimeter it is most important that the orifice in the agate should be of standard size,[12] since slight variations in the size give discordant results. Similarly Engler[13] lays the greatest possible stress on the necessity of adhering strictly to the measures given in his apparatus, if correct results are to be obtained.

Form and dimensions of apparatus used.—Three tubes were used in the determinations, each having slightly different dimensions. The volume of the bulb, A (Fig. 1), varied from 1—1·5 c.c. The diameter of the capillary, C, which constitutes the essential difference from the ordinary tubes, was 2 mm., and the length of the capillary was varied from 6—7 cm. Owing to the increased size of the capillary, a general increase in the dimensions of the tube resulted, so that about 12 c.c. of liquid were necessary to fill the bulb, A, and the limb containing the capillary and still leave a small amount in the bottom of the wider limb, B. The following figures will supply all further information needed for a description of the apparatus.



Constriction above A: diameter 2 mm.

Bulb A: diameter 10 mm; volume 1—1·5 c.c.

Capillary C: outside diameter 7·5 mm.; inside diameter 2 mm.; length 6—7 cm.

U piece D (ordinary glass tubing): diameter 9 mm.

Limb B: diameter 2 cm.; length 23—25 cm.

The tube was so constructed that the height of the liquid in B was still a couple of centimetres below the bottom of the capillary, C, whe the bulb, A, was empty

As the use of 12 c.c might have proved a objection in some case a tube was made in whic very small thin-walle tubing of 2 mm. diamete was used instead the heavy capillar described above. Th considerably reduced the other dimensions of the apparatus, so that a mu smaller volume could be worked with.

Good results were obtained with this tube, but figures given here were obtained by use of the heav and larger tube, which besides being stronger, could cleaned very much more rapidly

Determination of the viscosity.—It was first of all nec sary to compare the times of flow in consecutive exp ments with the same syrup, in order to ascertain w degree of accuracy might be expected from this meth The following figures are the times of flow for "gol syrup," of which 12 c.c. were run into the wider limb. The same 12 c.c. of syrup were used throughout. viscosimeter was immersed in a large beaker of wa which was very accurately maintained at the temperature of the experiment.

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[1] Beck, Z. Phys. Chem., 1907, **58**, 425—441, also Lorenz and Kalmus, *Ibid*, 1907, **59**. 244—251.

[2] Goodwin and Mailey, Trans. Amer. Chem. Soc., 1907, **11**, 211—223.

[3] Doelter, Sitzungsber. K. Akad. Wiss. Wien., 1905, **114**, 529, also Ann. Reports Chem. Soc., 1905, **2**. 269.

[4] Arndt, Z. Electrochem. 1907, **13**. 578—582.

[5] Proc. Roy. Soc. A, 1908, **80**, 290—298.

[6] Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 304—315.

[7] This J., 1886, 126; 127.

[8] This J., 1893, 292.

[9] Oils Fats and Waxes, pp. 76—83

[10] This J., 1887, 414.

[11] This J., 1912, 1063.

[12] This J., 1886, 126.

[13] This J., 1893, 292.

The densities of the different syrups were not determined and therefore values of the viscosity are not given. However, this is only necessary if the actual viscosities are required, but as the object of this investigation was rather to illustrate the degree of accuracy that could be attained by employment of the method described, than to determine the viscosity, the time of flow is the only figure necessary in this case.

Table 1.

Time of flow in seconds at various temperatures.

50° C.		40° C.	30° C.	25° C.
76·6	76·5	213·1	702·3	1370·8
76·5	76·6	212·7	702·5	1371·4
76·6	77·2	212·8	703·4	
76·4	76·8	213·1		
76·4	76·4	213·1		

According to these figures the error at 50° C. averages 0·16 second in 76·6 seconds or about 1 in 500. At 25° C. the mean error has decreased to 0·3 in 1371·1 or 1 in 4500. It must be borne in mind, however, that a determination at 25° C. is much more tedious than one performed at 50° C., owing to the greater difficulty in maintaining the temperature constant over the much longer period. These figures were borne out by later experiments, a similar degree of accuracy being obtained in all cases. One more series of figures is added to illustrate this.

Table 2.

Time of flow at various temperatures.

50° C.		40° C.	30° C.
77·8	77·5	214·1	704·3
77·6	77·7	214·3	705·0
77·7	77·9	214·5	
78·0	7··7	213·9	
77·6		214·5	

Having seen that a close agreement would be obtained between the times of flow for different experiments with the same filling of syrup, experiments were next conducted in which the tube was washed out after each reading and a fresh volume of syrup used for the next reading. It was found that small differences in the volume of syrup in the viscosimeter made appreciable differences in the time of flow, so that it became necessary to determine the weight of 12 c.c. and weigh in this amount each time.

Table 3.

Times of flow for different fillings of the viscosimeter at 40° C.

Syrup No. 1.	No. 2.	No. 3.
204·8	126·6	213·1
203·8	126·5	214·3
204·5	126·5	
203·8	126·7	

Table 4.

Times of flow for different fillings of the viscosimeter at various temperatures.

Syrup No.	40° C.		30° C.	25° C.
4	181·6 182·0 182·0	182·0 181·7 182·1	552·1 550·0	
5	150·0 150·2 150·2	150·2 150·3 149·7	457·4 459·0	856·6 854·0
6	223·0 224·0	222·6 224·0	705·0 703·0	

At 40° C. the mean difference between the times of flow obtained for different fillings is fairly small, being for the different syrups 1 in 500, 1 in 1300, 1 in 200, 1 in 1000, 1 in 750, and 1 in 400. Also at this temperature the time of flow is conveniently short, so that the temperature can very readily be kept constant throughout the experiment. At lower temperatures, the temperature of the bath has a much larger chance of fluctuating owing to the much longer time of flow, and the greater differences obtained at 25° C. and 30 C. are thus accounted for. The most convenient method, then, of determining the viscosity of such syrups as these would be to make the determinations at about 40° C. and calculate by means of a predetermined temperature coefficient the viscosity at any required temperature. If the temperature coefficient for any range of temperature can be shown to be the same for all syrups of the same class, one determination of this coefficient would suffice for all such samples. Tables 5a, 6a, and 7a give values of temperature coefficients of the time of flow for golden syrup, treacle, and molasses, and show that these values remain fairly constant for different samples.

Table 5.

Time of flow in seconds of golden syrup at various temperatures.

	A	B	C	D	E	F	G	H
20° C.	—	2669	3405	3486	2798	2302	2940	3225
30° C.	1080	677	820	833	684	590	730	774
40° C.	319	210	249	253	216	190	225	234
50° C.	113	80	90	92	81	73	85	86

Table 5a.

Temperature coefficient for different golden syrups calculated from the figures in Table 5.

°C.	A	B	C	D	E	F	G	H
20—30	—	3·95	4·15	4·18	4·09	4·22	4·11	4·16
30—40	3·39	3·22	3·27	3·29	3·17	3·10	3·24	3·30
40—50	2·82	2·63	2·77	2·76	2·67	2·70	2·61	2·70

Table 6.

Times of flow in seconds for different samples of treacle at various temperatures.

	A	B	C	D
20° C.	1685	1889	2690	2604
30° C.	426	490	650	615
40° C.	133	150	194	181
50° C.	50	59	71	66

Taple 6a.

Temperature coefficients for different treacles calculated from the figures in Table 6.

	A	B	C	D
20—30° C.	3·95	3·90	4·14	4·21
30—40° C.	3·23	3·27	3·34	3·39
40—50° C.	2·67	2·55	2·73	2·74

Table 7.

Times of flow in seconds for different samples of molasses at various temperatures.

	A	B	C	D
30° C.	542	163	276	410
40° C.	205	74	113	180
50° C.	96	37	53	90

TABLE 7A.

Temperature coefficients for different samples of molasses calculated from figures in Table 7.

	A	B	C	D
30—40° C.	2·35	2·20	2·44	2·27
40—50° C.	2·14	2·00	2·13	2·00

Comparison of the viscosity of the same sample determined in two different tubes.—In order to obtain a relative value for the viscosity of these syrups, the time of flow at any temperature was divided by the time of flow of pure glycerin at the same temperature. This gave a value of the viscosity (uncorrected for differences in density) relative to that of glycerin, which was taken as being the most convenient liquid to use as a standard.

The determination of the time of flow and temperature coefficients for glycerin, using three different tubes, resulted as follows:—

TABLE 8.

Time of flow in seconds for glycerin in different tubes and at different temperatures.

	Tube A.	Tube B.	Tube C.
20° C.	115·3	107·6	—
30° C.	49·55	46·4	34·0
40° C.	23·5	22·1	16·1

TABLE 8A.

Temperatures coefficients as calculated from the figures in Table 8.

	Tube A.	Tube B.	Tube C.
20—30° C. ..	2·33	2·32	—
30—40° C. ..	2·11	2·10	2·11

Tubes B and C, having rather different dimensions, were used in the next experiment with golden syrup: 15 grms. (the weight of 12 c.c.) of the syrup were weighed into each of the tubes and the time of flow in each tube observed at 30° C. and 40° C.

TABLE 9.

Times of flow in seconds of the same golden syrup in different tubes and at different temperatures.

	Tube B.	Tube C.
30° C.	632·5	456·0
40° C.	199·0	145·0
Temp. Coeff.	3·18	3·16

TABLE 9A.

Values of the time of flow of golden syrup relative to that of glycerin, as determined in two different tubes and at different temperatures.

	30° C.	40° C.
Tube B.	13·6	9·0
Tube C.	13·4	9·0

From these results it will be seen that no standard dimensions of the apparatus are necessary, as is the case with some other viscosimeters, it being necessary only to have an easily accessible standard liquid of constant viscosity. Various liquids have been suggested for this purpose, but glycerin was found to be very suitable when dealing with such heavy liquids as those here experimented on. Moreover the purity of the glycerin can very readily be determined by means of the refractometer.

CONCLUSIONS.

(1) An apparatus similar to Ostwald's viscosity tube appears to be very suitable for the determination of the viscosity of very viscous liquids.

(2) Consecutive observations of the time of flow for golden syrup, treacle, or molasses, for the same filling of the tube and for repeated fresh fillings, agree very closely.

(3) The temperature coefficients (for 10° C.) for times of flow, remain fairly constant for any particular class of liquid, thus enabling one to work at the most convenient temperature, and then to calculate the viscosity at any desired temperature by means of predetermined coefficients.

(4) Glycerin appears to be very suitable as a standard with which to compare the viscosities of such liquids as those mentioned.

(5) With the form of apparatus described the need for standard dimensions is done away with, a liquid of constant viscosity as a standard being all that is necessary.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Explosions in liquid air plants. W. Bramkamp. Chem. Ind., 1914, 37, 81—84.

Two out of three explosions in plants for the fractional separation of oxygen from nitrogen, were due to the unauthorised attempt to remove ice from the fractionating column by means of a blast-lamp and a red-hot spanner, respectively: the cork or silk lagging, saturated with oxygen, burnt explosively. The third was ascribed to an accumulation in the receiver of the oxygen fraction—of acetylene, partly as acetylide of copper, which had escaped from a neighbouring works. The author suggests as possible causes of explosions: stoppage of the tubes by solid argon; explosive vaporisation of solid argon warming; or accumulation of lubricant, or its decompo tion products, or even methane from the air, which mig become ignited on contact with ozone produced by electrification by friction of the non-conducting liqu oxygen.—O. E. M.

PATENTS.

Furnaces or kilns; Gas-fired ——. L. F. Tooth, Lond Eng. Pat. 1772, Jan. 22, 1913.

A HEATING chamber is formed above a combustion cham into which the gas jets project. Heated secondary ai supplied to the combustion chamber, which has a slo floor and side wall and is provided with baffles to direct the hot products of combustion into flues constructed in the sides of the furnace, by which they pass to the heating chamber above, entering at the sides. The gases then pass upwards to the vaulted roof of the heating chamber, by which they are deflected downwards to the centre of the hearth and thence rise again and escape through an opening in the centre of the roof.—W. H. C.

Furnace roofs and walls built of brickwork liable to shrink in heat; Construction and treatment of ——. E. C. R. Marks, London. From Veitscher Magnesitwerke-A.-G., Vienna. Eng. Pat. 8959, April 16, 1913.

Iron rods, sheets, etc., are embedded in the mortar between the magnesite bricks. The iron combines with the material of the bricks to form a slag, with increase of volume, thus compensating for the shrinkage. The walls may also be protected by a coating formed of a mixture of mortar and finely-divided iron.—W. H. C.

Grinding, crushing, pulverising and the like; Roller and ring mills for ——. J. Y. Johnson, London. From Gebr. Pfeiffer, Kaiserlautern, Germany. Eng. Pat. 10,883, May 8, 1913.

The ends of the grinding rolls are supported by plate springs fixed at one end to the casing. If several springs are employed the free ends of the springs overlap.—W. H. C.

Spraying viscous materials such as tar, molasses, heavy oils, and the like; Apparatus for ——. C. L. de W. Reader, Winchester. Eng. Pat. 20,036, Sept. 4, 1913.

The supply pipes by which the liquid is conveyed from the store tank to the spraying device are provided with internal steam pipes which pass through stuffing-boxes at the ends of the supply pipes.—W. H. C.

Washing, purifying and cooling gases; Atomising apparatus for ——. H. E. Theisen, Munich, Germany. Eng. Pat. 21,427, Sept. 23, 1913.

In the atomising gas washers described in Eng. Pats. 27,696 of 1911 and 27,417 of 1912 (this J., 1912, 1020; 1913, 820) additional water injectors are provided which give lateral and central supplies of water spray to prevent the treated gas from escaping past the beater-bars. Further, the water-supply channels in the rotary discs are so arranged that the beaters and discs can be lifted out through the top of the casing when necessary.—W. H. C.

Packing for machinery [*working at low temperatures*]. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. G. Claude), Paris. Eng. Pat. 23,564, Oct. 17, 1913. Under Int. Conv., Oct. 17, 1912.

Leather, freed from fatty material by treatment with any of the usual fat solvents and afterwards dried to remove moisture, forms a pliant material for cupped or semi-cupped packing for pump plungers in machines working at low temperatures such as in apparatus for the manufacture of liquid air, and is stated to give satisfactory results without the use of lubricants —N. C. A.

Mixing machine with revolving drum and material elevation. E. Gauhe, Oberlahnstein, Germany. Eng. Pat. 23,919, Oct. 22, 1913.

The machine is portable, the revolving mixing drum, mounted on tubular trunnions, easily and cheaply replaced. ies transversely on the carriage whereby a larger drum can e used than when mounted longitudinally. The drum is itted with a single aperture in the cylindrical portion for illing and discharging and the extra weight of the cover f the aperture is counterbalanced. An automatic djustment is fitted for checking the drum when the pening is directly beneath the discharge-bucket of the aterial-elevator which is mounted on the carriage along-de the drum.—N. C. A.

Filling material for absorption, reaction, mixing and cooling towers. Nitrogen Products and Carbide Co., Ltd., and H. Nielsen, London. Eng. Pat. 26,269, Nov. 15, 1913.

The filling material consists of pieces comprising three or more arms or blades radiating from a central boss. The blades may be either straight or helical and smooth or corrugated, and the central boss may be either with or without a central hole. It is claimed that filling material of this shape combines a large surface area with a minimum displacement and that the pieces may be made cheaply by pressing a plastic material through a die.—N. C. A.

Gaseous mixtures; Apparatus for separating ——. Genevet et Cie. Fr. Pat. 462,202, Nov. 16, 1912.

The claims are for the use of an appropriate jet to impart a constant acceleration to the current of gas; of a settling chamber provided with transverse baffles and of a separator formed of a jet which is shaped partly circular and partly of a form appropriate to the stream of fluid.
—W. H. C.

Filters; Vacuum —— *of the drum type, as used in beneficiating precious metals and for other industrial purposes.* G. Spence, Mexico City. Eng. Pat. 18,333, Aug. 12, 1913. Under Int. Conv., Aug. 31, 1912.

See Fr. Pat. 461,346 of 1913; this J., 1914, 187.—T. F. B.

Air and gases; Means for removing moisture from ——. P. Schou, Copenhagen. U.S. Pat. 1,086,089, Feb. 3, 1914.

See Eng. Pat. 16,510 of 1912; this J., 1913, 275.—T. F. B.

Vessels in which materials are treated with an inflammable liquid in presence of a protective gas; Process and apparatus for safe working in closed ——. Martini und Hüneke Maschinenbau Akt.-Ges. Fr. Pat. 462,332, July 3, 1913. Under Int. Conv., July 3, 1912.

See Eng. Pat. 15,263 of 1913; this J., 1914, 13.—T. F. B.

Chemical reactions; Apparatus for carrying out ——. F. E. Matthews, E. H. Strange, and C. A. Pim. Fr. Pat. 462,715, Sept. 17, 1913. Under Int. Conv., Oct. 5, 1912.

See Eng. Pat. 22,737 of 1912; this J., 1913, 1055.—T. F. B.

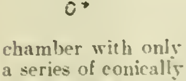
Disintegrating, separating, and mixing artificial fertilisers, ores, clay, chemical products, etc.; Apparatus for ——. G. M. Tyler. Fr. Pat. 462,736, Sept. 18, 1913. Under Int. Conv., March 8, 1913.

See Eng. Pat. 5760 of 1913; this J., 1913, 934.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; New process for the washing of ——. L. D. Ford. Trans. N. Engl. Inst. Min. and Mech. Eng., 1914, **64**, 91—106. (See also this J., 1911, 662.)

The construction of the *Rhéolaveur* which is the central device of the new method is illustrated diagrammatically in the figure. The coal is carried by a current of water, *c*, down the inclined plane, and another current entering at *a* prevents all but the heavier particles from falling through the opening. These heavier particles are carried away at the orifice, *o*. To save water, a number of such elements are combined, and arranged to discharge into a common chamber with only one discharge opening. By means of a series of conically bored discs this orifice can be made of such a size that it just allows the particles to pass without blocking the chamber. The author describes the working conditions and the union of several of the combined "Rhéolaveurs" into a continuous working plant. It is



found that the method is quite as efficient as the use of jigs, more compact and adaptable, also the working costs are reduced. The paper also contains a description of the *Controlavoir*, an apparatus for fractionating the coal on a small scale and obtaining information as to its behaviour on washing. The sample is placed in a U-tube and a water current turned on which will just keep in suspension the finest grains. The strength of the current is noted and the suspended matter is carried over into a specimen glass where it is collected and analysed. This process is continued till all the material has been carried over.—W. H. P.

Methane; Enrichment of gases with ——, and the production of coal-gas free from carbon monoxide. P. Jochum. J. Gasbeleucht., 1914, **57**, 73—80, 103—111, 124—131.

EXPERIMENTS were made with mixtures of carbon monoxide and hydrogen, ethylene and hydrogen, and with a mixture of carbon monoxide, hydrogen, methane and nitrogen of a composition similar to that of coal-gas, in order to ascertain the best conditions for carrying out the reactions (1) $CO+3H_2=CH_4+H_2O$; (2) $C_2H_4+H_2=C_2H_6$, in the presence of finely-divided nickel. The best temperature for the reduction of carbon monoxide was 270°—280° C. and for the catalyser to retain its activity as long as possible, the best proportion of gases in the mixture was 1 vol. of carbon monoxide to 5 vols. of hydrogen. When a mixture of equal volumes of ethylene and hydrogen was passed over the catalyser at 300° C., the ethane produced at first was almost all decomposed, forming methane, hydrogen and carbon. The maximum yield of methane from the coal-gas mixture was obtained at 260°—270° C. The gas used contained CO, 9·3; H_2, 50·0; CH_4 37·8 and N_2 2·9, and the resulting gas contained CO_2, 0·6; H_2, 4·1; CH_4, 89·1; and N_2, 6·2 per cent. Experiments were also made with purified lighting gas. It was not possible to purify the gas sufficiently to prevent deterioration of the catalyser: complete removal of sulphur was insufficient and the complete removal of aromatic hydrocarbons appeared to be necessary.—A. T. L.

Coal-gas; Analysis of ——, with the Bunte burette. E. Czakó. J. Gasbeleucht., 1914, **57**, 169—172.

IN accordance with some recent results obtained by C. Ab-der-Halden (J. des Usines à Gas, 1913, **19**, 296) it is shown that methane is appreciably soluble in aqueous reagents, including the cuprous chloride absorbent used in gas analysis. The consequent error is negligible, however, if the determinations are carried out in the manner outlined below. The perfectly colourless solution of cuprous chloride in hydrochloric acid is prepared according to the original method of Winkler. Three successive portions of 5 c.c. are introduced into the Bunte burette and in each case left in contact with the gas for 2 minutes, the burette being meanwhile tilted backwards and forwards very gently. Each portion of the reagent is withdrawn before the introduction of the next. The burette is then washed out by successive admission from the upper end of two portions of from 2 to 3 c.c. of concentrated hydrochloric acid, followed by the same amounts of distilled water; and before the final adjustment about 2 c.c. of potash solution are introduced at the lower end, after which the pressure is also equalised from below in the usual way. Especial importance is attached to the observance of the following points, viz., use of the smallest possible quantity of reagent; avoidance of violent shaking; careful and economical washing; and adjustment of pressure from below. Similar conditions hold for the estimation of other gases by absorption. The greater solubility of the homologues of methane in aqueous reagents is not important in the case of coal-gas, owing to their low partial pressures. The author considers that the absorption method cannot be bettered for the determination of carbon monoxide when the only other constituents to be determined are carbon dioxide and oxygen, as *e.g.*, in producer gas and furnace gases; but in cases involving the additional determination of hydrogen, methane and nitrogen, as *e.g.*, in coal-gas, a slow combustion method is recommended as preferable.—J. R.

Mahone petroleum. Its recent origin and the origin of petroleum in general. C. F. Mabery. J. Ind. Eng. Chem., 1914, **6**, 101—107.

MAHONE (Ohio) petroleum is obtained from a depth of 115—150 ft. and associated with the oil deposit are extensive beds of bituminous coal. The crude oil is nearly black, very viscous, optically inactive, sp. gr. 0·9036—0·9057 at 20° C., refractive index 1·4878—1·4822 at 26° C.; it is free from nitrogen and contains less than 0·01 per cent. S. It begins to distil at 230° C. and to decompose at 250° C., yielding less viscous oils. It was fractionated by distillation at 30 mm. pressure: at about 350° C. or somewhat lower decomposition occurred. Examination of the distillates showed that paraffins, C_nH_{2n} hydrocarbons, and asphaltic constituents were absent, the products consisting entirely of C_nH_{2n-2} and C_nH_{2n-4} hydrocarbons, the latter greatly predominating. The following hydrocarbons were isolated in a practically pure condition:

	B.pt.	Sp. gr. at 20° C.		B.pt.	Sp. gr. at 20° C.
	° C.			° C.	
$C_{11}H_{20}$	97—98	0·8549	$C_{15}H_{28}$	138—139	0·8662
$C_{12}H_{22}$	109—110	0·8576	$C_{16}H_{26}$	151—152	0·8692
$C_{13}H_{24}$	120—121	0·8614	$C_{17}H_{30}$	171—172	0·8716
$C_{14}H_{28}$	130—131	0·8654	$C_{19}H_{34}$	212—214	0·8790

Mahone petroleum is especially adapted for the preparation of high-grade lubricants, the C_nH_{2n-4} hydrocarbons and the lighter C_nH_{2-2} hydrocarbons, with viscosities of 100—125, being superior to any other petroleum products for lubricating purposes. The problem of the origin of petroleum is briefly discussed.—A. S.

Lubricating oils for motors; Testing ——. G. Lumet. Comptes rend., 1914, **158**, 172—175.

THE author describes apparatus designed for the Testing Laboratory of the Technical Commission of the Automobile Club of France, for the determination of the coefficient of friction under practical conditions. A rotatable metal cylinder is mounted horizontally. Against its interior surface four pieces of metal ("rubbers") are pressed by means of pistons mounted radially on a shaft which passes axially through the cylinder. The pistons are acted on by a cushion of oil (that to be tested) which, communicating with a pump by a channel along the shaft, can be maintained at any desired pressure. A small quantity of oil escapes from behind the pistons and this drops on the interior surface of the cylinder in the path of the "rubbers" and effects lubrication. The contact between the rotating cylinder and the "rubbers" tends to rotate the central shaft, and this tendency, which measures the friction, is exactly compensated by means of a weight movable on an arm attached to the shaft. The cylinder can be heated by Bunsen burners if necessary. The apparatus is adapted for linear velocities of 0—20 metres (0—65 feet) per sec., pressures of 0—5 kilos. per sq. cm. (0—70 lb. per sq. in.) and temperatures of 0°—300° C. The coefficient of friction, ϕ, is equal to KV^{β}/p^{a}, in which K is a viscosity constant, V is the linear velocity, p the pressure per unit area, and a and β are constants of which both are positive and neither is greater than unity. A large number of tests gave the average value 0·75 for a. With rise in temperature the value of β diminishes, and the coefficient of friction also diminishe in accordance with the expression $\phi=a/t^2+b/t+c$, in which a, b, and c are characteristic of the lubricant and the metal surfaces and dependent on the pressure and th velocity.—J. H. L

Paraffin waxes; Refractometric examination of —— D. Holde and H. Franck. Petroleum, 1914, **9**, 669—674

ONE grm. of the sample is dissolved in 50 c c. of chloroform the solution treated with 60 c.c. of 96 per cent. (by vol alcohol at 20° C., the precipitate separated (by suction the filtrate evaporated, the residue dissolved in 5 c.c. chloroform, and the solution treated with 15 c.c. of 96 p cent. alcohol. The second precipitate is separated as before, and the final filtrate evaporated to obtain the unprecipitated residue. The refractometer reading (Zeiss), *R*, at 90° C. of each of these fractions is determined. The following results are typical of those obtained :—

	1st precipitate.		2nd precipitate.		Un rec pitated residue.	
	R	Amount.	*R*	Amount.	*R*	Amount.
		per cent.		per cent.		per cent.
Ceresin 1, yellow soft	15·4	79·2	8·0	6·7	28·3	10·8
do. wth 10 per cent. paraffin wax m. pt. 50°—51° C.	14·5	75·3	4·6	7·5	23·0 (freed from oil + 0·6)	12·4
do. with 15 per cent. paraffin wax m. pt. 50°—51° C.	14·6	75·9	2·8	7·5	17·2 (freed from oil + 1·0)	13·0
Ceresin 2, white	13·8	81·3	5·7	8·6	12·3	8·2
do. with 10 per cent. paraffin wax	11·9	74·6	2·5	7·5	7·1 (freed from oil − 1·0)	11·0

On expressing the oil from the unprecipitated residue from ceresins the solid portion invariably gave a low refractometer reading (0·6—2·5). Paraffin waxes of various origin contained about 0·1 to 0·2 per cent. of oil showing refractometer readings of 22 to 48 at 90° C. Four samples of pure ceresin (m. pt 68° to 71° C.) gave refractometer readings of 11·5 to 13 at 90° C., whilst the readings given by 4 samples of hard paraffin wax, of different origin ranged from —2·6 to +1·5, and that of a sample of soft paraffin wax (m. pt. 41·5° to 42° C.) was —7·2. On fractional precipitation, as described, the hard paraffin waxes yielded first fractions of higher m. pt. than the original wax, but with refractometer readings not exceeding the limits of —1·2 and +1·7 at 90° C. The following fractions melted below 50° to 44° C., and had correspondingly low refractometer readings (—1 2 to —5), whilst the second fraction from the soft paraffin wax (m. pt. 36·5° to 38° C.) gave a reading of —8·5. The test is thus more sensitive for soft than for hard paraffin waxes. Certain commercial paraffin waxes (m. pt. up to 70° C.), prepared by distillation *in vacuo* and fractional "sweating," showed refractometer readings approximating the lower limit for ceresin (+10), and there was also less difference than with ordinary hard paraffin waxes in the readings given by the fractions. But such waxes are of higher price than normal paraffin waxes and are seldom on the market. In deciding whether a sample of ceresin contains added paraffin wax it must not be overlooked that ceresin-like products occur in petroleum. For example, by extracting a cylinder oil with alcohol-ether a wax was separated, which resembled ceresin in appearance, and had m. pt. 70° C. and a refractometer reading of 17·3 at 90° C.—C. A. M.

Electrically controlled and timed asphaltum penetrometer. Mahr. *See* IX.

Utilised of used oil for lubrication. Pellet. *See* XII.

Action of aluminium chloride on oil of turpentine. Steinkopf and Freund. *See* XIII.

PATENTS.

Briquetting ; Apparatus and process for preparing pulverulent materials for moulding or ——. E. B. A. Zwoyer, Hoboken and R. A. Zwoyer, Perth Amboy, N.J., Assignors to The Zwoyer Fuel Co., New York. U.S. Pats. 1,084,919 and 1,084,920, Jan. 20, 1914.

HE material is passed first through a horizontal chamber here it is dried by a current of hot air or gas, then rough a second horizontal chamber at a lower level, here it is intimately mixed with a binding agent, and ally through a third similar chamber at a still lower vel where it is showered or tossed about in a current of to cool the mixture to the point at which the binder comes plastic.—W. H. C.

Fuel ; Process for converting coal dust into a commercial ——. J. Evans. Fr. Pat. 461,400, Aug. 14, 1913. Under Int. Conv., Aug. 19, 1912.

COAL dust, etc., is mixed with from 2 to 5 per cent. of starch, flour, or similar paste, and the mixture compressed into blocks which are dried at 100° C., and dipped in tar or tar containing a small proportion of pitch or resin. The blocks are then heated sufficiently to volatilise part of the tar, and are finally cooled in a current of air, so that the surface of each block receives a hard protective coating.—H. H.

Combustibles ; Process for obtaining agglomerates of finely divided materials for ——. Soc. Houillère du Nord d'Alais. Fr. Pat. 461,855, Nov. 7, 1912.

FINELY divided coal, anthracite, lignite, peat, sawdust, oil-cake, etc., is mixed with a small proportion, *e.g.*, 2·5 per cent., of colloidal material such as starch, or wheat, rice, or cassava flour, the mixture being worked into a paste and then dried for 3 or 4 hours at a temperature of 100° to 200° C.—H. H.

Quenching coke ; Apparatus for ——. Berlin-Anhaltische Maschinenbau-Akt.-Ges., Berlin. Eng. Pat. 23,555, Oct. 17, 1913. Under Int. Conv., Oct. 6, 1913. Addition to Eng. Pat. 9269 of 1912, dated Nov. 25, 1911.

THE incandescent coke is introduced into a dipping tank having a water-tight horizontal bottom with a perforated bottom arranged a small distance above. The tank slowly becomes immersed in quenching liquid as the charge of coke increases, and during the early portion of the descent cooling is effected by contact between the quenching liquid and the outside walls of the tank only. As soon as the tank reaches a certain depth, however, sliding valves arranged at the bottom of the side walls are opened by contact with stops situated in the quenching tank, and liquid enters the double bottom of the tank so as to quench the coke by direct contact. The valves remain open when the tank is raised after quenching is complete, and thus allow water to drain away.—H. H.

Carbonising ; Method of —— and superheating gas. A. Berglof, Chicago, Ill. U.S. Pat. 1,085,096, Jan. 20, 1914.

A MASS of coke in a vertical chamber is heated by independent electric currents so as to maintain two zones at different temperatures. Preheated gas is passed first through the zone at the lower temperature and then through the zone at the higher temperature and finally through a mass of coal above the coke and with which the chamber is fed. The gas leaving the chamber passes through a heat interchanger and serves to preheat the incoming gas.—W. H. C.

Gas producer with temperature regulator and recovery of distillation products such as acetic acid, methyl alcohol, etc. G. Felizat. Fr. Pat. 461,314, Aug. 11, 1913. Under Int. Conv., Aug. 29, 1912.

THE hopper supplying waste vegetable materials to a gas producer is made in the form of a tube dipping into the upper portion of the producer. From the centre portion of this tube a mixture of distillation products and part of the producer gas is withdrawn through a side tube leading to a condenser coil and gasometer. The temperature of the distillation zone in the fuel-supply tube is regulated by varying the pressure in the gasometer, whereby a greater or smaller volume of hot producer gas is drawn through the tube.—H. H.

Inflammable gases in the air; Process for detecting and determining ——. Akkumulatorenfabrik A.-G. Ger. Pat. 269,131, April 24, 1913.

The testing apparatus contains two wires both of which can be heated electrically, but only one of which acts catalytically. The non-catalytic wire is first heated, the air to be tested is allowed to enter, then the apparatus is closed, and the catalytic wire is heated.—A. S.

Gas manufacture; Process and apparatus for obtaining a useful by-product [ammonium nitrate or nitrite] from —— and for the recovery of ammonia from gas manufacture. A. H. Lymn, London. Eng. Pat. 1851, Jan. 22, 1913.

The ammonia contained in coal-gas, producer gas, or the like, is brought into contact with nitrogen oxides or oxy-acids, obtained by the combustion (under pressure in a suitable furnace) of gas, which has already been freed from ammonia, with nitrogen and oxygen.—O. R.

Gas for lighting or heating; Separation and utilisation of carbon dioxide contained in ——. Athion Ges. m. b. H. Fr. Pat. 461,107, Aug. 4, 1913. Under Int. Conv., Aug. 7, 1912.

Carbon dioxide is completely extracted from coal gas by means of a solution of an alkali carbonate, and is recovered in the well-known manner by heating the solution. After the separation of carbon dioxide, the gas can be treated successfully for the removal of carbon bisulphide (see Eng. Pat. 3043 of 1912; this J., 1912, 526; also this J., 1913, 743, 818).—H. H.

Peat; Extracting liquid hydrocarbons and halogen derivatives thereof from ——. G. Tischenko and H. Plauson, St. Petersburg. Eng. Pat. 27,428, Nov. 28, 1912.

Moist peat is mixed with salts, oxides, or hydroxides of alkali or alkaline earth metals, or of aluminium, zinc, copper, lead, tin, iron, etc., or with the metals in the form of powder, the mixture is heated in retorts in an arc furnace at a temperature at which metallic carbides are formed, and the gases and vapours produced are washed with water, cooled, freed from water and led through heated tubes packed with a catalytic agent, whereby liquid hydrocarbons are obtained. If halogen salts are used, halogen derivatives of the hydrocarbons are obtained. Examples: (1) 100 kilos. of peat containing 35—50 per cent. H_2O, and 50 kilos. of sodium carbonate yield benzene 25, naphthalene 25, anthracene 1·5, benzenoid residues 5, paraffins 30, paraffin oil compounds 12, and gases and residues 10 kilos. (2) 100 kilos. of dry brown peat and 100 kilos. of unslaked lime yield benzene 36, paraffin hydrocarbons 30, and various volatile paraffin hydrocarbons 18 kilos.—A. T. L.

Hydrocarbons; Producing —— from carbides. G. Tischenko and H. Plauson, St. Petersburg. Eng. Pat. 27,429, Nov. 28, 1912.

Carbides which react with water in the cold yielding acetylene, methane, ethylene, hydrogen, etc. are heated above 500° C. and submitted to the action of steam, or of water, at various pressures. For example, superheated steam is passed through calcium carbide at 600°—700° C. "under a vacuum of 30—50 mm." forming a mixture containing 60 per cent. of benzene, together with other aromatic hydrocarbons, acetylene and ethylene. A mixture of 4 parts of calcium carbide and 3 parts of aluminium carbide, heated to 600° C. and treated with steam "under a vacuum of 8—10 mm." yields "pentine" according to the equation $2C_2H_2+CH_4=C_5H_8$; at atmospheric or higher pressure, terpenes are formed. Calcium and aluminium carbides mixed so as to yield equal volumes of acetylene and methane, and treated as in the first example, yield propylene and its polymers. Cerium carbide, CeC_2, under the same conditions yields pentane:—$C_2H_2+C_2H_4+CH_4+H_2=C_5H_{12}$.—A. T. L.

Combustible oils, tar, and pitch; Process for treating ——. W. M. Steadman, Bracebridge, Lincoln. Eng. Pat. 711, Jan. 9, 1913.

Crude oil, tar, etc., of sp. gr. not below 0·86, is introduced into a closed and preferably heated chamber where it is thoroughly agitated with water, naphtha, and air, or air and steam, so as to produce an emulsion which can be utilised as a fuel either for internal combustion engines or for general heating purposes. The preferred proportions of naphtha and water are 2 and 10 per cent. respectively.—H. H.

Oil-gas or vapour for heating or firing purposes; Method of and means for producing ——. W. M. and M. M. Burdon, Bellshill, Lanarkshire. Eng. Pat. 1766, Jan. 22, 1913.

Improvements in the process and apparatus described in Eng. Pats. 27,348 and 29,522 of 1910 and 14,657 of 1911, whereby a gyratory motion is imparted to the primary air before mixing it with the oil. After mixing the oil and air are passed through a heating chamber, then mixed with a suitable quantity of preheated secondary air and burned.—W. H. C.

Mineral oil; Manufacturing a new product from ——. The New Oil Refining Process, Ltd. and J. L. Rossini, London. Eng. Pat. 2672, Feb. 1, 1913.

The oil obtained by the processes described in Eng. Pats. 13,675 of 1908 and 28,460 of 1911 (this J., 1909, 133) is distilled and the fraction passing over below 390°F. (199° C.) is washed with sulphuric, phosphoric, or other oxyacid, then with ammonia, soda or other alkali, and distilled up to 390° F. (199° C.). The residue remaining in the still consists of polymerised substances and has drying properties which make it suitable for use as a varnish or lacquer, or as a binding material for paint.
—A. T. L.

Fuel for internal combustion engines and process of making same. W. R. Gulick, Jersey City, N.J., U.S.A. Eng. Pat. 18,681, Aug. 16, 1913.

A fine spray of crude petroleum or its non-volatile liquid by-products is injected into a closed chamber containing gasoline, which is agitated vigorously during the mixing operation and for about 2 hours afterwards. The mixtur is allowed to stand for several hours, and is then ready fo use. The proportion of gasoline to crude oil may be a low as 25 per cent., and may vary widely above tha limit. The product may be mixed with fresh gasolir in the fuel tanks of internal combustion engines, and stated to prevent the formation of hard carbon in tl cylinders.—H. H.

Paraffin compositions; Process for expressing fluid fro ——. J. Hansen, Texas City, Tex. U.S. Pat. 1,084,7 Jan. 20, 1914.

The paraffin composition is forced in succession throu two filters. Whilst passing through the first filter t material is cooled and whilst passing through the seco at a reduced speed, it is heated and subjected to increa pressure.—W. H. C.

Coke ovens; Process for the continuous working of vert —— and furnace for use therein. J. Lütz. Fr. P 461,843, Aug. 5, 1913. Under Int. Conv., Aug. 5, 19

See Ger. Pat. 263,767 of 1912; this J., 1913, 1058.—T. F

Wood-gas; Apparatus for manufacturing ——. R. L Poole, Mount Gambier, South Australia. U.S. 1,085,389, Jan. 27, 1914.

See Eng. Pat. 13,929 of 1913; this J., 1914, 190.—T. F

Gas; Apparatus for washing ——, especially for recovering ammonia from producer gas or other gases. A. H. Lymn. Fr. Pat. 463,067, May 14, 1913. Under Int. Conv., May 14, 1912, and Jan. 9, 1913.

SEE Eng. Pats. 11,452 of 1912 and 744 of 1913; this J., 1912, 1167; 1913, 1147.—T. F. B.

Petroleum; Process for the solidification of ——. C. Gérard, Brussels. U.S. Pat. 1,085,119, Jan. 27, 1914.

SEE Eng. Pat. 12,158 of 1911; this J., 1912, 632.—T. F. B.

Manufacture of hydrocyanic acid [from residues of coal-gas purification]. Eng. Pat. 18,168. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Tungsten lamp; Uses of the concentrated filament —— in the laboratory. F. A. McDermott. J. Amer. Chem. Soc., 1914, 36, 454—455.

THE author recommends for laboratory purposes the Mazda stereopticon lamp (concentrated filament) rated at 100 watts on a 110-volt circuit, and giving about 60 candle-power. The round bulb is about 7·5 cm. diam., and the filament is formed into a close coil looped over supports about 1 cm. apart, the loops forming an open cylinder about 1 cm. in diam.; as viewed from one side the entire light-giving element is concentrated in a space about 1 cm. square. The lamp has proved specially useful for microscopic work and for the polarimetric examination of solutions too highly coloured or turbid to give satisfactory results with light from ordinary sources.—A.S.

Nitrogen; Disappearance of —— in a tungsten lamp. Chemical reactions at very low pressures. II. I. Langmuir. J. Amer. Chem. Soc., 1913, 35, 931—943. Z. anorg. Chem., 1914, 85, 261—278. (See also this J., 1913, 1099.)

NITROGEN is consumed in a tungsten lamp in three ways: chemical, electrochemical and electrical. The chemical effect is caused by the direct union of tungsten vapour with nitrogen to form the nitride WN_2. At pressures up to 0·001 mm. the velocity of this change is proportional to the product of the rate of volatilisation of the tungsten and the pressure of the nitrogen. From about 0·003 to 1 mm. the velocity is dependent on the rate of volatilisation of the metal and independent of the pressure. At pressures over 2 mm. the velocity is still dependent on the rate of volatilisation but the latter is greatly diminished by the presence of nitrogen at this pressure. Nitrogen does not react under any conditions with solid tungsten. The velocity of evaporation of tungsten *in vacuo* at a emperature T on the thermodynamic scale is given by

$$\log_{10}M = 15{\cdot}402 - \frac{47444}{T} - 1{\cdot}4 \log_{10}T$$

where M is expressed in grms. of tungsten per second per q. cm. of surface; and the vapour pressure in mm. of nercury is given by

$$\log_{10}p = 15{\cdot}502 - \frac{47444}{T} - 0{\cdot}9 \log_{10}T$$

he latent heat being 218000—1·8T cals. per grm.-atom. he vapour pressure at the m. pt. (3270° C.) is about ·08 m.m., and the b. pt. is near 5000° C. The nitride WN_2 a clear brown substance when seen in thin layers, easily istinguishable from finely divided tungsten. It is deomposed by water, yielding ammonia and probably the ioxide WO_3. The electrochemical removal of nitrogen kes place at much lower temperatures (1600° C.) if otentials of over 40 volts are used, so that a perceptible scharge takes place through the gas. In this case so the nitride is formed. The purely electrical process curs at pressures below 0·005 mm. with 250 volts and ry high filament temperatures. It is very irregular and part at least of the nitrogen is easily recoverable by heating the bulb. The behaviour of nitrogen towards solid tungsten and tungsten vapour is very similar to that of oxygen towards platinum.—W. H. P.

PATENTS.

Distillation of carbonaceous material. H. G. Hills, Manchester, and R. W. Thom, Southport. Eng. Pat. 3284, Feb. 8, 1913.

THE material is placed in thin layers on trays in an externally heated oven from which the air is exhausted, and the distillation is carried out in stages at successively higher temperatures, the distillates being received in separate tar tanks. The process is intermittent, the trays being removed for recharging. The successive stages of the distillation may be effected in successive ovens of a series.—A. T. L.

Distillation gases; Process and apparatus for removing tar from warm ——, utilising tar, tar oils, or similar products as washing agents. Berlin-Anhaltische Maschinenbau-Act.-Ges. Abteilung Köln-Bayenthal. Fr. Pat. 461,956, Aug. 28, 1913. Under Int. Conv., Sept. 28, 1912.

THE gas is introduced beneath a flat plate perforated with holes of say 1 cm. diam. and immersed in a layer of tar, tar oil, or similar washing agent, so that large bubbles of the gas rise in a steady stream through the tar, the surface of which remains comparatively calm. Owing to surface tension, the bubbles become flattened as they reach the surface, and the tar, etc., contained in the gas is effectively removed as the bubbles escape from the surface.—H. H.

Heating material containing liquid; Processes and apparatus for ——. T. O. Franke, London. Eng. Pat. 12,232, May 26, 1913. Under Int. Conv, Jan. 27, 1913. Addition to Eng. Pat. 12,231 of 1913 (see U.S. Pat. 1,083,879 of 1914; following).

THE material (peat, ooze, wood pulp, etc.) is agitated by stirrers, knives or mixers during the heating by steam and the direction of the steam is reversed from time to time.
—W. H. C.

Heating material containing liquid; Apparatus for ——. J. Franke, London. U.S. Pat. 1,083,879, Jan. 6, 1914.

THE material is contained in a vessel which is revolved upon horizontal hollow trunnions through which the heating agent enters and leaves. By means of suitable automatic valves the direction of the flow of the heating agent through the vessel is reversed at every revolution of the vessel.—W. H. C.

Heating material containing liquid; Process and apparatus for ——. T. O. Franke, London. Eng. Pat. 12,231, May 26, 1913. Under Int. Conv., Aug. 26, 1912.

SEE U.S. Pat. 1,083,879 of 1914; preceding.—T. F. B.

Heating substances containing liquid; Process and apparatus for ——. T. O. Franke. Fr. Pat. 461,776, Aug. 25, 1913. Under Int. Conv., Aug. 26, 1912, and Jan. 27, 1913.

SEE Eng. Pat. 12,232 of 1913 and U.S. Pat. 1,083,879 of 1914; preceding.—T. F. B.

Heating air or gases; Heat-regenerator for ——. O. Gobbe, Jumet, Belgium. U.S. Pat. 1,086,322, Feb. 3, 1914.

SEE Eng. Pat. 5034 of 1913; this J., 1913, 903.—T. F. B.

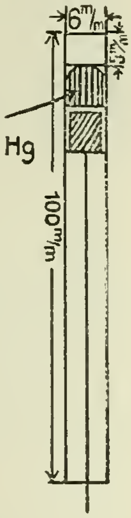
III.—TAR AND TAR PRODUCTS.

Peat tar; The phenols of ——. E. Börnstein and F. Bernstein. Z. angew. Chem., 1914, 27, 71—72.

A SAMPLE of tar obtained in the manufacture of coke from peat contained 18 per cent. of phenolic substances. Some of these were apparently methylated, so after a preliminary fractionation the methyl groups were first removed and the product further fractionated. In this way the presence in the tar of phenol, *o*-, *m*-, and *p*-cresol, 1.2.3- and 1.2.4-xylenol, catechol, homocatechol, and pyrogallol was demonstrated.—W. H. P.

Pitch ; Determination of the temperature of softening of ——. V. Abeles. Chem.-Zeit., 1914, **38**, 249.

A modification of Klinger's method (this J., 1914, 130) whereby the thickness of the layer of pitch is yet more rigorously defined. The mercury (5 grms.), supported in the tube by a movable cork or wad (see fig.), is adjusted so that the meniscus coincides with a mark on the tube 5 mm. from the end. The space above the mercury is then filled with molten pitch at 150° C., and after cooling in ice the wad is removed and the determination continued as described by Klinger. Böhm's method, in which weighed pieces of brass are used in place of the mercury, yields higher values and consequently greater differences in the case of high-melting asphaltums.
—J. R.



Patents.

Coal tar and the like hydrocarbon distillation. J. Rosen, London. Eng. Pat. 28,972, Dec. 16, 1912.

A volatile solvent which has a boiling point at least 80° C. below that of the product to be distilled, is introduced progressively into the heated tar or other mineral oil. The solvent is introduced at a considerably lower temperature than that to which the tar is heated, and its effect is to carry over the heavy constituents of the tar. The products are condensed separately, and the condensed solvent is led back to the still for a subsequent operation. The light oils of coal tar may be used as solvents in coal tar distillation, whilst for distilling a petroleum tar of b. pt. 330° C., light petroleum oils of b. pt. 170° C. are suitable. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 1980 of 1880 and 1411 of 1898.)
—T. F. B.

Coal tar, petroleum residues, creosote, schist oils and the like ; Conversion of —— *into pitch.* J. Rosen, London. Eng. Pat. 28,973, Dec. 16, 1912.

In carrying out the process described in Fr. Pat. 443,207 of 1911 (see this J., 1912, 978) it may be desirable to convert only part of the constituents of the coal tar, petroleum residues, etc., into pitch, and to recover the other constituents. In such a case, a current of air under pressure is introduced into the heated tar, etc., in a series of column-like or other stills, the constituents to be saved being removed and condensed separately, whilst the other vapours evolved are passed into the succeeding columns to be converted into pitch. The process is preferably carried out in columns from 6 to 10 metres high and 2 to 3 metres in diameter.—T. F. B.

Alpha-arylides of beta-naphthisatin ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 30,072, Dec. 31, 1913. Under Int. Conv., May 2, 1913.

β-Hydrocyanocarbodinaphthylimine or the mixed hydrocyanocarbo-β-naphthylarylimines can be converted into α-arylides of β-naphthisatin by treatment with aluminium chloride in absence of water. Intermediate products containing aluminium are formed during the reaction, but they can be easily converted into the free arylides, *e.g.*, by treatment with cold concentrated hydrochloric acid.—T. F. B.

Cresol ; Process for separating m- and p- ——. Schülke und Mayr. Ger. Pat. 268,780, Dec. 24, 1911.

A mixture of *m*- and *p*-cresol is allowed to stand for a long time at the ordinary temperature with about its own weight of 80—90 per cent. sulphuric acid, whereupon the greater part of the *m*-cresol is sulphonated, whilst the *p*-compound is unchanged. The *p*-cresol is separated from the mixture either by pouring into water or by extraction with ether or other organic solvent. The sulphonic group is removed from the *m*-cresolsulphonic acid by known methods.—T. F. B

α-Nitro compounds of acylated diaminoanthraquinones ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,984, Oct. 17, 1912.

When an acyl derivative of 1.4-diaminoanthraquinone is treated with a nitrating agent in concentrated sulphuric acid solution, the nitro group enters an α-position in the nucleus not containing the amino groups. By eliminating the acyl group, a new compound, 5-nitro-1.4-diaminoanthraquinone, is obtained.—T. F. B.

Hydrochlorides of primary aromatic amines and their derivatives ; Process for isolating the —— *from the reduction products of the corresponding nitro-, amino-nitro-, nitroso-, azoxy-, azo-, oxyazo-, and aminoazo-compounds.* H. Pomeranz. Ger. Pat. 269,542, Jan. 9, 1912.

The compounds mentioned in the title are reduced by means of hydrochloric acid and iron, the quantity of the latter being such that only ferrous chloride and no ferric chloride is formed, whilst the excess of hydrochloric acid is so regulated that the whole of the ferrous chloride formed remains in solution : by this means, the hydrochloride of the amino-compound is obtained in a pure condition.—T. F. B.

Phenols and their substitution products ; Process for preparing di- and polyhydric ——. C. F. Boehringer und Söhne. Ger. Pat. 269,544, Dec. 15, 1911.

Mono- or polyhalogenated phenols or their substitution products are heated under pressure with aqueous solutions of alkali hydroxides or carbonates, or mixtures of the two, in presence of copper or a copper salt. The yields are said to be very high ; for instance, the yield of catechol from *o*-chlorophenol was 83 per cent. —T. F. B.

Distilling hydrocarbons ; Process for ——. Soc. Anon. des Combustibles Industriels. Fr. Pat. 462,952, Dec. 4 1912.

See Eng. Pat. 28,972 of 1912 ; preceding.—T. F. B.

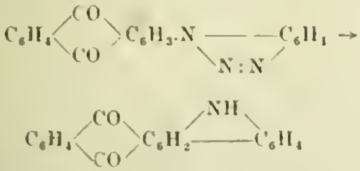
IV.—COLOURING MATTERS AND DYES.

Purpurogallin ; Preparation of ——. C. Graebe. Ber 1914, **47**, 337—338.

By oxidising pyrogallol with sodium nitrite and formi acid in the absence of air, 30—31 per cent. of the theoretic yield of purpurogallin is obtained, whereas by the usu method, using acetic acid in the presence of air, tl highest yield obtainable is 20 per cent. The product obtained quite pure without recrystallisation.—J. B.

Carbazole derivatives of the anthraquinone series. Ullmann and E. Illgen. Ber., 1914, **47**, 380—383.

The carbazoles of the α-aminoanthraquinone series for leuco-compounds which dye cotton, though faintly, shades fast to alkalis, in which respect they differ from t condensation product prepared from carbazole and phthalic anhydride (this J., 1911, 738) which, like the acridone derived from β-aminoanthraquinone, is not resistant to alkalis. The new compounds are prepared from azimino derivatives of α-aminoanthraquinone by heating, preferably in diphenylamine solution, *e.g.* :—



$$C_6H_4\langle{}^{CO}_{CO}\rangle C_6H_3.N\langle{}^{\quad\longrightarrow\quad}_{N:N}\rangle C_6H_4 \rightarrow$$

$$C_6H_4\langle{}^{CO}_{CO}\rangle C_6H_2\langle{}^{NH}_{\longrightarrow}\rangle C_6H_4$$

The azimides are obtained either by treating 1-anilino-2-aminoanthraquinones with nitrous acid, or by a new method according to which a 1-chloroanthraquinone is condensed with aziminobenzene.—J.B.

Diazotisation of various amines; Velocity of ——. E. Tassilly. Comptes rend., 1914, **158**, 489—491.

THE velocity of diazotisation of aniline, *o*- and *p*-toluidines, *m*-xylidine, *p*-anisidine and tolidine may be represented by the equation $\frac{dx}{dt}=K\ (100\text{-}x)^2$. The three nitranilines react very rapidly, but it is probable that they also follow the same course.—W. H. P.

Definition and testing of the fastness of dyestuffs. See VI.

PATENTS.

Triazoles of the aromatic series; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 29,224, Dec. 18, 1913.

o-AMINOAZO dyestuffs of the benzene, naphthalene, or anthracene series can be converted easily, and with good yields, into the corresponding triazoles (*pseudo*-azimines) by heating with metals acting as catalysts, in presence of organic solvents of high boiling-point. *Example.* Benzene-azo-β-naphthylamine (100 parts) and finely divided copper (1 part) are heated for five hours to boiling in nitrobenzene (1000 parts); the 2.1-naphtho-N-phenyl-triazole is isolated by filtering the solution and expelling the solvent by means of steam.—T. F. B.

[Indigoid] colouring matters; Treatment of insoluble ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 29,583, Dec. 23, 1912, and 10,583, May 5, 1913.

SEE Ger. Pat. 265,536 of 1912; this J., 1913, 1101. The sulphite-cellulose lye may be replaced by aromatic sulphonic or carboxylic acids, especially benzylated amino-sulphonic acids, phenolsulphonic acids, and condensation products of phenolsulphonic acids with formaldehyde. —T. F. B.

Vat dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Sept. 24, 1913, to Fr. Pat. 447,592, Aug. 23, 1912. Under Int. Conv., Nov. 14, 1912, March 20 and Sept. 1, 1913.

THE dyestuffs described in the principal patent (this J., 1913, 226) can be obtained by treating arylido-halogen-quinones with derivatives of thiocarbonic acid, such as he xanthates or trithiocarbonates. Further, when the reaction is carried out under pressure, preferably in presence of water, alcohol, or other diluent, and using any of the ulphur compounds mentioned, the reaction is accelerated without diminution of the yield. If higher temperatures re employed (*e.g.*, 180°—185° C.), products of somewhat ifferent shade are obtained. Again, in place of using ulphydrates as described in the principal patent, hydrogen ulphide may be used, preferably in a closed vessel under ressure, and in presence of a diluent.—T. F. B.

Dyestuffs soluble in sodium sulphide; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Bruning. Ger. Pat. 268,891, Jan. 14, 1912. Addition to Ger. Pat. 264,044 (see this J., 1913, 1005).

INSTEAD of treating the substances mentioned in the chief patent with sulphuric acid, an alkali sulphide, particularly a sulphydrate, is used.—T. F. B.

Sulphide dyestuffs of the carbazole series; Process for producing blue ——. L. Cassella und Co. G. m. b. H. Fr. Pat. 462,316, Nov. 19, 1912.

MONOSULPHONIC acids of carbazole or of its N-alkyl derivatives are condensed with *p*-nitrosophenol in presence of concentrated sulphuric acid, forming soluble blue indophenolsulphonic acids. These can also be obtained by treating with normal or acid sulphites the indophenols formed by condensing *p*-nitrosophenol with carbazole or its N-alkyl or N-aryl derivatives. On heating these indophenolsulphonic acids or their leuco compounds for prolonged times with alkali polysulphides, sulphide dyestuffs are produced which dye cotton blue shades very fast to light and to chlorine.—T. F. B.

Anthraquinone derivatives; Process for preparing ——. K. Brass. Ger. Pat. 268,646, Feb. 20, 1912.

ARYL-1-AMINOANTHRAQUINONES or their homologues or substitution products, in which the *p*-position to the imino group in the aryl nucleus is unoccupied, whilst the *o*-position to the imino group in the aryl or anthraquinonyl nucleus contains a carboxyl group, are treated with oxidising agents. When treated with condensing agents, the products are converted into vat dyestuffs of the anthraquinone-acridone type.—T. F. B.

Vat dyestuffs; Process for preparing ——. Kalle und Co., A.-G. Ger. Pat. 269,123, Nov. 15, 1912. Addition to Ger. Pat. 241,997 (see this J., 1912, 223).

PHENO-OXYNAPHTHOCARBAZOLES which are derived from β-naphthylamine, or their homologues or analogues, are condensed with reactive isatin-α-derivatives or their homologues or analogues, and the products are treated with halogens. The resulting dyestuffs give blue to violet-black dyeings from the vat.—T. F. B.

Azo dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 269,213, Nov. 6, 1912.

A DIAZOTISED aminobenzoylamine of the formula, $R.R'N.CO.C_6H_4.NH_2$ (where R and R′ may be aromatic radicals, or R an aromatic and R′ an aliphatic radical) is combined with an azo dyestuff component. The products dye wool from acid baths greenish-yellow to bluish-red shades fast to light.—T. F. B.

Vat [anthracene] dyestuffs; Process for preparing fast ——. R. Wedekind und Co. m. b. H. Ger. Pat. 269,215, Dec. 19, 1912.

THE yellow dyestuff containing bromine, obtained from dibromo-2-hydroxyanthraquinone according to Ger. Pat. 265,647 (see this J., 1913, 1101), is condensed with a primary aromatic amine. The products dye cotton from the alkaline vat, fast bright shades.—T. F. B.

Indigo dyestuffs; Mode of preparing finely-divided or colloid ——. A. Schmidt and A. Steindorff, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,085,361, Jan. 27, 1914.

SEE Ger. Pat. 242,532 of 1910; this J., 1912, 278.—T. F. B.

Azo dyes; Yellow ——. H. Geldermann, Berlin-Lichterfelde, and F. Ackermann, Berlin-Freidenau, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,086,155, Feb. 3, 1914.

SEE Eng. Pat. 6779 of 1913 this J., 1913 905.—T. F. B.

Vat dyestuffs of the benzanthrone series. Badische Anilin und Soda Fabrik. Fr. Pat. 462,576. Nov. 25, 1912.

See Eng. Pat. 26,551 of 1912; this J., 1913, 1004.—T. F. B.

Production of fast shades on vegetable fibres and dyestuffs therefor. Eng. Pat. 1435. *See* VI.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Esparto grass; The commercial importance of ——. C. J. Koch. Tropenpflanzer. 1914, **18**, 59—79.

The esparto plant grows best on mixed limestone and gravel soils; its natural region lies between 32° and 41° N. latitude, but it is capable of resisting considerable variations in temperature and is found at altitudes up to 3000 ft. The leaf ranges in length from 30 to 70 cm., attaining I m. under exceptional circumstances. It is pale green when growing but becomes yellow on drying; it rolls up under the influence of dryness, attaining its cylindrical form at the ripening stage. About 200,000 tons of the grass are imported almost exclusively by England; the quantity has remained stationary for 15 years, a decline from one source being made up by increased importations from other sources. If the leaf is harvested before maturity the quality of the fibre is very inferior, yielding a semi-transparent paper. In most districts the use of the knife is forbidden; a tuft of grass requires 8—15 years before it becomes productive, and may then be "pulled" annually for 30—50 years. The best time for pulling is the autumn; in most countries a close-season is fixed by regulation during the earlier months of the year. The harvested grass is stored and dried for a considerable time before packing for shipment; the hydraulic-pressed bales weigh about 22½ lb. per cub. ft. The majority of German papermakers are not interested in the grass, partly through unfamiliarity, partly owing to difficulties in procuring freights. Freights from Algiers and Oran run about 28s. per ton for Hamburg and 24s. for English ports. The area under esparto in Algeria is about 2,800,000 acres, of which about three-fourths are in the department of Oran. Regulations as to season of cropping are in force, also certain zones are reserved as a protection against sand-troubles. Exports from Algeria were 100,788 tons in 1911 and 116,632 tons in 1912, average price 52s. per ton; exports from Tunisia were 50,797 tons in 1911, average price 57s. per ton. Increases from these countries in recent years have taken place at the expense of the Tripoli trade, now practically ruined by war and scarcity of labour. The Spanish variety of esparto is still the most valuable although high prices and careless industrial habits have led to wasteful methods of cropping. Exports have declined from about 60,000 tons in 1897 to 41,000 in 1912, but the fluctuations since 1904 show a fairly steady average; the price runs about 95s. per ton and has fallen from more than double this figure since 1883. —J. F. B.

Patents.

Retting plants; Process for chemically ——. V. N. F. Lombard, Paris, and G. A. F. Lasègue, Alfortville, France. Eng. Pat. 23,355, Oct. 15, 1913. Under Int. Conv., July 19, 1913.

The plant is heated in an autoclave with a halogen derivative of a hydrocarbon mixed or emulsified with water, an alkali being added to neutralise any acid formed. The solvents preferred are the chlorine derivatives of acetylene, particularly trichloroethylene (b.pt. 85°—88° C.).—J. B.

Cotton resembling silk; Manufacture of ——. L. Hermsdorf and B. Teufer. Fr. Pat. 463,073, Sept. 29, 1913. Under Int. Conv., June 20, 1913.

Cotton, whether mercerised or not, is treated in a bath of soap solution and then dipped, without washing, into a solution of an acid, *e.g.*, acetic, sulphuric formic, lactic, or boric acid, etc. This imparts a silky "touch" to the cotton, which is subsequently calendered under heavy pressure between rolls engraved with numerous very fine lines, whereby a silky lustre is produced.—J. F. B.

Cellulose ethers and their transformation products; Manufacture of ——. H. Dreyfus. Fr. Pat. 462,274, Nov. 18, 1912.

Alkyl ethers of cellulose are prepared by steeping cellulose in a solution of caustic soda or potash sufficiently dilute to permit of the uniform distribution of 2—4 mols. of alkali per mol. of cellulose. The water is then more or less completely removed by evaporation *in vacuo*, preferably under a very high vacuum. The mass of alkali cellulose is treated with methyl or ethyl sulphate or chloride, which may be employed alone or diluted with a neutral solvent such as benzene to ensure uniform distribution, at a temperature preferably not exceeding 50°—60° C. The solubility of the products may be modified by subsequent treatment with mineral or organic acids, the action being interrupted at any stage when the desired solubility is attained.—J. F. B.

Cellulose from resinous woods; Manufacture of —— with recovery of oil of turpentine and resin oil. Soc. Anon. Le Camphre. Fr. Pat. 462,681, Nov. 27, 1912.

Resinous wood is digested in the form of small chips with a solution of caustic soda to which salts, such as sodium carbonate or sulphate, may be added. When the temperature and pressure in the digester have reached a suitable point, a cock in the upper portion of the vessel is slightly opened and the vapours of oil of turpentine are distilled off, condensed in a cooling worm and the distillate separated from the water. The digestion of the charge of wood is continued until complete, and the lye is separated from the cellulose. The liquid is concentrated and calcined in a closed vessel with the production of resin oils and tars. The latter are separated by treatment with soda and the resin oils purified by rectification; phenolic by-products are obtained by acidifying the alkaline solution of the tars.—J. F. B.

Sulphite pulp spent lyes; Preparation and utilisation of binding and impregnating substance from ——. E. Pollacsek. Fr. Pat. 462,429, Sept. 10, 1913. Under Int. Conv., Sept. 16, 1912.

The spent lyes are treated with a slight excess of lime and evaporated until a scum begins to form, a certain quantity of heavy mineral oil is then added drop by drop, which enables the compounds of lime to be skimmed off. The clarified liquid is further evaporated until it is just fluid and about 5 per cent. of heavy mineral oil is worked into the hot thickened mass. After cooling, the mass is mixed with a further quantity of heavy oil in the proportion of 5 parts of oil to 4 parts of the product; the whole is mixed with 1·5 part of lime paste and boiled up again. This product serves as a basis for binding and impregnating compounds by mixing with lime, heavy oil or water according to the purpose in view.—J. F. B.

Flax; Process of preparing ——. G. H. Campbell, Toronto. U.S. Pats. 1,086,270, 1,086,271, 1,086,272, and 1,086,273, Feb. 3, 1914.

See Eng. Pats. 14,715, 14,716, 14,717, and 14,718 of 1911; this J., 1912, 583, 714, 769.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Fastness of dyestuffs; The definition and testing of the ——. Report of the "Echtheitskommission" (Ver. Deutscher Chemiker). Z. angew. Chem., 1914, **27**, 57—63. Chem.-Zeit., 1914. **38**, 154—158.

The report of a committee appointed by the *Verein Deutscher Chemiker* to establish standard fastness tests and standard definitions of fastness. The standards of fastness or norms are identified by numbers, the lowest number indicating the least degree of fastness, the highest number the greatest degree of fastness. The norms are prepared with well-known dyestuffs, dyed according to given methods. The numbers in brackets after the names of dyestuffs refer to Schultz's Farbstofftabellen, 5th Ed. 1. *Fastness to light.* The standards are: *Cotton:* I. 5·5 per cent. Chicago Blue 6B (424), first bath. II. 1 per cent. Methylene Blue BG (659). III. 1 per cent. Indoin Blue R (126). IV. 20 per cent. Kyrogene Violet 3R, first bath. V. 2·5 per cent. Benzo Fast Red 8BL, first bath. VI. 9 per cent. Hydron Blue G in paste (748), first bath. VII. 8 per cent. Kyrogene Black, first bath. VIII. 25 per cent. Indanthrene Blue GC in paste (843), first bath. *Wool:* I. 3·15 per cent. Indigotine I (877). II. 3 per cent. Patent Blue A (545). III. 3·25 per cent. Amarant (168). IV. 4·4 per cent. Azo Acid Red B (64). V. 5 per cent. Acid Violet 4 RN. VI. 2·5 per cent. Diamine Fast Red F (343) after-chromed. VII. 4 per cent. Anthraquinone Green GXN (864). VIII. Indigo pure, dyed to the same strengths as the above seven standards. 2*a*. *Fastness to washing and to boiling of dyed cotton in contact with white cotton.* Two tests are used. (A) The sample is plaited with an equal weight of white cotton and treated with a solution of 2 grms. of Marseilles soap per litre for ½ hour at 40° C. in a 40 volumes bath, then alternately kneaded with the fingers and returned to the bath ten times and finally rinsed and dried. (B) The plait is boiled for ½ hour in a solution of 5 grms. of Marseilles soap and 3 grms. of soda ash per litre, cooled to 40° C. during ½ hour, and then worked with the fingers as in A. I. (Test A: shade only a little lighter, white stained). 3 per cent. Benzopurpurin 4B (363), dyed at the boil with 20 grms. of Glauber's salt per litre, evaporation being compensated. After 1 hour a further 20 grms. of Glauber's salt per litre is added and boiling continued for ¼ hour. II. (Test A: shade unchanged, white unstained or nearly so). 5 per cent. Primuline (616). dyed as under I., then diazotised and developed with β-naphthol, the dyed material being finally soaped at 35° C. for 5 minutes with a solution of 2 grms. of Marseilles soap per litre. III. (Test B: shade decidedly lighter, white only slightly stained). 2·5 per cent. Indoin Blue BB (126) on yarn mordanted with 6 per cent. of tannin and 3 per cent of antimony salt, dyeing with 5 per cent. of acetic acid. first ½ hour cold, then raising to the boil during ½ hour and boiling ¼ hour. IV. (Test B: shade unchanged, white only slightly stained). 12 per cent. Immedial Indone R conc. (733) dyed with 1½ times the dyestuff weight of sodium sulphide crystals, 3 grms. of soda and 20 grms. of salt per litre, evaporation being compensated. After 1 hour at the boil a further 20 grms. of salt per litre is added and boiling continued ¼ hour. Alternative standard: Indigo dyed to the same strength in a hydrosulphite vat containing 10 grms. of Indigo (20 per cent. paste) per litre, giving three dips with 10 minutes oxidation between. V. (Test B: shade unchanged, white unstained or nearly so). Alizarin Red ("Old Red"). 2*b*. *Fastness to washing of dyed wool plaited with white wool and cotton.* Two tests are used. A. The dyed material is plaited with equal weights of washed white wool and boiled out cotton and treated for ¼ hour at 40° C. in a 50 volume bath containing 10 grms. of Marseilles soap (free from caustic soda) and 0·5 grm. of soda ash per litre, then kneaded well by hand five times, squeezed, rinsed and dried. B. The plait is treated in the above solution at 0° C., removed, allowed to cool for ¼ hour, then worked by hand as before. *Fastness with regard to white wool.* I. (Test A: great change of shade, much bleeding into the white material). 2 per cent. Orange II (145) dyed 1 hour at the boil with 10 per cent. of Glauber's salt nd 10 per cent. of sodium bisulphate. III. (Test A: o change in shade or only a trace, no bleeding into the hite). 2 per cent. of Patent Blue A (545) dyed with 10 per ent. of Glauber's salt and 3 per cent. of acetic acid. aising from 40° C. to the boil in 20 minutes and oiling lightly for 1 hour, the bath being exhausted by dding 2 per cent. of sulphuric acid after ½ hour's boiling. . (Test B: no change in shade or only a trace, no bleeding to white). 7 per cent. of Palatine Chrome Black 6 B (181) dyed with 10 per cent. of Glauber's salt and 3 per cent. of acetic acid, raising from 60° C. to the boil in ¼ hour, boiling ½ hour, exhausting gradually with 2 per cent. of sulphuric acid, cooling to 70° C., adding 2·5 per cent. of potassium bichromate and boiling lightly for 40 minutes. *Fastness with regard to white cotton.* I. (Test A: much bleeding into white). 2 per cent. Chrysophenine G (304). dyed with 10 per cent. of Glauber's salt, raising to the boil from 40° C. in 20 minutes, boiling for 1 hour and exhausting with 2 per cent. of acetic acid after boiling ¾ hour. III. (Test A: no bleeding into white). 2 per cent. Patent Blue (545) dyed as before. V. (Test B: no bleeding into white). 7 per cent. Palatine Chrome Black 6 B (181) dyed as before. 3*a*. *Fastness to water of dyed cotton.* The dyed material is plaited with white cotton, silk and wool in the proportion of two parts of dyed material to one part of white, steeped for 1 hour in a 40 volume bath of distilled water at about 20° C. and dried at the ordinary temperature. I. (After one steeping shade somewhat lighter, white stained). 2 per cent. Chrysophenine G (304) dyed as under 2a I. III. (After one steeping shade unchanged and white not stained). 2 per cent. Chloramine Yellow C (617) dyed as the foregoing. V. (After three steepings, each with fresh water, no change and no staining). 8 per cent. Immedial Carbon B (720) dyed as under 2*a* IV. 3*b*. *Fastness to water of dyed wool.* The sample is treated for 12 hours as under 3*a*. I. (After one steeping shade changed or lighter, white stained). 2 per cent. Azo Yellow (141) dyed with 10 per cent. of Glauber's salt and 10 per cent. of sodium bisulphate, 1 hour at the boil. III. (After one steeping shade unchanged, no bleeding). 2 per cent. Patent Blue A (545) dyed as under 2*b*. V. (After three steepings, each with fresh water, shade unchanged, no bleeding or only a trace). 7 per cent. Palatine Chrome Black 6B (181) dyed as under 2*b*. 4. *Fastness to rubbing.* A piece of unfinished white cotton is stretched over the index finger and rubbed backwards and forwards over the dyed material ten times with a stroke 10 cm. long. No types given. 5*a*. *Fastness to hot ironing of dyed cotton.* The dyed material is wrapped in thin, white, unfinished cotton which has been moistened with distilled water and pressed with an iron, so hot that a woollen thread pressed by it begins to be singed, until the damp wrapper has become quite dry. The shade of the ironed part is compared with the neighbouring unironed parts, while it is still hot. I. (Shade much changed, colour bleeds into the white cotton). 1·5 per cent. Methylene Blue B (659) dyed after the usual method for basic dyestuffs during 1½ hours in 20 parts of distilled water with 2 per cent. of acetic acid on material mordanted with 6 per cent. of tannin and 3 per cent. of antimony salt. III. (Shade somewhat changed, no bleeding). 1 per cent. Benzopurpurin 4B (363) dyed as under 2*a*. V. (No change, no bleeding). 1 per cent. Chloramine Yellow C (617) dyed as under 2*a* I. 5*b*. *Fastness to hot ironing of dyed wool.* The dyed material is pressed for 10 seconds with an iron so hot that it just fails to scorch a white wool thread. I. (Shade greatly changed, the original tone returning very slowly or incompletely on cooling). 2 per cent. Fuchsin S (524) dyed with 10 per cent. of Glauber's salt and 10 per cent. of sodium bisulphate, 1 hour at the boil. III. (Shade rather strongly changed, returning quickly). 2 per cent. Amarant (168) dyed with 10 per cent. of Glauber's salt and 10 per cent. of sodium bisulphate. heating from 60 C. to the boil in 20 minutes and boiling 1 hour. V. (No change). 2 per cent. Tartrazine (23) dyed as I. 6. *Fastness to storing of dyed wool and cotton.* The sample is plaited with an equal weight of white wool, steeped in a solution of 5 grms. of Marseilles soap per litre at the ordinary temperature, wrung out, kept in an atmosphere of sulphur dioxide for 12 hours, rinsed and dried. *Dyed cotton.* I. (Shade changed, white wool stained). 1 per cent. Diamond Fuchsin (512) dyed as for Methylene Blue under 5*a*. III. (Shade very slightly changed, no staining). 1 per cent. Columbia Blsck F extra (463) dyed as under 2*a* I. V. (No change). 1 per cent. Diamine Black BH (333) developed with β-naphthol as for Primuline under 2*a*. *Dyed wool.* I. (Shade somewhat strongly changed, no bleeding into white or very little). 2 per cent. Diamine Scarlet B (319) dyed as under 2*b* I. III. (Slight change in shade, no bleeding or only a trace). 2 per cent. Milling Red G (293) dyed with 10 per cent. of Glauber's salt and 2 per cent. of acetic acid, heating from 30° C. to the boil in 20—30 minutes, boiling lightly 1 hour and exhausting with 3 per cent. of acetic acid after boiling for ¾ hour. V. (No change in shade, no bleeding or only a trace). 2 per cent. Palatine Scarlet A (81) dyed with 10 per cent. of Glauber's salt and 10 per cent. of sodium bisulphate, raising from 60° C. to the boil in 20 minutes and boiling 1 hour. 7*a*. *Fastness to perspiration of dyed cotton.* The sample, plaited with an equal weight of white cotton, is steeped for 10 minutes at 80° C. in a solution containing 5 c.c. of neutral ammonium acetate (7·5 Bé.=30 per cent.) per litre of distilled water and then dried without rinsing. I. (Shade becomes lighter, white cotton strongly stained). 1 per cent. Chrysophenine G (304) dyed as under 2*a* I. III. (Shade unchanged, white stained). 1 per cent. Diamine Black BH (333) dyed as I. V. (No change, white not stained). 20 per cent. Indanthrene Blue RS in paste (638). 7*b*. *Fastness to perspiration of dyed wool.* The dyeing is spotted with a 10 per cent. salt solution, dried at the ordinary temperature and brushed. I. (Great change in shade). 2 per cent. Amarant (168) dyed as under 5*b* III. III. (Moderate change in shade). 2 per cent. Wool Green S (566) dyed with 10 per cent. of Glauber's salt and 10 per cent. of sodium bisulphate for 1 hour at the boil. V. (No change), 2 per cent. Brilliant Crocein 3B (227) dyed as under I. Alternative test: The sample, plaited with white wool and cotton is treated with ammonium acetate as for cotton. I. (Shade unchanged or very slightly changed, white wool and cotton stained). 2 per cent. Azo Yellow (141) dyed as under 3*b*. III. (No change in shade, cotton not stained, wool only a little). 2 per cent. Amarant (168) dyed as under 5*b*. V. (No change, no staining). 7 per cent. Palatine Chrome Black 6B (181) dyed as under 2*b*. 8. *Fastness to alkali* (*and to street mud and dust*). The sample is spotted with a mixture containing 10 grms. of lime and 10 grms. of ammonia (24 per cent.) in a litre of water, pressed, allowed to dry at the ordinary temperature and brushed. *Wool.* I. (Strong change in shade). 2 per cent. Water Blue (539) dyed with 10 per cent. sodium bisulphate, raising from 60° C. to the boil in 20 minutes and boiling ¾ hour. III. (Moderate change). 2 per cent. Amarant (168) dyed as under 5*b*. V. (No change). 7 per cent. Palatine Chrome Black 6 B (181) dyed as under 2*b*. *Cotton.* I. (Great change). 1·5 per cent. Malachite Green conc. (495) dyed on tannin-antimony mordant as under 5*a* I. III. (Moderate change). 1 per cent. Direct Deep Black E extra (463) dyed as under 2*a* I. V. (No change). 8 per cent. Diamine Black BH (333) dyed as under 2*a* II. 9*a*. *Fastness of dyed cotton to cross-dyeing.* The dyed material, plaited with an equal weight of white wool and of white cotton, is boiled in a 40 volume bath with 10 per cent. of sodium bisulphate on the weight of the material. I. (Shade a little lighter, white wool stained). 2 per cent. Chloramine Yellow C (617) dyed as under 2*a* I. III. (Shade not affected or only slightly, white wool only slightly stained). 3 per cent. Primuline developed as under 2*a*. V. (No change, no staining). 8 per cent. Immedial Carbon B (720) dyed as under 2*a* IV. 9*b*. *Fastness to cross-dyeing of dyed wool.* The dyed material, plaited with white wool, is treated in a 70 volume bath with a solution containing 2·5 grms. of sodium bisulphate per litre for 1½ hour at 90—92° C. I. (Shade only a little changed, white wool stained). 2 per cent. Chrome Yellow D (177) dyed with 10 per cent. of Glauber's salt and 3 per cent. of acetic acid, raising from 60° C. to the boil in ¼ hour, exhausting after boiling ½ hour with 2 per cent. of sulphuric acid, cooling to 70° C., adding 1·25 per cent. of potassium bichromate and boiling lightly for ½ hour. III. (Shade unchanged, white only slightly stained). 2 per cent. Diamine Scarlet B (319) dyed as under 2*b* I. V. (Shade unchanged, white not stained or only slightly), 6 per cent. Alizarin Black WX extra in paste (774) dyed with 10 per cent. of Glauber's salt and 5 per cent. of acetic acid, raising from 60° C. to the boil in 20 minutes, boiling ½ hour, then exhausting with 5 per cent. of acetic acid, boiling a further 20 minutes, cooling to 70° C., adding 2 per cent. of potassium bichromate, and boiling lightly for 40 minutes. 10. *Fastness to acid of dyed cotton.* The material is spotted with 10 per cent. sulphuric acid and with 30 per cent. acetic acid and the spots compared with a plain water spot. I. (Mineral acid: great change; organic acid: little change). 3 per cent. Diamine Scarlet B (319). III. (Mineral acid: great change. Organic acid: unchanged). 0·5 per cent. Chrysophenine G (304). V. (No change with either acid). 20 per cent. Indanthrene Blue RS in paste (838). 11. *Fastness to kier boiling of dyed cotton.* The sample is tested in two ways: A, boiling for 6 hours along with white unbleached cotton in a circulating kier together with 7·5 per cent. of soda ash, 0·5 per cent. of Marseilles soap and 1 per cent. of "Ludigol"; liquor to cloth ratio, 5:1. B, boiling as above without the "Ludigol." I. (Test A: completely destroyed). Congo Red. II. (Test A: almost completely destroyed). Methylene Blue B. III. (Test A: rather changed but not spoiled). Indigo. IV. (Test A: no change). Helindone Orange R (913). V. (Test B: no change). Turkey Red ("Old Red"). 12. *Fastness to chlorine of dyed cotton.* The sample is plaited with an equal weight of white cotton, wetted out and treated for 1 hour at 15° C. in bleaching powder solution containing 1 grm. active chlorine per litre (a 5° Bé., sp. gr. 1·037, liquor diluted 1:20 and checked by titration) or in a sodium hypochlorite solution, prepared from bleaching powder and sodium carbonate, containing 1 grm. active chlorine per litre and not more than 0·3 grm. of sodium carbonate per litre. The sample is afterwards rinsed, soured, rinsed and dried. I. (Sodium hypochlorite: shade lighter, white stained. Bleaching powder: shade much lighter, white stained). I per cent. Methylene Blue B (659) dyed as under 5*a*. II. (Sodium hypochlorite: shade changed, white not stained. Bleaching powder: shade much changed, white not stained). 6 per cent. Indanthrene Olive G in powder (791) dyed ½ hour at 60° C. in a 20 volume bath of distilled water made up with 5 parts of caustic soda of 40 Bé. (sp. gr. 1·383) and 2½ parts of hydrosulphite on the weight of the dyestuff. III. (Sodium hypochlorite: only a little lighter, white not stained. Bleaching powder: shade much lighter, white not stained). Indigo dyed to the strength of 3 per cent. Diamine Fast Blue FFB dyed as under 2*a* I. IV. (Sodium hypochlorite: no change, no staining. Bleaching powder: shade distinctly lighter, white not stained). 10 per cent. Hydron Blue G 20 per cent. paste (748) dyed as under II., but with ½ part of caustic soda of 40 Bé. (sp. gr. 1·383) and ½ part of hydrosulphite on the weight of dyestuff. V. (No change and no staining with either sodium hypochlorite or bleaching powder). Turkey Red ("Old Red"). 13. *Fastness to mercerising of dyed cotton.* The dyed material is stitched into bleached, unfinished cotton cloth and steeped for 5 minutes in cold caustic soda of 30 Bé. (sp. gr. 1·263), pressed, rinsed, soured, rinsed and dried. I. (Shade the least changed, white cotton somewhat stained). 4 per cent. Primuline (616) dyed as under 2*a*. III. (Shade unchanged, white only very slightly stained). 1 per cent. Chloramine Yellow C (617) dyed as under 2*a* I. V. (Shade unchanged, no staining). 8 per cent. Immedial Carbon B (720) dyed as under 2*a* IV. 14. *Fastness to bleaching of dyed wool.* The dyed woollen cloth is stitched with white wool, cotton and silk and bleached with a solution of 100 parts of distilled water and 20 parts of hydrogen peroxide (10—12 vol. per cent.), maintained slightly alkaline with ammonia. The sample is entered at 50° C. in a 40—50 volume bath, which is allowed to cool gradually during 12 hours. I. (No change in shade, or very little, but silk, wool and cotton stained). 2 per cent. Azo Yellow (141) dyed as under 3*b*. II. (Shade lighter, little bleeding). 2 per cent. Patent Blue A (545) dyed as under 2*b*. III. (Shade lighter, no bleeding). 2 per cent. Fast Yellow S (137) dyed as for Azo Yellow under 3*b*. IV. (Shade not changed or only slightly, some bleeding into silk and cotton but none into wool). 2 per cent. Chrysophenine G (304) dyed as under 2*b*. V. (No change in shade or bleeding, or only a trace). 2 per cent. Sulfoncyanin GR extra (257) dyed with 20 per cent. of Glauber's salt and 5 per cent. of ammonium acetate, raising from 40° C. in ½ hour and dyeing at 80°—90° C. for ¾ hour. 15. *Fastness to milling of dyed wool.* Two tests: A. Neutral milling. The dyed material, plaited with equal weights of wool and cotton, is treated at 30° C. in a 40 volume bath of 20 grms. of Marseilles soap per litre of distilled water. The sample is first milled by hand, then allowed to stand two hours, again milled and finally washed and dried. B. Alkaline milling. Same treatment as in A but at 40° C. and with the addition of 5 grms. of soda ash to the soap solution. *Fastness with white wool.* I. (Test A: decided change in shade, strong bleeding into white). 2 per cent. Azo Yellow (141) dyed as in 3*b*. II. (Test A: little change in shade, little bleeding). 2 per cent. Ponceau RR (82) dyed as for Orange II under 2*b*. III. (Test A: No change or only a trace, no bleeding). 6 per cent. Sulfoncyanin Black 2B (265) dyed as under 14 IV. IV. (Test B: no change or only a trace, little bleeding). 2 per cent. Chrome Yellow D (177) dyed as under 9*b*. V. (Test B: No change or only a trace, no bleeding). 7 per cent. Anthracene Chrome Black P extra (185) dyed as under 2*b* V. *Fastness with white cotton.* I. (Strong bleeding into white cotton). 2 per cent. Diamine Scarlet B (319) dyed as under 2*b* I. II. (Little bleeding). 2 per cent. Ponceau RR (82) dyed as for Orange II. under 2*b*. III. (No bleeding). 6 per cent. Sulfoncyanin Black 2B (265) dyed as under 14 IV. IV. (Little bleeding). 5 per cent. Diamond Black F (277) after-chromed with 1·5 per cent. of potassium bichromate, otherwise dyed as under 2*b* V. V. (No bleeding). 7 per cent. Diamond Black PV (157) dyed as under 2*b* V. 16. *Fastness to carbonising.* The sample is steeped in sulphuric acid of 5° Bé. (sp. gr. 1·037) for ½ hour, squeezed so as to retain 100 per cent. of moisture, dried at 80° C. for 1 hour, washed for ¼ hour with 200 parts of distilled water, squeezed, neutralised in 200 parts of sodium carbonate solution (2 per 1000), washed till neutral to litmus and dried. I. (Great change in shade). 2 per cent. Alizarin Red W (780) dyed with 2 per cent. of acetic acid, raising from 30° C. to the boil in ½ hour and boiling 1½ hour, on wool previously mordanted with 3 per cent. of potassium bichromate and 2½ per cent. of sodium bisulphate 1¼ hour at the boil. III. (Little change). 2 per cent. Orange IV (139) dyed with 10 per cent. of Glauber's salt and 10 per cent. of sodium bisulphate 1 hour at the boil. V. (No change or only a trace). 2 per cent. Palatine Scarlet A (81) dyed with 10 per cent. of Glauber's salt and 10 per cent. of sodium bisulphate, raising from 60° C. to the boil in 20 minutes and boiling 1 hour. 17. *Fastness to potting of dyed wool.* Two tests: A. The dyed material, plaited with equal weights of white wool and cotton, is treated with 60 parts of distilled water at 90° C., washed and dried. B. As in A with the addition of 1 grm. of Marseilles soap per litre. I. (Test A: shade changed, white wool or cotton strongly stained). 2 per cent. Patent Blue A (545) dyed as under 2*b*. III. (Test A: No change or only a trace, wool and cotton somewhat stained). 5 per cent. Diamond Black F (277) dyed as under 15 IV. V. (Test B: no change or only a trace, no bleeding). 7 per cent. Alizarin Black WX extra, dyed as under 2*b* V. 18. *Fastness to decatising of dyed wool.* Two tests: A. The material is wound on a decatising cylinder and steamed in a closed apparatus for 5 minutes at a pressure of 1 atmosphere. B. The same but at 2·5 atmospheres pressure for 10 minutes. I. (Test A: rather great change in shade). 2 per cent. Sulfoncyanin GR extra (257) dyed as under 14 V. III. (Test A: no change). 2 per cent. Crocein AZ (225) dyed as Brilliant-Crocein 3B under 7*b*. V. (Test B: no change). 9 per cent. Naphthol Black 6B (269) dyed with 10 per cent. of sodium bisulphate, raising from 40° C. to the boil in ½ hour and boiling lightly 1 hour. 19. *Fastness to sea water of dyed wool.* The dyed material, plaited with an equal weight of white wool, is treated for 24 hours with 40 parts of a cold solution containing 30 grms. of salt and 6 grms. of calcium chloride per litre and dried without rinsing. I. (Shade only slightly changed, white wool strongly stained). 2 per cent. Chrysoin (143) dyed as under 3*b* I. III. (Shade not changed or only very slightly, white somewhat strongly stained). 2 per cent. Cyanol extra (546) dyed as under 2*b* III. V. (No change, no staining). 6 per cent. Sulfoncyanin Black (265) dyed as under 14 V.—J. B.

Adsorption in solutions. II. G. von Georgievics. Kolloid-Zeits., 1914, **14**, 69—74.

The author has shown previously (this J., 1912, 68) that in the absorption of acids by wool there is first solution of the acid by the wool, followed by adsorption. In Boedecker's distribution formula: $\frac{\sqrt[x]{C_{\text{liquor}}}}{C_{\text{fibre}}} = K$, if $x = 1$, the process is one of solution, and in cases of solution plus adsorption, the value of x is greater than 1 and increases with the amount of adsorption. The values of x for the absorption of thirteen different acids by wool are tabulated. They follow the same order as the relative "strengths" of the acids, and the author draws the conclusion that the adsorption as distinct from the solution of the acids is due to the chemical affinity of the acids for wool substance. Evidence is cited in favour of the view that this hypothesis of adsorption is of general application.
—A. S.

Wool; The action of formaldehyde on ——, and a note on the constitution of wool. A. Kann. Färber-Zeit., 1914, **25**, 73—75.

When treated with formaldehyde solution of about 4 per cent. concentration wool becomes resistant to the action of alkali and at the same time loses its affinity for dyestuffs. The author has found that by the use of very weak formaldehyde (solutions containing 0·25 or as low as 0·10 per cent. of commercial formaldehyde) the wool can be protected against the tendering action of alkali without loss of affinity for dyestuffs. The reaction between wool and formaldehyde takes place with great ease in slightly alkaline solution and much less advantageously in acid or neutral solution. Wool thus treated can be dyed with sulphide dyestuffs, it shrinks less on steaming and it can be scoured with caustic alkali, using very little soap. The treated wool reacts with nitrous acid just like untreated wool. This shows that wool does not contain an amino group, for such a group would have been rendered inactive by the formaldehyde. It is concluded that wool contains the imino group, and the product of reaction with nitrous acid is a nitrosamine. Wool treated with nitrous acid retains its power of reacting with formaldehyde so that the condensation must be of the aldol type and takes place with the carboxyl groups of the wool. These facts support the view that wool contains imino and carboxyl groups and not amino and ketonic groups.
—J. B.

Patents.

[Scouring] Textile piece goods, warp yarns and the like; Machines for treating —— with liquids. J. S. Ainley, Huddersfield. Eng. Pat. 6970, March 22, 1913.

In a machine of the usual type for scouring warps or fabrics in rope form, the sloping side on which the material falls from the taking-off roller is provided with an endless apron between which and another endless apron the fabric is grouped in folds, in which form emerging from beneath the upper apron it comes under a "possing" or squeezing plate. The two aprons and the squeezing plate are all driven intermittently.—J. B.

Ozone: Treating [bleaching] fibrous materials with ——. E. Gminder, Reutlingen, Germany. Eng. Pat. 28,763. Dec. 12, 1913. Under Int. Conv., Dec. 14, 1912.

The goods, more especially laundry goods, are treated in a hydro-extractor with a spray produced by atomising water with ozonised air.—J. B.

Fast shades on vegetable fibres; Production of —— and dyestuffs therefor. H. Levinstein, J. Baddiley and Levinstein, Ltd., Manchester. Eng. Pat. 1435, Jan. 17, 1913.

The new dyestuffs are produced by combining the tetrazo-compound of a diamine with 2 mols. of middle components capable of undergoing re-diazotisation after coupling, at least one of which is an extra-nuclear amino-derivative of an aminonaphtholsulphonic acid; tetrazotising the intermediate product thus obtained and combining with 2 mols. of resorcinol. The dyestuffs by after-treatment on the fibre with formaldehyde become fast to washing. Shades ranging from orange to purple and dark green are produced; for instance, tetrazotised *m*-azoxytoluidine combined with 1 mol. of *m*-aminobenzoyl-2-amino-5-naphthol-7-sulphonic acid and 1 mol. of 2-amino-5-naphthol-7-sulphonic acid, tetrazotised and combined with 2 mols. of resorcinol gives an orange colour.—J. B.

Dyeing textile fibres; Machines for ——. J. Fitton, Wakefield. Eng. Pat. 13,210, June 7, 1913.

The dye-vat is provided with an inner concentric vessel, the vertical sides of which are perforated. Inside this again is a movable vessel which also has its vertical sides perforated. The material is packed in the space between these two perforated walls and the dye-liquor is circulated horizontally through the material from the inside of the innermost vessel by means of a pump.—J. B.

Dyeing pelts, hairs, feathers, etc.; Process for ——. Act.-Ges. für Anilin-Fabr., Berlin. Eng. Pat. 61, Jan. 1, 1914. Under Int. Conv., June 14, 1913.

A clear greenish yellow shade is produced by treating the material, mordanted or not, with a solution of 2-hydroxy-3-methoxybenzaldehyde (a by-product in the manufacture of vanillin).—J. B.

Dry-dyeing of furs or fur goods; Process for the ——. O. Lange. Ger. Pat. 266,515, Feb. 2, 1913.

Compounds obtained by heating oxidisable organic bases, such as *p*-phenylenediamine, with olein, are dissolved in the baths, in which carbon tetrachloride, petroleum spirit, etc., is used as solvent.—T. F. B.

Dyeing [and impregnating] materials which are difficult to dye completely; Process for ——. J. Weller. Ger. Pat. 266,708, Jan. 24, 1913.

Hard substances, such as wood, stone, horn, etc., or densely packed textiles, such as cops, are treated with an easily volatile substance, such as ether, carbon tetrachloride, or petroleum spirit, and then immersed in hot dyestuff solutions. The preliminary treatment may also be applied before impregnating wood, horn, or stone with substances other than dyestuffs.—T. F. B.

Aniline Black; Process for producing ——. A. Ehrenzweig. Ger. Pat. 267,628, Jan. 13, 1912.

p-Phenylenediamine or its homologues, a copper salt, a chlorate, aluminium acetate, and lactic acid are used in the production of Aniline Black. The fibres are dried at temperatures up to 100° C. The following proportions are given:—For 100 litres of dyebath are added (*a*) 4000 grms. of aniline oil, 5200 grms. of 30 per cent. hydrochloric acid, and 2600 grms. of 50 per cent. lactic acid, (*b*) 320 grms. of powdered alumina and 1120 grms. of acetic acid of 8·5° B. (sp. gr. 1·064), (*c*) 350 grms. of *p*-phenylenediamine, 700 grms. of sodium chlorate and 840 grms. of copper sulphate.—T. F. B.

Dyeings on vegetable and animal fibres; Process for producing fast ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 268,779, June 22, 1911.

A diazoamino compound of the anthraquinone series is converted into its leuco compound by treatment with an alkaline reducing agent, this is applied to unmordanted animal or vegetable fibre, and the dyestuff is developed by oxidation.—T. F. B.

Discharges on indigo or similar dischargeable dyestuffs; Process for producing white or coloured ——. C. Sunder, and Moritz Ribbert A.-G. Ger. Pat. 267,408, Feb. 1, 1913.

The dyed goods are printed with a paste containing glucose, zinc oxide, and stannous oxide, or a tin salt, with or without an undischargeable vat dyestuff; after drying, the goods are passed through a boiling bath of caustic soda or potash of 20° B. (sp. gr. 1·162), washed and dried.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphur in pyrites; New method for the determination of ——. E. Martin. Monit. Scient., 1914, **4**, 86.

Details are given of certain precautions necessary in the volumetric method described recently (this J., 1913, 1065): to ensure complete precipitation of the barium carbonate it is essential to have present a considerable excess of sodium carbonate and to use only sufficient carbon dioxide just to discharge the pink colour of the phenolphthalein.—A. S.

Ammonia soda process; Another form of the ——. P. P. Fedotieff and J. Koltunoff. Z. anorg. Chem., 1914, **85**, 247—260.

In view of the advantages of carrying out the ammonia soda reaction with sodium nitrate as raw material (see Colson, this J., 1910, 190), the authors made a complete study of the reaction on the same lines as that of the ammonia soda reaction proper (this J., 1904, 865). Working in the same way as with sodium chloride (*i.e.*, by passing carbon dioxide into an ammoniacal solution of the nitrate) the results are similar to those obtained in the ordinary process. The mother liquor may be treated with lime and a residue of calcium and sodium nitrates obtained, valuable for manurial purposes; or the liquor may be evaporated till all the dissolved sodium bicarbonate has reacted with ammonium nitrate, giving off carbon dioxide and ammonia, then further evaporated to about half the volume, when about half of the ammonium nitrate will crystallise out. On adding sodium nitrate, ammonia and water in quantities sufficient to bring the solution back to its original composition, and carbonating, all the newly added sodium nitrate will be converted into bicarbonate and 87 per cent. of the ammonia into ammonium nitrate, while the remaining 12 per cent. of ammonia can be recovered on evaporation.—W. H. P.

Calcium hydroxide. T. Seliwanow. Z. anorg. Chem., 1914, **85**, 329—352.

Amorphous calcium hydroxide usually yields more water than corresponds with the formula $Ca(OH)_2$, but it reaches this composition on drying at 110° C., or in a desiccator at ordinary temperatures. The excess water is greater in specimens of the hydroxide obtained by precipitation of calcium chloride with sodium hydroxide, than in specimens obtained by slaking the oxide, although the latter on being kept under water for a long time approach the former in moisture content. The precipitated hydroxide absorbs water vapour more readily than the slaked hydroxide, the absorption being similar to that for other colloidal substances, with no definite hydrate formation. A crystalline hydroxide can be obtained from supersaturated solutions by evaporation at 28°—30° C. under reduced pressure. It has the formula $Ca(OH)_2$ and is less soluble than the amorphous product. Supersaturated solutions which readily deposit crystalline hydroxide on warming, are indifferent to the solid hydroxide and do not deposit their excess at ordinary temperatures. The cryohydrate obtained by freezing lime water is a mixture of ice with $2Ca(OH)_2,H_2O$. The latter is less soluble than, and has a characteristic crystalline form quite different from, that of the hydroxide; it is unstable, readily passing into the amorphous hydroxide. The author concludes that the amorphous hydroxide is a polymeride of $Ca(OH)_2$, containing not less than four atoms of calcium in its molecule. The crystalline product is probably not less complicated, and this view is supported by its polymorphism.—W. H. P.

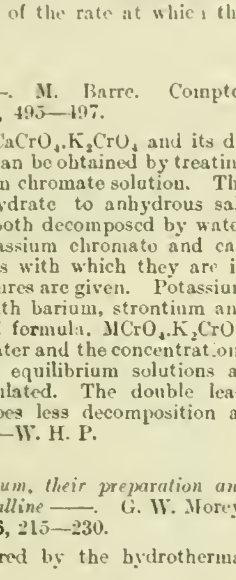
Sulphates; Physico-chemical determination of ——. A. Kling and A. Lassieur. Comptes rend., 1914, **158**, 487—489.

The criticisms advanced by Bruno and d'Auzay (this J., 1912, 506 and 742) against Dutoit's method of determining sulphates (this J., 1908, 871 and 912) are endorsed by the authors, who used barium acetate as precipitant. The low results obtained are attributed to the removal of soluble sulphate by the earlier portions of the barium sulphate precipitate. This removal is most pronounced in the more concentrated solutions at low temperatures, and in the presence of alcohol. It is more marked with potassium and rubidium sulphates than with those of the other alkali metals. It only takes place when the barium sulphate is precipitated *in situ*; a potassium sulphate solution suffers no fall in concentration on being left in contact with previously precipitated barium sulphate. In alkaline solutions the alkali is absorbed and the sulphate left in solution, and a precipitate containing absorbed sulphate may have this partially displaced on treatment with alkali. The actual extent of the absorption is a function of the rate at which the precipitant is added.—W. H. P.

Double chromates; Some ——. M. Barre. Comptes rend., 1914, **158**, 495—497.

Calcium potassium chromate, $CaCrO_4.K_2CrO_4$ and its dihydrate, $CaCrO_4.K_2CrO_4.2H_2O$ can be obtained by treating calcium chromate with potassium chromate solution. The transition temperature from hydrate to anhydrous salt is about 45° C. The salts are both decomposed by water and the concentrations in potassium chromate and calcium chromate of the solutions with which they are in equilibrium at various temperatures are given. Potassium chromate forms double salts with barium, strontium and lead chromates of the general formula, $MCrO_4.K_2CrO_4$. These also are decomposed by water and the concentrations of potassium chromate in the equilibrium solutions at various temperatures are tabulated. The double lead salt unlike the others undergoes less decomposition at high than at low temperatures.—W. H. P.

Silicates of potassium and sodium, their preparation and general properties; New crystalline ——. G. W. Morey. J. Amer. Chem. Soc., 1914, **36**, 215—230.



The new silicates were prepared by the hydrothermal method, the reacting substances being heated in presence of water in a closed bomb at a high temperature and consequent high pressure. The bomb used, made of tool steel, consisted of a cylinder, E, 3 ins. diam. and 8 ins. long, in which was bored a hole of 1¼ in. diam. enlarged at the top to receive the plug, B, which was screwed down hard by means of a wrench; between the plug and the plunger was a steel washer to ensure that the latter did not rotate when the plug was screwed down. The ½-in. rod, C, of the plunger passed through the washer and the plug with a clearance of about $\frac{1}{32}$ in. The plunger fitted tightly into the bomb just above and below the shoulder and the joint was sealed by a flat copper washer, D, $\frac{1}{16}$ in. thick, which was softened by annealing in a flame just before use. A bomb of this type was used in 200 experiments without a leak being observed. It was heated in an electric furnace, and the temperature measured by a thermo-element inserted in the hole, F, ¼ in. diam. The reacting substances, usually water and finely powdered glasses (made from quartz and alkali carbonate), were placed in the gold crucible, G. The products obtained varied according to the temperature, composition of the original glass (ratio of alkali oxide: silica) and concentration of the water (pressure) Four new crystalline silicates, namely $K_2Si_2O_5$, $KHSi_2O_5$, $Na_2Si_2O_5$ and Na_2SiO_3, were obtained, all in the form of orthorhombic crystals. $K_2Si_2O_5$ and Na_2SiO_3 were readily attacked by water, $Na_2Si_2O_5$ less readily, whilst $KHSi_2O_5$ was not appreciably decomposed even when left in contact with water for some hours at 100 C. A series of hydrous glasses was also obtained representing supercooled solutions unsaturated under the experimental conditions. They were quite hard though containing up to 25 per cent. of water. When heated in the air they lost water, and swelled up to a sponge-like mass often with extremely thin vesicular walls. In most of the experiments the bomb after being heated was plunged into cold water: when the crucible was supported in the upper part of the bomb, so that on cooling, the vapour space, below the crucible, was cooled more rapidly than the reaction-mixture, the resulting rapid diminution of pressure caused the water in the mixture to vaporise suddenly and a nearly anhydrous, light, porous pumice-like product was obtained.—A. S.

Persilicates; The possible existence of ——. E. Jordis. Chem.-Zeit., 1914, **38**, 221—222.

When a solution of an alkali silicate is electrolysed, a portion of the oxygen set free at the anode is absorbed; the same takes place in the case of sulphuric acid solutions of silicates where the dilution is such as to prohibit the formation of persulphates. These facts afford some support for the assumption that persilicates are capable of existing (see also this J., 1914, 199). Solutions of alkali silicates absorb oxygen when exposed to the air for about 12 months; on acidifying such solutions with hydrochloric acid, chlorine is evolved together with large quantities of carbon dioxide.—W. P. S.

Molybdenum; Preparation of a metaphosphate of tervalent ——. A. Colani. Comptes rend., 1914, **158**, 499—501.

Molybdic acid can be reduced in the presence of phosphoric acid at a high temperature by a variety of methods with the formation of a yellowish crystalline substance of the formula, $Mo(PO_3)_3$. The most convenient reducing agent is molybdenum sulphide, and the reaction is carried out in a gold Rose crucible in a current of carbon dioxide. The phosphate has the sp. gr. 3·28 at 0 C. and remains unaltered in dry air. It only oxidises slightly on being heated and is practically unaffected by mineral acids at 100° C. It is slowly attacked by boiling sulphuric acid or cold *aqua regia*, and it dissolves completely in a sealed tube at 200° C. in a slightly acid solution of bichromate or iodic acid. Heated with water alone in the absence of air to 250°—300° C., it gives phosphoric acid and a small quantity of hydrogen.—W. H. P.

Oxides of cobalt. H. T. Kalmus. J. Ind. Eng. Chem., 1914, **6**, 115—116.

Many oxides of cobalt have been described in the literature, but the existence of several of them is doubtful and only the three oxides, Co_3O_4, Co_6O_7 and CoO, are of special concern to the manufacturer of commercial cobalt oxide. When cobalt hydroxide produced by precipitating a chloride or sulphate solution with bleaching powder, is calcined at 105° C., a chocolate brown powder, $Co_2O_3.H_2O$, is produced, which on heating at a higher temperature (385°—910° C., preferably about 750° C.) is converted into a black oxide consisting, like the commercial black oxide, of Co_3O_4, mixed with a small proportion of Co_6O_7. Above 910° C. the black oxide loses oxygen and changes gradually into the gray monoxide, CoO, which can be reduced to metal by carbon monoxide above 450° C. or by hydrogen above 250 C. The monoxide also exists as a yellow-green modification, which can be obtained by heating Co_3O_4 with 2—3 per cent. of carbon at about 900° C. The monoxide is oxidised to Co_3O_4, or Co_3O_4 plus Co_6O_7, when heated in air at 385°—910° C. The oxides mentioned are all non-magnetic.—A. S.

Lead chloride and potassium chloride in aqueous solution; Equilibrium between ——. Demassieux. Comptes rend., 1914, **158**, 183—184.

Isothermals at 14°, 50° and 100° C. are represented graphically. The three curves are of the same general form, and show branches corresponding to the existence of two double salts, $2PbCl_2,KCl$ and $PbCl_2,KCl,\frac{1}{3}H_2O$.
—J. H. L.

Sulphur dioxide with ammonia; Products of the reaction of ——. M. Ogawa and S. Aoyama. Science Rep. Tôhoku Imp. Univ., Ser. I., 1913, II, 121—129.

With ammonia in excess, and in ethereal solution at the temperature of a mixture of ice and salt, under the conditions given by Divers and Ogawa (this J., 1900, 245) sulphur and ammonia give the white ammonium aminosulphite, $NH_2SO_2NH_4$; with sulphur dioxide in excess, the pale-yellow aminosulphurous acid, NH_2SO_2H, is formed. At ordinary temperatures, if the excess of ammonia is removed, the ammonium salt decomposes to a red mass containing sulphite, sulphate, trithionate, and sulphamide; the acid decomposes on slight warming to a similar mass. The red substance is not a compound of the formula $N_4H_{12}S_5O_{10}$, as supposed by Divers and Ogawa, but is principally ammonium trithionate. Ephraim and Piotrowiski (this J., 1911, 358) have denied that the red substance is a decomposition-product, on the ground that they obtained it directly at —38° C.; but this was because the reacting gases were imperfectly controlled, and the heat of the reaction dissipated with insufficient rapidity.—O. E. M.

Colloidal solutions; Preparation of —— by mechanical subdivision. G. Wegelin. Kolloid-Zeits., 1914, **14**, 65—69.

The author has succeeded in converting a number of substances into the colloidal condition by more or less prolonged grinding in an agate mortar, preferably with addition of a little water. Colloidal solutions of vanadium pentoxide and trioxide, silicon, antimony, and tungstic, titanic and molybdic acids were prepared in this way, but negative results were obtained with the ductile metals, copper and bismuth, and with selenium, tellurium, graphite, sulphur, violet chromium chloride, calcium fluoride, oxides of copper, iron, cobalt, and zinc, and lead dioxide. The properties of the vanadium pentoxide and trioxide sols are described in detail. A colloidal solution of vanadium pentoxide in alcohol was prepared in a similar manner, but negative results were obtained with petroleum coagulation. Starch after being ground in an agate mortar benzine and addition of the latter to the alcohosol caused swelled immediately when treated with cold water, and on further grinding, a solution was obtained which could be filtered clear and gave an intense blue colour with iodine.—A. S.

Iodine; Solubility of —— in sodium iodide solution. H. W. Gill. J. Chem., Met. and Min. Soc., S. Africa, 1913, **14**, 290—292.

By substituting sodium iodide for the potassium salt in iodometric analysis, the iodine can be recovered from waste solutions (this J., 1913, 961). The solubility of iodine in sodium iodide was found to be directly proportional to the concentration of the iodide; each 1 per cent. of iodide brings about the solution of 1 per cent. of iodine, from which it would seem that a compound $NaI_2,2H_2O$ exists in solution.—W. R. S.

Kaolin; Catalytic effect of —— on the union of hydrogen and oxygen. J. Joannis. Comptes rend., 1914, **158**, 501—504.

The presence of kaolin favours the combination of hydrogen and oxygen at temperatures from 230° C. upwards, *i.e.*, considerably below the temperature (above 350° C.) at which is can be observed in absence of kaolin. The amount of water formed appears to be proportional to the time of contact between the gases and the catalyst. The activity of the kaolin depends greatly upon the temperature at which it has previously been heated, and the extent to which it has lost its water of constitution. The lower the water content the smaller is the activity.
—W. H. P.

Oxygen and nitrogen; The Plumboxan process for the decomposition of atmospheric air into ——. G. Kassner. Arch. Pharm., 1913, **251**, 596—609. (See also this J., 1911, 621.)

Steam is passed over a mixture of an alkali metaplumbate and an alkali manganate (Plumboxan), at a temperature of 400°—500° C., when oxygen is evolved. The mixture can be regenerated by passing dry air over it at the same temperature. Under suitable conditions the absorption of oxygen is complete and pure nitrogen is obtained. The mechanism of the reaction is discussed in detail and evidence brought forward in support of the view that the evolution of oxygen is due to the alternate formation and decomposition of a perplumbate. Using 1 kilo of Plumboxan, a litre of oxygen can be obtained in 5 minutes by treatment with steam at 400° C., whilst at temperatures of 450°—500° C., the rate of production is doubled or trebled.
—F. Shdn.

Active nitrogen. E. Tiede and E. Domcke. Ber., 1914, **47**, 420—425. (See also this J., 1913, 232; 1914, 76.)

By means of a jointless glass apparatus in which commercial nitrogen (Linde) was passed over copper heated electrically to a temperature measured by a thermocouple, it was shown that the after-glow was suppressed unless the nitrogen was purposely contaminated with oxygen, provided that the temperature and pressure were such that no dissociation of copper oxide took place. On raising the temperature beyond a limit depending on the pressure, the glow was restored. The phosphorescence of sulphur, iodine, sodium, and thallium chloride, observed on heating them in nitrogen which has been subjected to the action of the electric discharge, and attributed by Strutt to the presence of active nitrogen, was similarly suppressed in the absence of oxygen.—O. E. M.

Ozone, nitrogen peroxide and hydrogen peroxide; Determination and distinction of ——, at high dilutions. J. N. Pring. Chem. News, 1914, **109**, 73—75.

Potassium iodide dissolved in its own weight of water was used as the reagent. In the case of ozone the ratio of free iodine (plus hypoiodite) to iodate (plus periodate) decreased with the total amount of ozone passed and also with the concentration of the ozone. The ratio was determined by successive titration with sodium thiosulphate in neutral and acid solution. With very dilute ozone mixtures the former products were formed exclusively and the amount of alkali produced was too small to be detected with phenolphthalein or litmus. The alkalinity test was therefore inconclusive in the case of highly diluted ozone. The iodine test failed when the dilution was greater than one part of ozone per million parts of gaseous mixture; at twice this concentration ozone still had a decided odour. Below the cryoscopic point of the reagent (—24° C.) iodate always predominated. Nitrogen peroxide differed from ozone in always yielding iodate as the main product in neutral solution. With an acid solution of the reagent in contact with atmospheric oxygen even minute quantities of nitrogen peroxide could be detected through a characteristic catalytic process, whereby iodine was continuously liberated. Very dilute gaseous mixtures of hydrogen peroxide behaved like similar mixtures of ozone; but with increasing concentration the final result was a catalytic decomposition of the peroxide:

$$KIO + H_2O_2 = KI + H_2O + O_2.$$

A solution of titanium sulphate in sulphuric acid turned yellow in presence of traces of hydrogen peroxide but was unaffected by ozone.—J. R.

Phosphorus; The modifications of ——. I. The transformations of phosphorus vapour by the silent electric discharge. V. Kohlschütter and A. Frumkin. Z. Elektrochem., 1914, 20, 110—123.

The action of the silent electric discharge on phosphorus vapour results in the formation of a layer of a homogeneous product of a high degree of dispersion. The degree of dispersion and consequently the appearance of the deposit vary considerably with the nature of the indifferent gas present in the tube, just as they do in the case of metals under somewhat similar circumstances (this J., 1912, 645). Argon and helium at 0·5 mm. pressure produce a kind of loosening of the deposit which is more marked in the case of argon than in that of helium. An excess of phosphorus vapour beyond the quantity transformed, which can be ensured by heating the tube, has also a similar effect. Argon and phosphorus vapour are absorbed by the deposit and can be expelled by subsequent heating. Hydrogen and nitrogen unite with the phosphorus vapour under the influence of the discharge, forming solid compounds. These compounds may be deposited in the layer of transformed phosphorus without affecting its homogeneous appearance under the microscope. It is only at relatively high pressures that visible quantities of different solids are formed. On heating the homogeneous deposits obtained under various conditions they are all transformed into ordinary red phosphorus, and the differences in colour caused by differences in the conditions of deposition entirely disappear. The process and the structural forms observed appear to be very similar to those observed in the case of silver (this J., 1912, 188). The original deposits are related to Hittorf's phosphorus, in the same way as mirror silver to the crystalline metal. Just as the degree of dispersion of the mirror silver decreases on heating so does that of the phosphorus, the somewhat sintered red phosphorus being formed. This is a disperse form analogous to anhydrous stannic oxide gel, and in suitable "mineralising" melts may be converted into Hittorf's crystalline phosphorus just as the stannic oxide can be converted into cassiterite.—W. H. P.

Artificial graphite; Sulphuretted hydrogen from ——. W. H. Woodcock and B. Blount. Analyst, 1914, 39, 67—69.

A sample of Acheson's massive graphite emitted hydrogen sulphide when broken or scraped. It contained 0·11 per cent. S. and 0·20 per cent. of ash consisting of:—Si 0·052, Al 0·014, Fe 0·012, Ca 0·029, and Mg 0·008 per cent. Experiments showed that hydrogen sulphide was not occluded by the material, but that the gas was derived from an unstable sulphide of the type Al_2S_3, which is decomposed by moist air, when not protected by the graphite. It was pointed out by W. J. A. Butterfield that minute traces of hydrogen sulphide could be detected by the odour with more certainty than by means of lead acetate paper as ordinarily used.—C. A. M.

Esters of chromic acid. Wienhaus. *See* XX.

Solubility of silica in hydrochloric, nitric, and sulphuric acids. Wunder and Suleimann. *See* XXIII.

Titration of ferric salts by reduction. Russo. *See* XXIII.

Analysis of nitrates, chlorates and peroxides by reduction. Russo and Sensi. *See* XXIII.

Patents.

Phosphoric acid; Method of manufacturing ——. M. M. Haff, Assignor to T. L. Willson, Ottawa, Canada. U.S. Pat. 1,084,856, Jan. 20, 1914.

A charge of phosphatic and silicious material is fused in an electric furnace, broken carbon is placed on the bath to form a conducting path of increased current density, and air is mixed with the furnace gases to re-oxidise any reduced phosphorus oxides.—O. R.

Boron nitride; Manufacture of stable ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 12,377, May 27, 1913.

Boron nitride is stabilised by heating to 2000° C. or more in an electric resistance furnace, preferably in the presence of about 20 per cent. of a boron compound, which is volatile at the temperature of treatment, the resulting atmosphere of boron compounds serving to prevent oxidation of boron nitride.—O. R.

Nitrides; Process of manufacture of ——. G. Coutagne. First Addition, dated Nov. 8, 1912, to Fr. Pat. 457,992, July 25, 1912 (this J., 1913, 1010).

When the second electrode is constituted as described in the chief patent, either by one of the agglomerated carbon rings of the furnace lining, or by a carbon bar encased in one of these rings, the arc is no longer caused to rotate rapidly but remains fixed; its point of attachment to the second electrode then either describes a circle or turns about its own axis, according as it is attached eccentrically or axially, its motion being imparted to it by the slow rotation of the furnace and being unaffected by the gaseous current.—O. R.

Chromic acid salts of the heavy metals and of the alkaline earth metals; Process for the manufacture of ——, and also of chromium colouring matter. J. Mühlbauer, Prague, Bohemia. Eng. Pat. 14,226, June 19, 1913. Under Int. Conv., June 19, 1912.

Alkaline-earth chromates are obtained by heating chromic oxide or hydroxide with alkaline-earth oxides or hydroxides to a red heat in an oxygen-containing gas under pressure; by the similar treatment of chromic oxide or hydroxide, alone or together with oxides or hydroxides of the heavy metals, intensely coloured pigments are produced.—O. R.

Hydrocyanic acid [from residues of coal-gas purification]; Process for the manufacture of ——. Fabriques de Produits Chimiques de Thann et de Mulhouse, Thann, Germany, South Metropolitan Gas Co., London, and G. Freyss, Nancy, France. Eng. Pat. 18,168, Aug. 9, 1913.

The sludge obtained by washing crude coal-gas with ferrous sulphate solution, is boiled with slaked lime until free from ammonium compounds, and the resulting calcium ferrocyanide is treated with ammonium sulphate to form a precipitate of calcium-ammonium ferrocyanide and calcium sulphate, which is filtered off, washed, and boiled with dilute sulphuric acid with the formation of pure hydrocyanic acid and ammonium ferrous ferrocyanide, the latter compound yielding calcium ferrocyanide again when boiled with lime. The reactions are represented by the equations: (1), $Ca_2Fe(CN)_6 + (NH_4)_2SO_4 = Ca(NH_4)_2,Fe(CN)_6 + CaSO_4$; (2), $2Ca(NH_4)_2Fe(CN)_6 + 3H_2SO_4 = Fe(NH_4)_2Fe(CN)_6 + 2CaSO_4 + (NH_4)_2SO_4 + 6HCN$: (3), $Fe(NH_4)_2Fe(CN)_6 + 2Ca(OH)_2 = Ca_2Fe(CN)_4 + Fe(OH)_2 + 2(NH_4)OH$.—O. R.

Common salt; Manufacture of ——. International Salt Co., Ltd., London. Eng. Pat. 22,455, Oct. 6, 1913. Under Int. Conv., July 31, 1913.

Common salt is fused in a furnace, then run continuously into a revolving system of concentric pans, disposed one below the other; as the material cools and overflows from one pan into another, it is stirred by means of a pronged device, adapted to be lowered into each of the pans as required, the granulated salt being automatically discharged from the finishing pan by means of a tubular scoop.—O. R.

Phosphorus pentachloride; Manufacture of ——. S. Peacock, Philadelphia. Pa., U.S.A. Eng. Pat. 23.023. Oct. 11, 1913.

Tri-calcium phosphate is heated with potassium chloride in an atmosphere void of oxygen, in proportions corresponding with the equation: $Ca_3P_2O_8 + 10KCl = 3CaO + 5K_2O + 2PCl_5$. To obtain a high velocity of reaction and to minimise dissociation of the pentachloride, the gaseous products of the reaction are removed by suction, a yield of 97—98 per cent. being obtained at a temperature of about 1100° C. and a pressure of about 500 mm. If desired, the phosphorus pentachloride may be treated with hot water to form phosphoric and hydrochloric acids, and caustic potash may be recovered from the solid residue of the double decomposition.—O. R.

Calcium cyanamide; Process of producing ——. Dettifoss Power Co., Ltd., and J. H. Lidholm, London. Eng. Pat. 28.524, Dec. 10, 1913. Under Int. Conv., Feb 24, 1913.

Calcium carbide is introduced continuously but gradually into a furnace chamber, which is heated to a high temperature and supplied with nitrogen; owing to the small quantity of carbide fed into the furnace at a time, the material almost instantly acquires the reaction temperature, so that the fresh carbide is constantly being heated by the heat of reaction of cyanamide in the process of formation; the block of cyanamide, when complete, is removed all at once from the reaction chamber. to which end it is collected in a separate vessel, having perforated sides and resting on the furnace bottom; the latter is removable and quickly replaceable by another furnace bottom carrying an empty collector, so that no appreciable amount of heat is lost when changing collectors.—O. R.

Lead salts of acetic acid; Manufacture of ——. A. G. Bloxam, London. From Westdeutsche Bleifarbenwerke Kalkow G.m.b.H., Offenbach a/M., Germany. Eng. Pat. 29,048, Dec. 16, 1913.

A mass of lead rests inside a cylindrical vessel upon a grating, the space between which and the bottom of the vessel contains acetic acid or normal lead acetate solution; the level of the liquid reaches to just below the grating. Compressed air is forced through the liquid and raises it in the form of foam into intimate contact with the superposed lead, with the result that the lead is rapidly oxidised and dissolved.—O. R.

Radioactive matter in thorium-containing solutions; Method of obtaining the ——. F. Glaser, Wiesbaden, Germany, Assignor to C. Glaser, Baltimore, Md. U.S. Pat. 1,084,734, Jan. 20, 1914.

Solutions containing thorium, phosphoric acid, and radioactive matter, are diluted with water and heated, whereby thorium compounds and radioactive matter are deposited in a precipitate of relatively small bulk.—O. R.

Hydrogen; Purification of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 14,509, June 23, 1913.

Hydrogen, or a gas containing it, is freed from sulphur and sulphur compounds by heating with a solution of caustic alkali under a pressure greater than 5 atmospheres. Thus, caustic soda of from 10 to 50 per cent. strength may be employed at a temperature of 150°—225° C. and a pressure of 50 atmospheres.—O. R.

Hydrogen from iron ore and steam; Reducing and oxidising apparatus for generating ——. Berlin-Anhaltische Maschinenbau-A.-G., Berlin. Eng. Pat. 28,390, Dec. 9, 1913. Under Int. Conv., Dec. 11, 1912.

A cylinder of refractory material is divided into separate shafts by means of refractory partitions, and is encased in a gas-tight, metal jacket. This subdivision of the cylinder ensures the uniform action of the reducing gases and steam on the whole charge of material in each shaft, and the temperature in the shafts can be regulated in such a manner that, whilst the whole column of ore is sufficiently heated, its partial fusion is avoided. Each shaft is provided with Morton closing devices at either end for the introduction and discharge of the iron ore. By a suitable arrangement of valve-controlled supply and discharge pipes, for reducing gases and steam, it is possible to cut out one of the shafts temporarily, so that its contents can be withdrawn and the shaft recharged, without interfering with the working of the adjoining shafts.—O. R.

Hydrogen and oxygen; Apparatus for the electrolytic production and collection of ——. E. Benker. Fr. Pat. 461,981, Aug. 29, 1913. Under Int. Conv., Sept. 7, 1912.

Hydrogen containing not more than 1 per cent. by vol. of oxygen, and oxygen containing not more than 3—4 per cent. by vol. of hydrogen, are prepared by electrolysis in an apparatus of the bell-collector type, in which the anode bell is submerged more deeply than the cathode bell, and in which the length of the cathode is about two-thirds of the length of the anode. Current leads extend to the bottom of each bell, and the relative dimensions given refer to the portions of the electrodes extending from the bottoms of the bells downwards.—O. R.

Nitrogen; Method of obtaining—and making compounds therefrom. T. L. Willson and M. M. Haff, Ottawa, Canada. U.S. Pat. 1,084,774. Jan. 20, 1914.

Sulphur is burnt in a confined body of air, and the mixture of nitrogen, sulphur dioxide, and oxygen is passed through a solution containing lime, to form a bisulphite liquor: the residual nitrogen, containing traces of oxygen, is then passed over heated sulphur, and the sulphur dioxide formed is absorbed as before.—O. R.

Bleaching and like fluids; Apparatus for preparing ——. C. A. M. Buckley, London. U.S. Pat. 1,085,718, Feb. 3, 1914.

See Eng. Pat. 18,600 of 1912; this J., 1913, 1007.—T.F.B.

Common salt; Manufacture of ——. A. W. Brown, Belfast, J. H. Webster, Carrickfergus, and A. G. Salamon, London. U.S. Pat. 1,086,020, Feb. 3, 1914.

See Eng. Pat. 17,300 of 1912; this J., 1913, 1107.—T.F.B.

Graphite; Method of purifying ——. A. Humann and F. Teisler, Dohna, Saxony. Eng. Pat. 10,547, May 5, 1913.

See Fr. Pat. 458,441 of 1913; this J., 1913, 1068.—T.F.B.

Hydrogen under pressure: Process of working with ——. C. Bosch, Assigner to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,086,130, Feb. 3, 1914.

See Eng. Pats. 29,260 of 1912 and 13,258 of 1913; this J., 1913, 1010.—T. F. B.

Hydrogen; Furnace for the manufacture of ——. A. Messerschmitt. Fr. Pat. 461,625, Aug. 4, 1913. Unde Int. Conv., Nov. 2, 1912.

See Ger. Pat. 268,062 of 1912; this J., 1914, 137.—T.F.B

Hydrogen; Apparatus for producing —— by successi oxidation and reduction of ferruginous contact masse A. Messerschmitt. Fr. Pat. 462.379, Aug. 27, 191 Under Int. Conv., Oct. 17, 1912.

See Ger. Pat. 268,339 of 1912; this J.. 1914, 137.—T.F.

Obtaining a useful by-product [ammonium nitrate or nitrite] from coal gas. Eng. Pat. 1851. *See* IIa.

VIII.—GLASS; CERAMICS.

British clays under the osmose purification process. W. R. Ormandy. Trans. Eng. Ceram. Soc., 1913—14, **13,** 35—48.

In a previous paper (see this J., 1913, 488) the osmose process as applied to various Continental clays was described. The purification of British clays is now described and illustrated. Coloured china clays may be induced to yield paper-white clays if previously green or bluish, as the impurity is here due to tourmaline or double silicates containing some iron, and either neutral or electro-positive, but it is more difficult to remove yellow or brown colouring matter due to the presence of iron phosphate and humic substances. The suitability of a china clay for the manufacture of hard porcelain depends on its contraction at 1500° C., which should be 17 per cent. English china clays show only 10—12 per cent. contraction, but after osmose treatment may give 16 per cent. A contraction of 19 per cent. is found to be accompanied by a percentage of alumina in excess of that required by theory for pure kaolinite. The colour of china clay is not essential in hard porcelain, as the iron exerts no colouring effect at the temperature employed. A new addition to the osmose plant, an electrical filter-press by which the most plastic clay can be filtered rapidly under a pressure of a few pounds, solves the topographical difficulty caused by the pits being a considerable distance from a railway station, as it can be erected close to the railway at the "dries," whither the clay has been sent through pipes as a 10 per cent. suspension. Ball and fire clays purified by the osmose process are more suitable for use in the manufacture of grey and brown paper than low-grade china clay or gypsum. The treatment of ball clays for pottery reduces their sintering temperature by 200°—300° C.; few clays in the natural state sinter below 1450° C. The peacock marl at Hanley, from which nothing but low-grade fire bricks had previously been made, is after purification now used for making sanitary ware. A yellow clay thrown out from an iron mine sintered and melted at practically the same temperature, but after treatment there was a margin of over 150° C. between the two temperatures, i.e., a margin wide enough to enable high-grade vitrified floor and roofing tiles to be made from a hitherto valueless product.
—H. H. S.

Iron; Extraction of — from potters' materials by means of magnets. H. H. Thompson. Trans. Eng. Ceram. Soc., 1913—14, **13,** 15—29.

The apparatus described consists primarily of an inclined trough having a series of electro-magnetic bars fixed laterally in the bottom, the magnet windings being housed underneath. Electro-magnets are said to be from 2·5 to 10 times as efficient as permanent magnets. The edge of each bar is magnetised along the whole of its length and width. The projections are curved like a fan facing the approach of the liquid slip which is broken against a number of vertical serrations on the curved faces. The trough is inclined at an angle of 50°, and the liquid flowing down it is throughout in actual contact with magnets, a condition which is necessary owing to the resistance offered by the slip to the passage through it of minute particles of iron. Moreover, minute particles possess only sufficient magnetic permeability to be held by a magnet when actually in contact with it; a magnet which attracted horizontally a 6-inch nail from a distance of 10 inches was able to attract a speck of iron from only 2¼ inches. In the event of the current failing a collapsible bridge is provided to prevent the iron accumulated on the magnets from being washed into the purified clay. The bridge is also used in cleaning the iron from the magnets by a hose, the current having been switched off.—H. H. S.

Magnetic pottery; A note on ——. J. W. Mellor. Trans. Eng. Ceram. Soc., 1913—14, **13,** 80—82.

Oxides of iron, practically always present in pottery materials, are converted into magnetite, the stable oxide, during firing. A photomicrograph of a bone china section is given illustrating the formation of magnetite crystals. Free metallic iron is absent from normal pottery. The magnetic qualities of clay wares are due to magnetic oxide of iron either free or dissolved in vitreous granules of ferrous silicate. Hopwood's supposition of a magnetic iron silicate (this J., 1913, 827) is regarded as unnecessary.
—H. H. S.

Fritted glazes for stoneware and fine earthenware, with special regard to leadless glazes. A. Berge. Sprechsaal, 1914, **47,** 97—101, 113—115.

The formulæ and mixings of twelve lead and ten leadless glazes which are fired at cone 010 and have all been found of commercial value are given, as illustrated in the following table. The constituents were fritted with the exception of additions in the mill of felspar, kaolin and sand.

	SiO_2	Al_2O_3	B_2O_3	K_2O	CaO	Na_2O	SrO	ZnO	MgO	BaO	PbO
Lead.											
1	3·0	0·30	0·5	0·2	0·3	—	—	—	—	—	0·5
2	2·0	0·30	0·4	0·2	0·2	0·2	—	—	—	—	0·4
3	2·4	0·25	0·3	0·1	—	0·1	0·3	—	—	—	0·5
4	2·5	0·15	0·25	0·15	—	0·3	—	0·15	—	—	0·4
5	3·0	0·30	0·3	0·2	—	0·15	—	—	0·15	—	0·6
6	2·0	0·10	0·3	—	0·2	0·4	—	—	0·2	—	0·2
7	2·3	0·25	0·25	0·2	0·1	—	—	—	0·1	—	0·6
8	2·8	0·20	0·25	0·1	—	—	—	—	0·1	0·15	0·65
9	3·2	0·30	0·35	0·15	0·1	0·15	—	0·1	—	—	0·5
10	2·5	0·20	0·4	0·2	0·1	0·15	—	—	0·15	—	0·4
11	2·0	0·25	0·4	0·2	0·3	0·1	—	—	—	0·1	0·3
12	3·0	0·23	0·3	0·1	0·1	0·05	—	0·05	0·05	—	0·65
Leadless.											
1	4·0	1 0	2·0	—	—	1·0	—	—	—	—	
2	2·8	0·25	0·3	0·5	0·5	—	—	—	—	—	
3	3·0	0·3	0·7	0·5	0·25	0·35	—	—	—	—	
4	2·2	0·2	0·6	0·2	0·2	0·3	—	—	—	0·3	
5	2·0	0·2	0·5	0·2	—	0·25	—	—	0·1	0·45	
6	2·5	0·2	0·6	0·2	—	0·3	0·3	—	—	0·2	
7	3·0	0·3	0·46	0·3	0·27	0·23	0·3	—	—	—	
8	2·3	0·15	0·54	0·3	—	0·35	—	0·15	0·2	—	
9	3·2	0·1	0·6	0·1	0·2	0·3	0·2	—	0·2	—	
10	3·0	0·2	0·5	0·2	0·15	0·25	0·3	—	—	0·10	

The different behaviour of stains in different glazes is shown by the pink of composition: $1{\cdot}8\ SiO_2$, $0{\cdot}05\ Cr_2O_3$, $0{\cdot}95$ CaO, $0{\cdot}05\ K_2O$, which developed well under glaze 11 of the lead series but was quickly decomposed by glaze 4.—H. H. S.

Clays; The causes of plasticity, binding power, shrinkage and absorption of ——. P. Rohland. Sprechsaal, 1914, **47**, 129—130.

In reply to Keppeler's statement (see this J., 1913, 827) that plasticity depends on clay-substance, the author recounts his colloid theory (see J., 1909, 1250). So-called "zinc clays" produced by the action of hot water containing silicic acid on zinc blende, and of the composition ZnO 74·1, SiO_2 35·4, Al_2O_3 1·6, Na_2O 1·8, loss on ignition 8·0 per cent., are strongly plastic though devoid of "clay substance," but rich in colloids. The presence of colloids in clay explains its other properties, binding power, shrinkage and absorption of dyes.—H. H. S.

Crazing of lead glazes on earthenware bodies. J. A. Callcott. Trans. Eng. Ceram. Soc., 1913—14, **13**, 49—60.

Crazing may be caused by excess of some constituent in the glaze or body, by application of the glaze to too porous a body, or by incorrect firing. It is due generally to excess of soda in the glaze or of china clay in the body. Lime may be substituted for soda if opacity and dullness do not follow, a consequence which is avoided by rapid cooling through the temperature range, 1000°—500° C., in which crystallisation is most likely to take place. Cornish stone is also a useful substitute for soda. China clay in the body may be replaced by Cornish stone or flint or, if colour be no object, by ball clay. Substitution of buff for purple Cornish stone in the body may be a cause of crazing. The function of flint is to alter the coefficient of expansion and to promote chemical combination between clay and fluxes. Vitreous bodies, usually deficient in flint, are especially liable to exhibit crazing. If the mixings are unaltered, a higher temperature or more prolonged firing is required.—H. H. S.

Nickel in glaze colours. H. Wicks and J. W. Mellor. Trans. Eng. Ceram. Soc., 1913—14, **13**, 61—66.

Nickel oxide imparts a variety of tints in blue, green, yellow and brown, varying according to the composition of the glaze, but which in general can be better produced without the aid of nickel. Increase of alumina in the glaze formulæ renders the colour more stable with a wider margin of safety in firing. Silica and boric acid deepen the tint and augment the solubility of the oxide. The influence of the alkali, alkaline earth and magnesium-zinc groups of metals is in harmony with the respective positions of the individual elements in the periodic table. With the alkalis, nickel yields a brown tint which deepens in passing from lithium to potassium. The alkaline earths also cause deepening of brown from calcium to barium. Beryllium gives yellowish-brown, magnesium green and zinc blue. When used as underglaze, nickel colours are attacked by lead glazes forming the common brown of nickel-lead silicate, which bears a similar relation to nickel-zinc blue that violet cobalt silicate bears to Thenard's blue and Rinmann's green. The molecular formulæ used for the glazes in these experiments was PbO, $0{\cdot}15\ Al_2O_3$, $1{\cdot}75\ SiO_2$, the lead being replaced by another oxide to the extent of 0·3 equivalent and 2 per cent. of nickel oxide being added.—H. H. S.

Nickel underglaze colours. T. Perry. Trans. Eng. Ceram. Soc., 1913–14, **13**, 67—69.

Underglaze colouring agents were prepared by firing powdered mixtures of nickel oxide with various non-colouring acid and basic oxides in the first ring of a tile-biscuit oven, each of the stains thus produced being subsequently used under each of the glazes of general formula: 0·3 PbO, $0{\cdot}3\ Na_2O$, 0·4 RO, $0{\cdot}25\ Al_2O_3$, $2{\cdot}95\ SiO_2$, $0{\cdot}25\ B_2O_3$, where R in turn represented the alkali and alkaline earth metals and zinc, cadmium, lead and bismuth. Nickel oxide formed with basic oxides, alone or with silica, powders varying in colour from pale brown to dark olive green. Magnesia, however, produced a strong yellow green (NiO : MgO), and, with stannic oxide added, a brilliant light green. Zinc with silica and nickel oxide gave a dark blue powder. Whatever the basic oxide present, the introduction of alumina induced a light matt-blue. Titania and nickel oxide, with or without other basic oxides, produced yellow. Stannic and zirconium oxides gave buff or brownish colours. The behaviour of these stains when fired under glazes varied considerably. Colours made from nickel and another basic oxide gave straw browns. The higher the firing temperature and the more energetic the flux, the darker was the brown colour produced. Addition of silica to the powders lightened the colours and imparted a greenish tinge. Blues produced by addition of alumina were very unstable under the action of glazes. The zinc-silica dark blue was also unstable under glaze. A high content of zinc in the glaze tended to preserve the alumina and zinc blue stains, but as soon as action began the colour changed to grey and then brown. Magnesia greens were also readily destroyed. Titania yellows were fairly stable both as regards firing temperature and difference in glaze composition. The most stable colours were those produced by stannic and zirconium oxides. In all glazes of the earthenware type nickel tended to give a brown colouration and was only safe for underglaze use when brown tints were desired.—H. H. S.

Glazes; Behaviour of some —— in the glost oven (II.): Damp and dry spots. J. W. Mellor. Trans. Eng. Ceram. Soc., 1913–14, **13**, 30—34. (See this J., 1913, 488.)

Loss in manufacture occurs when the glaze accumulates on some parts of the ware and recedes from others, leaving patches. The fault is said to be more common in heavily fritted or leadless glazes, and more liable on overfired and vitreous ware than on more porous bodies. It is also seen on some underglaze colours such as matt blue and chrome-tin pinks. The fault may be due to the biscuit, the underglaze colour or the glaze. In the first instance, adherence of the unfired glaze to the body is prevented by damp patches, greasy or oily patches, accumulations of dust on the biscuit, or overfiring of the biscuit. Underglaze colours if overground produce the same effect as dust on the biscuit. They may be defective also in their composition, having too much or too little flux to hold the softening glaze; or they may be correct in composition but overfired in the hardening-on kiln. When the glaze itself is at fault, the cause is over-grinding, too much frit, or thick dipping, or excess of raw clay making the glaze too hard. The general causes of the defect are stated to be that the adhesive power of the softening glaze which holds it to the body is so equally balanced against the cohesive force which gives all glazes a tendency to crawl from free edges and roll into beads, that a slight disturbance, local or otherwise, may cause the glaze to leave the body in patches; and that the absorption of the glaze at local spots may produce patches more thinly dipped than the remainder. The latter modification does not show such thickened edges surrounding a bare patch as the former cause.—H. H. S.

PATENTS.

Refractory vitreous substances, such as quartz-glass, and the like; Manufacture of ——. H. J. S. Sand, Nottingham. Eng. Pat. 15,629, July 7, 1913.

In the manufacture of vitreous substances, which cannot be converted into mobile liquids by heat, the inclusion o air bubbles, dust, and the like is avoided by placing th refractory, vitreous material inside an envelope of suitabl shape, and preferably of the same material as that to b manufactured. The envelope is then exhausted, heated and collapsed on to the enclosed substance, which is thereb heated and converted into the required product.—O. R

Brick and similar kilns. J. C. Blythe, Birtley, Durham. Eng. Pat. 6895, Mar. 20, 1913.

In a kiln of the oven type, a fire-box, having a perforated roof and solid walls, is situated immediately below a combustion chamber, through which the products of combustion pass before entering the kiln; the perforated roof of the fire-box forms part of a partition of spaced bricks, which separates the fire-box from the combustion chamber, the walls of the latter being also in the form of spaced bricks, allowing free access to the kiln. Means are provided for supplying air and steam under pressure to the fire-box, to induce a forced draught, which ensures thorough combustion and admits of the employment of low-grade fuel.—O. R.

Kiln; Continuous —— for burning clay-ware. L. N. Legg, Calhoun, Ga. U.S. Pat. 1,085,448, Jan. 27, 1914.

A continuous down-draught kiln comprising a number of compartments arranged in a row, each having openings in both end walls for the introduction and removal of ware. Adjacent to the side walls of each compartment are combustion chambers, with fire-boxes in the end walls. Flues are arranged so that a suitable draught is maintained, the air from each compartment being supplied to the combustion chambers of the next compartment of the series, and the collection flue of the last compartment being in communication with the combustion chambers of the first compartment.—T. St.

Ceramic products; Process for avoiding efflorescence in the manufacture of ——. Soc. de Produits Céramiques de Massy. First Addition, dated Sept. 24, 1912, to Fr. Pat. 446,875, Oct. 13, 1911 (this J., 1913, 143).

The soluble metallic salts, especially chlorides and sulphates of iron or the like, added, according to the chief patent, to prevent efflorescence, may also be added for the purpose of colouring any ceramic products, such as biscuit ware, porcelain, fayence, terra-cotta, glazes, and enamels. —O. R.

White enamel; Process of producing ——. E. Heilmann, Güstrow, Germany. Eng. Pat. 26,498, Nov. 18, 1912. Under Int. Conv., Nov. 23, 1911.

As a clouding agent for white enamels, use is made of a mixture of magnesia or zinc oxide with alumina, previously calcined to temperatures sufficiently high to form a spinel, or instead of these a solid solution of magnesium spinel in magnesia or alumina, or of zinc spinel in zinc oxide or aluminia may be used. These mixtures or solid solutions may be admixed with white refractory materials, such as silicic acid, tin oxide, zirconium oxide or titanic acid, the ingredients being calcined at a high temperature after mixing.—W. C. H.

Vitreous substance. F. Wolf-Burckhardt, Biebrich, and W. Borchers, Aachen, Assignors to Zirkonglas Ges. m. b. H., Frankfort, Germany. U.S. Pat. 1,086,113, Feb. 3, 1914.

See Fr. Pat. 432,786 of 1911; this J., 1912, 130.—T. F. B.

IX.—BUILDING MATERIALS.

Firebricks; Action of flue dust on ——. J. W. Mellor. Trans. Eng. Ceram. Soc., 1913-14, **13**, 12—14.

A muffle built of good refractory material and heated by gas from a producer immediately below was stopped by the choking of the flues leading from the producer with a fusible ferruginous slag. Analysis of the slag showed it to consist of 95—99 per cent. of fuel ash from the producer mixed with a very small amount of the refractory material which it had attacked in the muffle or in the flues. The fuel ash contained 28 per cent. of iron oxide and the results show that ordinary fireclays are very sensitive to the presence of admixed iron compounds under reducing conditions which were here caused by the 10 per cent. of carbonaceous matter in the ash. The stream of producer gas would bring flue dust, probably fused beforehand, into contact with the muffle whereby a skin would be formed and chemical interaction would take place. Ultimately the glaze produced would begin to trickle down, carrying with it in solution some of the refractory material. A silica muffle would not overcome the difficulty; the natural remedy is to use a fuel with less fusible ash and to clean the producer gas free from dust before it reaches the muffle.—H. H. S.

Asphaltum penetrometer; A new electrically controlled and timed ——. Effect on penetrations of variations in standard needles. H. W. Mahr. J. Ind. Eng. Chem., 1914, **6**, 133—136.

The essential part of the new penetrometer consists of an electro-magnetic clutch timed and controlled by a Sieman's intermediate relay with time-limit, by which the penetrometer circuit is broken and automatically made at the end of five seconds. The brass-clad steel rod which holds the needle and can be weighted to the desired extent, moves up and down through openings in two thin German silver plates, and is partly enclosed by the concave poles of the electro-magnet. The rod is held by the electromagnet whilst the needle is being set on the surface of the asphaltum, then the circuit is broken by pressing a button. The depth of penetration is measured by means of a rack and pinion connected with an adjustable hand on a dial. The results obtained with the apparatus are accurate and concordant, and the personal error is entirely avoided. Comparative tests showed that errors due to variations in standard needles are negligible. (See also this J., 1909, 710.)—A. S.

Patents.

Acid-, fire-, and water-proof elastic material, and a process for the manufacture thereof. N. Magelssen, Christiania, Norway. Eng. Pat. 1703, Jan. 21, 1913.

The composition consists of a mixture of water-glass, containing an excess preferably of both sodium and potassium hydroxides, equivalent to at least 6 per cent. by weight of the water-glass, and filling materials, such as chalk or asbestos, to which an acid, or substance having an acid reaction, or a salt is added. The salts suggested are sulphates of iron, zinc or aluminium.—W. C. H.

Artificial stone, concrete and the like and materials therefor. R. Ettling, Swanscomb, and W. Chappell, Gravesend. Eng. Pat. 6697, March 18, 1913.

From 1 to 4 oz. of chrome alum mixed with ¼ to 1 oz. of "common soda" or sulphate of iron are dissolved in each gallon of water that is mixed with the aggregate, or the unmatured concrete or artificial stone may have applied to its surface, or be soaked in, a solution of chrome alum and common soda in water in the above proportions. —W. C. H.

Artificial stone, etc.; Process for treating ——. C. H. Seaman, Assignor to O. H. Foerster, Milwaukee, Wis. U.S. Pat. 1,085,227, Jan. 27, 1914.

A solution of 2 oz. of stearic acid in about 1 quart of alcohol is applied to the surface of stone-like bodies in order to render the latter non-porous, and to remove moisture.—T. St.

Mortar; Process and apparatus for the manufacture of dry, portable ——. J. Joachim. Fr. Pat. 461,129, Aug. 5, 1913. Under Int. Conv., Aug. 6, 1912, and May 14, 1913.

Sand and lime, suitably moistened, are passed through a rotating drum, divided into communicating compartments. The heat evolved by the hydration of the lime serves to heat fresh charges of raw material, and the mixture is crushed in the third and successive compartments by means of wooden balls, which travel with the material into the final compartment. The wall of the latter is perforated, and the mortar mixture passes through the perforations whilst the wooden balls, together with the coarse material, are retained; the balls, after being heated if necessary, are returned and used again. The mortar passes from the drum into a silo, where it is allowed to mature, and is afterwards prepared for transport by subjecting it to trituration in a conical grinding mill, inside which a sprinkling appliance admits the final quantities of water required. In a modified form of the apparatus, a number of rotating drums are mounted one inside the other, the combination being sealed from the air except as regards the inlet to the first drum and the outlet from the last. In this case the first drum, usually the central one, acts as a preliminary slaker and mixer, a portion only of the sand and water being admitted to it, and the remainder added in the second and succeeding drums.—O. R.

Quicklime; Process for the manufacture of —— in blocks. L. Negro and F. Neumerkel. Fr. Pat. 461,359, Aug. 13, 1913. Under Int. Conv., April 15, 1913.

Quicklime in lump form is cooled, pressed to the desired shape at 800—1000 atmospheres pressure, and allowed to expand freely immediately after compression has taken place, when the block becomes mechanically strong and durable. Powdered quicklime must first undergo a preliminary, moderate compression, the resulting block being reduced to pieces of appropriate size, and these fragments then treated like the first-mentioned material in lump form.—O. R.

Dyeing [and impregnating] materials which are difficult to dye completely. Ger. Pat. 266,708. *See* VI.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Zinc industry of Upper Silesia. Board of Trade J., Feb. 12, 1914. [T.R.]

According to the "Börsen Zeitung" (Berlin) of 28th January, the production of raw zinc in Upper Silesia last year amounted to approximately the same as in 1912, which latter year's production showed an increase of 11·2 per cent. over 1911. For years the industry had been greatly retarded through manufacturers being able to dispose of their production of sulphuric acid only at considerable loss, on account of the abnormally high railway tariff on this commodity. The efforts which have been made during the past twelve months to lower the tariff on sulphuric acid have, however, been partially successful, which is all the more significant, inasmuch as the production of sulphuric acid in Upper Silesia is increasing rapidly from year to year, and with it the heavy demands which had resulted from the requirements of the blende-smelting trade. In 1900 the production of sulphuric acid per ton of raw zinc amounted only to 0·08 metric ton; in 1905 it had increased ten-fold to 0·85 metric ton, and last year it still further increased to 1·34 metric tons. The production of sheet zinc increased by about 5487 metric tons, or about 9·7 per cent. As far as prices were concerned the year was quite satisfactory, as the average value of a ton of raw zinc increased by 8·6 per cent., and of sheet zinc by 9·2 per cent.

Iron ore; Electric smelting of —— in Canada. T. R. Loudon. Appl. Sci. (Toronto), 1914, **8**, 219—223.

In the furnace used by the Moffat-Irving Steel Co., Toronto, a continuous shower of ore (fine magnetite) and limestone is passed from the upper stack, through the reduction chamber—wherein the ore is partly reduced by carbon monoxide—to the crucible in which the reduction is completed by means of finely powdered coke introduced at the top of the crucible arch. The furnace, of 300 kilowatt capacity and operated on three-phase current, has three electrodes arranged at equal intervals around the crucible, and dipping into the latter at about 60° to the horizontal. The electrodes are of 5⅛ in. graphite, water-cooled, and regulated by hand; the voltage employed ranges from 56 to 84. The steel produced in eight experimental smeltings contained 0·12—0·35 per cent. C and gave a percentage elongation (on 2 in.) of 10—17·5 before and 20—35 after, heat treatment.—W. E. F. P.

Rail steels for electric railways. Experiments on the Metropolitan Railway. W. Willcox. Inst. Civil Eng. Times Eng. Suppl., Feb. 25, 1914.

The results of some tests made to determine the most suitable rail to withstand the heavy wear of electric railway rolling stock, were given. For the last seven years high-silicon steel has been used and has proved more durable and considerably less liable to rusting than ordinary steel. It is made from basic open-hearth, basic Bessemer or acid Bessemer steels by the Sandberg process, in which during manufacture the whole of the silicon is extracted and a known quantity added. The rails are 45 ft. long and weigh 86 lb. per yard. The results as regards life were:—High-silicon basic open-hearth, over 23 months; high-silicon acid Bessemer, first lot of rails in the down road, 11 months, second lot of rails just over 15 months, and on the up road just over 15 months: basic open-hearth titanium, 9⅓ months; and ordinary basic open-hearth, 9⅓ months on the down road, and barely 11 months average on the up road. Silicon steel is specially suitable in tunnels, on account of its comparative freedom from rusting as compared with ordinary steel; moreover the price is not more than 10s. per ton in excess of the price of ordinary steel, whereas nickel-steel, chrome-steel, etc., cost much more. A test was made of rolled manganese-steel rails, containing C 1·20, Si 0·30, S 0·03, P 0·06, and Mn 12·00 per cent. Two pairs of 95 lb. rolled manganese rails of British standard section were placed near Moorgate Street on a 15-chain curve. After being there nine months, they were put in the curve between Farringdon Street and Aldersgate Street, on the down road just outside the tunnel part of the curve. The original weights when put in the road near Moorgate-street were No. 1 high rail, 1,425 lb.; No. 1 low rail, 1,427 lb.; No. 2 high rail, 1,428 lb.; and No. 2 low rail, 1,400 lb. When put in the curve at Farringdon Street on January 6, 1912, No. 1 high rail had lost 22 lb. in weight, No. 1 low rail 1 lb., No. 2 high rail 14 lb., and No. 2 low rail 17 lb. This gives an average loss of about 1·56 lb. per yard per annum. Weighed again on October 11, 1913, the weights were No. 1 high rail, 1,333 lb., No. 1 low rail, 1,393 lb., No. 2 high rail, 1,375 lb., and No. 2 low rail, 1,365 lb. The total loss in weight, therefore, is No. 1 high rail, 92 lb., No. 1 low rail, 34 lb., No. 2 high rail, 53 lb., and No. 2 low rail 35 lb., equal to an average of 1·43 lb. per yard per annum. After a period of two years and six months these rails, although wearing away, are wearing evenly, and show n signs of battering, as even the hardest of the other rail tested, did.

Nickel-chromium steels; Transformation points and struc ture of ——. L. Guillet. Comptes rend., 1914, 15 412—414.

The effect of chromium in lowering the transformatio temperature on cooling of a steel with a fixed percentage nickel is not proportional to the amount of chromiu present; beyond 3 to 5 per cent. (according to the nick content) the effect becomes more or less constant. Ste containing nickel and chromium divide themselves rough into three main classes. In the first the transformati on heating is not greatly different from that on coolin Such steels have usually a pearlitic structure. In t second class are those of martensitic structure, in which the chromium increases there is an increasing differer between the two points. In steels of the third class, containing carbides, the chromium is not all dissolved and its effect does not increase as more is added. The first class disappears when the amount of nickel present is sufficient in itself to produce a considerable difference in the transformation temperatures. The carbide steels are relatively very resistant to ammonia and nitric acid. The martensitic steels are produced when the transformation point on cooling falls to about 350° C.—W. H. P.

High-speed tool-steel ; The analysis of ——. F. Fettweis. Stahl u. Eisen, 1914, **34**, 274—275.

In the estimation of tungsten, chromium, molybdenum and vanadium, when these metals occur together in steel, *Vanadium* does not interfere with the usual volumetric chromium method, if the titration be carried out at 35° C., since at this temperature the vanadium is oxidised quickly and the chromium is not oxidised. In the estimation of vanadium, the greater part of the iron is first removed by ether, and the remainder, together with chromium, etc., by means of sodium hydroxide. Before the latter precipitation it is desirable to evaporate to dryness with sulphuric acid, dissolve in water, add hydrogen peroxide, and again evaporate to fuming. Loss of vanadium in the precipitation is thus avoided. *Molybdenum* is separated from vanadium, after removal of the iron by sodium hydroxide, by precipitation with hydrogen sulphide. Molybdenum does not interfere with the ordinary volumetric determinations of chromium and vanadium. *Cobalt* is best estimated electrolytically.—T. St.

Copper ; Influence of movement on the solution of —— *in nitric acid.* M. Drapier. Comptes rend., 1914, **158**, 338—340.

Copper dissolves rapidly in nitric acid when allowed to remain at rest, but the rate of solution diminishes and ceases almost entirely when the metal is kept moving, or the acid agitated. This is not due to local elevation of temperature, for a copper tube through which a current of cold water is passed, dissolves rapidly in nitric acid, but rather to the fact that agitation of the acid removes reduction products (nitrous acid) away from the metal. Nitric acid to which sodium nitrite has been added dissolves copper as rapidly when in movement as when at rest. If two copper electrodes be immersed in nitric acid, there is a difference of potential of 0·1 volt when one electrode is stationary and the other is rotated rapidly. (See also Stansbie, this J., 1913, 1135.)—W. P. S.

Titanium ; The influence of —— *on copper and some of its commercially important alloys.* F. O. Bensel. Metall u. Erz., 1914, **11**, 10—20, 46—60.

By electrolysis of copper-titanium fluoride in a bath of fused fluorspar an alloy containing : Cu 83·70, Ti 3·15, Ca 9·51, and Pb 1·79 per cent. was obtained, whilst by electrolysis of a mixture of titanic oxide and copper fluoride under similar conditions an alloy containing : Cu 58·67, Ti 26·51, Ca 11·74 per cent. was deposited. The electrolysis of cuprous chloride and calcium chloride in a bath of fluorspar and calcium chloride yielded an alloy containing Cu 70, and Ca 23 per cent. The reduction of titanic oxide by carbon in presence of cuprous sulphide always gave a product with over 5 per cent. S. The alumino-thermite treatment of mixtures of copper oxide and titanic oxide yielded always alloys containing 5 per cent. and upwards of aluminium. Nickel-titanium alloys with traces only of aluminium and manganese-titanium alloys with 5 to 6 per cent. Al were also prepared by the thermit reaction. These alloys were used to introduce small percentages of titanium into copper, copper-tin, copper-manganese, and copper-nickel. With the first three of these considerable loss of titanium always took place and the fluid alloys became very thick, so that a maximum titanium content of only 1 per cent. was obtained. Microscopic examination showed that with more than about 0·4 per cent. Ti, this latter separated as slag-like inclusions. The titanium had an injurious effect on the mechanical properties, but somewhat increased the resistance to the action of dilute solutions of nitric acid and sodium chloride at nearly 100° C. With copper-nickel up to 5 per cent. Ti was introduced : the tensile strength with 2 per cent. Ti was almost doubled, the elongation being diminished to about 6 per cent. This alloy (Cu 88, Ni 10, Ti 2 per cent.) might find technical application. The introduction of titanium into copper-nickel caused a slight diminution in the resistance to corrosion.—T. St.

Nickel-copper-gold alloys ; Ternary ——. P. De Cesaris. Gaz. chim. ital., 1914, **44**, I., 27—35.

Of the three pairs of metals of which the ternary alloys are composed, copper forms a continuous series of solid solutions with nickel and with gold, but nickel and gold are only partially miscible in the solid state, the two saturated solid solutions containing respectively 8 and 80 per cent. Ni. Fifty-six ternary alloys were studied by the method of thermal analysis and isotherms at intervals of 25° C., representing the temperature of initial solidification, are plotted in a triangular diagram. In order to fix approximately the region of limited miscibility in the ternary system (equilibrium was not attained in the thermal experiments), a series of the alloys was examined micrographically before and after annealing at 820° C. Of the alloys represented in the following table, Nos. 16, 22, 27, 31 and 48 belonged to the region of limited miscibility, whilst the others were outside this region : No. 48 was close to the border line between the two regions :—

No.	Ni	Cu	Au	No.	Ni.	Cu	Au
	%	%	%		%	%	%
2	10	20	70	31	60	10	30
10	20	20	60	42	10	25	65
16	30	10	60	45	15	15	70
17	30	20	50	46	15	20	65
22	40	10	50	48	20	15	65
23	40	20	40	52	5	5	90
27	50	10	40	56	7·5	7·5	85
28	50	20	30				

—A. S.

Nickel arsenide ; Temiskamite, a new —— *from Ontario.* T. L. Walker. Amer. J. Sci., 1914, **37**, 170—172.

Temiskamite has a composition, apart from small proportions of isomorphous elements, corresponding to Ni_4As_3. The mineral occurs in calcite veins carrying niccolite and smaller amounts of native bismuth and silver. It is silver-white with a touch of red, tarnishing very quickly to madder grey. Hardness, 5·5 ; sp. gr., 7·901 ; fusibility, 2 ; lustre, metallic ; it is opaque and non-magnetic, and gives a brownish black streak.—T. St.

Cobalt ; Preparation of metallic —— *by reduction of the oxide, and preliminary experiments on cobalt and its alloys.* H. T. Kalmus. Report to Canadian Dept. Mines. J. Ind. Eng. Chem., 1914, **6**, 107—115. Trans. Canadian Min. Inst., 1913, **16**, 255—270.

Black cobalt oxide, Co_3O_4, is now produced on a fairly large scale in Canada. A sample contained Co 70·36, Ni 1·12, Fe 0·82, S 0·45 per cent. It was purified by precipitating a hydrochloric acid solution with marble to remove iron and arsenic ; fractionally precipitating a chloride solution with bleaching powder whereby practically all the cobalt was precipitated as hydroxide before any nickel ; and boiling with sodium carbonate and with hydrochloric acid to remove sulphur. A sample of the purified oxide contained : Co 71·99, Ni 0·04, Fe 0·11, S 0·02 per cent. For the production of moderate quantities of pure cobalt free from carbon, reduction with hydrogen proved satisfactory ; the rate of reduction increased rapidly between 700° and 1100° C. Reduction was effected more rapidly by carbon monoxide than by hydrogen, over 90 per cent. of the oxide being reduced in a few minutes between 500° and 750° C., whilst complete reduction was rapidly attained at 900° C. Between 350° and 450° C. finely divided cobalt decomposed carbon monoxide with liberation of carbon. Metallic cobalt prepared by the alumino-thermite reaction was free from carbon and frequently contained less than 1 per cent. Al. The cheapest method of reduction was by heating with powdered carbon for $1\frac{1}{2}$ hours at 900°—1200° C.; the metal contained 0·2—0·3 per cent. C.; powdered charcoal and lampblack gave somewhat better results than anthracite coal, and the rate of reduction was increased by briquetting the charges. In an electric furnace not specially designed for the purpose, 15 lb. of cobalt were produced in 1 hour with a consumption of 20 kilowatts. Metallic cobalt method at 1497° C. (2727° F.). When cast it had a marked tendency to occlude gases, but sound castings were obtained by adding a few tenths per cent. Mn. and heating at a little above the melting point for ½ hour before teeming. Cast cobalt was about as hard as wrought iron; tensile strength 61,000 lb. per sq. in., compressive strength 158,000 lb. per sq. in. Cobalt could be deposited electrolytically in a similar manner to nickel and gave somewhat tougher deposits. A brief account of some alloys of cobalt with other metals is given (see this J., 1910, 1253; 1911, 1318; 1913, 28; 1914, 203). An alloy containing: Co 45, Cr 15, and W 40 per cent. would drill glass dry and one containing Co 60, Cr 15, W 25 was equal to the best self-hardening tool steel. A cobalt bronze: Cu 66·66, Sn 12·13, Co 15·15, Cr 3·03, Al 3·03 per cent could be readily cast and turned; it was somewhat harder but of slightly lower tensile and compressive strength than the corresponding nickel alloy. Other possible applications of cobalt, which are still being investigated, are the production of non-corrosive Co-Sn and Co-Cu-Sn alloys, magnetic Co-Fe alloys, and the use of cobalt and cobalt oxide instead of nickel and nickel oxide in Edison storage cells.—A. S.

Tin ores and concentrates; The assay of ——. The Pearce-Low method. E. A. Wraight and P. L. Teed. Inst. Min. and Met., Feb. 19, 1914. [Advance proof.]

A series of tests in which various minerals were added to tin ores and concentrates of known tin content, and the mixtures then assayed for tin by the Pearce-Low method (Low, "Techn. Methods of Ore Analysis," Third Ed., 1908, p. 208) proved that the method is very accurate except when compounds of titanium, tungsten, or bismuth are present. The modification proposed when titanium is present, is to fuse the ore with potassium bisulphate, and treat the melt with dilute sulphuric acid, when all the titanium goes into solution, and the residue, containing all the tin, is fused with sodium peroxide in the usual way. Tungsten, if present with titanium, can be completely removed by treating the residue from the titanium solution with ammonium carbonate. Ores containing tungsten may also be digested, after finely powdering, with sodium hydroxide solution, when all the tungsten goes into solution. When tin ores contain bismuth, the bismuth is precipitated by the nickel. As the precipitate consumes iodine, it must be removed by filtration, and the solution again reduced before titration. In general, in carrying out the Pearce-Low assay, the authors recommend grinding the sample to 100-mesh at least; fusion in nickel crucibles, and reduction with nickel; the temperature of the solution at titration to be below 70° F. (21° C.); avoidance of large amounts of cuprous chloride and ferrous chloride; the bulk of the solution before reduction to be 400 c.c., containing 125 c.c. of hydrochloric acid.
—T. St.

Tin ores; The assay of ——. H. W. Hutchin. Inst. Min. and Met., Feb. 19, 1914. [Advance proof.]

Experiments in which tin ores and tailings were heated under various conditions with zinc oxide, lime, etc., showed that by heating with lime for 15 to 20 minutes over a large Teclu burner, it is possible to convert the whole of the tin into calcium stannate, which can then be dissolved in hydrochloric acid, and the tin estimated volumetrically in the usual way. The new process is a modification of the "Beranger" method.—T. St.

Antimony and arsenic; Determination of —— in lead-antimony alloys and anti-friction metals. L. Bertiaux. Ann. Chim. analyt., 1914, **19**, 49—51.

From 1 to 10 grms. of the metal are heated with 20—60 c.c. of sulphuric acid until any precipitated sulphur has redissolved and sulphur dioxide has been completely expelled, the solution is diluted with its own volume of water, and arsenic and antimony determined together by titrating the boiling solution with permanganate (the iron factor of the permanganate multiplied by 1·0714 gives the equivalent amount of antimony and arsenic in terms of antimony). Another portion of the metal is heated with ferrous sulphate and hydrochloric acid, and arsenic determined in the distillate with iodine solution as usual. If much iron be present, it must be determined separately and deducted from the antimony-arsenic result. Tin, bismuth, and zinc do not interfere with the determination, nor does copper unless present in such quantity that its colour affects the end point in the permanganate titration.—W. P. S.

Vanadium ores and their treatment. H. Manz. Metall u. Erz, 1913, **10**, 379—384. (See also this J., 1913, 90.)

The occurrence and composition of the chief vanadium ores, and statistics relating to production and value are given. Almost all extraction methods aim at the production of an alkali vanadate solution, from which either vanadium pentoxide or iron vanadate is obtained. Ferro-vanadium is produced either by reduction with carbon in the electric furnace, or by the alumino-thermit process. The former method has the disadvantage of yielding a product with from 1·5 to 6·0 per cent. C. The thermite process is carried out in sheet-iron vessels lined with magnesite. A mixture of vanadium pentoxide, hammer-scale and aluminium, sometimes with addition of iron turnings, is introduced in successive portions, a mass weighing about 35 kilos., and containing 30 to 40 per cent. V being thus obtainable in a single operation. The most useful commercial alloy contains about 30 per cent. V. It is hard, but not brittle, and is difficult to pulverise; sp. gr. 7·34, m. pt. 1340° to 1400° C.—T. St.

Tungsten and carbon. O. Ruff and R. Wunsch. Z. anorg. Chem., 1914, **85**, 292—328.

The melting points of tungsten-carbon alloys in a furnace with a reducing atmosphere (carbon monoxide) depend very greatly on the rate of heating and on the composition of the furnace gases. An outer layer rich in carbon is formed which has a high melting point, so that fusion takes place from within outwards. The rate of heating has thus a twofold effect on the temperature of visible fusion; it affects the degree of carbonisation of the outer layer and also the rate at which the carbon can diffuse to the interior. The carbides found by the authors were W_3C (m. pt. over 2700° C.), WC (decomposes on melting), and the metallographic observations suggested a third component, probably W_2C. Three eutectics were observed, composed of tungsten and WC (1·4 per cent. C., m. pt. 2690° C.), W_3C, WC, and another unidentified carbide (2·4 per cent. C, m. pt. 2660° C., probably metastable), and WC and probably W_2C (3·5 per cent. C, m. pt. 2580° C.)
—W. H. P.

Tungsten-thorium, a ductile alloy. L. v. Grotthuss. Metall u. Erz, 1913, **10**, 844.

One hundred grms. of purified tungstic oxide were mixed with a solution in absolute alcohol of 1·05 grm. of thorium chloride, and the alcohol evaporated with constant stirring. The mixture was dried at 100° C., heated in a rapid stream of hydrogen for $1\frac{1}{2}$ hours over a luminous gas flame, and then for half an hour over the blow-pipe (about 900° C.). The black amorphous powder thus obtained was formed into small U-shaped rods with an organic binding material, and heated in a stream of hydrogen at about 1100° C., the rods changing to gray-black, but still remaining non-metallic. They were then placed in an exhausted vessel, and heated to incandescence by a current of 5 to 7 amps. at 250 volts, ammonia being admitted at the same time. The resulting thin threads had a metallic lustre and were ductile. On increasing the thorium content to more than 1 per cent., the ductility disappeared.—T. St.

Uranium, radium, and vanadium ; A preliminary report on ——. R. B. Moore and K. L. Kithil. U.S. Dept. of the Interior, Bureau of Mines. Bull. 70, 1913. 97 pages.

A summary of available information regarding the sources of these metals, the methods used in treating the ores, and the uses of the finished products.

Carnotite deposits. These are the most important radium-bearing deposits known, and occur in the arid regions of Colorado west of the Rocky Mountains and E. Utah. The yellow carnotite (uranyl potassium vanadate, probably $K_2O,2UO_3,V_2O_5,3H_2O$; sp. gr. 4·136) is found mostly in massive white sandstone underlying the red Dakota conglomerate (lower Cretaceous) as an incrustation on the faces of joints and fractures and is deposited around and between the individual grains of the sandstone ; small cylindrical pockets of richer ore are found in places, while red calcium vanadate is occasionally met with as well as black radio-active material. The ore mined must be hand-sorted in order to yield a shipping grade, *i.e.*, 2 per cent. U_3O_8. None of the deposits are extensive, and all are more or less difficult of access. The present method of mining and sorting is wasteful, and much low-grade ore is left in the mine or thrown on the dump. The ore can be concentrated either wet or dry. In the wet process the ore is reduced to 40- or 80-mesh, the crushing being accompanied by rubbing so as to loosen the carnotite from the sand grains. On subsequent washing in a revolving tank the particles of carnotite in suspension can be drawn off after the sand grains have settled. Where water is scarce the rock is crushed to about 40-mesh and passed over an oscillating 150-mesh screen, the undersize forming the concentrate. The screen must be encased, and all the dust carefully collected. *Uraninite (pitchblende) deposits.* Near Central City, Colorado, are five mines that have produced pitchblende as very high-grade ore. About 1905—6 the Kirk mine produced 20 tons of ore averaging 35 per cent. U_3O_8 and 100 tons of 3—4 per cent. ore. Low-grade material has been mostly neglected, but it can be concentrated with fair results, and it is hoped that 0·5 per cent. ore will be utilised. The important European deposits of pitchblende are found at Joachimsthal (Bohemia) and Johanngeorgenstadt and Annaberg (Saxony). *Autunite* (uranium calcium phosphate) is mined in Northern Portugal by a French company. Several finds of uraniferous ores, such as autunite, carnotite, and torbernite (uranium copper phosphate) have been reported from South Australia. *Vanadium ores other than carnotite.* Roscoelite (vanadium mica) occurs in S.W. Colorado ; the deposit is low-grade (1—2 per cent. V_2O_5) but is being mined at a profit because it is large and easily worked. In the same State, roscoelite has been found associated with silver ore, while the ash from grahamite (a solid native bitumen) found in West Virginia and Oklahoma gave 6·77—34·5 per cent. V_2O_5. Peru possesses an important vanadium ore deposit composed chiefly of patronite (a sulphide of vanadium) besides red calcium vanadate and other minerals. The mines are worked by an American company. *Production.* In 1912, 28·8 tons of uranium oxide was produced in the United States. Assuming that the radium is in equilibrium with the uranium (the normal ratio of Ra to U being 1 : 2,940,000) this is equivalent to 9·77 grms. of radium chloride. The Austrian output for 1911 was 2·647 grms., and that from all other sources probably less than 1·5 grms. America supplied in 1912 approximately 285 tons of vanadium metal, chiefly in the form of ferro-vanadium.—W. R. S.

Gold and silver ; Zinc-dust precipitation of ——. A. M. Merton. Min. and Eng. World, 1913, 429. J. Chem. Met. and Min. Soc., S. Africa, 1913, **14**, 317—319.

Zinc-dust, or fume, has largely displaced zinc shavings as a precipitant of gold and silver from cyanide liquors. A small stream of an emulsion of zinc-dust is incorporated with the cyanide solution, which is forced through filter-presses by means of triplex pumps. The reaction between the zinc and the cyanides is complete in less than a minute provided there is thorough diffusion of the dust through the solution. The efficiency of precipitation by dust is very high (98—99 per cent.), and is unimpaired even if the precipitate carries 40 per cent. Cu. The consumption of dust will usually be 25—50 per cent. less than of shavings, while the latter cost about 30 per cent. more than dust. The essential thing is to add the right amount of dust to the liquor ; it is also important to test the dust before use, as it varies greatly in composition. It should be stored in a dry place, as it oxidises rapidly and is liable to spontaneous combustion.—W. R. S.

Sodium ; Studies on the preparation of ——. *I.* B. Neumann and S. Giertsen. Z. angew. Chem., 1914, **27**, 65—70.

The authors carried out experiments in an apparatus of about 16 kilos. capacity, constructed on the lines of Castner's apparatus. When the proper conditions were mantained, chief among which is the adoption of a device for separating the anode from the cathode and thus facilitating the evolution of water, current yields of upwards of 50 per cent. could be obtained, as compared with 30—40 per cent. in practice. An important point was the correct adjustment of the temperature of the bath which should be about 320° C., being slightly lower for high currents. If the temperature were too high the sodium globules did not unite readily, were not easily separated from the melt, and adhered to the ladle in which they were removed. In installations of suitable size, using correspondingly higher currents, it is probable that the authors' modifications would greatly improve not only the current yield but also the energy yield in the manufacture of sodium.—W. H. P.

Metals ; Densities of some —— *in the liquid state.* P. Pascal and A. Jouniaux. Comptes rend., 1914, **158**, 414—416.

The densities were determined at various temperatures by a method involving the use of a quartz float. Formulæ are given for the variations in density of tin, lead, zinc, antimony, aluminium and copper, with temperature. The curve of specific volume of tin shows a marked inflexion at 620° C., suggestive of dynamic allotropy such as is exhibited by sulphur. A metal with a high coefficient of expansion as a solid has also a high one as a liquid. The change in volume on fusion is not usually more than 1 or 2 per cent.—W. H. P.

Determination of sulphur in pyrites. Martin. *See* VII.

Fine-meshed brass gauze as a substitutes for platinum in electro-analysis. Calhane and Wheaton. *See* XXIII.

Patents.

Steel. A. J. Rossi, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,085,488, Jan. 27, 1914.

The steel contains Ti less than 0·50, C more than 0·60 per cent., and manganese, and is unalloyed with other metals.—T. St.

Steel ; Manufacture of ——. W. R. Walker, New York. U.S. Pat. 1,086,003, Feb. 3, 1914.

Steel is manufactured from iron having a phosphorus content below that of basic Bessemer iron, by partially blowing the iron in an acid converter to remove silicon and a portion of the carbon ; transferring the metal first to an intermediate basic open-hearth mixer, where the metal is treated with a basic slag of iron ore and lime, to remove phosphorus, then in portions from time to time to acid electric furnaces in which a non-oxidising atmosphere is maintained, and next to an acid mixer in which a substantial quantity of molten metal is maintained, in order to obtain uniformity as regards carbon and other ingredients.—T. St.

Ores or concentrates; Decomposition of complex ——. W. A. Hall, New York. Eng. Pat. 21,826, Sept. 25, 1912.

Complex sulphide ores or concentrates of zinc, lead and iron are subjected to the action of a reducing flame and a limited quantity of steam insufficient in itself to decompose the ore or concentrate, whereby some of the sulphur is removed in the elementary form (see Fr. Pat. 458,028 of 1912; this J., 1913, 1156), together with the volatile metallic sulphides, the latter being recovered separately by fractional condensation. The ore is kept agitated during the process, which may be carried out in a mechanical furnace of the Wedge or Herreshoff type, steam being introduced between the shelves.—A. S.

Metallurgical-furnace part. W. W. Case, jun., Denver, Colo. U.S. Pat. 1,085,540, Jan. 27, 1914.

The crucible of a tilting furnace has a short pouring spout semi-circular in cross-section and disposed at right angles to the vertical axis of the crucible. A curved lining forming a pouring trough is mounted on the furnace below the spout, both spout and trough being provided with flanges to make a suitable connection. The lid of the crucible has a lip which covers the pouring spout. The furnace cover has a central aperture, and a recess on its lower face, forming a passage way above the crucible lid for the escape of the products of combustion.—T. St.

Metals; Process of preventing oxidation of —— during annealing. J. F. Thompson, Brooklyn, and E. E. Seelye, Tomkinsville, N.Y. Assignors to The International Nickel Co., N.J. U.S. Pat. 1,085,768, Feb. 3, 1914.

Metallic articles are protected from oxidation during annealing, by first coating their surfaces with an emulsion with water of CaF_2 2 parts and $CaCl_2$ 1 part.—T. St.

Metals; Electric fusion of ——. A. P. Strohmenger, Assignor to Ester and Co., Ltd., London. U.S. Pat. 1,085,951, Feb. 3, 1914.

Two rods of metal are placed parallel to each other, with a layer between them of fusible insulating material adapted to form a slag, and containing alloying ingredients. The rods are then connected with the poles of a source of electricity so that an arc passes between their ends. The fused metal drops into a crucible, where it is heated.—T. St.

Brass-pickling solutions; Method of maintaining the efficiency of ——. R. R. Parish, Assignor to Chase Rolling Mill Co., Waterbury, Conn. U.S. Pat. 1,086,079, Feb. 3, 1914.

The solution, composed of copper sulphate, zinc sulphate, sulphuric acid and water, is circulated continuously through an electrolysing tank containing insoluble anodes and metallic cathodes, so that a predetermined amount of acidity is maintained by the removal of a portion of the copper and the restoration of an equivalent amount of sulphuric acid.—T. St.

Iron; Process for the industrial manufacture of electrolytic ——. A. Boucher, Prilly-Chasseur, Switzerland, Assignor to Soc. "Le Fer," Grenoble, France. U.S. Pat. 1,086,132, Feb. 3, 1914.

See Fr. Pat. 458,294 of 1912; this J., 1913, 1115.—T. F. B.

Iron and other metals; Manufacture of ——. *Means or apparatus in or relating to the manufacture of iron and other metals.* A. E. Bourcoud, London. U.S. Pats. 1,086,133 and 1,086,134, Feb. 3, 1914.

See Eng. Pat. 676 of 1910; this J., 1911, 629.—T. F. B.

Iron and steel; Manufacture of ——. Billings Process Co. Fr. Pat. 462,851, Sept. 22, 1913.

See U.S. Pat. 1,073,587 of 1913; this J., 1913, 1017.—T. F. B.

Alloys containing cobalt. E. Haynes, Kokomo, Ind., U.S.A. Eng. Pat. 2487, Jan. 30, 1913.

See U.S. Pat. 1,057,828 of 1913; this J., 1913, 493.—T. F. B.

Aluminium; Production of —— from its compounds. G. Giulini, Ludwigshafen on Rhine, Germany. Eng. Pat. 8166, April 7, 1913. Under Int. Conv., May 3, 1912.

See Fr. Pat. 456,290 of 1913; this J., 1913, 948.—T. F. B.

Aluminium alloys. T. A. Bayliss and B. G. Clark. Fr. Pat. 462,361, Aug. 18, 1913. Under Int. Conv., Aug. 24, 1912.

See Eng. Pat. 19,452 of 1912; this J., 1913, 948.—T. F. B.

Thorium; Production of metallic ——. W. C. Arsem, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,085,098, Jan. 27, 1914.

See Eng. Pat. 14,972 of 1905; this J., 1906, 866.—T. F. B.

Metallurgical and chemical process; Economic ——. [*Purification of metals.*] J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co. U.S. Pat. 1,086,019, Feb. 3, 1914.

See Fr. Pat. 459,853 of 1913; this J., 1913, 1159.—T. F. B.

Metals; Process for fusing ——. Ester and Co., Ltd. Fr. Pat. 462,739, Sept. 18, 1913. Under Int. Conv., Nov. 30, 1912.

See U.S. Pat. 1,073,543 of 1913; this J., 1913, 981.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Refractories; High-temperature [electrical] resistivity of —— A new method of measuring, with results for alundum. E. F. Northrup. Met. and Chem. Eng., 1914, 12, 125—128.

The refractory material was mixed with a small quantity of water and moulded under pressure into thin rectangular slabs (3·4 cm. wide, 4·8 cm. long and 0·25 cm. thick) three

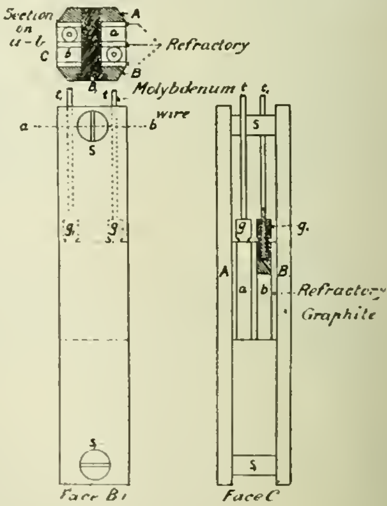


Fig. 1.

of which, after being dried, were clamped between the graphite plates A, a, B, b, (Fig. 1) by means of the graphite screws S and S_1, the external plates A, B, being sufficiently long to ensure, by their natural spring, the maintenance of a uniform pressure upon the refractory pieces during the subsequent changes of temperature. The electrical connections were made as shown in Fig. 1. and diagrammatically in Fig 2, the terminals t, t_1, of molybdenum wire, being fastened to the plates a, b, by means of the graphite screws g, g_1. If R is the measured resistance between the terminals t, t_1, l the thickness of one refractory slab, S its cross section (width × length) and ρ its specific resistance in ohms per cm.³, then $\rho = \frac{3S}{2l}R$. With the dimensions chosen, $\frac{3S}{2l} = 100$, so that $\rho_t = 100R_t$, the subscript t indicating that ρ and R are determined at the measured temperature t° C. The arrangement shown in Fig. 1 was placed in the bottom of the tubular chamber of an electrically heated furnace (Met. and Chem. Eng., 1914, **12**, 31) and the two molybdenum wires passed through a cylindrical cover-piece which tightly closed the top of the furnace, and through which a thermo-couple of platinum and platinum + 10 per cent. rhodium (enclosed in a porcelain tube) was also passed to a point close to the refractory pieces. An electrodynamometer method was used for measuring the electrical resistance, the two molybdenum terminals being joined to the + posts of the bridge arrangement shown in Fig. 3, and the thermo-couple readings made with a potentiometer. Before beginning the final measurements, the material was heated twice to about 1500° C. since it was found that the chemical composition of any refractory material is not in an equilibrium position at a high temperature unless it has been previously heated to that temperature. The measurements of temperature and resistance were taken with rising temperature in the furnace, tight clamping of the refractory pieces between the graphite plates being thus assured by expansion. It is stated that relative values obtainable by this means are accurate to within 2 or 3 per cent. and absolute values probably to within 10 or 15 per cent. The resistivity of alundum (finely ground) between 750° and 1600° C. is shown by means of a curve, the values obtained at these two temperatures being respectively 50,000 and 190 ohms per cm.³
—W. E. F. P.

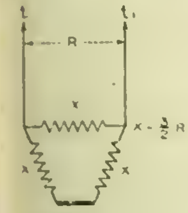


FIG. 2.

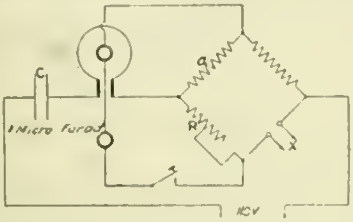


FIG. 3.

Water power resources in Alaska for electro-chemical industries. Board of Trade J., Feb. 19, 1914. [T.R.]

THE Report for the year ended 30th June, 1913, of the overnor of Alaska to the United States Secretary of the nterior states that there is a great deal of water power n Alaska that could be utilised, in conjunction with the ther natural resources of the country, for the development of electro-chemical industries. Water power is lready being developed at Speel River, about 35 miles outh-east of Juneau, the purpose being the establishment of a large electro-chemical and industrial plant to nanufacture carbides, sulphuric acid and other chemicals, ig iron from clinker iron, wood pulp, and sulphur, etc. here is a practically unlimited supply of raw materials, ncluding timber, lime, sulphur, etc., near at hand, and itable fuel will be obtainable from the Alaska coal mines hen opened, or from British Columbia.

Fine-meshed brass gauze as a substitute for platinum in electro-analysis. Calhane and Wheaton. *See* XXIII.

PATENTS.

Ozone-generator. S. Held, Assignor to The Held Co., Chicago, Ill. U.S. Pat. 1,085,579, Jan. 27, 1914.

THE space between concentric outer and inner dielectric tubes forms the ozone chamber. The outer tube is open at one end and is provided with a restricted outlet at the opposite end. In contact with the greater part of its outer surface is an electrode. The inner tube consists of a closed vacuum tube and contains a hollow electrode extending nearly its whole length. The tubes are connected at the closed end of the outer tube, and this is provided with projections on its inner surface at its open end to maintain the correct spacing between the two tubes.—T. ST.

Ozone-generator. W. O. Freet, Hackensack, N.J., Assignor to Steynis Ozone Co., New York. U.S. Pat. 1,085,598, Feb. 3, 1914.

THE generator consists of a base of insulating material, a flat electrode supported by the base, a flat dielectric supported over the electrode, and flat strips, constituting electrodes, supported in racks having vertical slots, and situated above the dielectric.—T. ST.

Furnace; Electric ——. B. Guthrie, Pittsburgh, and J. P. Karch, Sewickley, Pa., Assignors to C. P. Carpenter, trustee, Pittsburgh, Pa. U.S. Pat. 1,086,164, Feb. 3, 1914.

A CRUCIBLE is heated by the current passing between two electrodes which are movable towards and away from the crucible, in a horizontal direction. Each electrode encloses substantially one-half of the crucible, and is shaped so that it is in contact with the latter at the bottom, and diverges from it towards the top. The space between the electrodes and the crucible is filled with a broken carbon resistance.—T. ST.

Battery compounds. J. W. Mackenzie, London. From Cook Railway Signal Co., Denver, U.S.A. Eng. Pat. 7298, March 27, 1913.

SEE U.S.Pat.1,060,832 of 1913; this J., 1913, 611.—T. F. B.

Absorbent for use in the cells of electric dry batteries; Process for preparing an ——. P. Rabbidge. Fr. Pat. 462,664, Sept. 2, 1913. Under Int. Conv., Sept. 27, 1912.

SEE Eng. Pat. 19,783 of 1913; this J., 1914, 89.—T. F. B.

Electric discharges in gases; Method of and furnace for securing products of reaction by ——. C. F. R. von Koch, Stockholm. U.S. Pat. 1,085,440, Jan. 27, 1914.

SEE Fr. Pat. 451,361 of 1912; this J., 1913, 611.—T. F. B.

Manufacture of nitrides. Addition to Fr. Pat. 457,922. *See* VII.

Apparatus for the electrolytic production and collection of hydrogen and oxygen. Fr. Pat. 461,981. *See* VII.

XII.—FATS; OILS; WAXES.

Palm-kernel oil: Composition of ——. G. D. Elsdon. Analyst, 1914, **39**, 78—80.

FRACTIONATION of palm-kernel oil by the process of alcoholysis, as used for cocoanut oil (this J., 1913, 149), gave the following approximately quantitative proportions of fatty acids:—Caproic acid, 2; caprylic acid, 5; capric acid, 6; lauric acid, 55; myristic acid, 12; palmitic acid, 9; stearic acid, 7; and oleic acid, 4 per cent. These results indicate that it might not be possible to distinguish between certain samples of cocoanut oil and palm-kernel oil, even in the pure condition. Haller's process of alcoholysis (this J., 1907, 328; 1908, 324) does not give reliable qualitative results and is unsuitable for preliminary tests.—C. A. M.

Argemone Mexicana; The oil of ——. K. Bhaduri. Amer. J. Pharm., 1914, **86**, 49—54.

The crushed seeds of *Argemone Mexicana*, which now grows wild in India, yielded 22·3 per cent. of a thin brown oil on extraction with light petroleum. The expressed oil gradually thickened on keeping and deposited a very small amount of a red crystalline substance, m.pt. 172° C. The oil solidified at 16°—17° C. The following characters were observed: sp. gr. 0·9117 at 28° C., and 0·9007 at 100° C., refractive index, 1·46552 at 32° C.; saponification value, 185·5; acetyl value, 27·9; acid value, 146; bromine value, 102·2; Reichert-Meisel value, 0·61; Hehner value, 94·02; glycerol, 15·48 per cent.; Maumené test, 65° C.; The fatty acids contained 77 per cent. of liquid acids having the iodine value 147·4. Evidence was obtained of the presence of acetic, valeric and lauric acids.—F. Shdn.

Hydrogenated oils; Analytical constants of ——. C. Ellis. J. Ind. Eng. Chem., 1914, **6**, 117—122.

A review of the published data on the analytical characters of hydrogenated oils (see this J., 1912, 996; 1913, 201, 370, 665, 797; 1914, 206), together with some of the author's own observations. The saponification value and content of free fatty acids and of unsaponifiable matter are not appreciably affected by hydrogenation; the refractive index is diminished as is shown by the following values for hydrogenated oils, the melting points of which are given in brackets: corn or maize (55·7° C.), 1·4514; whale (41·5° C.), 1·4550; soya bean (50·3° C.), 1·4538; cocoanut ("olein") (24·7° C.), 1·4425; linseed (42·3° C.), 1·4610; palm (38·7° C.), 1·4517; palm (44·8° C.), 1·4494; peanut or arachis (34·7° C.), 1·4547. Hydrogenated arachis (peanut) and sesamé oils cannot in some cases be distinguished from lard nor hydrogenated whale oil from mutton or beef tallow by means of the usual analytical constants. —A. S.

Oil; Utilisation of used —— for lubrication. M. Pellet. Intern. Sugar J., 1914, **16**, 63—64.

According to the experience of the author, used oil preserves its lubricating properties almost intact, its density, viscosity, flash point, and acidity not being notably altered. The oil may be purified by passing it through medium-mesh wire gauze to remove solid impurities, and then treating it with steam in a tank containing a coil pierced with holes on the lower side. The steaming is continued for 15—30 minutes from the time when the mass becomes hot, and the separated oil is centrifuged or filtered through flannel, the filter being disposed in a warm place, or provided with a hot-water jacket.—J. P. O.

Sulphonated oils; Analysis of ——. *Provisional method of the Amer. Leather Chem. Assoc.* J. Amer. Leather Chem. Assoc., 1914, **9**, 68—70. (See also this J., 1914, 32.)

Moisture.—30 to 40 grms. of the oil, mixed with 75 c.c. of xylene saturated with water, are distilled from an oil bath into a graduated tube until the distillate is clear. The water in the distillate is measured. *Unsaponifiable.*—10 grms. of oil are boiled for 1 hour under a reflux condenser with 5 c.c. of aqueous potassium hydroxide (50 grms. per 100 c.c.), 45 c.c. of alcohol, and a few glass beads. After adding 100 c.c. of water and cooling, the mixture is shaken at least three times with petroleum ether (b.pt. 40°—75° C.), using 50 c.c. each time. The petroleum ether solution is washed at least three times in succession with 50 c.c. of water containing 10 c.c. of alcohol, using alcohol to break emulsions, and is then evaporated, and the residue weighed. *Combined SO_3.*—(See this J, 1914, 32.) *Total fatty oil* is taken as the difference between 100 and the sum of moisture, ash, and unsaponifiable matter.—J. R. B.

Fish-scrap fertiliser industry of the Atlantic Coast (U.S.A.). Turrentine. *See* XVI.

Patents.

Soap; Manufacture of milled ——. F. A. V. Klopfer, Dresden-Leubnitz, Germany. U.S. Pat. 1,085,437, Jan. 27, 1914.

See Eng. Pat. 2191 of 1912; this J., 1912, 546.—T. F. B.

Obtaining products [oils and a fertiliser] from sewage sludge. Eng. Pat. 1564. *See* XIXb.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Zinc white; Preventing the injurious effect of —— on the fastness to light of water colours. E. Täuber. Farbenzeit., 1913, **19**, 475—485. Chem. Zentr., 1914, **1**, 503.

The injurious effect of zinc white (this J., 1911, 1170) may be due to an impurity. By treating commercial zinc white with hydrogen peroxide and using glycerin in addition to gum as a vehicle, a permanent Chinese white can be obtained which apparently does not affect the fastness to light of other water colours. Zinc white has an injurious action on Prussian blue even in the dark. Calcium tungstate is recommended as a valuable though expensive white pigment, which approaches zinc white in covering power and has no injurious effect on the fastness to light of other colours.—A. S.

Paint vapours; Composition of ——. H. A. Gardner. J. Ind. Eng. Chem., 1914, **6**, 91—95.

A current of purified air was drawn through vessels which had been coated inside with a drying oil (raw linseed, soya bean, tung, and menhaden oils), or with mixtures of various pigments with raw linseed oil. Armstrong and Klein's statement (this J., 1913, 320) that no volatile metallic compounds are evolved from oil paints containing lead or zinc pigments was confirmed. The absorption of oxygen by thin films of drying oils was accompanied by the evolution of considerable quantities of carbon dioxide and organic compounds and a small quantity of carbon monoxide (detected by the liberation of iodine from heated iodine pentoxide). In the vapours from drying paints the presence of aldehydes, acids (formic acid, etc.), carbon dioxide and monoxide was detected; the production of volatile substances appeared to be stimulated by the presence of basic pigments and oil of turpentine.—A. S.

Wood turpentine industry; The present status of the —— E. H. French and J. R. Withrow. Met. and Chem. Eng., 1914, **12**, 95—99.

In a resumé of the general methods of manufacture, th economics of the steam, solvent, alkali, bath, and destructive distillation processes are considered, particulars bein given of the approximate yield and operating cost in eac case, and suggestions made as to possible improvement and future developments. The authors are of opinio that for the successful operation of the steam proce a minimum price of 50 cents. per gal. for wood turpentin is necessary; that the solvent process may prove commercial value if operated on a scale sufficientl extensive to permit of the utilisation of the treated chi for the economic manufacture of paper pulp: and that t alkali process (essentially the manufacture of paper pu from resinous woods, with recovery of turpentine a rosin) will eventually be of commercial importan although at present requiring capital expenditure develop the mechanical details. Since the destructive distillation process has alone withstood the recent price depression, it is concluded that this method possesses inherent advantages; in processes of this type, however, considerable improvement is required in refining and in the utilisation of waste products. It is stated that although the industry practically owes its existence to abnormal market conditions, the manufacture of wood turpentine will necessarily become of far-reaching importance in the future, as a means of utilising an absolutely waste product and at the same time clearing cut-over lands for occupation.—W. E. F. P.

Turpentine; Action of aluminium chloride on oil of ——. W. Steinkopf and M. Freund. Ber., 1914, 47, 411—420.

By the action of aluminium chloride on French oil of turpentine cooled by ice and kept agitated, the chief product was a resinous polymeride of pinene melting at 77°—78° C. When, after the treatment, the reaction product, without separation of the aluminium chloride, was decomposed by heating, a mixture of substances was obtained of the same qualitative composition as the mixture obtained under similar conditions from amylene, hexylene, etc. (compare this J., 1910, 10, 338), *i.e.*, the most volatile portion consisted mainly of saturated paraffin hydrocarbons, then as the boiling point rose the fractions contained increasing quantities of naphthenes and, later, of polynaphthenes, whilst the least volatile portions consisted of oils of the same composition and properties as lubricating oils from natural petroleum.—A. S.

Abietic acid and some of its salts. E. O. Ellingson. J. Amer. Chem. Soc., 1914, 36, 325—335.

Pure abietic acid, prepared from colophony by extraction with 70 per cent. alcohol and recrystallisation from 95 per cent. alcohol, melted at 150°—152° C. and appeared to be oxidised at temperatures near the melting point, the heat of combustion of the melted acid being somewhat lower than that of the unmelted acid. The salts of the acid with sodium, potassium, and some of the heavy metals were prepared, but nearly all of them contained more than the theoretical quantity of abietic acid. Sodium abietate was soluble in water and in methyl, ethyl, and amyl alcohols. The abietates of the heavy metals, on he other hand, were insoluble in water, slightly soluble n methyl alcohol, but readily soluble in most organic olvents.—A. S.

Patents.

mpregnating or coating surfaces, binding colours, and addition to colours principally for the purpose of rust prevention; Manufacture of compositions for ——. R. Eberhard, Munich, Germany. Eng. Pat. 20,954 of 1913, dated of Appl., Dec. 3, 1912.

ILs or fats, or their distillation or oxidation products, are eated with permanganic acid, in conjunction with erchlorides of the heavy metals; stannic anhydride ay also be added. For example: manganese perloride, 3 parts, dissolved in ether, 10 parts, and peranganic acid, 3 parts, are mixed with linseed oil, 100 arts, to which stannic anhydride, 1·5 part, has been lded; or antimony pentachloride, 2 parts; dissolved in chloroform, 15 parts, and permanganic acid, 5 parts, are mixed with linseed oil, 100 parts, in which tin tetrachloride, 5 parts, and stannic anhydride, 1·5 part, have been dissolved.—E. W. L.

Colour-lake and process of making same. A. Strupler, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,085,178, Jan. 27, 1914.

See Eng. Pat. 7757 of 1913; this J., 1913, 759.—T. F. B.

Varnish and process of making same. Standard Varnish Works. Fr. Pat. 462,409, Sept. 9, 1913. Under Int. Conv., Nov. 4, 1912.

See U.S. Pat. 1,062,419 of 1913; this J., 1913, 666.—T. F. B.

Printing ink; Process for making ——. M. Wolff. Fr. Pat. 462,452, Sept. 11, 1913.

See Eng. Pat. 30,037 of 1912; this J., 1913, 1162.—T. F. B.

Manufacturing a new product from mineral oil. Eng. Pat. 2672. *See* II A.

Manufacture of cellulose from resinous woods, with recovery of oil of turpentine and resin oil. Fr. Pat. 462,681. *See* V.

Manufacture of chromic acid salts and of chromium colouring matter. Eng. Pat. 14,226. *See* VII

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber exports from the Amazon Basin in 1913. Board of Trade J., Feb. 28, 1914. [T.R.]

H.M. Consul at Pará reports that the quantity of rubber exported from Pará, Manaos, Iquitos, and Itacoatiara, *via* Pará, during the years 1912 and 1913, was as follows:—

——	Fine.	Medium.	Coarse.	Caucho.	Total.
Year 1913.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.
To the United States	7,296,134	1,387,132	5,511,869	3,272,716	17,467,851
To Europe	11,618,956	1,604,731	2,344,861	6,676,778	22,245,326
Total, 1913	18,915,090	2,991,863	7,856,730	9,949,494	39,713,177
Total, 1912	21,585,629	3,488,771	9,311,559	8,473,344	42,859,303

Rubber; Yield of —— from Manihot Glaziovii. E. Fickendey. Gummi-Zeit., 1914, 28, 747—748.

It has been proposed to increase the flow of latex from *Hevea Brasiliensis* by removing the dead parts of the bark before tapping, down to the green cork-cambium, and repeating this periodically during the tapping period (Ger. Pat. 265,937). This process fails in *Kickxia* trees in which there is no wound response. The author gives experiments showing that the method causes a better yield in the case of *Manihot* trees also; details of the treatment of the trees are given. (See also this J., 1911, 374).—H. E. P.

Synthetic caoutchouc from isoprene. G. Steimmig. Ber., 1914, 47, 350—354.

Harries (this J., 1913, 203, 983) concluded that synthetic caoutchouc, prepared by polymerisation of isoprene by heat in presence of glacial acetic acid, was identical with natural caoutchouc, from the similarity of the diozonides of these two substances, and the fact that both yielded lævulinic acid and lævulinic aldehyde on hydrolysis, which occurred with the same reaction-velocity. Harries also suggested that another caoutchouc might be produced by the asymmetric condensation of two molecules of isoprene. The author applied Harries' methods to the caoutchouc prepared according to the patents of the Badische Anilin und Soda Fabrik (see this J., 1913, 152, 372, 667), by heating isoprene in presence of ozonides or peroxides or by the action of sodium on isoprene in presence of carbon dioxide; these products differ from that obtained by heating isoprene. It was found that, in addition to lævulinic acid and aldehyde, the products of hydrolysis of the diozonide contained succinic acid and acetonylacetone. The latter was separated from lævulinic aldehyde by converting both substances into their diphenylhydrazones and decomposing these with steam, when 1 mol. of phenylhydrazine was split off in each case, the lævulinic acid derivative giving phenylmethyldihydropyridazine and the acetonylacetone derivative 1-phenylamino-2.5-dimethylpyrrole, the latter of which is volatile in steam. The caoutchouc obtained by heat polymerisation of isoprene gave similar results, but no succinic acid or acetonylacetone could be detected in the products of hydrolysis of the diozonide from natural caoutchouc. It is deduced that natural caoutchouc is composed only of 1.5-dimethylcyclo-octadiene-1.5 rings, whereas the above artificial caoutchoucs contain an estimated quantity of 20 per cent. of 1.6-dimethylcyclo-octadiene-1.5 which may be considered to result from the asymmetric condensation of isoprene.—H. E. P.

Reclaimed rubber and plantation rubber. W. F. de B. Maclaren. India Rubber J., 1914, **47**, 269—272.

The author estimates that in recent years the amount of waste rubber goods annually collected has been about 400,000 tons; the scrap therefrom capable of treatment, 280,000 tons; rubber compounds recovered, 140,000 tons (United States and Canada, 65,000 tons; Great Britain, 25,000 tons; the Continent, 50,000 tons); actual rubber contents, 56,000 tons. Allowing for the rubber worn away from tyres and for articles sent to out-of-the-way regions, and not recoverable, it seems clear that this quantity of reclaimed rubber can only have been collected by drawing on the world's accumulated stocks of old rubber. It is considered that reclaimed rubber does not displace plantation rubber so much as inferior raw rubber and fillers, and that as plantation rubber becomes cheaper it will be difficult for reclaimed rubber to compete in price to the same extent as hitherto.—H. E. P.

Vulcanisation of rubber; Influence of nitrogenous and resinous constituents on the ——. H. P. Stevens. Kolloid-Zeits., 1914, **14**, 91—96. India-Rubber J., 1914, **47**, 403—406.

Following previous work (this J., 1912, 999, 1099; 1913, 203) on the nitrogenous and insoluble constituents of rubber, the author has tried the effect of incorporating various substances with rubber which has been freed from insoluble constituents by treatment with benzene as described previously. Peptone in a slightly damp condition was incorporated directly by means of a mixing machine and also by emulsifying an aqueous solution with a solution of the rubber in benzene. Starch was incorporated directly. The results of experiments with a number of samples subjected to different preliminary treatments are shown in the following table: the samples were mixed on the hot rolls with 7 per cent. S, then rolled into a sheet, vulcanised in the usual way, and tested after 1 week.

		Resistance to stretching.	Sub-permanent extension.	Vulcanisatica coefficient.
No.	Sample.	Load in grms. per sq. mm. of cross-section of sample required to stretch the rubber to five times its original length.	Extensioa per cent., immediately after removing load after five stretchings with a maximum load of 200 grms. per sq. mm.	Calculated to rubber free from protein and resia.
1	Untreated rubber (Unsmoked plantation sheet from Malaya)	178	25·6	2·86
2	Rubber swollen in benzene	182	24·4	2·83
3	Swollen in benzene and worked on the kneading machine	163	33·2	2·68
4	Rubber containing excess of insoluble constituents	267	12·4	3·62
5	,, free from insoluble constituents	55	Broke	1·15
6	No. 5 with 3 per cent. of peptone incorporated	165	20·0	3·22
7	No. 5 emulsified with a solution of 3 per cent. of peptone	166	23·6	2·89
8	No. 5 emulsified with a solution of 3 per cent. of casein	106	57·2	1·76
9	No. 5 with 3 per cent. of starch incorporated	73	Broke	1·42
10	No. 5 with 10 per cent. of litharge incorporated	308	8·8	3·02
11	No. 5 vulcanised for 8 hours instead of 3 hours	158	24·0	2·16
12	Rubber freed from resin	213	18·0	2·71
13	,, ,, ,, ,, and then the resin again incorporated	184	20·0	3·12
14	No. 12 with 2·5 per cent. of Pontianac resin incorporated	181	22·0	2·58
15	No. 12 with 2·5 per cent. of colophony incorporated	156	31·6	2·85
16	No. 4 extracted with acetone	280	12·8	3·34
17	No. 5 ,, ,, ,, (*i.e.* pure caoutchouc)	66	Broke	1·08

Note.—After about 5 months Nos. 7 and 13 were practically equal to No. 1, and No. 6 was only slightly weaker, but Nos. 12, 14, 15, 16, and 17 showed great deterioration.

—A. S.

Sulphur in rubber; Determination of ——. H. P. Stevens. Analyst, 1914, **39**, 74—78.

On oxidising rubber with nitric acid a variable loss o sulphur takes place owing to the volatilisation of product containing sulphur. Such volatile products may b absorbed by passing the gases into a solution of potassiu hydroxide, nitric acid, or even water, and the absorbe sulphur may be subsequently determined as bariu sulphate. Or the oxidation of the rubber product may b carried out in a vessel provided with a suitable con densing apparatus, such as a Young's fractionati column with ground-glass connection. A sample unvulcanised rubber containing 7·3 per cent. S yielded onl 7·02 per cent. when oxidised in a beaker. When oxidis in a flask connected with a U-tube containing nitric aci the contents of the flask contained 7·10 and those of the U-tube 0·19 per cent. S.—C. A. M.

Patents.

Caoutchouc ; Vulcanisation of products resembling or related to ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 8781, April 14, 1913.

The products obtained as described in Eng. Pat. 975 of 1913 (this J., 1914, 93) may be vulcanised. For example the product obtained according to the fifth example may be vulcanised by heating with 10 per cent. of sulphur. The vulcanised product is light gray in colour. The product obtained according to Eng. Pat. 26,550 of 1912 (this J., 1913, 1164) and treated according to Eng. Pat. 975 of 1913 (*loc. cit.*) with 8 per cent. of sulphur may be vulcanised, forming a light gray product, by heating in a press for two hours at two atmospheres steam pressure. If heated for three hours at three atmospheres pressure an almost black soft product is obtained. With higher proportions of sulphur and prolonged heating products resembling ebonite may be obtained.—E. W. L.

Vulcanised rubber ; Process for preparing a product analogous to ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,387, Dec. 25, 1912. Addition to Ger. Pat. 266,618.

The product of the polymerisation of βγ-dimethylbutadiene described by Kondakow (J. prakt. Chem., **64**, 109), is vulcanised in presence of a derivative of piperidine or its homologues, *e.g.*, N-thiopiperidine, benzal-dipiperyl, etc.—T. F. B.

Rubber ; Process for regenerating ——. C. Harries. Ger. Pats. 267,993 and 267,994, Dec. 29, 1912, and Jan. 21, 1913. Additions to Ger. Pat. 267,277 (see this J., 1914, 94).

(1.) The decomposition of the hydrohalogenides of caoutchouc is effected by heating with bases at a high temperature and under pressure. (2) The hydrohalogenides are decomposed by heating with carbonates or other salts of weak acids, at normal or increased pressure.—T. F. B.

Caoutchouc-like products ; Process of manufacturing ——. A. Caroselli, Assignor to Chem. Fabr. Flörsheim Dr. H. Noerdlinger, Flörsheim on Maine, Germany. U.S. Pat. 1,086,139, Feb. 3, 1914.

See Ger. Pat. 253,517 of 1910 ; this J., 1913, 36.—T. F. B.

Caoutchouc ; Process for producing substances resembling ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated July 1, 1913, to Fr. Pat. 434,989, Oct. 7, 1911. Under Int. Conv., July 22, 1912.

See U.S. Pat. 1,073,845 of 1913 ; this J., 1913, 1164.—T. F. B.

Rubber ; Cementing of ——. A. Pidoux, Geneva, and P. de Carsalade du Pont, Brussels. Eng. Pat. 11,175, May 13, 1913. Under Int. Conv., May 11, 1912.

See Fr. Pat. 456,104 of 1913 ; this J., 1913, 984.—T.F.B.

Process for preparing isoprene. Ger. Pat. 268,101. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Sulphides in lime liquors ; Determination of ——. J. R. Blockey and P. V. Mehd. Collegium, 1914, 73—75.

The failure of McCandlish and Wilson (this J., 1913, 153) to obtain correct results by the method of Blockey and Mehd (this J., 1912, 369) is due to the fact that they omitted to add ammonium chloride in preparing the reagent which should consist of a *N*/10 solution of zinc sulphate to which has been added ammonia until the precipitate has just redissolved and also 50 grms. of ammonium chloride per litre. McCandlish and Wilson also used liquor of much lower concentration than are met with in practice. The mechanism, from the point of view of the ionic hypothesis, of the reactions involved in the estimation of sulphides in lime liquors with zinc sulphate is discussed.—J. R. B.

Analysis of sulphonated oils. See XII.

Patents.

Condensation products of formaldehyde [and naphthalenesulphonic acids] : Manufacture of soluble ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7137, March 25, 1913.

Readily soluble condensation products, stated to possess valuable tanning properties, are obtained by treating naphthalenesulphonic acids or their homologues with formaldehyde or its equivalent, with or without the use of condensing agents, under suitable conditions. In particular, a large excess of sulphuric acid and too prolonged an action thereof, should be avoided. Similar products are obtained by sulphonating the insoluble condensation products of formaldehyde or its equivalent and naphthalene or its homologues. *Example.* Ten parts of naphthalene are heated with 12·5 parts of 98 per cent. sulphuric acid at 130°—140° C. When sulphonation is complete, the mass is cooled to 80°—90° C., and 4 parts of 30 per cent. formaldehyde are added, with constant agitation, keeping the temperature between 60° and 100° C After a time the mass becomes thick, whereupon sufficient water is added to enable it to be stirred, and stirring is continued, at the same temperature, until the odour of formaldehyde has disappeared. The cooled product is a solid, resinous, slightly coloured mass soluble in cold water. The solution is itself capable of tanning and also has the property of rendering soluble the less easily soluble portion of quebracho.—T. F. B.

Tanning hides and skins ; Process and apparatus for ——. A. Bracher. Ger. Pat. 268,126. Oct. 6, 1911.

The hides or skins are suspended on long shafts, and are moved forward from time to time, in the direction of their length, towards the end of the vat, at which fresh tanning liquor is introduced, the spent liquor being withdrawn from the other end of the vat. By this means the hides are progressively treated by stronger liquors. —T. F. B.

Leather ; Process for preparing multi-coloured, figured ——. A. Wolff. Ger. Pat. 268,449, Oct. 24, 1912.

Leather which has been mordanted with a chromium, aluminium, or iron compound is printed with a mordant dyestuff together with a thickening material such as is used in textile printing ; the dyestuffs are fixed by steaming at temperatures below 100° C., preferably between 60 and 70° C.—T. F. B.

Tannic extract and process of manufacturing the same. X. F. Debédat, Bordeaux, France. Eng. Pat. 5369, March 3, 1913, Under Int. Conv., March 7, 1912.

See Fr. Pat. 441,217 of 1912 ; this J., 1912, 830.—T. F. B.

Drying varnished leather or the like ; Process for ——. C Heyl. Fr. Pat. 462,501, Sept. 12, 1913 Under Int Conv., Sept. 12, 1912.

See Eng. Pat. 20,795 of 1913 ; this J., 1914, 95.—T.F.B.

Leather ; Process for treating —— to waterproof it and to render it non-slipping. A. McLennan. Fr. Pat. 462,932. Aug. 28, 1913. Under Int. Conv., Sept. 16, 1912.

See Eng. Pat. 21,081 of 1912 ; this J., 1914, 95.—T.F.B.

XVI.—SOILS ; FERTILISERS.

Organic nitrogen of Hawaiian soils. W. P. Kelley and A. R. Thompson. J. Amer. Chem. Soc., 1914, **36**, 429—444.

Products of acid hydrolysis. The soils examined were of the laterite class and comprised silty loams, a loam containing considerable gravel, a highly organic sandy soil, silty soils, and a highly humic soil. The content of total nitrogen ranged from 0·122 to 1·241 per cent., nitrate nitrogen 0 to 70 parts per million, and ammonia nitrogen 10 to 220 parts per million, all calculated to the water-free soil. Samples of the air-dried soils (50 grms.) were heated with 750 c.c. of strong hydrochloric acid for 10 hours under a reflux condenser, and in the filtered solution the proportions of the different classes of nitrogenous compounds were determined. From 67·51 to 91·80 per cent. of the total nitrogen in the different soils was brought into solution during the hydrolysis. The amide nitrogen (determined by distillation with magnesia) ranged from 18·99 to 30·96 (average 23·91) per cent. of the soluble nitrogen, the basic nitrogen (precipitated by phosphotungstic acid) from 5·01 to 13·81 (average 9·98), and the non-basic nitrogen (by diff.) from 54·82 to 70·42 (average 64·57) per cent.

Effects of heat on soil nitrogen. The effect of heating in an air-bath and in presence of steam under pressure was studied. The nitrates were decomposed, disappearing almost completely at 200° C. The ammonia-nitrogen increased considerably between 150° and 200° C., usually decreasing again at 250° C. The effect of steam at 2 atmospheres pressure was similar to that of heating in air at 150° C. The effect of heating to 200° C. on the organic nitrogen compounds varied with the different soils, but in general there was a loss of nitrogen and formation of considerable quantities of ammonia, largely at the expense of the compounds which yield non-basic nitrogen on acid hydrolysis.

The nitrogen of humus. The soils examined, the same as those used in the experiments described above, contained from 0·004 to 0·041 per cent. N soluble in 1 per cent. hydrochloric acid. After treatment with the acid, humic substances were extracted from the soils by means of a 3 per cent. solution of sodium hydroxide ; except in two cases the solution contained more than one-half of the total nitrogen. A portion of the alkaline solution was acidified with dilute hydrochloric acid and the precipitates subjected to acid hydrolysis. The detailed results show that whilst the absolute amounts of amide, basic, and non-basic nitrogen in the humus are less than the quantities produced by hydrolysis of the entire soil, the total humus nitrogen contained relatively more amide and basic nitrogen and less non-basic nitrogen than the total nitrogen of the soil. This indicates that the formation of humus is accompanied by a considerable simplification of the protein complex and hence may be regarded as a step towards the production of available nitrogen.—A. S.

Fish-scrap fertiliser industry of the Atlantic coast (*U.S.A.*). J. W. Turrentine. Bull. U.S. Dept. Agric. No. 2, Bureau of Soils, Dec. 27, 1913. (See also this J., 1914, 96).

The fish-scrap industry is centred round Chesapeake Bay and comprises about 40 factories employed in converting the "menhaden" fish into manure and collecting the oil. The actual fishing takes place from April to November or December. A specimen of this fish on analysis was found to contain: water, 77·150, and oil, 3·914 per cent. 12,000 to 15,000 fish give 1 ton of dried scrap and the 900,000,000 caught annually produce 70,000 tons of dried scrap. The yield of oil varies mainly with the season of the year: in the spring no oil may be obtained, whereas in the autumn 1000 fish may give 12 to 15 gallons. In 1900 the average yield at the Rhode Island factories was 5·76 gals. per 1000 fish. The moisture and oil are expressed from the fish (previously cooked by the aid of steam) by means of a continuous action-press. The scrap is finally dried by hot air in a revolving drum 30 to 40 ft. long by 6 ft. diameter, through which the material passes continuously, emerging with a moisture content of about 7 per cent. Before marketing the fish scrap is usually mixed with other fertiliser ingredients. The average analysis of ten samples of dried fish scrap give :—Nitrogen, 9·13 per cent., phosphoric acid (P_2O_5) 7·25 per cent., moisture about 7 to 9 per cent. oils 6·99 per cent., the remainder being mostly organic matter. The oil and water pressed out are pumped into tanks heated by steam pipes to facilitate separation, the oil being run off over consecutive weirs into barrels or tanks. About 35,000 barrels or about 2 to 2½ million gallons of oil are produced annually, and in 1911 the price was 23 to 28 cents per gallon. The following values of the specific gravity and iodine value of menhaden oil are given :—

	Sp. gr. at 20° C.	Iodine value (Hübl).
Extra bleached winter	0·9237	150·4
Bleached refined	0·9273	161·2
Regular	0·9249	165·7
Dark brown	0·9250	154·5

The oil varies from light amber to dark brown in colour, and was formerly used for currying leather and as an illuminant. Of all the fish oils "menhaden" is said to be the best for use in paint manufacture, and when mixed with 25 per cent. of linseed oil and a "drier" gives excellent results. It is also used as a lubricant and for tempering steel. Menhaden oil can replace linseed oil in the production of printing ink and in the manufacture of patent leather.—N. C. A.

Patents.

Fertiliser containing nitrogen and phosphoric acid in a water-soluble form ; Manufacture of a —— from nitrolim (*crude calcium cyanamide*). O. Ungnade and E. Nolte. Ger. Pat. 268,882, July 25, 1912.

The crude calcium cyanamide is treated with a mixture of phosphoric and sulphuric acids.—A. S.

Fertilisers : Production of ——. E. C. R. Marks, London. From Electric Smelting and Aluminium Co., Sewaren, N.J., U.S.A. Eng. Pat. 2485, Jan. 30, 1913.

See Fr. Pat. 454,336 of 1913 ; this J., 1913, 878.—T. F. B.

Dicalcium phosphate ; Process for producing ——. E. C. R. Marks, London. From Electric Smelting and Aluminium Co., Sewaren, N.J., U.S.A. Eng. Pat. 2486, Jan. 30, 1913.

See Fr. Pat. 454,056 of 1913 ; this J., 1913, 878.—T. F. B.

Obtaining products [*oils and a fertiliser*] *from sewage sludge.* Eng. Pat. 1564. *See* XIXb.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugars ; Differences in the analysis of raw ——. F. Sachs. Z. Ver. deut. Zuckerind., 1914, 144—157.

The author has collated the results of analyses, made in each case by about 30 British and Continental chemists, of 22 first or second product beet sugars. The ratio of ash to organic non-sugar in the different samples ranged from 1·5 to 2·2, save in one, probably abnormal sample. Of the polarisation values (663 in number), 81·2 per cent differed from the mean for the sample by less than 0· per cent., and the results were practically as accurate with the second as with the first products. The values fo invert sugar (in most cases trace or nil) generally agree very well. Of the ash-contents, 84 per cent. did no differ from the mean for the sample by more than 0·0 per cent. ; the results were rather more accurate wit the first than with the second products. Small quantities of raffinose were found in some cases, but the results were often very discordant.—L. E.

Magnesia ; Rôle of —— in the carbonatation process [*of sugar manufacture*]. H. Pellet. Intern. Sugar. J., 1914, **16**, 77.

Magnesia introduced into sugar juice by the use of impure limestone causes various difficulties, chiefly in increasing the amount of incrustation in the effect evaporators (this J., 1914, 154). When in the cane or the beet factory it is impossible to obtain a material free from magnesia, carbonatation should be stopped at an alkalinity of 0·5—0·6 grm. CaO per litre, and the juice filtered. At this point practically all the magnesia is insoluble, whereas if the operation be continued, a greater or less amount passes into solution.—J. P. O.

Sugar manufacture ; Use of bagasse carbon for decolourisation in white ——. W. Clacher. Intern. Sugar J., 1914, **16**, 64—66.

Bagasse carbon is stated to possess considerable decolourising power. It is preferably used at two different stages of sugar manufacture, viz., as soon as feasible after the juice leaves the mill, using as fine a powder as can be worked (the carbon separates in the scums); or after concentration to syrup before entering the vacuum pans, the syrup being run through a cistern, similar to the type used in refineries. After use the carbon may be revivified by heating as in the case of animal charcoal, and when finally spent may be utilised as fuel.—J. P. O.

Carbohydrates ; Picrate colourimetric method for the determination of ——. W. M. Dehn and F. A. Hartman. J. Amer. Chem. Soc., 1914, **36**, 403—409.

The authors recommend, for the rapid determination of sugars, measuring the depth of colour produced by heating under standardised conditions with a solution of picric acid rendered alkaline with sodium carbonate: the use of sodium hydroxide is inadmissible owing to the decomposing action on the sugars. The colour produced is compared with that of standards prepared by treating a pure sugar under the same conditions. The method may be applied to the determination of lactose in milk after coagulation and separation of the casein. (See also Chapman, this J., 1910, 1413.)—A. S.

Influence of small amounts of alcohol on fermentation in cane sugar syrup. Cochran and Perkins. *See* XVIII.

Action of micro-organisms on betaine. Ehrlich and Lange. *See* XVIII.

Beet leaves [*as cattle food*]. Hitier. *See* XIXa.

Patents.

Sugar and the like ; Centrifugal apparatus for separating liquids from ——. A. Mazzacani, Bologna, Italy. Eng. Pat. 14,096, June 18, 1913.

For moulding masses of sugar a centrifugal machine is provided with triangular vertical wedges attached to the inside surface of the drum, and between the wedges are open moulds or frames held in position by overhanging rims at the tops of the wedges. The upper walls of the frames and the rims on the wedges which project over them, are curved to a circle having its centre in the plane of the bottom on or beyond a line connecting the lower corners of he frame situated towards the centre of the drum. Thus he masses of sugar formed in the frames are easily removed by pulling the tops forward towards the centre of the drum. When the wedges are removed the machine operates as an rdinary centrifugal drainer.—J. F. B.

Purifying and decolourising liquids, especially sugar solutions ; Process for ——. F. Tiemann. Fr. Pat. 461,485, Aug. 19, 1913.

ee Ger. Pat. 268,047 of 1912; this J., 1914, 155.—T. F. B.

Saccharine juices from sacchariferous plants ; Extraction process and apparatus for obtaining ——. Maschinen- u. Werkzeugfabrik Akt. Ges. vorm. Aug. Paschen. Fr. Pat. 462,725, Sept. 18, 1913. Under Int. Conv., Sept. 18, 1912, Feb. 20 and 21, 1913.

See U.S. Pat. 1,077,296 of 1913; this J., 1913, 1123.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Malt ; Formation of colour and aroma in curing ——. T. Langer. Z. ges. Brauw., 1914, **37**, 90—93.

For the production of dark aromatic malt it is essential that the grain should not be dried to a high degree on the top floor. The curves representing variations in the moisture-content of the grain on the top floor and the relative humidity of the superincumbent stratum of air are parallel, being similarly affected by any irregularity of the air current. The author gives a short account of recent work on the action of amino-acids on sugars and the significance of this action in respect of the formation of colour and aroma during the curing of malt (cp. Matthews and Lott, this J., 1908, 869; Ling, *ibid.* 1034; Maillard, *ibid.* 1912, 144; Lintner, Z. ges. Brauw., 1912, 554).—L. E.

Malt extracts ; Determination of the diastatic power of ——. A. Monnier. Ann. Chim. analyt., 1914, **19**, 51—54.

Commercial malt extracts contain large quantities of reducing sugars, hence in determining the diastatic power by Lintner's method it is necessary, in addition to the usual quantity of 5 c.c. of Fehling's solution introduced into each test-tube, to add quantities of Fehling's solution corresponding exactly to the reducing sugars present in the different amounts of the malt extract solution placed in the tubes. The author prefers to express the results in terms of maltose: 10 grms. of a malt extract having a diastatic power of 100 (Lintner) will produce 77·8 grms. of maltose from starch in 1 hour at 18° C. Commercial malt extracts, of which 10 grms. produce from 10 to 16 grms. of maltose may be considered very rich in diastase; extracts yielding from 5 to 10 grms. of maltose are fairly active, whilst those giving less than 3 grms. are unsatisfactory.—W. P. S.

Yeast ; Nitrogenous nutrition of pressed ——. H. I. Waterman. Folia microbiol., Holländ. Beiträge zur ges. Mikrobiol. 2, Heft 2. Chem. Zentr., 1914, **1**, 484—485.

The nutrient solution used consisted of a solution in tap-water of: glucose (anhydrous) 2, KH_2PO_4 0·2, and $MgSO_4$ 0·1 per cent., and in most cases 0·1 per cent. of the nitrogenous compound. After sterilising for 10 mins. at 120° C., the solution was inoculated with a pure culture of pressed yeast and kept at 30° C. No growth took place in the absence of a nitrogenous compound. Growth took place in presence of nitrogenous compounds of many different types, but especially with aliphatic amines, aromatic amines with amino-groups in the side-chain, ammonium chloride, and ammonium nitrate. Potassium nitrate, sodium nitrite, nitro-methane, and the compound, $C(CH_2OH)_3NO_2$, proved unsuitable as sources of nitrogen for the yeast. No growth occurred in the presence of amides of non-nitrogenous acids except in cases (*e.g.* urea, formamide, etc.) where these reacted with water to yield ammonia. Amides of amino-acids, such as asparagin, aspartic acid, hippuric acid, α-aminocinnamic acid amide, gave favourable results.—A. S.

Invertase ; Chemical constitution of ——. I. J. M. Nelson and S. Born. J. Amer. Chem. Soc., 1914, **36**, 393—403.

Invertase was prepared from 200 lb. of pressed yeast, which was allowed to autolyse in presence of toluene, the resulting liquid being filtered and the enzyme precipitated by alcohol and purified by re-precipitation from aqueous solution with alcohol, treatment with lead acetate and kaolin, dialysis, and precipitation with alcohol in presence of a small quantity of an added electrolyte (sodium chloride, potassium acetate, or acetic acid). The final product (about 200 grms.), after drying in a vacuum over sulphuric acid, gave the biuret, Millon, and xanthoproteic reactions for proteins when sufficient material was used: the most active preparation had an activity of ± 0°=37 mins. at 37° C. (see this J., 1890, 816, 1049), contained: ash 0·9, N 1·3 and P 0·3 per cent. The aqueous solution did not coagulate on heating, gave no precipitate with phosphotungstic acid, mercuric acetate or lead acetate, and the enzyme could not be salted out by ammonium sulphate, magnesium sulphate, or zinc sulphate. Yeast gum was prepared from the invertase by Salkowski's method (this J., 1894, 411; 1901, 489): it contained phosphorus, one sample showing 0·32 per cent. and another, not quite so pure, 0·23 per cent. An acetyl derivative (acetyl value 42·5—44·4 per cent.) of the gum, prepared by the action of acetyl bromide or of a mixture of acetic anhydride and sulphuric acid, contained 0·25—0·31 per cent. P; among the products of hydrolysis of the acetyl derivative were mannose and dextrose. After hydrolysis of the invertase with 10 per cent. sulphuric acid for 4 hours, the solution gave precipitates with phosphotungstic acid and mercuric acetate. The protein isolated from these precipitates represented only a small proportion of the nitrogen content of the invertase; it was free from phosphorus, soluble in water, did not reduce Fehling's solution, and gave a strong biuret reaction. Invertase is not destroyed by the action of trypsin (Wroblewski, J. prakt. Chem., 1901, **64**, 1; this J., 1901, 1009), diastase (Mathews and Glenn, J. Biol. Chem., 1911, **9**, 29; this J., 1911 439), ptyalin, pancreatic amylase, or castor bean lipase.—A. S.

Enzymes; Chemical composition and formation of ——. X. Influence of temperature and aeration on the formation of invertase. H. Euler and H. Cramér. Z. physiol. Chem., 1914, **89**, 272—278. (See this J., 1914, 97.)

The formation of invertase in living yeast when the latter is kept in nutrient sugar solutions proceeds more rapidly at 16° than at 39° C. and is not accelerated but rather retarded by vigorous aeration.—J. H. L.

Maltase of beer yeast; Conditions of activity of the ——. III. The nature of the different kinds of inhibition of enzymic action. L. Michaelis and P. Rona. Biochem. Zeits., 1914, **60**, 62—78. (See also this J., 1913, 442, 1123; 1914, 37.)

The inhibitive influence which some compounds exert on the activity of enzymes may be due either to a diminution of the velocity-constant of the enzymic hydrolysis, or to affinity, and consequent combination, between the inhibiting substance and the enzyme. From a study of the influence of various substances on the kinetics of the decomposition of α-methylglucoside by yeast extract, the author concludes that sodium chloride, sodium nitrate and glycerol inhibit the process by lowering the velocity-constant of hydrolysis, whereas dextrose and lithium chloride act simply by combining with the enzyme and thus reducing the active concentration of the latter. No inhibition is produced by lævulose or β-methylglucoside. The affinity of dextrose for the enzyme is about 5 times greater than that of α-methylglucoside itself.—J. H. L.

Invertase action; Different causes of inhibition of ——. L. Michaelis and H. Pechstein. Biochem. Zeits., 1914, **60**, 79—90. (See preceding abstract.)

Lævulose inhibits the action of invertase by combining with the enzyme and thus rendering it inactive. Glycerol and α-methylglucoside have no affinity for invertase but they lower the velocity-constant of its hydrolytic action. Maltose, lactose and β-methylglucoside neither possess any affinity for invertase, nor do they affect its activity in any way. It appears therefore that a hydrolysable sugar (disaccharide, glucoside) which is not decomposed by invertase has no affinity for this enzyme. The combination of invertase with a hydrolysable sugar is accordingly the necessary and sufficient condition for the hydrolysis of the latter.—J. H. L.

Fermentation; Alteration of the concentration of hydrogen ions during ——. H. Lüers. Z. ges. Brauw., 1914, **37**, 79—82. (See also Emslander, this J., 1914, 212.)

Ten per cent. solutions of sugar containing small quantities of nutrient salts, and possessing a concentration of hydrogen ions ($p_H=5·47$) approximately the same as that of brewery worts before fermentation, were fermented with yeast (5 grms. per litre) at 8° and at 25° C. A 10 per cent. sugar solution containing no salts was similarly fermented at 25° C. In all cases a considerable amount of acid was formed, and practically the same final concentration of hydrogen ions was attained ($p_H=2·66$—$2·73$). Another sugar solution, of which the concentration of hydrogen ions had been raised to this value by addition of lactic acid prior to fermentation, underwent only a slight increase of acidity during fermentation (final value of $p_H=2·51$); the degree of attenuation attained in this case was however only 39·6, compared with 67·3 and 60·7 in the other cases. It appears therefore that in the fermentation of sugar solutions, with or without salts, and at widely different temperatures, the yeast always tends to produce the same final concentration of hydrogen ions, independent of the initial value of this factor. An experiment with brewery wort ($p_H=5·11$) gave somewhat different results; the concentration of hydrogen ions increased to $p_H=3·67$ and finally diminished again to $p_H=4·00$.—J. H. L.

Fermentative equilibria; Resumption of hydrolysis or synthesis in consequence of alterations made in the composition of the mixture. E. Bourquelot and M. Bridel. Comptes rend., 1914, **158**, 206—209.

After equilibrium has been attained in solutions containing dextrose, alcohol and glucoside in presence of the corresponding enzyme (emulsin or α-glucosidase, see this J., 1913, 251, 378, 456, 762) further synthesis can be induced by addition of more sugar, or on the other hand further hydrolysis may be provoked by the removal of sugar, for example, by addition of yeast, and in fact continued fermentation of the sugar will lead finally to the hydrolysis of the whole of the glucoside originally present. It is very probable that in germinating plants, the living cell, acting as the yeast in the authors' experiments, consumes the products of hydrolysis of the reserve food-stuffs, and thus renders possible the continued and complete hydrolysis of the latter by the same enzymes which previously effected their synthesis.—J. H. L.

α-Methylgalactoside; Biochemical synthesis of ——. H. Hérissey and A. Aubry. Comptes rend., 1914, **158**, 204—206. (See also Bourquelot and others, this J., 1913, 251, 378, 456, 762.)

The authors, finding that α-methylgalactoside is ver slowly hydrolysed by maceration juice prepared fron bottom fermentation yeast, attempted to synthesise i by means of the same agent. A solution containin 95—100 grms. of galactose, 2 litres of yeast maccratio juice, 1·5 litres of pure commercial methyl alcohol (99· per cent.) and sufficient water to make up the liquid t 10 litres, was left for 4 months in presence of toluen From 5 litres of the product about 1 grm. of α-methy galactoside was isolated.—J. H. L.

Cane sugar syrup; Influence of small amounts of eth alcohol on fermentation in ——. C. B. Cochran an J. H. Perkins. J. Ind. Eng. Chem., 1914, **6**, 141.

Syrups of sp. gr. from 1·2112 to 1·26 at 20° C. were ma by dissolving granulated cane sugar in warm wat varying quantities of alcohol (up to 5 per cent. by vo were added, and fermentation tests with yeast (Fleisc mann's yeast cake) were made at 31°—32° C. In presen of quantities of alcohol up to 1 per cent., fermentati was markedly accelerated; 1·25 per cent. had litt influence and higher percentages retarded fermentatio —A. S.

Wines and fermented beverages; Determination of to solids in ——. P. Malvezin. Ann. Chim. analy 1914, **19**, 62—65.

To obtain the total solids free from glycerol, 50 c.c. the wine are evaporated at 80° C. to a pasty consiste in a flat bottomed flask connected with an exhaust pump. The temperature is then raised to 100° C., a current of steam passed through the flask for 1 hour and the residue dried at 100° C. for 10 minutes, the low pressure being maintained throughout.—W. P. S.

Betaine; Action of micro-organisms on ——. F. Ehrlich and F. Lange. Z. Ver. deut. Zuckerind., 1914, 158—171.

The ammonia formed in the biochemical decomposition of betaine cannot be detected in most cases (see this J., 1913, 986). It is now found, however, that if the decomposition is effected with *Penicillium glaucum*, *Aspergillus niger*, or certain allied organisms, an appreciable quantity of ammonia can be detected in the culture liquid. It is suggested that this discovery may find technical application in the treatment of the betaine in molasses and vinasse. —L. E.

Patents.

Brewers' worts; Caramelising of ——. W. T. Ramsden, London. Eng. Pat. 3064, Feb. 6, 1913.

In apparatus where the wort is heated to temperatures above 220° F. (104° C.) in a closed vessel, the lower part of which is steam-jacketed, a rouser, having flexible blades working close to the walls of the vessel, is provided with the object of maintaining the wort in circulation and preventing the formation of a scale of caramelised wort on the hot parts of the vessel.—W. P. S.

Producing lactic acid from waste doughs of cracker or biscuit bakeries. Eng. Pat. 14,479. *See* XIXa.

XIXa.—FOODS.

Casein in milk; Rapid method for determining ——. W. O. Walker. J. Ind. Eng. Chem., 1914, **6**, 131—133.

The method of titrating with alkali after addition of formaldehyde, recommended by Richmond (this J., 1911, 148) for the determination of total protein in milk, can also be used for the rapid determination of casein: using 10 c.c. of milk, 1 c.c. of $N/9$ alkali = 1·63 per cent. of casein.—A. S.

Peptone. I. A. Bernardi. Biochem. Zeits., 1914, **60**, 56—61.

By heating a solution of Witte's peptone for several hours with freshly prepared cupric hydroxide, a blue solution was obtained which after filtration, concentration, addition of alcohol and purification of the precipitate thus formed, yielded a compound corresponding to the formula $C_{51}H_{92}N_{14}O_{24}CuS$. By dissolving this in water and treating it with hydrogen sulphide the copper was removed, and the substance, $C_{51}H_{94}N_{14}O_{24}S$, obtained which appeared to possess fairly definite chemical characters different in some respects from those of the original peptone. —J. H. L.

Boric acid normally present in, or added to, foodstuffs; Rapid determination of ——. G. Bertrand and H. Agulhon. Comptes rend., 1914, **158**, 201—204. (See also this J., 1910, 375; 1914, 105).

The colourimetric method previously described (*loc. cit.*) has been applied to a number of foodstuffs and the results are tabulated. The quantities of boric acid found, ranged downwards from 0·12 grm. per kilo. of dried material. In carrying out the colourimetric method the distillation of the methyl borate should be included, as otherwise the method is scarcely of more than qualitative value.—J. H. L.

Boric acid in foods and other substances; Determination of ——. Jay. Comptes rend., 1914, **158**, 357—358.

Employing a method described previously by Dupasquier nd himself (this J., 1895, 889), the author has found the ollowing quantities of boric acid per kilo. of various egetable substances:—dry figs, 0·045 grm.; dry carrots, ·052 grm.; fresh onions, 0·129 grm; grapes, 0·080 to ·220 grm.; tobacco, 0·124 grm.; the ash of sweet chestnuts, 6·0 grms. Boric acid is, therefore, widely distributed and is absorbed from the soil by vegetables. The author is of opinion that boric acid is not assimilated by animals when taken in small doses.—W. P. S.

Linseed; Rate of liberation of hydrocyanic acid from ——. S. H. Collins and H. Blair. Analyst, 1914, **39**, 70—74.

The samples were digested with water, with and without acids, etc., and the volatile products were expelled by a current of hydrogen at 45° C. at the rate of 10 litres per hour. The hydrocyanic acid was received in dilute sodium hydroxide solution, and cyanides were colourimetrically determined therein by the Prussian blue test. A sample of Calcutta linseed yielded 0·38 mgrm. of hydrocyanic acid per grm. when treated with water, half of the amount being emitted in 46 mins., whilst an aqueous solution of hydrocyanic acid yielded half the total amount in 26 mins., and from 98 to 99 per cent. in 3 hours. On acidifying the linseed with hydrochloric acid ($N/100$) the action of the enzyme was inhibited, and the same effect was produced by the addition of pepsin and rennet in acid solution. Even $N/1000$ acid checked the rate of liberation of the hydrocyanic acid. From these results it appears that linseed cannot under ordinary conditions produce hydrocyanic acid when given to non-ruminant animals, owing to the action of the acid in the stomach. In the case of ruminants any small quantities of hydrocyanic acid formed during rumination would probably escape into the air, so that there is little chance of full-grown cattle being poisoned by dry linseed or linseed cake. As regards the use of linseed mash for calves the mode of preparing the mash is an important factor. Linseed that has been heated with a large volume of water at 100° C. for 30 mins. is no longer capable of yielding hydrocyanic acid, but heating the mash at 60° C. only slightly checks the action of the enzyme, whilst at 90° C. the cyanogenetic action is nearly inhibited. On the other hand if dry linseed be heated for 30 mins. at 100° C., the subsequent evolution of hydrocyanic acid is increased. Fine grinding of the seed in a mortar also results in increased liberation of hydrocyanic acid. Where calves have died from prussic acid poisoning the explanation appears to be that lumps were formed in heating the linseed with water at 100° C., that only a little hydrocyanic acid was then liberated in the presence of a small quantity of water, and that when subsequently the lumps were broked up in the stomach of the calf, the hydrocyanic acid mechanically enclosed in them was quickly liberated. Removal of oil concentrates both enzyme and glucoside, and, hence, linseed cake is liable to be more poisonous than the original linseed. —C. A. M.

Beetroot leaves [*as cattle food*]. H. Hitier. Bull. Soc. d'Encour., 1914, **121**, 67—78.

The storing of beet leaves and tops in silos for use as cattle food is recommended. According to Saillard (Conférences à la Société industrielle de St.-Quentin et de l'Aisne, March 5, 1911) the total cost would be 2·3 francs per metric ton (1s. 10d. per ton), and the composition of the fodder (calculated on the dry matter) would be: proteins, 18·81; non-nitrogenous substances, other than cellulose, 62·38; and cellulose, 18·81 per cent. Beet leaves contain about 3 per cent. of oxalic acid (referred to the dry matter), partly in the free state, hence the ration should be previously mixed with a suitable amount of calcium carbonate. Bachelier (La Sucrerie Indigène, 1913, 488) claims to have obtained good results in feeding cattle and sheep with a mixture of equal parts of beet leaves and tops and distillery pulp to which some grain was added, the ration having the following composition: water, 72·15; nitrogenous substances, 3·73; fat, 0·98; carbohydrates, 10·20; cellulose, 2·27; and ash, 10·67 per cent. Mixed rations such as this may be preserved by means of the ferment "lacto-pulpe," the results being similar to those previously observed with beet slices (this J., 1910, 1027) and the product being readily taken without any injurious effects. —J. P. O.

Picrate colourimetric method for the determination of carbohydrates. Dehn and Hartman. *See* XVII.

PATENTS.

Lactic acid from waste doughs of cracker or biscuit bakeries ; Process for producing ——. E. Saxe, New York. Eng. Pat. 14,479, June 23, 1913.

THE refuse dough from biscuit making, both raw and scorched, consisting of flour, sugar and milk is boiled with water until the starchy matters are dissolved ; the starch is then converted by boiling the solution with dilute sulphuric acid, a lactic ferment is added and the liquid fermented at a temperature of 36° C., with the addition of lime to neutralise excessive acidity. The fermented solution is concentrated and the lactic acid liberated by adding sulphuric acid, filtering and concentrating.
—J. F. B.

Preservatives for raw, fresh, or green foods. S. Rosenbaum, Ujvidék, Hungary. Eng. Pat. 16,359, July 16, 1913.

A MIXTURE of alum, 45 to 50, ground mustard seed, 30 to 35, and salicylic acid, 15 to 25 parts by weight, is sprinkled into vessels used for storing such substances as cucumbers, peas, beans, etc., before the vessels are closed.
—W. P. S.

Grain ; Milling of ——. E. Zappert, London. From F. A. V. Klopfer, Dresden-Leubnitz, Germany. Eng. Pat. 20,115, Sept. 5, 1913.

THE grain is passed through a series of disintegrators surrounded by sieves of gradually increasing degrees of fineness ; the grist from the first three disintegrators is conducted, separately, to sieves, the portion which does not pass through each sieve being transferred to the next disintegrator in the series.—W. P. S.

Grain ; Method of treating washed or damped ——. C Jaquet, Strasburg, Alsace. Eng. Pat. 20,787, Sept. 15, 1913.

To attain uniformity in the degree of humidity of washed or damped grain, the latter is subjected to a current of air or other gas, whilst passing from the supply bin to the milling apparatus.—W. P. S.

Agar ; Purification of ——. F. Steinitzer. Ger. Pat. 269,088, July 26, 1912.

SOLUTIONS containing alimentary substances and agar, *e.g.*, meat broth-agar, become turbid on long standing, or when repeatedly heated, owing to the presence of calcium and aluminium salts in the agar. These compounds may be precipitated by treatment with alkali or alkaline salts, especially sodium phosphate, but if an agar solution be so treated the insoluble aluminium or calcium compounds remain to a considerable extent in colloidal solution and cannot be separated by filtration. According to the present patent the agar is moistened with a quantity of a solution of sodium phosphate or carbonate insufficient to cause notable swelling, and is then dried first in the air and later at 100°—110° C. On subsequently dissolving in hot water (with addition of some hydrogen peroxide to bleach the agar), the calcium and aluminium compounds do not go into colloidal solution, and may be removed by filtering, centrifuging, or the like.—A. S.

Milk ; Process for making desiccated ——. C. H. Campbell. Fr. Pat. 462,973, Sept. 25, 1913. Under Int. Conv., Oct. 7, 1912.

SEE U.S. Pat. 1,070,781 of 1913 ; this J., 1913, 921.—T. F. B.

Soup ; Process for making a solution of substances with the odour and taste of ——. Andernache Dörrgemüse und Conserven-Fabrik Luithlen und Neumann. Fr. Pat. 463,105, Sept. 30, 1913.

SEE Eng. Pat. 22,052 of 1912 ; this J., 1913, 621.—T. F. B.

XIXB.—WATER PURIFICATION ; SANITATION.

Carbon monoxide ; Laws of absorption of —— *by blood in vivo.* M. Nicloux. Comptes rend 1914, **158**, 363—365.

RESULTS of experiments on the absorption of carbon monoxide by blood *in vivo* show that practically the same results are obtained as when the experiments are carried out *in vitro* (see this J., 1914, 99). In the case of dog's blood the reaction constant, K, was found to have a value of 0·00316. When an animal breathes air or oxygen containing a quantity of carbon monoxide insufficient to cause death, the carbon monoxide is absorbed by the blood up to a certain limit which cannot be exceeded. Oxygen is capable of displacing carbon monoxide from blood, and the administration of oxygen is, therefore, essential in cases of carbon monoxide poisoning.—W. P. S.

PATENTS.

Water ; Method and means for purifying [removing free chlorine from] ——. T. Goldschmidt Akt.-Ges., Essen-on-the-Ruhr, Germany. Eng. Pat. 23,569, Oct. 17, 1913. Under Int. Conv., Nov. 8, 1912.

THE water is passed through a layer of filtering material consisting of a mixture of 1 part by weight of powdered iron, aluminium, or tin and 10 parts of sand. This mixture may be regenerated or revivified, when necessary, by treating it with dilute hydrochloric acid to remove the thin films, probably of oxides or hydroxides, which are formed.
—W. P. S.

Water-sterilising tank. S. Held, Assignor to The Held Co., Chicago, Ill. U.S. Pat. 1,085,578, Jan. 27, 1914.

THE tank contains superimposed annular channels whose radii become greater in the downward direction. Water admitted at the top of the tank runs from channel to channel, and is discharged from an outlet at the bottom. In the channels are perforated tubular members communicating with a supply of compressed ozonised air.
—T. ST.

Sewage sludge ; Process for obtaining products [oils and a fertiliser] from ——. J. Noad and Oil Shale Products, Ltd., London. Eng. Pat. 1564, Jan. 20, 1913.

PRESSED sewage sludge is distilled at a temperature of from 400° to 500° F. (204° to 260° C.) in a retort such as that described in Eng. Pat. 18,433 of 1909 (this J., 1910, 1448). Water or steam may be admitted to the retort during the distillation. The fatty and oily matters distilling over are separated from the condensed water and the aqueous portion of the distillate is added to the residue discharged from the lower part of the retort, the mixture thus obtained forming a fertiliser. Dilute sulphuric acid may be added to the distillate in order to convert the ammonia into ammonium sulphate, or the acid may be added to the raw sludge.—W. P. S.

Liquids [sewage effluents] ; Apparatus for the aeration and gasification of ——. T. K. Irwin, London. Eng. Pat. 1925, Jan. 23, 1913.

THE effluent is conducted into a centrifugal drum having a porous outer wall through which the liquid is forced. This outer wall may consist of a series of layers of perforated plates or gauze with a layer of sand on the inside or a porous medium like cement or unglazed porcelai may be used ; an inner layer of sand is also employe in the latter case. Means are provided for the introduction of air or suitable reagents into the liquid in th drum and for removing and renewing the inner layer o sand.—W. P. S.

Liquids ; Apparatus for the aeration and gasification of —— T. K. Irwin, London. Eng. Pat. 3526, Feb. 11, 191 Addition to Eng. Pat. 1925, Jan. 23, 1913 (preceding

MEANS for supplying solid or liquid material to the centr fugal drum, and for removing solid material from th walls of the latter, are carried or supported by the central shaft of the drum. Devices are described for maintaining a difference in speed between the drum and the cleaning apparatus.—W. P. S.

Disinfectants; Preparation of ——. J. J. Balthasart, Brussels. Eng. Pat. 1911, Jan. 23, 1913.

One part of a 20 per cent. solution of hard or soft soap is emulsified with 3 parts of a mixture of tar oils containing phenol, cresol, and the like, both preferably heated to 50° C. Formaldehyde or analogous substances may also be added.—W. P. S.

Refuse-destructor. H. N. Leask, Egremont. U.S. Pat. 1,085,445, Jan. 27, 1914.

See Eng. Pats. 22,137 of 1909 and 7458 of 1910; this J., 1910, 1267.—T. F. B

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Strychnine; Determination of —— in the presence of quinine. C. Simmonds. Analyst, 1914, **39**, 81—83.

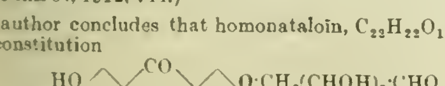
The method is based upon the fact that a 4 per cent. acid solution of potassium ferrocyanide precipitates strychnine much more readily than quinine. Slight simultaneous precipitation of quinine invariably occurs, but the quantity is small in the absence of excess of ferrocyanide. The mixed alkaloids from *e.g.* 50 c.c. of "syrup of iron phosphate with quinine and strychnine" are weighed and dissolved in 50 c.c. of 20 per cent. sulphuric acid, and the solution treated with 5 c.c. of 4 per cent. ferrocyanide solution, added drop by drop, with continual stirring. After a few hours, the precipitate is collected and lightly washed with 3 successive portions of about 3 c.c. of 5 per cent. sulphuric acid, then transferred to a funnel by means of about 10 c.c. of 10 per cent. ammonia solution and water, and extracted successively with 15, 10, and 5 c.c. of chloroform. The united extracts are shaken with 30, 10, and 10 c.c. of 20 per cent. sulphuric acid, and the precipitation and extractions repeated until the chloroform extracts are again obtained. The chloroform is then evaporated (with the addition of a little alcohol at the end to prevent spurting), and the residue of strychnine dried at 100° C. and weighed. If desired the quinine may be determined in an aliquot portion of the filtrate by precipitation with ammonia and extraction with chloroform. It is essential that not much more than 0·1 grm. of strychnine should be present in 50 c.c. of the acid; otherwise separation of strychnine sulphate may occur.—C. A. M.

Purines. XIV. 2.8-Dihydroxy-1.7.9-trimethylpurine, an isomeride of caffeine and 2.8-dihydroxy-1.7-dimethylpurine, an isomeride of theobromine. C. O. Johns. J. Biol. Chem., 1914, **17**, 1—7.

2.8-Dihydroxy-1.7.9-trimethylpurine, m. pt. 240° C., was prepared by alkylating 2.8-dihydroxy-1.9-dimethylpurine with dimethyl sulphate. It is more soluble in water than caffeine and, unlike the latter, does not give a ourple colouration when evaporated with chlorine water and he residue moistened with ammonia. 2.8-Dihydroxy-1.7-limethylpurine, prepared in the same way from 2.8-lihydroxy-1-methylpurine, crystallises in acicular prisms rom water and chars below 320° C. On further methylation t is converted into 2.8-dihydroxy-1.7.9-trimethylpurine. F. Shdn.

lomonataloïn and nataloïn; Constitution of ——. E. Léger. Comptes rend., 1914, **158**, 185—188. (See also this J., 1912, 744.)

HE author concludes that homonataloïn, $C_{22}H_{22}O_{10}$, has he constitution



and that nataloïn, $C_{23}H_{24}O_{10}$, which is present with it in Natal aloes, has a similar constitution except that the group ·CH₂OH is replaced by C_2H_4OH. Both compounds appear to contain a pentose molecule with a free aldehyde group, and both give rise to penta-acetyl derivatives.—J. H. L.

Lemon oils; Determination of the hydrocarbon content of concentrated ——. E. Böcker. J. prakt. Chem., 1914, **89**, 199—207.

Ten c.c. of the oil are measured into a cassia flask and the citral determined by shaking with freshly prepared sodium sulphite solution according to Burgess' method (this J., 1901, 1178). If the amount of undissolved oil is small, the citral is removed in the same way from another 5 or 10 c.c. of the oil. 5 c.c. of the oil freed from citral are transferred to a stoppered funnel of 600—700 c.c. capacity containing 500 c.c. of 51 per cent. alcohol (by volume) cooled to —2° to 0° C. The whole is thoroughly shaken, when the aromatic portions of the oil pass into solution leaving the hydrocarbons practically undissolved. The funnel is inverted, kept for 8—10 hours in ice-water at 0° C., carefully returned to the upright position and allowed to stand till the alcoholic portion has become clear, which may take from 12 to 48 hours. The alcoholic portion is drawn off and the oil (hydrocarbons) transferred to a small measuring cylinder, any drops adhering to the funnel being washed down with a little 51 per cent. alcohol. Larger quantities of the original oil can be fractionated at reduced pressure to separate terpenes and sesquiterpenes. The citral in the separate fractions is determined as above and the undissolved oil from each treated with a corresponding volume of 51 per cent. alcohol so as to ascertain the relative proportions of terpenes and sesquiterpenes.—F. Shdn.

Essential oils; Constituents of ——. *Nopinane, β-dihydrolimonene and carane.* F. W. Semmler and J. Feldstein. Ber., 1914, **47**, 384—389.

When the hydrazones of certain ketones are heated with sodium ethoxide, hydrocarbons are produced. Nopinane, C_9H_{16}, obtained in this way from nopinone boiled at 149° C. at 747 mm., had the sp. gr. 0·8611 at 22°/22° C., $n_D = 1·46141$, and was optically inactive. β-Dihydrolimonene, $C_{10}H_{18}$ (prepared from dihydrocarvone) boiled at 168°—169° C. at 750 mm., had the sp. gr. 0·8217 at 21°/16° C., $n_D = 1·45673$, and was optically inactive. Carone similarly yielded carane, $C_{10}H_{18}$, b. pt. 49°—50° C. at 9 mm., sp. gr. 0·8381 at 20°/20° C., $n_D = 1·45823$ and $\alpha_D = -34°$. The characters of dihydroterpinolene prepared from pulegone were: b. pt. 169°—170° C. at 748 mm., sp. gr. 0·8189 at 22°/21° C., $n_D = 1·45823$. Tanacetane, $C_{10}H_{18}$, obtained from tanacetone boiled at 156°—157° C. at 747 mm., had the sp. gr. 0·8158 at 22°/21° C., and $n_D = 1·44121$.—F. Shdn.

Dihydroxydiaminoarsenobenzene [Salvarsan] and silver Compounds of chlorine, bromine and iodine with ——. J. Danysz. Comptes rend., 1914, **158**, 199—201. (See Ehrlich and Bertheim, this J., 1912, 407.)

Silver chloride, bromide and iodide, when freshly prepared, dissolve in solutions of Ehrlich's arsenobenzene hydrochloride (606), but the bromide and iodide only dissolve slowly and it is best to dissolve them first in solutions of potassium cyanide. The preparation of the new products presents no difficulty and is typified in the following particular case:—A solution of silver bromide in potassium cyanide solution is added drop by drop to a solution of the arsenic compound. As each drop falls a precipitate is formed which redissolves, and the liquid becomes darker in colour and disengages hydrogen cyanide. As soon as a permanent precipitate is produced, it is redissolved by addition of hydrochloric acid drop by drop, and in this way it is possible to introduce 1 mol. of silver bromide for each mol. of arsenobenzene hydrochloride. From the solution thus obtained sulphuric acid precipitates the arsenobenzene-silver bromide compound in the form of an insoluble sulphate, which after being washed free from the last traces of potassium chloride and cyanide forms a powder varying in colour from orange yellow to deep brown according to the quantity of silver in it. It dissolves readily in water rendered slightly alkaline with sodium carbonate. The chlorine compounds possess the least, and the bromine compounds the most pronounced antiseptic and therapeutic properties. Dihydroxydiaminoarsenobenzene may combine with various proportions of silver salts, but certain limits cannot be passed without lessening the therapeutic activity of the products. The toxicity of the bromine compound is nearly the same as that of dihydroxydiaminoarsenobenzene, whilst its sterilising power *in vitro* and *in vivo* is considerably greater. The compounds of dihydroxydiaminoarsenobenzene with mercury, gold, and platinum, though rather more active than the silver compounds, are less stable and relatively much more toxic.—J. H. L.

Cholesterol ; Colourimetric determination of ——. A. Grigaut. J. Pharm. Chim., 1914, **9**, 146—149.

Liebermann's reaction (development of a purple colouration passing rapidly through blue into green, when acetic anhydride and sulphuric acid are added to a solution of cholesterol in chloroform) can be used for the estimation of cholesterol. The time required to develop the maximum colour, and the length of time this colour remains constant, depend on the amount of sulphuric acid used. The colouration is compared with that given by a standard solution of cholesterol, using the same amount of sulphuric acid must be used in each case. The estimation is correct to within 5 per cent.—T. C.

Benzoic acid ; Simple test for halogens in ——. E. Wende. Apoth.-Zeit., 1914, **29**, 157.

A mixture of 0·1 grm. of benzoic acid and 0·5 grm. of yellow mercuric oxide is heated in a dry test-tube with constant turning over a small flame about 1 cm. high. When the reaction is over, about 10 c.c. of dilute nitric acid are added, the whole heated nearly to boiling and filtered. The filtrate should not give more than a slight opalescence with silver nitrate solution.—F. Shdn.

Spirit of nitrous ether ; Determination of ——. D. B. Dott. Pharm. J., 1914, **92**, 164.

The method for the determination of spirit of nitrous ether based on the reaction :

$$2C_2H_5NO_2+2KI+H_2SO_4=2C_2H_6O+2NO+K_2SO_4+I_2,$$

with titration of the liberated iodine by thiosulphate, gives high results, owing to oxidation of nitric oxide by atmospheric oxygen to nitrogen peroxide, which liberates a further quantity of iodine. A simple form of apparatus to overcome this defect consists of a bottle fitted with a cork through which passes a short length of glass tubing reaching to just below the cork ; the stem of a thistle funnel slides freely in this tube and reaches to the bottom of the bottle. Four c.c. of potassium iodide solution and 2 c.c. of dilute sulphuric acid are placed in the bottle, which is then filled to within 6 c.c. with magnesium sulphate solution. Five c.c. of the spirit are introduced gradually through the thistle funnel, the bottle is shaken, emptied into a dish after 5 mins., and the solution titrated with thiosulphate.—A. S.

Spirit of nitrous ether ; Note on an old sample of ——. D. B. Dott. Pharm. J., 1914, **92**, 164.

Spirit of nitrous ether prepared by the rapid method described by the author in 1909 (Pharm. J. (4), **28**, 429)—addition of a strong solution of sodium nitrite to a mixture of alcohol and sulphuric acid and filtering from the precipitated sodium sulphate—maintains its strength well on keeping. A sample which in 1909 was rather over the B.P. standard showed 2·35 per cent. $C_2H_5NO_2$ when recently tested.—A. S.

Esters of chromic acid. H. Wienhaus. Ber., 1914, **47**, 322—331.

The chromic esters of tertiary alcohols are obtained on treating a solution of the alcohol in carbon tetrachloride or light petroleum with an excess of dry chromic anhydride, pouring off the liquid through a filter, and concentrating in a vacuum. Primary and secondary alcohols are oxidised by this treatment. The neutral esters of chromic acid, A_2CrO_4 (where A represents the alcohol residue) are formed ; they are liquid or crystalline, range in colour from yellow to wine-red, and are soluble in ether, benzene, acetone, and glacial acetic acid, but insoluble in water. They resist hydrolysis by aqueous alkalis and baryta, but readily yield the tertiary alcohol when warmed with alcoholic alkalis. The reaction, which also takes place with aqueous chromic acid, may be used for the detection of the acid, and in many cases for distinguishing tertiary alcohols ; it also serves for the isolation of the alcohols. The preparation of the chromic esters of a number of hydroaromatic alcohols is described. The esters of α- and β-terpineol and the *p*-menthanols resulting from their catalytic hydrogenation were somewhat unstable, and could not be obtained crystalline. Methylfenchyl chromate, m.pt. 130° C. (with decomposition), $[\alpha]_{\text{Li red}}=-30\cdot0°$ in carbon tetrachloride or light petroleum, formed red crystals, stable in absence of light; ethylfenchyl chromate, $[\alpha]_{\text{Li red}}=+22\cdot5$, decomposed on heating ; methylbornyl chromate formed light orange crystals which decomposed on heating : it was lævorotatory in carbon tetrachloride solution ; cedryl chromate, m. pt. 115° C., formed yellowish-red prisms ; ledyl chromate (from ledum camphor), m. pt. 92° C., $[\alpha]_{\text{Li red}}=+30\cdot0°$, formed wine-red monoclinic prisms. Methylborneol produced a red colouration in carbon tetrachloride containing chromic anhydride, while camphor did not.—O. E. M.

Catalytic hydrogenations ; The reaction velocities of —— in presence of platinum black. G. Vavon. Comptes rend., 1914, **158**, 409—412.

The velocity curves for the absorption of hydrogen in the case of substances which can fix several molecules of this gas (*e.g.* limonene), have a gradient which varies considerably with the quantity of catalyst present. Apparently the metal can become fatigued so that its activity is sufficient to bring about the easier stages quite readily, but is not enough for the more difficult stages. This is more marked on heating the catalyst to temperatures of between 300° and 500° C., when its activity can be varied and suited to the different stages in a quite regular manner. After heating to temperatures above 500° C. it becomes quite inactive.—W. H. P.

Determination of the diastatic power of malt extracts. Monnier. See XVIII.

Patents.

Medicinal preparations containing menthol and formaldehyde. C. Buchwald, Düsseldorf-Gerresheim, Germany. Eng. Pat. 15,915, July 10, 1913.

Menthol (10 parts), formaldehyde, preferably in the polymerised form (2 parts), and "anæsthesine" (2 parts) are added to melted ceresin or similar fusible carrier. Boric acid (2 parts) may also be added if desired.—T. F. B.

Methylphenylglycine-arsinic acid and its reduction product, arsenomethylphenylglycine ; Process for preparing ——. Poulenc frères, and K. Oechslin. Fr. Pat. 462,276, Nov. 18, 1912.

The esters of methylphenylglycine-arsinic acid, obtained by the action of arsenious chloride on phenylglycine esters are very easily saponified by means of excess of sod at a temperature about 60° C. ; when the solutions ar acidified by acetic or hydrochloric acid, methylphenyl glycine-arsinic acid, $H_2O_3As.C_6H_4.N(CH_3)CH_2.COOH$, i precipitated in the form of white crystals, sparingly solubl in water, which do not melt on heating but evolve carbo dioxide, with formation of dimethylaminophenylarsini acid. Reduction of methylphenylglycine-arsinic acid b means of sodium hydrosulphite at a high temperatu results in the production of arsenomethylphenylglycin which is stable towards air and oxidising agents, and solubl in solutions of sodium hydroxide or carbonate, formin neutral salts.—T. F. B.

p-Aminophenylarsinic acid ; Process for preparing ac derivatives of ——. Chem. Fabr. auf Actien, vorm E. Schering. Ger. Pat. 268,983, Nov. 9, 1912.

p-Aminophenylarsinic acid is converted into iod acyl derivatives by the usual methods. The produc are stated to have a low toxicity compared with the aminophenylarsinic acid.—T. F. B.

Aromatic stibinic acids; Process for preparing ——. Chem. Fabr. von Heyden A. G. Ger. Pat. 269,205, Aug. 6, 1912. Addition to Ger. Pat. 254,421 (see Eng. Pat. 16,350 of 1912; this J., 1913, 109).

Secondary and tertiary aromatic stibinic acids are obtained by decomposing aromatic diazo compounds with antimonious oxide substituted with one or two aromatic groups. (See also this J., 1913, 711, 841, 925.)—T. F. B.

Aromatic stibinoxides or their derivatives; Process for preparing secondary ——. Chem. Fabr. von Heyden A. G. Ger. Pat. 269,206, March 8, 1913. Addition to Ger. Pat. 268,451 (see this J., 1914, 219).

Diarylstibinic acids or their derivatives are converted into secondary aromatic stibinoxides by treatment with reducing agents.—T. F. B.

Benzyl alcohol; Process for obtaining ——. F. W. Klever. Fr. Pat. 462,438, Sept. 10, 1913. Under Int. Conv., Sept. 11, 1912.

Benzyl chloride can be converted quantitatively into benzyl alcohol by heating it, in presence of excess of water, with magnesium hydroxide, an alkaline-earth hydroxide, zinc hydroxide, or other basic hydroxide other than that of lead, the mixture being thoroughly agitated during the process. When one mol. of benzyl chloride is treated with 0·6 mol. of magnesium hydroxide at 100° C. in presence of 8 to 10 times the theoretical quantity of water, a yield of about 96 per cent. of benzyl alcohol is produced. When calcium hydroxide is used, the yield is somewhat lower. —T. F. B.

Benzyl esters of lower fatty acids and benzyl alcohol from benzyl chloride; Process for obtaining ——. F. W. Klever. Fr. Pat. 462,439, Sept. 10, 1913.

Good yields of benzyl esters of the lower fatty acids are obtained by heating a mixture of benzyl chloride and an anhydrous salt of the acid in presence of a small quantity of the free acid itself, *e.g.*, 0·1 to 1 mol., the presence of water being avoided. The following mixture is given for the preparation of benzyl acetate:—Benzyl chloride, 1 mol.; anhydrous sodium acetate, 1·1 to 1·2 mols.; glacial acetic acid, 0·1 to 1 mol. For preparing benzyl formate the following mixture may be used:—Benzyl chloride, 1 mol.; anhydrous sodium formate, 1·1 to 1·2 mols.; anhydrous formic acid, 1·25 to 1·5 mols. The mixture obtained after the preparation of benzyl acetate by this method may be heated with water until the odour of the acetate has disappeared, the liquid neutralised and the benzyl alcohol separated.—T. F. B.

Hydrohalogen addition products of acetylene; Process for making ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 462,711, Sept. 17, 1913.

Acetylene and a hydrogen halide are caused to combine by passing them over heated catalytic substances at the ordinary pressure or under increased pressure. Mercury salts are especially suitable for use as catalysts, but other substances, such as metals, oxides, etc., can be used. The catalyst can also be used in solution or in suspension. The reacting gases may be passed over the catalyst simultaneously or alternately; for example, a solution of a mercury salt may be saturated with hydrogen chloride, and acetylene then passed into it. When the gases are applied simultaneously, it is advisable to bring them to the reaction vessel from different points. In the case where the catalyst is used in the form of a liquid, the reaction can be carried out under pressure and at a temperature above he normal boiling point of the liquid.—T. F. B.

soprene; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 268,101, Feb. 11, 1913. Addition to Ger. Pats. 255,519 and 268,100 (see Eng. Pats. 21,616 of 1912 and 13,327 of 1913; this J., 1913, 924).

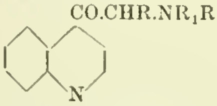
Methylbutenol ethers are converted into isoprene by eating with catalytic substances at high temperatures, and preferably under diminished pressures. The methylbutenol ethers may be obtained by the action of alcoholic potash on compounds such as 2.4-dibromo-2-methylbutane or 3-bromo-2-methylbutene-(2), $(CH_3)_2C:CBr.CH_3$. —T. F. B.

Quinolylketones; Process for preparing ——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 268,830, March 30, 1913.

Quinolinecarboxylic esters and esters of the general formulæ, $R'.CH_2COOR''$ (where R' = hydrogen or alkyl; R''=alkyl) are treated with sodium ethoxide or other alkaline condensing agent, and the β-ketone ester is converted into the quinolylketone by the usual method. —T. F. B.

Aminoketones of the quinoline series; Process for preparing ——. A. Kaufmann. Ger. Pat. 268,931, March 26, 1913.

Quinolyl-4-ketones, in which the carbonyl group is adjacent to a methyl or methylene group, are treated with halogens or substances which evolve halogens and then with primary or secondary aliphatic amines. The products have the general formula,



(where R and R_1 represent hydrogen or alkyl and R_2 alkyl), and possess antipyretic properties.—T. F. B.

Bismuth gallocarboxylate; Process for preparing basic ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,932, Aug. 23, 1912.

Basic bismuth salts of gallocarboxylic acid are obtained by the action of the acid on acid solutions of bismuth salts or on bismuth hydroxide. They are suitable for use as antiseptics for internal or external application.—T. F. B.

C-Propenylphenolcarboxylic acids and their nucleus substitution products; Process for preparing ——. L. Claisen. Ger. Pat. 268,982, Nov. 3, 1912.

C-Allylphenolcarboxylic acids, obtained from O-allylphenolcarboxylic acids and their nucleus substitution products (see Ger. Pat. 268,099; this J., 1914, 220), are converted into the corresponding C-propenylphenolcarboxylic acids by heating with alkali hydroxides.—T. F. B.

o-Dihydroxyphenyl-α-propanolamine; Process for preparing optically active ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 269,327. Nov. 26, 1911.

Synthetic, racemic *o*-dihydroxyphenyl-α-propanolamine is separated into its optically active components by the aid of *d*- or *l*-tartaric acid. A sparingly soluble *d*-tartrate of the lævorotatory base is obtained, the therapeutic (hæmostatic) properties of which are more marked than in the racemic base.—T. F. B.

Hydroxybenzoyl-o-benzoic acids, their homologues and substitution products; Preparation of esters of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 269,336, Jan. 19, 1913.

Therapeutically active compounds are obtained by esterifying hydroxybenzoyl-*o*-benzoic acids, or their homologues or substitution products, by the usual methods, with alcohols other than methyl alcohol.—T. F. B.

o-Aminophenylsulpho-acetic acid; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,337, Jan. 23, 1913.

o-Nitrophenylsulpho-acetic acid is reduced by means of iron or zinc dust in neutral or feebly (organic) acid solution, the mixture is made alkaline, and the free aminophenylsulpho-acetic acid is separated from the filtered solution of its alkali salt by adding the equivalent quantity of an acid in the cold. The product can be readily converted into sulphazone.—T. F. B.

Sulphazone; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,428, Nov. 16, 1912.

o-NITROPHENYLSULPHO-ACETIC acid is treated with metallic iron in neutral solution or suspension, preferably in presence of a neutral salt, and excess of mineral acid is then added. The yield is stated to be about 95 per cent. of theory, whilst that obtained by the process of Claass (Ger. Pat. 256,342; see this J., 1913, 417) is only about 77 per cent.—T. F. B.

aa′-Diphenyl-N-methyl-γ-piperidone; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 269,429, July 18, 1913.

DIBENZAL-ACETONE is condensed with methylamine to form *aa′*-diphenyl-N-methyl-γ-piperidone, which is applicable in medicine or for the preparation of medicinal products.—T. F. B.

Monochlorhydrin from glycerin and hydrochloric acid; Process for preparing ——. Sprengstoffwerke Dr. R. Nahnsen und Co. A.-G. Ger. Pat. 269,657, Dec. 19, 1912.

GLYCEROL vapour is treated with gaseous hydrogen chloride *in vacuo*, and the product is passed for a considerable time through a series of tubes heated to 170°—180° C., to complete the reaction. The liquid thus obtained is passed into a retort heated to about 150° C., and the monochlorhydrin is separated from the lower-boiling products by cooling.—T. F. B.

Acetaldehyde; Preparation of ——. Consortium f. Elektrochemische Industrie G. m. b. H., Nuremberg, Germany. Eng. Pat. 6000, March 11, 1913. Under Int. Conv., May 22, 1912.

SEE Fr. Pat. 455,370 of 1913; this J., 1913, 959.—T. F. B.

Isoprene; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 8782, April 14, 1913. Addition to Eng. Pat. 13,327 of 1913, dated Sept. 23, 1912.

SEE Ger. Pat. 268,101 of 1913; preceding.—T. F. B.

Sulphur derivatives of hydrocarbons [thiophen, etc.]; Process of producing ——. W. Steinkopf, Karlsruhe, Germany. U.S. Pat. 1,085,708, Feb. 3, 1914.

SEE Ger. Pat. 252,375 of 1911; this J., 1912, 1201.—T. F. B.

Organic solvents [acetaldol, etc.]; Manufacture of ——. H. Hibbert, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,086,048, Feb. 3, 1914.

SEE Fr. Pat. 449,605 of 1912; this J., 1913, 507.—T. F. B.

Ethylene or gases containing ethylene; Process for purifying —— *for the catalytic manufacture of ethane.* Elektrochem. Werke G. m. b. H. Fr. Pat. 462,528, Sept. 13, 1913. Under Int. Conv., Oct. 15, 1912.

SEE Ger. Pat. 265,297 of 1912; this J., 1913, 1087.—T. F. B.

Ethylene; Process for purifying —— *for use in catalytic reactions, especially for the manufacture of ethane.* Elektrochem. Werke.G.m. b.H. Fr. Pat. 462,529, Sept, 13, 1913. Under Int. Conv., Oct. 15, 1912.

SEE Ger. Pat. 266,519 of 1912; this J., 1913, 1170.—T. F. B.

Ethane from ethylene and hydrogen; Catalytic process for making pure ——. Elektrochem. Werke G.m.b.H. Fr. Pat. 462,893, Sept. 24, 1913. Under Int. Conv., Oct. 15, 1912.

SEE Ger. Pat. 265,171 of 1912; this J., 1913, 1087.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Kinematograph films; The carbon process of photography for producing ——. J. E. Thornton, Rochester, N.Y., U.S.A. Eng. Pat 29,113, Dec. 17, 1912.

THE bichromated colloid is mixed with a dyestuff which is mordanted or rendered insoluble by the bichromate and forms a transparent lake in the colloid without the use of an auxiliary mordant. Suitable dyestuffs are stated to be those of the Chromotrope or Erio-group.—T. F. B.

Colour-screens [for colour photography]; Process of making ——. O. S. Dawson and C. L. Finlay, Assignors to G. F. R. Baguley, London. U. S. Pat. 1,085,727, Feb. 3, 1914.

SEE Eng. Pat. 4208 of 1910; this J., 1911, 308.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Cap-compositions which do not cause rusting in rifle barrels. O. Mertens. Z. ges. Schiess- u. Sprengstoffw., 1914, **9** 70—71.

THE rusting of rifle-barrels by chlorate cap-compositions was found to be caused by chlorine. By substituting barium nitrate for the chlorate, adding basic substances such as certain carbonates, diphenylamine, etc., to suppress the deteriorating action of the nitrate on the fulminate, and covering the composition with tinfoil and a varnish free from moisture, a stable cap which did not cause rusting was produced. It was deficient in power, however; to improve this, the proportion of fulminate, or the total quantity in the cap, was increased, or some of the antimony sulphide was replaced by a more easily ignited substance, such as antimony phosphide.—O. E. M.

PATENT.

Explosive mixtures which can be detonated directly; Process for preparing ——. Ver. Köln-Rottweiler Pulverfabriken. Ger. Pat. 267,542, April 28, 1912.

A SALT of a nitrated naphthalenesulphonic acid is mixed with a nitrate, and also, if desired, with other explosive components. The salts of mononitronaphthalenesulphonic acid when mixed with nitrates can be detonated directly.
—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Electro-analysis; Fine-meshed brass gauze as a substitute for platinum in ——. D. F. Calhane and T. C. Wheaton. Met. and Chem. Eng., 1914, **12**, 87—89.

BRASS wire gauze (100 meshes per linear inch) has been successfully used (over a period of two years) in the electrolytic determination of copper, zinc and nickel The cathode employed was made from a piece of gauze 5¼ in. by 3¼ in., the longer edges of which were lapped ove and hammered down, and the shorter ones bent over 12 in. loop of copper wire (22-gauge) the ends of whic were afterwards twisted together. The cylinder thu formed was thinly plated with copper, then washed dipped in alcohol, dried and weighed for use. The anod consisted of a spiral made from 10—12 in. of platinu wire weighing about 1 grm. In the case of ammoniac solutions, the copper wire stem of the cathode had a insert of platinum wire, two pieces of which, each 3 i long, were attached to the gauze, twisted together and s joined to the stem. Brass gauze could not be used in th separation of silver from copper in cyanide solution, the zinc dissolved and silver was deposited; but in a successful cases the efficiency of the brass was equal that of platinum gauze, the time factor for the form with still electrolyte being nearly as good as that for th latter with magnetic stirring. Details are given of the procedure followed in the electro-analysis of copper scale and various alloys of nickel, copper and zinc.—W. E. F. P.

Silica; Solubility of —— in hydrochloric, nitric, and sulphuric acids. M. Wunder and A. Suleimann. Ann. Chim. analyt., 1914, **19**, 45—49.

When hydrated silica is evaporated to dryness with hydrochloric acid, the residue heated to 110° C., and the silica separated in the usual way, about 0·75 per cent. remains in solution, but may be recovered by evaporating the filtrate to dryness and collecting the insoluble residue thus obtained. Similar results are found when nitric acid is used, but, owing to the difficulty of removing all the nitric acid by washing, there is a tendency for the results to be too high. About 3·5 per cent. of the weight of the silica remains in solution when sulphuric acid is used (in this case, the mixture cannot be evaporated to complete dryness), but the loss is recovered by a second evaporation. Hydrated silica was found to dissolve in dilute hydrochloric acid of various strengths (1 : 2; 1 : 1; 2 : 1) to the extent of from 0·03 to 0·33 grm. per litre, the largest quantity being dissolved at 100° C. by the 2 : 1 acid. Nitric and sulphuric acids dissolved smaller quantities, namely, from 0·02 to 0·1 grm. per litre.—W. P. S.

Ferric salts; New method of titration of —— by reduction. C. Russo. Gaz. chim. ital., 1914, **44**, I., 1—8.

The direct titration of ferric salts with stannous chloride solution gives accurate results only in daylight and when the iron solution is concentrated. The author has found that accurate results can be obtained even with dilute solutions and in artificial light if 2 drops of a 10 per cent. solution of methylene blue be added as indicator and the solution contains free hydrochloric acid in the proportion of about 10 c.c. of the concentrated acid per 100 c.c. The acid ferric solution is heated to boiling, 2 drops of the methylene blue solution are added, the boiling is continued until practically all dissolved air is expelled from the solution, and the latter is then titrated with a standardised solution of stannous chloride (about $N/5$): towards the end of the titration the solution is heated to boiling and the stannous chloride added drop by drop until the blue colour begins to fade; after again boiling for a few minutes a drop of stannous chloride is usually sufficient to complete the decolourisation. In a mixture of ferrous and ferric salts, the ferrous salt may be titrated with permanganate, the slight excess of the latter decomposed with oxalic acid, and then the total ferric salt determined as above after addition of hydrochloric acid.—A. S.

Nitrates, chlorates, and peroxides; New method of analysis by reduction of ——. C. Russo and G. Sensi. Gaz. chim. ital., 1914, **44**, I., 9—15.

The method of titrating ferric salts with stannous chloride in presence of methylene blue as indicator (see preceding abstract) has been applied to the analysis of nitrates, chlorates, and manganese dioxide. For the analysis of nitrates a flask of about 500 c.c. capacity is used, provided with inlet and outlet tubes for a current of carbon dioxide; the outlet tube passes to the bottom of a second flask of 300 c.c. capacity containing 120 c.c. of water to which a solution of decolourised methylene blue (2—3 c.c. of water, 2 drops of a 10 per cent. solution of methylene blue, and 1 drop of $N/5$ stannous chloride, heated to boiling) has been added. After all the air in the large flask has been expelled by carbon dioxide, 3 grms. of ferrous ammonium sulphate and about 0·2 grm. of the nitrate are introduced, followed by 10 c.c. of concentrated hydrochloric acid. The mixture is heated gently at first and finally to boiling and the water in the smaller flask is also heated to boiling. When the reaction is completed, the flames are removed and the current of carbon dioxide is cut off: on cooling, the boiled water is sucked over from the smaller into the larger flask, and the solution in the latter is then titrated with stannous chloride as described in the preceding abstract. In the case of chlorates access of air has practically no effect on the results. The ferrous salt is added to the boiling solution of the chlorate, followed by 10 c.c. of concentrated hydrochloric acid, added gradually. When the reaction is completed, the solution is titrated with stannous chloride. For the analysis of manganese dioxide a weighed quantity is suspended in 100 c.c. of boiled water, then the ferrous salt and hydrochloric acid are added, the whole is boiled until a clear solution is obtained, and this is titrated with stannous chloride.—A. S.

Titanium; Use of the ammonium salt of nitrosophenylhydroxylamine ("cupferron") in the quantitative separation of —— from iron. W. M. Thornton, jun. Amer. J. Sci., 1914, **37**, 173—178.

Titanium is quantitatively precipitated by "cupferron" (see this J., 1910, 115, and 1911, 1090) in presence of tartaric acid and oxidation of the tartaric acid after separating iron as sulphide is therefore unnecessary. To the solution containing iron and titanium, tartaric acid equal to three times the combined weight of the oxides of iron and titanium present (about 0·4 grm.), is added, the solution neutralised by ammonia, 2 c.c. of sulphuric acid (1 : 1) added, and the volume made up to about 100 c.c. Hydrogen sulphide is then introduced until the iron is reduced, the solution made ammoniacal, and more hydrogen sulphide introduced until the iron is completely precipitated. The filtrate is acidified with 25 c.c. of sulphuric acid (1 : 1), the hydrogen sulphide expelled, the acid partially neutralised with ammonia so as to leave about 2·5 c.c. of sulphuric acid (1 : 1) for every 100 c.c. of solution, and a slight excess of a 6 per cent. solution of "cupferron" in cold water added in the cold. The precipitate is allowed to settle, filtered, and washed with cold water. The filter and precipitate are transferred wet to a weighed platinum crucible, dried at 110° C., and heated very carefully at first, and then strongly until the weight is constant.—T. St.

Hydroxyl groups; Use of pyridine as a solvent in the determination of —— by means of alkyl-magnesium halides. A. P. Tanberg. J. Amer. Chem. Soc., 1914, **36**, 335—337.

Pyridine has been recommended by Zerewitinoff (this J., 1908, 839; 1911, 107; 1912, 1057; 1913, 1162) as a solvent in the determination of hydroxyl groups by means of methyl-magnesium iodide. The author has been unable to obtain satisfactory results with either commercial or specially purified pyridine, and blank determinations with different samples showed that considerable quantities of gas are evolved on treatment with a solution of methyl-magnesium iodide in anhydrous amyl ether. —A. S.

Analysis of coal gas with the Bunte burette. Czakó. *See* IIa.

Testing lubricating oils for motors. Lumet. *See* IIa.

Refractometric examination of paraffin waxes. Holde. *See* IIa.

Determination of the temperature of softening of pitch. Abeles. *See* III.

Determination of sulphur in pyrites. Martin. *See* VII.

Physico-chemical determination of sulphates. Kling and Lassieur. *See* VII.

Solubility of iodine in sodium iodide solution. Gill. *See* VII.

Determination and distinction of ozone, nitrogen peroxide, and hydrogen peroxide at high dilutions. Pring. *See* VII.

Electrically controlled and timed asphaltum penetrometer. Mahr. *See* IX.

Analysis of high-speed tool steel. Fettweis. *See* X.

Assay of tin ores and concentrates; The Pearce-Low method. Wraight and Teed. *See* X.

Assay of tin ores. Hutchin. *See* X.

Determination of antimony and arsenic in lead-antimony alloys and anti-friction metals. Bertiaux. *See* X.

Analysis of sulphonated oils. *See* XII.

Determination of sulphur in rubber. Stevens. *See* XIV.

Determination of sulphides in lime liquors. Blockey and Mehd. *See* XV.

Differences in the analysis of raw sugars. Sachs. *See* XVII.

Picrate colourimetric method for the determination of carbohydrates. Dehn and Hartman. *See* XVII.

Determination of the diastatic power of malt extracts. Monnier. *See* XVIII.

Determination of total solids in wines and fermented beverages. Malvezin. *See* XVIII.

Rapid determination of casein in milk. Walker. *See* XIXa.

Rapid determination of boric acid normally present in, or added to, foodstuffs. Bertrand and Agulhon. *See* XIXa.

Determination of strychnine in presence of quinine. Simmonds. *See* XX.

Determination of the hydrocarbon content of concentrated lemon oils. Böcker. *See* XX.

Colourimetric determination of cholesterol. Grigaut. *See* XX.

Test for halogens in benzoic acid. Wende. *See* XX.

Determination of spirit of nitrous ether. Dott. *See* XX.

Esters of chromic acid. Wienhaus. *See* XX.

PATENTS

Density of gases, liquids, or solids ; Process and apparatus for determining the ——. A. Kalähne. Fr. Pat. 461,932, Aug. 27, 1913.

See Ger. Pat. 268,353 of 1912 ; this J., 1914, 163.—T. F. B.

Process for detecting and determining inflammable gases in the air. Ger. Pat. 269,131. *See* IIa.

XXIV.—MISCELLANEOUS ABSTRACTS.

Palladium ; Sorption [adsorption and absorption] o hydrogen by ——. F. Halla. Z. physik. Chem., 1914, **86**, 496—505.

THE work of Andrew and Holt (Proc. Roy. Soc. 1913, A. **89**, 170—186) which leads to the conclusion that palladium is dimorphic, is discussed and the author shows that palladium black prepared by Graham's method is not inactive. He also shows that occlusion by active palladium is not hindered at ordinary temperatures by contact with the inactive metal. The velocity curve of adsorption by active metal is in agreement with the view that the first process is a mechanical adsorption on the surface of the metal followed by diffusion towards the interior, which proceeds more rapidly at first on account of the heat produced by the initial adsorption.—W. H. P.

Fluorine in the animal economy. A. Gautier. Comptes rend., 1914, **158**, 159—166. (See also this J., 1912, 663, 703.)

THE author has observed a certain uniformity in the relative amounts of fluorine and phosphorus present in animal tissues. In the more vital tissues (muscles, glands, nerves, and secretions such as milk, blood, etc.) the ratio by weight of fluorine to phosphorus is 1 : 350—750 or more. In bone, cartilage, tendons, etc., it is 1 : 130—180, whilst in structures which may almost be regarded as non-living (hair, feathers, nails and skin) it is 1 : 3—8, corresponding approximately with the relative amounts of fluorine and phosphorus present in fluophosphates such as apatite.—J. H. L.

Books Received.

UEBER DIE KONSTITUTION UND KONFIGURATION VON VERBINDUNGEN HÖHERER ORDNUNG. (Vortrag, gehalten in Stockholm an 11 Dezember 1913, in Anschluss an die Entgegennahme des Nobelpreieses.) Von Professor Dr. ALFRED WERNER. Julius Springer's Verlag. 1914. Berlin, W 9. Linkstr. 23—24. Price M. 1.20. Pamphlet of 21 pages.

FORTSCHRITTE DER EDELMETALLAUGEREI WÄHREND DER LETZTEN JAHRZEHNTE. Von R. BORCHERS. Verlag von W. Knapp. Halle (Saale), 1913. Price M. 7.80.

THIS volume ($9\frac{3}{4}$ by $6\frac{3}{4}$ ins.), contains 151 pages of subject-matter, with 136 illustrations, and alphabetical indexes of names and subjects. The classification of the subject matter is as follows:—I. GOLD. (*a*) Chlorinating processes. (*b*) Cyanide treatment, etc. II. SILVER. (*a*) The Patera-Hofmann process. (*b*) The Ziervogel process.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Cordier*, C. F. : Les machines à vapeur. 123 fig., in-18. O. Doin et fils. Paris. 1914. bds. 5 fr.

Garnier, A. R., et V. *Sylvestre*. Production de la force motrice. Les moteurs électriques et leurs applications industrielles. 206 fig., in-4°. Dunod et Pinat. Paris. 1914. 8 fr.

Gill, A. H. : Engine room chemistry. 2nd ed., rev. and enl. N.Y., McGraw-Hill. 1913 c. 211 p. il. 16°. 1914. $1.

Kalender f. Kälte-Techniker 1914. Hrsg. v. G. Göttsche. 6. Jahrg. (VII, 277 S. m. Abbildgn.) kl. 8°. Altona (Klopstockstr. 11), Verlag f. Kälte-Industrie. Cloth M.5.

Macintire, H. J. : Mechanical Refrigeration. 8vo. Chapman and Hall. London. 1914. Net 17s.

IIa. *Garforth*, W. E. : Coal and Stone Dust Investigations. 8vo., pp. 34. Instit. of Mining Engineers.

Craig, E. H. C. : Oil-Finding. An introduction to the Geological Study of Petroleum. 2nd impression 8vo, pp. 208. E. Arnold. London. 1914. Net 8s. 6d.

Parish, W. F. : Untersuchungen üb. Schmieröle. (8 S. m. eingedr. Bildnis u. 8 Abbildgn.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1914. M.1.

Singer, Dr. L. : Die Fabrikation der Naturgaskondensate. (17 S.m. 7 Fig.) Lex 8°. Berlin. Verlag f. Fachliteratur. 1914. M.1.

Westcott, H. P. : Handbook of Natural Gas. Cr. 8vo. Spon. London. 1914. Net 17s.

V. *Altmann*, P. E. : Die Strohstoff-Fabrikation. Handbuch f. Studium u. Praxis. (31 S. m. 7 Abbildgn. im Text u. auf 1 Taf.) Lex 8°. Berlin. M. Krayn. 1914. M.2.

Duran, L. : Raw Silk. A Practical Handbook for the Buyer. Cr. 8vo. Spon. London. 1914. Net 10s. 6d.

VI. *Lagache*, H. : De l'apprêt des tissus de laine peignée. 214 fig., in-8°. Dunod et Pinat. Paris. 1914. Bds. 19fr. 50.

Textile World Record. Hosiery and knit goods, dyeing, bleaching, finishing, comp. from the Questions and Answers Department of the "Textile World Record," by C. Hutton. Bost., Lord and Nagle. c. 7-102 p. il. 16°. (Textile World Record kink books.) 1914. 75 c.

Werner, H. : Das Färben der Rauchwaren. Ausführliche Abhandlg üb. das Arbeitsgebiet, die Geheimvorschriften u. -Mittel der alten Pelzveredlungskünste, die Entstehg. sowie die Ausbreitg. der neuzeitl. Rauchwarenindustrien, die neueren u. neuesten Rezepte der Tötungen, Beizen,

Farben u. Flotten f. Haar- u. Federpelzwerk, das Blenden der Edelfelle, die Kenntnis der Berufsgefahren der Rauchwarenfärberei nebst e. Anh.: Persianergeheimnisse. Mit zahlreichen Textabbildgn. u. statist. Tabellen. (VIII, 110 S.) Lex 8°. Leipzig. B. F. Voigt. 1914. Cloth M. 12.

VIII. *Dümmler*, K.: Ziegel-Fabrikation. 2. Aufl 18. u. 19. (Schluss-) Lfg. Halle, Knapp. 1914. M. 4.

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Canadian Section.

Meeting held at Toronto on Thursday, 19th February, 1914.

PROF. J. WATSON BAIN IN THE CHAIR.

THE USE OF DRY AIR IN THE BLAST FURNACE.

BY H. G. GIRVIN.

The average amount of moisture in the air at our Hamilton Works, where the dry blast plant is located, was 3·152 grains per cubic foot for the year 1912, and slightly higher for 1913, about 3·25 grains per cu. ft. These data are obtained by averaging hourly determinations during the whole year. Assuming a daily average content of 3·152 grains of moisture per cu. ft. and 50,000 cu. ft. of air per minute we find that we are blowing into our furnaces a little more than 16 tons of water vapour in 24 hrs. Of course in the summer months the moisture contained in the air is much higher than in the winter time, and we frequently extract as much as 33 to 35 tons of water in one day. Our best record has been the extraction of 39·9 tons in 24 hrs.

Briefly, our system is to reduce the temperature of the air to 32° F. by means of cooled brine, and then to cool the air further to from 0° to 5° F. In the summer about two-thirds of the moisture is extracted in the first stage of the process, and in the second stage the percentage of moisture can be reduced to any desired limit.

The following is a description of the units in the dry blast system, as installed at the Hamilton Works of the Steel Co., Canada, Ltd. :—

The Steam End. The compression side of this plant consists of three horizontal machines, twin cross-compound type (De La Vergne pattern) Each machine has one high pressure horizontal steam cylinder 24 in. in diameter and 33 in. stroke, and one low-pressure horizontal steam cylinder 48 in. in diameter and 33 in. stroke, with long-range Corliss automatic cut-off and governor.

The high pressure side is designed to withstand a pressure of 150 lb. and the low side a pressure of 50 lb. per sq. in. above the atmosphere with safety and without undue heating.

The engines will work the compressors with maximum economy at normal speed of 65 r.p.m. under the following conditions :—

Discharge pressure, 150 lb. per sq. in. above atmos. ; suction, 17 lb. per sq. in. above atmos. ; steam, 125 lb. per sq. in. above atmos. ; vacuum, 24 in. mercury in exhaust pipe.

When running non-condensing the engines will make 65 r.p.m. under the following conditions :—

Discharge pressure, 190 lb. per sq. in above atmos. ; suction, 17 lb. per sq. in. above atmos. ; steam, 90 lb. per sq. in above atmos.

The Ammonia End. The ammonia compressors have a refrigerating capacity of 300 tons each under the above conditions, and consist of two water-jacketed horizontal double-acting compressors 18¼ in. diameter and 33 in. stroke ; they have been tested to a hydrostatic pressure of 500 lb. per sq. in. and are absolutely gas tight.

The ammonia condensers (De La Vergne type) are of the double-pipe surface condensing variety, consisting of 78 stands containing 12 double pipes each, and are arranged and connected in three units, each having 26 stands, the pipes being 2 in. and 1¼ in. respectively. The total weight of these condensers is 125,400 lb., and the total effective cooling surface is 6270 sq. ft. This, of course, represents the outer surface of the 1¼ in. pipe, as the 2 in. pipe carries the ammonia.

The ammonia condensers are of sufficient size to condense enough ammonia to cool 1908 U.S. galls. of brine per minute from 17° F. to 7° F., when working in connection with the other units and with condensing water at a temperature of 80° F. and a condensing pressure of 190 lb. per sq. in. This is equivalent to 678 refrigerative tons per 24 hours.

The ammonia receivers, of which there are six, are made of wrought iron, each being 12 ft. long and 15 in. diameter, tested to 1000 lb. pressure. They are horizontal, and receive the ammonia from the condensers. There it is carried into the bottom of the brine coolers, which are large insulated tanks containing the brine coils. The liquid ammonia is passed in through an expansion valve and the tank is filled to within about a foot of the top. The compressor pumps the gasified ammonia from the top of these tanks at a pressure of 17 lb. (gauge pressure) and delivers it to the condensers again, still in the form of gas, at a pressure from 100 to 190 lb., thereby making a complete cycle.

The brine coolers are of the Isbell-Porter Shell type and are four in number, each with a riveted steel shell 59 in. in diameter and 12 ft. long, closed with cast iron dished heads and supported on cast iron columns. Each cooler has sufficient 1¼, 1½, and 2-inch double-wound pipe coils of extra heavy wrought iron pipe, to aggregate a cooling surface of about 10,000 sq. ft. for the four coolers. Each coil projects through stuffing boxes well secured at each end, and assembled in junction-boxes at the top and bottom. All coolers are thoroughly insulated. They have sufficient capacity to cool 1908 U.S. galls. of brine per minute from 17° F. to 7° F. when operating with the other parts of the refrigerating apparatus with ammonia suction pressure of 17 lb. per sq. in. The total weight of the four coolers is 145,000 lb., and the brine referred to is calcium chloride brine with a sp.gr. of 1·21 and a specific heat of 0·70.

To circulate the brine we have four steam pumps. Three of these are of the cross-compound crank and fly-wheel type, with a capacity of 700 galls. per minute each, and the fourth one is of the duplex compound type, with a capacity of 1000 galls. per minute.

We also have two fans, one at each end of the building, to draw the outside air into the building and over the brine coils at a slight increase in pressure. These are driven by vertical steam engines, and each fan has a capacity of 40,000 cb. ft. per minute.

The brine pumps force the brine through the coils in the brine coolers, where it is cooled by the evaporating ammonia to the temperature required, and then to the brine coils in the refrigerating room proper where these are located. The pipes in this part of the building are made of 2-inch lap-welded iron pipe, each length of pipe 20 ft. long *plus* the return bends, and if placed in one line would stretch 40 miles. These pipes have a cooling surface of 132,000 sq. ft.

The oiling system in connection with these machines is of the gravity feed type, with water, separators and Burt filters. This plant has run on 40 galls. of engine oil for over 13 months, and will easily exceed this record.

The air, which has now passed completely through the system, is delivered to the blowing-engines at a moisture content of about 0·85 grain per cb. ft. and a temperature of about 20° F. Both temperature and water vapour can be controlled to a nicety, thereby eliminating the one great variable in the running of blast furnaces.

We find in practice that the actual saving in fuel is far greater than can be shown by calculation. This may be accounted for in several ways. The temperature of the top gases is greatly reduced, the loss of stock in the form of flue dust is materially lessened, and figuring per unit of production, the amount of coke, stone, and air charged is much less, therefore the capacity of the stoves, blowing-engines etc., is correspondingly increased, and the working capacity of the furnace is also increased, giving a greater production.

According to our records, we are producing more iron with less coke consumption than we did when running under the conditions of natural air. I have taken averages for a whole year in each case, and for the sake of comparison have used the records showing the best results during the last six years, for a single year under both dry and natural blast.

On basic iron our furnace A produced in 1913 about 16 per cent. more iron with 12 per cent. less coke than it did in 1907, which was the best year under natural blast. and our furnace B, making foundry iron, produced 22·3 per cent. more iron in 1913 with 2·7 per cent. less coke than in 1908 which was the best year under natural blast.

One peculiar factor in the dry blast plant is that occasionally in winter, when the temperature falls to say 10° or 15° below zero, the moisture in the outside air is lower than we require, and therefore, as we prefer to have a constant rather than an extremely low moisture content, we sometimes run the dry blast plant backwards, and add to the original percentage of moisture. Ordinarily we keep the moisture content in the dried air uniformly between 0·80 and 0·90 grain per cb. ft. For instance, on February 12, 1914, the temperature of the outside air was 5° F. below zero and the moisture content was 0·2 grain per cb. ft. This air was delivered to the furnace at a temperature at 11·2° F. with moisture at 0·76 grain. To do this it was necessary to add to the blast 5557 lb. of moisture in the 24 hours. This was accomplished by passing 10 per cent. of the first stage brine circulation through a closed coil steam heater and keeping the first stage brine at a temperature of 20° F. Cold dry air from the outside was warmed in passing the first stage coils and rapidly absorbed moisture by sublimation of the snow on the second stage coils. Regulation of the moisture can be effected in this manner as long as any snow remains on the second stage coils.

Thus, as the records show, there has been a general improvement in amount of product, also from cast to cast the chemical composition of the metal produced is more uniform, and lastly this has been accomplished with less fuel per ton of product under the conditions of dry blast as compared with that of natural air.

In concluding, I wish to express my thanks to Mr. Jas. Campbell, Chief Engineer of the dry blast, to Mr. John Scott, our Consulting Engineer, and to Mr. Corbett Whitton, all of whom kindly gave me every facility to obtain any data required.

London Section.

Meeting held at Burlington House on Monday, March 2nd, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE BLEACHING OF CHEMICAL PULP AND SUGGESTIONS FOR A STANDARD METHOD.

BY ARTHUR BAKER AND JAMES JENNISON.

In view of the publication in Nos. 95 and 96 of the Papier-Zeitung of a paper under the title of " Die Bleichende Wirkung von Chlorkalklösungen auf Zellstoff," by E. Simonsen, the authors have been induced to publish the results of experiments carried out in 1906, on the same subject.

The question was then studied more particularly from the industrial, or manufacturing point of view, rather than the chemical standpoint, and we have determined :—

1. The rate of bleaching at constant temperature.
2. The rate of bleaching at varying temperatures.
3. The influence of residual bleach liquor on the economy of the process.
4. The influence of preliminary acid or alkaline treatment, and the effect of adding the bleach in two portions.
5. The influence of the concentration of the pulp.

The method adopted in carrying out the experiments to be described below was as follows :—

Several sheets of the pulp chosen, which was a typical easy bleaching sulphate pulp, were allowed to become thoroughly air dry, representative samples were taken for the moisture determination, and the remainder was cut up and carefully weighed out into 50 grm. lots. In conducting an experiment one of these lots was carefully torn up by hand into very small pieces, thrown into a known bulk of water, and the pulp obtained thoroughly churned with a strongly made egg-beater fitted with teeth, until a finely divided and uniform pulp was obtained. This was filtered through a large porcelain funnel of about 8 in. diameter, the filtrate being poured through again until all the fine fibres were retained. The pulp was finally transferred to a 4-lb. stoppered bottle and sufficient water added to make it possible to mix effectively the contents by vigorous shaking after the addition of the bleach solution required by the condition of the experiment. The bleach was then added, and the observations taken as demanded by the nature of the trial.

This procedure was adopted in all cases, and was found to be all that was necessary when using an easy bleaching pulp. But in some later experiments, when using a strong non-bleaching sulphite, we found it impossible to obtain a uniform pulp in this manner. The half-stuff in such cases was obtained by breaking up the sheets in an experimental beater, making up to a known bulk and taking an aliquot portion.

After bleaching, the pulp was filtered through filter paper by throwing on to the filter funnel, and the residual liquor exhausted by a water pump. The pulp was then washed with fresh water until the filtrate was free from chlorine by the starch iodide test. The first liquor and washings were made up to bulk, and the available chlorine estimated in an aliquot portion. The pulp left on the filter was washed with dilute acetic acid, and finally with water, until free from chlorine by the silver nitrate test, exhausted by the pump, air dried, and if the yield was required, finally oven dried. In such cases a weighed filter paper was used above.

This method reduced the inevitable browning on drying to a minimum, and the pulp was available for making into sheets for reference.

In all our experiments tap water was used. It had a temporary hardness of 0 parts per 100,000.

The bleach is expressed in all cases as bleaching powder containing 35 per cent. available chlorine.

Series I. Rate of bleaching at constant temperature.
Weight of pulp, 50 grms. air-dry ; 46·03 oven dry.
Concentration of pulp 1 : 16, when bleach is added.

TABLE I.

Bleach taken on oven-dry pulp, 18·15 *per cent.*
Temp. 65° F.

Time bleaching hours.	Bleach used on oven-dry pulp.	Colour.
	per cent.	
2	9·74	Poor
4	10·80	Not good
8	12·65	Good
12	14·31	Excellent
16	15·14	Excellent

The following curve plotted out with the time in hours as ordinates, and the percentage of bleach consumed on the oven-dry pulp as abscissa, illustrates in a more graphic manner the above results.

In this series of trials it will be noticed that a larger amount of bleach was added than necessary to bring the pulp to a good colour, which would tend to exaggerate any action taking place and thus show what was going on more clearly. The bottles were placed in the dark during the period of bleaching.

Series II. Rates of bleaching at variable temperstures

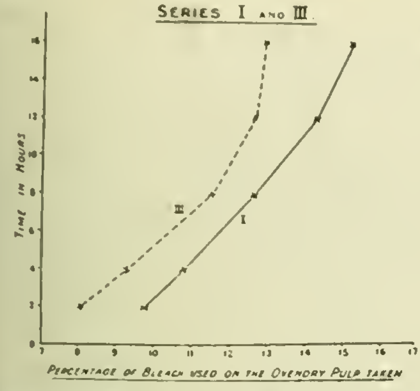
TABLE II.

Bleach taken on oven-dry pulp, 18·15 *per cent.*

Temp. °F.	Per cent. of bleach used on oven dry pulp.	Time bleaching.	Colour.
65	9·74	2 hrs.	Poor
100	15·05	2 hrs.	Excellent
120	17·45	2 hrs.	Excellent
140	18·15	80 mins.	Not good
160	18·15	50 mins.	Not good

The above series is strictly comparable with Series A curve plotted out below serves for comparison with th for Series I.

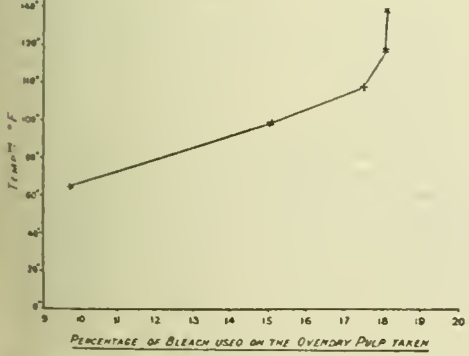
These figures show in a very clear manner how harmful is the action of high temperature upon the economy of the operation, and how deleterious with reference to the colour of the bleached half-stuff. Yet one is sorry to say that in many mills this point seems to be entirely lost sight of.



We estimated the yield of bleached pulp in the above series of experiments, and found the losses to be :—

At 100° F. the loss was 1·684% on the oven dry pulp taken.
120° F. ,, 1·860% ,, ,,
140° F. ,, 2·191% ,, ,,
160° F. ,, 2·782% ,, ,,

In Hofman's "Praktisches Handbuch der Papier-Fabrikation," second edition, there is mention on page 148 of some experiments conducted by Dr. Charles Cresson, who had repeatedly weighed pure wood cellulose before and after bleaching, and failed to find any discrepancy worth mentioning.



Our results on this head from Series 2 confirm what resson says, provided that the operation is carried out a reasonable temperature

On the large scale the loss between the half-stuff un-cached stage and the finished paper is anywhere about —5 per cent., the bulk of which is due to loss of small res in handling.

On comparing the curve plotted out from the results tained in Series No. I. with those published by Sindall and ckford in the World's Paper Trade Review for cember 2. 1904. on the rate of bleach consumption, we nd that the rate of bleach consumption in our trials s about 20 per cent. higher than they obtained in their periments. Thinking that possibly the large excess of ach present in our case might have caused the rate to be elerated in the earlier stages of the operation, we re-ted the whole of that series, using an amount of bleach der equal to the amount consumed during 2 hours at emperature of 100° F. in Series No. II., viz., 15·05 per t. of bleach powder on the oven dry pulp taken.

eries III. Rate of bleaching at constant temperature h less bleach present than in Series No. I.

TABLE III.

Temp. 65 F. *Bleach added*, 15·05 *per cent.*

Time bleaching hours.	Bleach used on oven dry pulp.	Colour.
	Per cent.	
2	8·07	Very poor.
4	9·33	Poor
8	11·56	Good
12	12·65	Excellent
16	12·82	Excellent

The results are plotted out below, against those obtained in Series 1.

It will be observed that the curves are almost parallel until the later stages when the bleach consumption falls off slightly in Series No. III., showing that the relative rate of bleach consumption is the same until about 12 hours have elapsed.

The results seem to indicate that at this concentration of pulp there will always be about 10—20 per cent. of the bleach added, left unconsumed in the residual liquors, if the bleaching is only carried on a reasonable length of time, *i.e.*, not exceeding 12 hours at a temperature of 65° F. or for 2 hours at a temperature of 100° F.

Griffin and Little say in their book—"We have frequently tested the liquor in the chest, in order to determine the proportion of chlorine present after the pulp had come to colour, and have found in many cases it amounted to ¼ or more of that originally introduced."

This is possibly quite common in many mills where it is the custom to use a fair excess of bleach to hasten the process.

We shall see later that the concentration of the pulp is a most important factor in hastening the time occupied for the bleaching operation, as well as reducing the waste of unconsumed bleach in the back liquor to a minimum.

On examining the colours of the bleached pulps obtained in Series I. and II., we observed that the colour of the pulp bleached for 2 hours at 100° F. and that of the pulp bleached for 12 hours at 65° F. were practically identical. Further, the amount of bleach consumed under the conditions of these two trials were approximately the same. We therefore decided that the other trials should be carried out at a temperature of 100° F. for a period of 2 hours, as this time and temperature were very convenient for conducting a number of experiments side by side.

It was explained above why an excess of bleach was taken in Series I. and II. From the comparison of colour and bleach consumption, it appeared that as far as economy went there was little to choose between bleaching for 12 hours at 65° F. or for 2 hours at 100° F., at any rate under the conditions of those experiments.

We therefore repeated the tests under the same respective conditions, but using the same amount of bleach as in Series III., viz., 15·05 per cent.

The results given below were confirmatory of the previous trials with a greater amount of bleach present. The slightly higher bleach consumption at 100° F. is probably explained by the figures obtained in Series IV.

The conditions of experiment were exactly the same as in Series III., the temperature and time varying.

TABLE IIIA.

Bleach added 15·05 *per cent.*

Time bleaching.	Temp.	Per cent. of bleach used on oven dry pulp.	Colour.
2 hrs.	100° F.	13·34	Excellent
12 hrs.	65° F.	12·65	Excellent

Series IV. The influence of residual liquors.

TABLE IV.

Bleach added 15·05 *per cent.*

Per cent of bleach used on oven dry pulp.	Colour.	
13·34	Excellent	Fresh bleach
14·47	Not so good	Fresh bleach + residue

In this series the amount of bleach added was made up in one instance of part bleach contained in some back liquor obtained from a previous trial, and of part fresh bleach solution, the total amount being equal to 15·05 per cent. on the pulp taken. The result of the test being compared with the standard obtained with the same amount of fresh bleach under the same conditions, *i.e.*, 2 hours at 100° F.

The bleach in the second experiment in Table IV. was made by mixing 0·4519 grm. bleach in the back liquor with 6·4776 grms. in the fresh bleach solution.

From the above results it is quite evident that some of the bleach in this experiment was used up by further action on the organic matter present in the back liquor, which action is no doubt accelerated by increased temperature.

Very possibly the slight increase of bleach consumption mentioned in Series III. is accounted for on this ground, also taking into consideration the slight decomposition of the bleach itself which very likely takes place.

In order to further study the influence of back liquors, we made up solutions of fresh bleach, and a solution composed of part fresh bleach and part bleach contained in some mill back liquors.

The solutions were kept in the dark, contained in stoppered glass bottles, and tested periodically, with the following results :—

Table V.

Time standing.	Solution containing	
	100 per cent. fresh bleach.	19 per cent. bleach in the back liquor. 81 per cent. fresh bleach.
	Loss per cent.	Loss per cent.
0 hours	—	—
48 hours	Nil	10·2
1 week	Nil	27·0
2 weeks	2·8	47·0

Fresh solutions made up on similar lines to the above were now tested for 2 hours at 100° F. and for 2 hours at 65° F. The available chlorine contents of the solutions used are given :—

Solution 1 contained 0·7346 grms. of available chlorine from fresh bleach and 0·0098 grm. ditto from back liquor, made up to 300 c.cs.

Solution 2 contained 0·7346 grm. available chlorine from fresh bleach, made up to 300 c.cs.

Table VI.

Solution.	Time.	Temp.	Loss per cent.
1.	2 hrs.	65° F.	11·80
2.	2 hrs.	65° F.	Nil.
1.	2 hrs.	100° F.	23·13
2.	2 hrs.	100° F.	0·47

These figures illustrate very clearly how uneconomical it is to use back liquors over again, and confirm some similar results published by Temperly (Paper and Pulp, January 1901). Since no details are given of the strength of the solutions he employed, it is impossible to compare them in a satisfactory manner. Our results appear, however, to confirm his in a general way.

Series V. The influence of preliminary alkaline and acid treatment, and of adding the bleach in two portions.

Seeing that we were dealing with the question from the standpoint of an easy bleaching pulp, we did not think it worth while trying the effect of a preliminary washing with water, as a pulp requiring such treatment on the large scale could not be classified as an easy bleaching one.

Afterwards, however, we examined the water extract from the unbleached pulp on which the trials had been made with reference to the amount of bleach which the faintly coloured water extract would account for.

Fifty grms. of the air dry pulp was extracted with 1½ litres of cold water. Two separate 500 c.cs. were taken to which was added 50 c.c. of bleach solution of a known strength. During the time the solutions were under observation, one was kept at 100° F. and the other at 65° F.; 50 c.c. of bleach solution contained 2·3399 grms. 35 per cent. bleaching powder.

Table VII.

Solution.	Temp.	Loss per cent. on the bleach added.		
		2 hrs.	4 hrs.	5 hrs.
1.	100° F.	5·58	5·58	5·58
2.	65° F.	4·29	4·29	4·29

These are the losses caused by the extract contained in 500 c.c., therefore if the whole extract had been taken the losses would have been trebled.

The figures show that a certain amount of bleach is consumed in oxidising organic matters which could be extracted by washing with water, but as the economy thus effected would in the case of a pulp requiring say 12 per cent. bleach only amount to 15 per cent. of 12 per cent., *i.e.*, 1·8 per cent. bleach on the pulp taken, it is hardly worth the time and trouble that would have to be spent on it during the washing process.

The amount of bleach consumed by the wash waters of the pulp we had under consideration are very closely in agreement with the 1·5 per cent. obtained by Sindall and Heckford in experiments conducted on somewhat similar lines (see Paper Trade Review, October 7, 1904).

Our results show that the extract is rapidly oxidised, after which little action goes on in the way of decomposing the remaining bleach.

We thought, however, that it might be worth while trying if any economy could be effected by a preliminary acid or alkaline treatment. With an easy bleaching pulp like the one under consideration the results were disappointing, for although the colour was much improved by the acid treatment in the case of soda pulp and by alkali treatment in the case of sulphite pulps, the economy effected in the bleach consumption was insignificant. The acid treatment consisted in saturating the pulp with a solution of hydrochloric acid in amount equal to 1 per cent. on the weight of air dry pulp, which was allowed to stand 2 hours, the pulp was then washed on the filter until the filtrate was free from chlorides, when the pulp was ready for bleaching in the usual way. The alkali treatment was effected in exactly the same manner, 1 pe cent. caustic soda being used on the air dry pulp taken

In the trial where the bleach was added in two portions the second lot of bleach was added immediately the firs was consumed. This latter trial was undertaken becaus it is still the practice in some mills to add the bleach i this manner, without first washing out the product extracted by the first lot of bleach. The results ar instructive, and only what one would expect from a consideration of the earlier trials with back liquor.

Table VIII.

Alkali and acid treatment. Bleach added, 15·05 *per cen*

Per cent. of bleach used on oven dry pulp.	Colour.	Treatment.
13·34	Excellent	None.
12·80	Excellent	Alkaline
12·95	Brilliant	Acid
12·47	Not so good	Bleached in tw portions

The colour of the bleached pulp that had had a previo acid treatment was brilliant in comparison with others, the pulp having had a previous alkaline treatm being a good second. In the trial in which the bleach added in two portions the colour was poor. In the lat case the bleach was added in two equal portions, the lot being exhausted in 40 mins.

Series VI. The influence of the concentration of pulp.

We were well aware from numerous experiments this factor is perhaps the most important one in bleaching of material in the pulp state. Indeed, one might say that it is impossible to obtain the highest economy without careful attention to this most vital point.

Sindall and Heckford emphasise this in their remarks on the subject, as also do Cross and Bevan in their text book on papermaking, but do not give any data bearing on the question.

The former investigators say in an article published in the Paper Trade Review, September 16, 1904 :—

"This question of the proportion of water in relation to the bleach consumption is really an important one. The influence of the quantity of water used per cwt. pulp in the beater is not so fully appreciated by papermakers as it should be, and a few definite trials under carefully regulated conditions would soon convince them that the operation of bleaching wood pulp is not such a simple matter of routine after all. 'More water more bleach' is a common expression, and a common experience, but it is a fact that has not been properly studied. We are ready to accept the idea that the extra bleach is simply consumed by the extra water itself. But the amount used is always considerably in excess of that actually required to neutralise the water, and we are forced to seek some better explanation. Probably the active bleach in solution attacks the chlorinated organic compounds formed during the process, and the actual bleaching of the pulp is retarded, so that not only is the consumption of bleach greater, but the period occupied is longer."

We conducted 3 trials at different concentrations of the pulp, the intermediate one being the same concentration used throughout all the experiments detailed above.

TABLE IX.

Temperature, 100° *F. Time,* 2 *hours. Bleach added,* 15·05 *per cent.*

Per cent. of Bleach used on oven-dry pulp.	Concentration.	Colour.
11·86	1·24	Very poor
13·34	1·16	Excellent
14·04	1·12	Brilliant

The results are not only of interest, but we think of value, showing that the idea that the bleach is consumed by the water, or that it is used up in attacking chlorinated organic compounds is erroneous, as the above trials show conclusively that the bulk of the bleach is simply left unchanged in the back liquor.

The old mill maxim "more water more bleach" is thus ounded on fact. The explanation appears to be, that n weak solution the action is not sufficiently energetic o cause a reasonable exhaustion of the available chlorine. n other words, it is a case of mass action.

All the above described experiments were conducted on n easy bleaching so called soda pulp, which was really sulphate pulp. We found however, that the results btained applied equally well with reference to easy bleaching sulphite pulps, with the exception, already mentioned, hat with a preliminary alkaline treatment the colour btained after bleaching was much better than that given y a preliminary acid treatment.

The net result of the work we have carried out is as ollows :—

1. That the use of back liquors is attended with an ncrease in the bleach consumption, and accompanied by lowering of the colour of the resultant bleached pulp.

Its only legitimate use is in the early washing of boiled gs, or similar operations, prior to bleaching, when it n be thoroughly removed before the bleach is added to e clean half-stuff.

2. That preliminary washing either by water, dilute id, or dilute alkali, is not worth while in the case of easy leaching pulps.

3. That the concentration of the pulp is the most portant factor to be taken into consideration, and due gard to this point is absolutely essential in order to obtain the highest economy in the bleaching process as carried out in the paper mill.

4. That when bleaching with the aid of heat, a temperature of 120° F. should not be exceeded, our results tending to show that temperature of 100° F. is all that is necessary. Wherever possible the pulp should be heated before the bleach is added, as if heated when the bleaching is going on there must always be excessive local heating of the pulp, even if a fairly rapid circulation of the stuff is maintained, of course detracting from the economy of the operation.

Due regard having been paid to the above points, it is a matter for consideration whether the operation is best carried out at 100° F., or at say the temperature of the atmosphere. It is simply a question of cost of equipment.

In bleaching at 100° F. it is tolerably certain that it will be necessary to circulate the pulp during the greater part of the time it is bleaching, whilst practice has shown that when bleaching for a considerable length of time in the cold, occasional agitation is all that is necessary, in spite of teaching to the contrary. Some manufacturers have realised this, and it is modern practice to fit bleaching potchers with fast and loose pulleys in order to economise power.

All work upon the subject of bleaching pulps leads one to the point—Why is there not a standard method of bleaching pulp, and standards of colour for reference in cases of dispute ? There can be no question that a standard method would meet with general approval. Various investigators have raised the question, and it has even been discussed by the Wood Pulp Association. As Sindall and Bacon point out in their work, "The Testing of Wood Pulp," the real difficulty is not the method of performing the operation, but rather the difficulty of fixing suitable standards of reference. They put forward in a tentative sort of way the suggestion that the use of Lovibond's Tintometer might meet the case, but it has apparently found little support. Whilst the tintometer is a useful instrument in the hands of a skilled operator for certain purposes in other industries, it is our opinion that such a method for measuring the colour of bleached wood pulp is extremely unlikely to find favour in the pulp and paper industries, not because of any inherent defects in the proposed method of judging colour value, but simply because the type of man who usually sells and buys pulp would be the last person to pay any attention to such a highly technical method of stating colour value.

Looking at the subject from a practical point of view, one must arrive at the conclusion that any standard test which will find general acceptance must be simple and easily understood by the commercial man, on the point of reference to colour value. Settle this point, and a standard method of procedure in the actual bleaching test itself will soon be agreed upon by all interested.

We therefore suggest that four standards of colour should be fixed by suitable representatives of pulp and paper manufacturers. These standards to be matched in dull porcelain as follows :—

A. Colour obtained by first quality easy bleaching sulphite.

B. Colour obtained by second quality easy bleaching sulphite.

C. Colour obtained by first quality easy bleaching sulphate.

D. Colour obtained by second quality easy bleaching sulphate.

Under the conditions of the standard test given below. Standards to be kept by the Paper Makers Association and the Wood Pulp Associations of the various countries as official standards. The buyer would then be enabled to contract for a bleaching pulp with a specific clause in his contract to the effect that the pulp mentioned would give under the conditions of the standard test a colour of A., B., C. or D. with a stated percentage consumption of bleaching powder. In a case of dispute, the arbitrators would then have available a recognised standard of bleaching quality, and would not be compelled to fall back upon what is commercially known as the "brand," whatever that may happen to mean in any particular case.

Each paper maker and pulp seller would be able to provide himself with similar standards to the official ones, and once knowing the percentage of bleach powder required to produce a colour represented by any one of the four standards could, by a glance at his colour standards, readily form an estimate of the value of any pulp as far as its bleaching qualities were concerned.

Following is the method employed in making the actual bleach test itself :—

Suggested standard bleaching test :—

Minimum quantity to be taken, 10 grms.

10 grms.—10 per cent. air dry pulp.

160 c.c. of water containing bleaching powder (35 per cent chlorine) equivalent to 12 per cent of bleaching powder on the pulp taken.

Temperature—100° F. Time of bleaching—2 hours.

We have used this test for some years, and find it can be suitably carried out by tearing the pulp into shreds by hand, throwing into a litre of water, agitating with a powerful egg beater made of brass, and fitted with teeth, until a uniform pulp is obtained. Throw the resultant pulp into a porcelain filter and exhaust with the water pump, finally squeezing by hand, leaving the pulp approx. 30 per cent. dry. Place in a suitable vessel which is standing in a water bath, and is at the temperature of the bath, *i.e.*, 100° F. Take 100 c.c. of water at 105° F., add the requisite number of c.c. of bleach solution to give the required percentage, and pour on to the pulp. Stir well, and bleach for two hours at 100° F., stirring occasionally with the thermometer.

We find that with filtered mill solution at 4½° Tw. approximately 30 c.c. of bleach solution will be required. This is checked at the time of the experiment.

After the time has expired throw the bleached pulp upon the porcelain funnel, exhaust with the pump, wash, make the filtrate and washings to 2 litres and titrate an aliquot portion. Calculate the bleach consumed as percentage on the 10 per cent. air-dry pulp taken.

We use a calcium chloride bath, fitted with a steam coil, and are able to make a dozen tests side by side, but any arrangement that will provide a constant temperature of the water bath will answer quite as well.

Make suitable sheets of the pulp for reference, and it is important to note that these should be air dried.

By bleaching at 100° F. one is able to make a large number of tests in a short time, and with suitable apparatus to make a large proportion side by side.

DISCUSSION.

Mr. R. W. **SINDALL** said that the paper-maker found that the consumption of bleach varied from say 8 per cent. up to 25 per cent. of the weight of pulp used. It was therefore important to him to have some method by which the minimum of bleach required to produce a given colour should be readily estimated. Discordant results were often due to causes such as the method of extracting the bleaching powder and antiquated methods of treating the pulp. From his own experience he had found it necessary to correlate the actual consumption of the bleach with the colour produced, in order to find the lowest consumption of bleach at which the maximum colour was reached. He used the tintometer as standard of colour because it was the handiest instrument. He quite agreed that in the hands of an untrained man deplorable mistakes and disputes might occur, but in the hands of a trained observer the tintometer could be used for the purpose. By its aid, an independent observer had been able to place in the correct order a series of pulps bleached at 100° F. and at the ordinary temperature, with amounts of bleaching powder varying from 2 to 20 per cent.

Dr. E. K. **RIDEAL** said that in the standardisation of bleach pulp the actual acidity or alkalinity, as the case might be, of the bleach used, should be stated, because the bleaching power was considerably raised in presence of free acid.

Mr **GRANT HOOPER** said that the suggested test struck him as leaving the essential point still to be decided. He took it that at the end they had still to decide what degree of colour remained in the pulp. It seemed to him to be very much better to follow the line which Mr. Sindall had suggested, namely, to rely directly on the tintometer. In the use of that instrument for deciding the colour of such a substance as flour, he had found no difficulty, and Mr. Sindall's experience seemed to have been equally satisfactory. The authors had suggested that the use of the tintometer by the practical man was a difficulty, but there were many trained persons incapable of deciding finer shades of colour. Would the amount of bleach used invariably indicate the degree of whiteness, and if not, was it not better and more direct to rely on the tintometer in the first instance ?

Mr. **BAKER**, in reply, said that the alkalinity of the bleach solution used should not be overlooked in fixing the details of the standard test. The effect of free lime was to retard the operation. He believed that Cross and Bevan had dealt with that subject very thoroughly in a paper called "Some Considerations of the Chemistry of Hypochlorite Bleaching." With regard to the question of colour, the difficulty was not one of fine differences, but of very marked differences. They had found in practice that under the conditions of the standard test all pulps sold as bleaching pulps fell within the range of the proposed standards. The trials exhibited, which represented a large number of pulps, had been roughly classified into four classes, which might form a basis for fixing four colour standards. There was a wide difference between the highest and the lowest colour. As regards the colour measurement, he was afraid if they put before the business head of a concern a series of tintometer readings, it would not be very convincing, but if they could put before him some definite colour values representing the colour obtained by stated percentages of bleach consumption, he would readily make up his mind. It was certainly their intention to state the percentage of bleaching powder as well as the colour.

A TABLE OF SPECIFIC GRAVITIES OF SPIRITS CORRESPONDING TO INDICATIONS OF GLASS HYDROMETERS FOR USE WITH BEDFORD'S CORRECTED SIKES' TABLES.

BY JITENDRA NATH RAKSHIT AND SACHINDRA NATH SINHA, M.A.

Bedford, in his "Corrected Sikes's Tables" for ascertaining the strength of spirits with glass hydrometers (see this J., 1913, 1172), reproduces the specific gravity table (see page 130) from Sikes' original tables, which was meant for use with brass hydrometers. But he has not made it quite distinct in his book how far the results obtained are affected (1) by the use of tables meant for brass instruments, with those of glass, and (2) by the application of what was meant to be true strength on the basis of Ure's experimental determinations o spirit strengths relative to those of Otto Hehner's which formed the basis of the corrected Sikes' table for glass hydrometers.

A table for this purpose is readily prepared in the following way. Taking any indication, *e.g.*, 86·2°, the corresponding spirit strength found from Bedford's table at 60° F. i 41·50 per cent. proof spirit. By Hehner's table (Analyst vol. 5.) the specific gravity for a spirit containing 41·5 pe cent. proof spirit is 0·9724. Hence 86·2° indication b glass hydrometer represents 0·9724 specific gravit whereas that from Table I. of Bedford is 0·9726. Th table thus constructed gives the specific gravities of spiri at 60° F. compared with water at 60° F. for an indicatic at 60° F., and the reverse.

Again, if a specific gravity determined at anoth temperature by glass pyknometer, which is, in fact, apparent gravity, is referred to this table, an apparent i dication is also obtained. Next by the use of Bedford corrected table for the above apparent indication tr spirit strength may be obtained. Thus the error due the different temperature in pyknometrical determinatio may be conveniently eliminated.

Divs. on stem A.	Sp. gr.	Divs. on stem A.	Sp. gr.	Divs. on stem A.	Sp. gr.	Divs. on stem A.	Sp. gr.
7·0	0·7939	10·4	0·8004	13·8	0·8062	17·2	0·8117
7·2	0·7942	10·6	0·8009	14·0	0·8065	17·4	0·8119
7·4	0·7945	10·8	0·8012	14·2	0·8069	17·6	0·8122
7·6	0·7951	11·0	0·8015	14·4	0·8071	17·8	0·8124
7·8	0·7954	11·2	0·8017	14·6	0·8074	18·0	0·8128
8·0	0·7957	11·4	0·8022	14·8	0·8078	18·2	0·8130
8·2	0·7960	11·6	0·8025	15·0	0·8081	18·4	0·8133
8·4	0·7965	11·8	0·8028	15·2	0·8083	18·6	0·8135
8·6	0·7968	12·0	0·8031	15·4	0·8088	18·8	0·8139
8·8	0·7971	12·2	0·8036	15·6	0·8090	19·0	0·8141
9·0	0·7977	12·4	0·8039	15·8	0·8093	19·2	0·8143
9·2	0·7980	12·6	0·8041	16·0	0·8097	19·4	0·8148
9·4	0·7986	12·8	0·8046	16·2	0·8100	19·6	0·8150
9·6	0·7989	13·0	0·8049	16·4	0·8103	19·8	0·8152
9·8	0·7992	13·2	0·8052	16·6	0·8107	20·0	0·8156
10·0	0·7998	13·4,	0·8057	16·8	0·8110		
10·2	0·8001	13·6	0·8059	17·0	0·8112		

Divs. on stem.	Sp. gr.	Divs. on stem.	Sp. gr.	Divs. on stem.	Sp. gr.	Divs. on stem.	Sp. gr.
0·0	0·8156	14·0	0·8390	28·0	0·8633	42·0	0·8883
0·2	0·8159	14·2	0·8392	28·2	0·8638	42·2	0·8887
0·4	0·8161	14·4	0·8396	28·4	0·8641	42·4	0·8891
0·6	0·8165	14·6	0·8400	28·6	0·8644	42·6	0·8895
0·8	0·8167	14·8	0·8404	28·8	0·8647	42·8	0·8898
1·0	0·8169	15·0	0·8407	29·0	0·8652	43·0	0·8902
1·2	0·8174	15·2	0·8411	29·2	0·8655	43·2	0·8906
1·4	0·8176	15·4	0·8413	29·4	0·8658	43·4	0·8910
1·6	0·8180	15·6	0·8417	29·6	0·8662	43·6	0·8913
1·8	0·8183	15·8	0·8421	29·8	0·8665	43·8	0·8917
2·0	0·8187	16·0	0·8424	30·0	0·8668	44·0	0·8922
2·2	0·8190	16·2	0·8428	30·2	0·8673	44·2	0·8925
2·4	0·8194	16·4	0·8432	30·4	0·8676	44·4	0·8928
2·6	0·8196	16·6	0·8434	30·6	0·8679	44·6	0·8932
2·8	0·8201	16·8	0·8437	30·8	0·8682	44·8	0·8935
3·0	0·8203	17·0	0·8441	31·0	0·8687	45·0	0·8939
3·2	0·8205	17·2	0·8444	31·2	0·8690	45·2	0·8942
3·4	0·8210	17·4	0·8448	31·4	0·8693	45·4	0·8945
3·6	0·8214	17·6	0·8451	31·6	0·8698	45·6	0·8949
3·8	0·8219	17·8	0·8455	31·8	0·8701	45·8	0·8952
4·0	0·8221	18·0	0·8458	32·0	0·8704	46·0	0·8956
4·2	0·8223	18·2	0·8462	32·2	0·8708	46·2	0·8961
4·4	0·8228	18·4	0·8465	32·4	0·8711	46·4	0·8965
4·6	0·8232	18·6	0·8468	32·6	0·8714	46·6	0·8968
4·8	0·8234	18·8	0·8472	32·8	0·8719	46·8	0·8970
5·0	0·8238	19·0	0·8477	33·0	0·8722	47·0	0·8974
5·2	0·8240	19·2	0·8480	33·2	0·8725	47·2	0·8978
5·4	0·8244	19·4	0·8483	33·4	0·8728	47·4	0·8982
5·6	0·8248	19·6	0·8486	33·6	0·8733	47·6	0·8986
5·8	0·8252	19·8	0·8490	33·8	0·8736	47·8	0·8990
6·0	0·8254	20·0	0·8494	34·0	0·8739	48·0	0·8994
6·2	0·8257	20·2	0·8497	34·2	0·8744	48·2	0·8998
6·4	0·8261	20·4	0·8501	34·4	0·8747	48·4	0·9000
6·6	0·8263	20·6	0·8504	34·6	0·8751	48·6	0·9005
6·8	0·8267	20·8	0·8508	34·8	0·8754	48·8	0·9007
7·0	0·8270	21·0	0·8511	35·0	0·8757	49·0	0·9012
7·2	0·8274	21·2	0·8515	35·2	0·8762	49·2	0·9016
7·4	0·8278	21·4	0·8518	35·4	0·8765	49·4	0·9020
7·6	0·8280	21·6	0·8522	35·6	0·8768	49·6	0·9025
7·8	0·8284	21·8	0·8525	35·8	0·8771	49·8	0·9027
8·0	0·8288	22·0	0·8529	36·0	0·8776	50·0	0·9030
8·2	0·8292	22·2	0·8532	36·2	0·8779	50·2	0·9034
8·4	0·8294	22·4	0·8535	36·4	0·8782	50·4	0·9038
8·6	0·8297	22·6	0·8538	36·6	0·8786	50·6	0·9042
8·8	0·8301	22·8	0·8542	36·8	0·8789	50·8	0·9045
9·0	0·8305	23·0	0·8545	37·0	0·8794	51·0	0·9048
9·2	0·8307	23·2	0·8550	37·2	0·8798	51·2	0·9051
9·4	0·8311	23·4	0·8553	37·4	0·8801	51·4	0·9054
9·6	0·8315	23·6	0·8556	37·6	0·8805	51·6	0·9058
9·8	0·8319	23·8	0·8560	37·8	0·8808	51·8	0·9062
10·0	0·8321	24·0	0·8563	38·0	0·8811	52·0	0·9066
10·2	0·8325	24·2	0·8566	38·2	0·8815	52·2	0·9069
10·4	0·8329	24·4	0·8571	38·4	0·8818	52·4	0·9072
10·6	0·8332	24·6	0·8574	38·6	0·8823	52·6	0·9076
10·8	0·8336	24·8	0·8577	38·8	0·8826	52·8	0·9080
11·0	0·8338	25·0	0·8581	39·0	0·8830	53·0	0·9084
11·2	0·8342	25·2	0·8585	39·2	0·8833	53·2	0·9087
11·4	0·8346	25·4	0·8588	39·4	0·8836	53·4	0·9091
11·6	0·8348	25·6	0·8592	39·6	0·8841	53·6	0·9095
11·8	0·8352	25·8	0·8595	39·8	0·8844	53·8	0·9099
12·0	0·8355	26·0	0·8599	40·0	0·8848	54·0	0·9103
12·2	0·8359	26·2	0·8602	40·2	0·8852	54·2	0·9107
12·4	0·8363	26·4	0·8605	40·4	0·8855	54·4	0·9111
12·6	0·8367	26·6	0·8609	40·6	0·8859	54·6	0·9115
12·8	0·8370	26·8	0·8612	40·8	0·8862	54·8	0·9118
13·0	0·8374	27·0	0·8615	41·0	0·8866	55·0	0·9122
13·2	0·8376	27·2	0·8618	41·2	0·8870	55·2	0·9126
13·4	0·8379	27·4	0·8622	41·4	0·8873	55·4	0·9130
13·6	0·8383	27·6	0·8627	41·6	0·8876	55·6	0·9133
13·8	0·8387	27·8	0·8630	41·8	0·8880	55·8	0·9137

Divs. on stem.	Sp. gr.	Divs. on stem.	Sp. gr.	Divs. on stem	Sp. gr.	Divs. on stem.	Sp. gr.
56·0	0·9141	67·0	0·9351	78·0	0·9563	89·0	0·9779
56·2	0·9146	67·2	0·9354	78·2	0·9567	89·2	0·9783
56·4	0·9150	67·4	0·9359	78·4	0·9571	89·4	0·9786
56·6	0·9153	67·6	0·9362	78·6	0·9575	89·6	0·9790
56·8	0·9157	67·8	0·9366	78·8	0·9579	89·8	0·9794
57·0	0·9161	68·0	0·9369	79·0	0·9583	90·0	0·9798
57·2	0·9164	68·2	0·9374	79·2	0·9586	90·2	0·9802
57·4	0·9168	68·4	0·9378	79·4	0·9590	90·4	0·9806
57·6	0·9172	68·6	0·9381	79·6	0·9594	90·6	0·9811
57·8	0·9176	68·8	0·9384	79·8	0·9598	90·8	0·9815
58·0	0·9180	69·0	0·9388	80·0	0·9602	91·0	0·9819
58·2	0·9184	69·2	0·9393	80·2	0·9608	91·2	0·9823
58·4	0·9187	69·4	0·9397	80·4	0·9610	91·4	0·9827
58·6	0·9191	69·6	0·9400	80·6	0·9613	91·6	0·9831
58·8	0·9194	69·8	0·9403	80·8	0·9617	91·8	0·9834
59·0	0·9198	70·0	0·9407	81·0	0·9621	92·0	0·9839
59·2	0·9202	70·2	0·9411	81·2	0·9626	92·2	0·9842
59·4	0·9206	70·4	0·9416	81·4	0·9629	92·4	0·9846
59·6	0·9210	70·6	0·9419	81·6	0·9633	92·6	0·9850
59·8	0·9213	70·8	0·9422	81·8	0·9637	92·8	0·9854
60·0	0·9217	71·0	0·9426	82·0	0·9642	93·0	0·9859
60·2	0·9221	71·2	0·9430	82·2	0·9646	93·2	0·9863
60·4	0·9224	71·4	0·9433	82·4	0·9650	93·4	0·9867
60·6	0·9228	71·6	0·9437	82·6	0·9654	93·6	0·9871
60·8	0·9232	71·8	0·9441	82·8	0·9657	93·8	0·9874
61·0	0·9235	72·0	0·9445	83·0	0·9661	94·0	0·9878
61·2	0·9239	72·2	0·9448	83·2	0·9665	94·2	0·9882
61·4	0·9243	72·4	0·9452	83·4	0·9669	94·4	0·9886
61·6	0·9246	72·6	0·9456	83·8	0·9673	94·6	0·9890
61·8	0·9250	72·8	0·9459	83·8	0·9676	94·8	0·9894
62·0	0·9255	73·0	0·9463	84·0	0·9680	95·0	0·9898
62·2	0·9258	73·2	0·9467	84·2	0·9684	95·2	0·9900
62·4	0·9262	73·4	0·9471	84·4	0·9688	95·4	0·9907
62·6	0·9266	73·6	0·9475	84·6	0·9693	95·6	0·9911
62·8	0·9269	73·8	0·9479	84·8	0·9696	95·8	0·9915
63·0	0·9273	74·0	0·9483	85·0	0·9700	96·0	0·9919
63·2	0·9278	74·2	0·9487	85·2	0·9704	96·2	0·9924
63·4	0·9281	74·4	0·9491	85·4	0·9708	96·4	0·9928
63·6	0·9285	74·6	0·9496	85·6	0·9712	96·6	0·9933
63·8	0·9289	74·8	0·9500	85·8	0·9716	96·8	0·9937
64·0	0·9292	75·0	0·9504	86·0	0·9720	97·0	0·9941
64·2	0·9297	75·2	0·9509	86·2	0·9724	97·2	0·9945
64·4	0·9300	75·4	0·9513	86·4	0·9727	97·4	0·9949
64·6	0·9304	75·6	0·9516	86·6	0·9732	97·6	0·9953
64·8	0·9308	75·8	0·9520	86·8	0·9735	97·8	0·9958
65·0	0·9311	76·0	0·9523	87·0	0·9739	98·0	0·9962
65·2	0·9315	76·2	0·9527	87·2	0·9743	98·2	0·9966
65·4	0·9319	76·4	0·9531	87·4	0·9748	98·4	0·9970
65·6	0·9323	76·6	0·9535	87·6	0·9752	98·6	0·9974
65·8	0·9327	76·8	0·9539	87·8	0·9756	98·8	0·9979
66·0	0·9331	77·0	0·9543	88·0	0·9760	99·0	0·9983
66·2	0·9334	77·2	0·9547	88·2	0·9764	99·2	0·9987
66·4	0·9339	77·4	0·9551	88·4	0·9768	99·4	0·9991
66·6	0·9342	77·6	0·9555	88·6	0·9771	99·6	0·9996
66·8	0·9346	77·8	0·9559	88·8	0·9775	99·8	1·0000
						100·0	

Manchester Section.

Meeting held at the Grand Hotel on Friday, February 6th, 1914.

MR. JULIUS HÜBNER IN THE CHAIR.

ON THE COAGULATION OF THE LATEX OF HEVEA BRAZILIENSIS, AND ITS BEARING ON THE STRENGTH OF RUBBER.

BY NEWTON W. BARRITT, B.A.,

International Institute of Agriculture, Rome, formerly Economic Botanist, Federated Malay States.

The question of strength in rubber has been exercising the minds of rubber growers and their chemists since plantation rubber first entered the market in competition with the native Brazilian product. With outputs increasing and prices steadily declining since 1910, this competition has become keener and the question of quality has assumed greater importance. Notwithstanding this, our knowledge of the strength of rubber is limited chiefly to physical determinations. The manufacturer of rubber goods has a definite standard of quality. He can make reliable determinations of the strength of different samples of rubber and upon them base his valuation. On the other hand, little or no reliable information is available as to what these qualities depend upon or with what they are directly associated. Consequently the planter is still at a loss to know why his rubber is inferior in strength to the native Fine Hard Para and what means he may adopt to improve it. At the present prices* of Fine Hard Para and plantation rubber, 3s. 2d. and 2s. 3d. respectively, the superiority of the former, considering its 15 to 20 per cent. impurity, is equivalent to an increased value in the caoutchouc of 75 per cent. as compared with the plantation product.

Though some authorities do not admit the existence of any superiority in Brazilian rubber, nevertheless many theories have been put forward to account for it. Numerous empirical methods of preparing rubber have been devised, more or less in imitation of the Amazonian smoking method, but none except direct imitations of this method have been proved equal to it, and these, unfortunately, are not adaptable to plantation conditions. Samples of rubber have been prepared at the Botanical Gardens, Singapore, by the smoking method of coagulation, and after vulcanisation gave physical tests equal to those of Fine Hard Para.† Many estates also claim to have produced superior samples of rubber, but, as Eaton has already pointed out, these results are not the outcome of scientific experiment, but of fortunate methods adopted by careful managers and factory superintendents. In 1907 Beadle and Stevens conducted experiments to show that plantation rubber was superior to Fine Hard Para and obtained results accordingly. Results so undoubtedly exceptional are of little value unless fully interpreted in relation to the methods of coagulation employed and the subsequent treatment of the rubber.

Now the Amazonian smoking method consists essentially in coagulating successive films of latex on a stick rotating in a jet of smoke produced by the slow combustion of certain palm nuts. The influences to which the latex is subjected in such a process are increase of temperature, action of smoke, action of volatile organic acids, evaporation of water and consequent concentration of serum.

The use of acetic acid as a coagulant, now generally adopted by most estates in the East, was suggested by its occurrence in the distillation products of wood and in Brazilian rubber, and the practice of smoking sheet rubber in drying sheds is believed to improve the quality of plantation rubber on the supposition that Brazilian rubber owes its superior strength to the action of smoke and other distillation products of wood.

The effect of temperature on coagulation and the quality of the rubber has not been worked out. Henri observed that the "Brownian movement" of the globules of caoutchouc increases with rise of temperature and the caoutchouc becomes less viscous. The writer found that coagulation takes place more readily as the temperature is increased up to 70° or 80° C., but that at higher temperatures it is more difficult to obtain. This result is in agreement with Whitby's suggestion as to the existence of a coagulating enzyme in latex.

The evaporation of water and the consequent increase in concentration of the serum as a factor influencing coagulation, appear to have been entirely neglected by previous workers—a negligence which is all the more surprising when we consider the recent progress in the study of colloidal proteins and their behaviour in salt solutions of various concentrations. This attitude towards such an obviously important factor is no doubt due to the prevailing ideas concerning the part played by the protein in the coagulation of the latex and the quality of the final product. The manufacturer's appreciation of the obvious merits of a clean rubber has encouraged the planter to produce rubber which is almost chemically pure caoutchouc, on the supposition that quality was dependent on purity. The inferior physical properties of synthetic rubber and of caoutchouc prepared from raw rubber do not support such a supposition. Besides, Lock and Bamber have shown that the breaking strains of a number of samples of plantation rubber vary inversely as the percentages of caoutchouc contained in the samples; while Beadle and Stevens, working on the insoluble nitrogenous constituents left after solution of the caoutchouc hydrocarbon in benzene, have shown that their removal from a sample of rubber results in a deterioration of the sample. The nitrogenous constituent would thus appear to exercise a greater influence on the quality of rubber than is generally supposed.

Biffen and Weber both held the view that the proteins play an important part in coagulation, forming a clot which entangles the caoutchouc globules, and that variations in coagulation are dependent on the qualities of the particular albuminoids present in the latex. Frank also supported this view by his experiments on the latex of *Hevea* and *Kickxia*. On the other hand, De Jong and Tromp de Haas obtained coagulation of the latex of *Castilloa elastica* after removal of the proteins by means of alcohol. Spence obtained similar results with *Kickxia*, and Crossley obtained coagulation of *Hevea* latex after considerable dilution with water. Gardner removed the protein from the latices of *Hevea*, *Castilloa*, and *Micranda* by dialysis after digestion with papain, and obtained coagulation in each case. Henri, as a result of microscopic examination, concluded that protein was not essential to coagulation, but he, along with Weber, drew a distinction between coagulation and coalescence or mere fusion of the caoutchouc globules. Zimmermann observes that coagulation can take place in the absence of protein, but believes that the protein in the latex tends to promote coagulation.

The writer examined the behaviour of *Hevea* latex microscopically and found that agglutination and coalescence of the caoutchouc globules is possible without any change taking place in the condition of the protein solution, and that small clots of caoutchouc are formed in this way. This process he considers to be quite independent of true or complete coagulation, in which the caoutchouc globules are embedded in a matrix of coagulated protein. Fusion of the globules and protein with formation of a homogeneous structure takes place when pressure is applied.

Considering these facts, it seemed to the writer that a study of the colloidal properties of latex under different conditions might afford interesting information likely to lead to a better understanding of the process of coagulation and to a clearer conception of strength in rubber. A considerable amount of work on the coagulation of *Hevea* latex by acids and salts has already been done by various workers, notably Parkin, Crossley, Eaton, Whitby, and others, but with little consistency in the results; while apparently no one, except perhaps Whitby, has attempted a quantitative comparison of the effects of different concentrations of the same and of different reagents.

Accordingly, with this object in view, the writer carried out the following experiments on the coagulation of fresh *Hevea* latex in solutions of varying concentration of acid and salt. The experiments were conducted by methods similar to those of Wood in his work on the strength of wheat gluten.

Concentration of Salt.										
N/2	51	52	53	54	55	56	57	58	59	60
N/5	41	42	43	44	45	46	47	48	49	50
N/10	31	32	33	34°	35	36	37	°38	39	40
N/25	21	22°	23	24	25	26	27	28°	29	30
N/50	11	°12	13	14	15	16	17	18	°19	20
N/100	1°	2	3	4	5	6	7	8	9°	10
	N/500	N/250	N/100	N/50	N/25	N/10	N/5	N/2	N	2N

Concentration of Acid.

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* India Rubber Journal, Nov. 15, 1913.

† L. Wray in Bulletin of Straits Settlements, Vol. X.

In the absence of facilities for dialysing the latex, the following mode of procedure was found most suitable. A number of large test-tubes were each marked at 50 c.c. and numbered from 1 to 60. Standard solutions of acid and salt were run in from a burette in sufficient quantities to make the required strengths, as shown in the above table. One half c.c. of clean fresh latex was then added to each tube, and the liquid thoroughly stirred to effect complete diffusion of the latex throughout. The tubes were placed in racks and allowed to stand for 24 hours to ensure equilibrium between the colloid and its solution. A comparative examination of the tubes was then made. The numbers of all the tubes in which coagulation was just short of completeness were indicated in the table as shown above. The points thus obtained were plotted on squared paper with concentrations of acids as abscissæ and concentrations of salt as ordinates. Such a graph shows the coagulating effect of varying concentrations of salt as measured against the disintegrating effect of varying concentrations of acid. The method of working and the appearance of the latex in varying concentrations of sodium chloride and hydrochloric acid is shown in Plate I. The curves obtained for various acids and salts are given in Plates II., III. and IV.

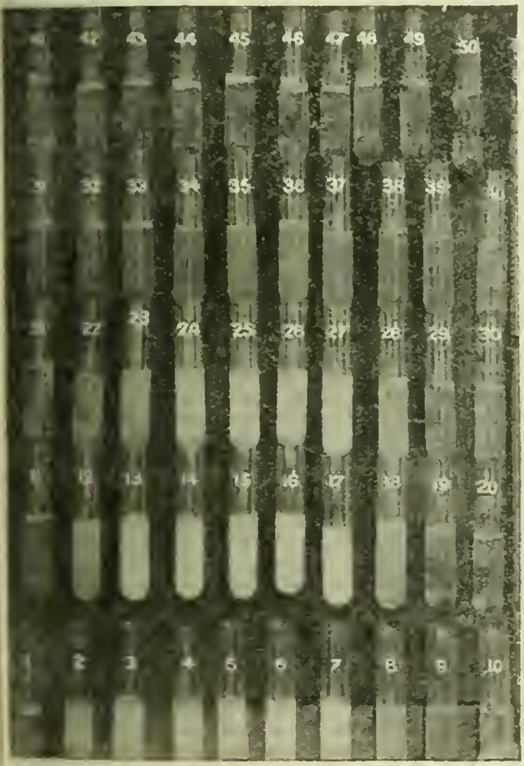
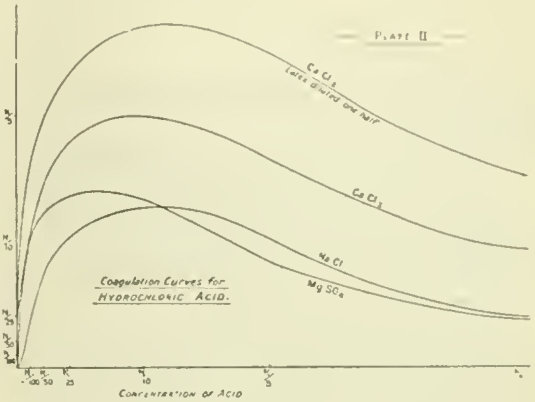


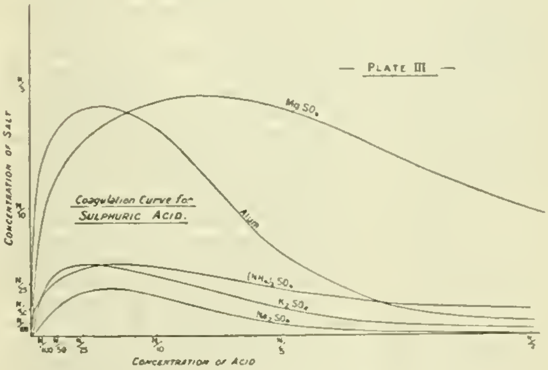
Plate I.

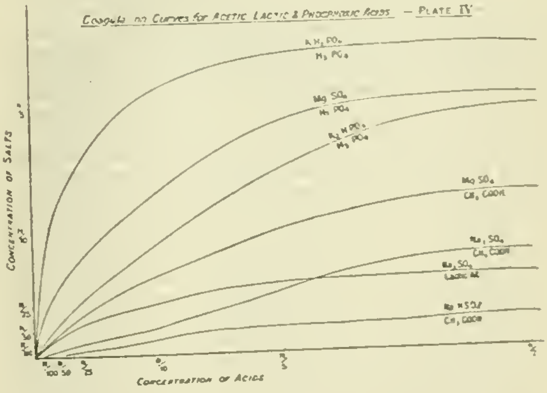
At concentrations of acid and salt corresponding to ny point within the curve coagulation does not take lace and the solution remains permanently milky, though thin skin or coagulum, due to the creaming of the rger caoutchouc globules, may form at the surface. xamination of the opaque serum after several days iows the presence of caoutchouc globules in a state of rownian movement.

At concentrations of acid and salt corresponding to ıy point outside the curve coagulation is complete, and caoutchouc globules are to be found in the serum hich is quite clear. Proceeding from any point of ncentration inside the curve in a vertical direction, as e concentration of the salt increases, the degree of agulation increases, becoming complete on reaching a int outside the curve and increasing in intensity the ther we get from it.

The difference in intensity of the coagulation between points remote from the curve and points adjacent to it was distinctly perceptible in all experiments. The coagula formed by high concentration of salt at points distant from the curve were tougher and stronger in texture, while those formed at low concentration of salt were soft and spongy. Thus one could easily arrange a number of samples of coagula according to their position with respect to the curve. On rolling the samples, however, these differences were much less obvious.







The water-absorbing capacity of the protein in the different samples was determined as follows. The clots from a vertical series of tubes were first washed thoroughly in running water, and dried between sheets of blotting paper and in the open for 24 hours. They were then weighed and afterwards dried to a constant weight in a steam oven. The results were as follows :—

Loss of water on heating rubber to 100° *C.*

Sample.	Initial weight.	Dry weight.	Difference.	Percentage loss.	Concentration of Salt.	Concentration of Acid.
1	3·55	3·16	0·39	10·9	N	N/50
2	3·10	2·76	0·34	10·9	N/2	N/50
3	3·17	2·90	0·27	8·5	N/5	N/50
4	2·70	2·54	0·16	5·9	N/10	N/50
5	2·05	1·92	0·13	6·3	—	2N

thus showing that the water-absorbing capacity of the coagulum varies inversely as the concentration of salt in the serum.

Examination of the curves shows that the inhibiting effect of acids on coagulation increases with increase of concentration of acid up to a certain maximum. Beyond that, in the case of hydrochloric and sulphuric acids, the inhibiting effect begins to diminish with increasing concentration of the acid, until at a concentration of *N*/2 coagulation takes place without the addition of salt. With acetic, lactic, and phosphoric acids, further increase in concentration has no effect, and these acids are unable to produce coagulation at any concentration in the absence of salt. Small differences in the concentration of the organic acids have very little influence on the degree of coagulation produced by salts. Particularly is this the case with acetic acid in the presence of sodium sulphate or bisulphite. This accounts for the fact that acetic acid as used on plantations allows considerable variation in the strength required for coagulation.

Sulphuric acid in the presence of sodium salts behaves similarly but in a less degree. At concentrations of sodium salts above *N*/25 coagulation is produced at all concentrations of acid. Eaton, using undiluted latex, found that coagulation was produced at all concentrations of sulphuric acid. It follows, therefore, that the concentration of salts in latex corresponds to at least *N*/25 sodium sulphate. Comparison of the coagulating effect of various salts shows that the valency of the radicles does not appear to exert much influence. Considering the curves for sodium salts, the sulphate is more powerful than the phosphates or chloride, and comparing the effects of the basic radicles, arranged in order of effectiveness they form a series thus: Na, K, NH_4, Al, Mg. These results do not agree with those of Wood, who found that with wheat gluten the coagulating effect of salts was related to the valency of the kations. They agree, however, with Hofmeister's series, and probably represent the comparative water-drawing capacities of the salts.

Chick and Martin, experimenting with egg albumen, found that the precipitation of protein was analogous to the salting out of alcohol. The first effect of concentrated salt is to withdraw water from the protein aggregates. When precipitation is about to take place, the anion or kation of the electrolyte present can complete the process by neutralising the charges of the particles. Thus in studying the total effect of the concentration of salt on coagulation, the influence of the ions of the electrolytes must be regarded as subsidiary to the dehydrating effect of the salt as a whole. It would appear that coagulation of latex is analogous to the salting-out of proteins like casein and egg-albumen. On this supposition, the addition of salts like sodium and magnesium sulphate to latex causes a separation into two phases, one protein-rich and the other protein-poor, whatever the charge upon the protein aggregates, if enough salt be added. Such phase-separation would be facilitated if the particles were positively charged, that is, in solutions more acid than the isoelectric point. With negatively charged particles in an alkaline solution, the charge cannot be neutralised by the more potent SO_4'', which, if adsorbed, would still further increase the negative charge. Thus the addition of the proper quantity of acid to latex, normally alkaline, gives the particles a positive charge, and enables the salts in the latex to effect coagulation.

The system on separating into two phases attains equilibrium, and any alteration in the amount of any one of their three components is followed by a change both in their composition and volume. Thus increase in concentration of salt or of protein is followed by a corresponding increase in the protein-rich phase (precipitate). This influence of the quantity of protein on coagulation is seen in the curves for HCl and $CaCl_2$, showing that latex diluted until it contains half the quantity of protein requires more salt to effect coagulation. Eaton also gives analytical results in support of this theory as follows:—

Sample.	Vol. of latex.	Vol. of water added.	Vol. of acetic acid, 1 per cent.	Composition of Coagulum. Protein, per cent.	Composition of Coagulum. Ash per cent.
	c.c.	c.c.	c.c.		
1	100	200	10	2·2	0·13
2	100	100	10	2·4	0·10
3	100	50	10	2·5	0·12
4	100	—	10	2·6	0·12

The influence of the increase in the concentration of salt on the physical properties of the coagulum has already been shown. It also affects the composition, but to a less degree. Increase in the salt component is divided proportionally between the two phases, so that most of it remains in the watery phase and only a small quantity enters into the protein-rich phase, which loses a certain quantity of its water. Chick and Martin found this to be the case with egg-albumen and in the above analysis of rubber there is very little difference, if any, in the salt content of the coagulum formed at different concentrations of the latex. In Eaton's analysis this increase was so small as to be imperceptible. His results show little or no difference in the salt content on diluting the latex.

The foregoing results support the theory of Biffen-Weber and others that the protein constituents play a most important part in coagulation and determine to a considerable degree the physical properties of the resulting rubber coagulum.

According to the analysis of Seeligmann, *Hevea* latex from Brazil contains 55 per cent. of water and 9 per cent. of mineral salts, chiefly sodium and calcium, in combination with complex organic acids. It follows therefore that in the Amazonian smoking method, coagulation of the latex takes place at a concentration of salt higher than 18 per cent. It seems very probable that the high concentration of salt and protein in this process is a factor determining the superior qualities of Brazilian rubber, and that the dilution of latex on Eastern plantations by the direct addition of water and acid solution is largely responsible for the inferiority of plantation rubber. If this be the case, then those substances (the protein and ash), hitherto regarded as undesirable impurities in the rubber, are just the factors upon which the quality of the product depends.

This theory would account for the variability which exists among plantation rubbers even from the same estate. Tapping experiments in several countries have shown that the yield and composition of the latex vary considerably with respect to the percentages of caoutchouc, protein and ash, according to the length of tapping, age of trees and rainfall. This variation in composition, in addition to that directly due to artificial dilution of th latex in the factory, will result in considerable variatio in the quality of the rubber produced from day to day The standardisation of plantation rubber therefor involves testing the daily output of the factories, since, i the method of preparation were standardised, the natura variation in the composition of latex itself would caus daily variation in the quantity of rubber produced. I then, dilution of the latex lowers the quality of the rubbe it should be possible to improve it by increasing th concentration of salts or protein in the latex. The writ has prepared samples of rubber by coagulation in th presence of varying concentrations of salt, but befo expressing an opinion on the value of this method, man facturers' tests of these samples are being obtained. such tests, however, require a considerable time, t results so far obtained were considered sufficiently suggestive to warrant publication by themselves. The results of these vulcanising tests will be published as soon as available.

Spence, as a result of microscopic examination of Para rubber, attributes the superior qualities of Fine Hard Para to the presence of tough protein fibres. He does not account for the differences in the degree of toughness of the fibres of different rubbers, nor does he attempt to correlate the existence of such fibrous material running through the caoutchouc with the physical properties of rubber. The writer has not been able to detect the presence of fibres in raw rubber. Observation of the process of coagulation under the microscope showed that the caoutchouc globules are embedded in the protein rather than *vice versa*, and that on pressing the coagulum beneath the coverslip coalescence of the caoutchouc and protein takes place with formation of what appears to be a solid solution of the two constituents.

The part played by caoutchouc globules during coagulation also requires consideration. Since they exist in the latex in a state of Brownian movement which is considerably affected by changes in concentration of salt and acid, it is very probable that their physical properties in the final product are also affected by these changes. Schidrowitz has shown that the viscosities of rubber solutions in benzene vary according to the quality of the rubber. In preparing such solutions, the clear liquid is decanted off from the insoluble nitrogenous constituent. It follows therefore that the properties of the protein in the rubber have no influence on the viscosity determination and that the condition of the caoutchouc itself varies according to the method of preparation of the sample. Further, if the quality of a sample of rubber is dependent on the properties both of the caoutchouc and of the protein, and these properties may vary in different directions at the same time, it is possible that a given sample of rubber may be inferior in general physical properties to another sample after vulcanisation, but superior to it in the viscosity test. This is found to be the case in actual practice, and as a result much doubt has been thrown on the value of viscosity tests.

The problem that remains to be solved, therefore, is what conditions determine the physical properties of the caoutchouc in rubber. The writer leaves further discussion of this question until the above-mentioned vulcanisation tests are available.

Before concluding I wish to express my indebtedness to Mr. Sharples, A.R.C.Sc., of the Mycological Department, Fed. Malay States, who conducted experiments in conjunction with these on the effect of varying salt concentrations on the growth of organisms causing the spotting of plantation rubber, results of which will appear elsewhere; also to Mr. Lambourne, F.R.H.S., Superintendent of Government Plantations, for assistance in many other ways.

Summary.

It is shown that the physical properties of the coagula of *Hevea* latex depend on the concentration of acid and salts in the serum at the time of coagulation, and it is suggested that these have an important bearing on the difference in quality between rubber produced by different methods, notably Fine Hard Para and plantation rubber.

Suggestions are made for improving the plantation methods of coagulation and the difficulties of standardisation are shown.

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POWER AND HEAT COSTS IN CHEMICAL WORKS.

BY T. ROLAND WOLLASTON, M.I.M.E.

At the Annual Dinner of the Manchester Section, a speaker expressed the view that the future of British chemical industries was assured if the horse-power could be obtained at a cost of 30s. per annum. This suggested to the author that it might be of value to set forth the true position in regard to power costs in chemical works.

There is hardly an industry in the country in which chemistry is not associated with engineering in the production of saleable commodities, therefore one must perforce deal with the above subject on broad and general lines. In chemical works economy "power" and "heat" costs seem to be inseparable, but to vary in relation to one another in a marked degree. For example, in two different works, of each 100 tons of coal consumed, one will require 20 tons for motive power and 80 tons for heating, whilst the other will have these conditions reversed. The substitution of more economical engines for power purposes in the two works will have very different significance. This may perhaps be best illustrated by a recent case in my own experience. A firm consulted me upon a proposal to pull out several small and wasteful steam engines and to substitute two gas engines with suction gas plants. They had good boiler plant, but in bad condition and inefficiently worked. Though the engines were wasteful, the bulk of the steam generated seemed to be utilised for heating and boiling, and the boiler efficiency seemed to be low.

Simple tests confirmed these suspicions. The boiler efficiency was only about 50 per cent. and only 20 per cent. of the steam generated went for motive power. Upon the basis of burning 100 tons of coal, 20 tons of this would go for power. The installation of the gas plant would reduce this amount say to 5 tons, or the whole consumption to 85 tons. The alternative suggested was to spend half the money the gas plants would have cost on boiler house improvements so as to bring its efficiency up to 70 per cent. Thus without any alteration within the works the 100 tons of coal would be reduced to about 72 tons. The first proposal, taking capital charges into account, showed 15 per cent. on its outlay involved, the second 50 per cent. on its outlay, obviously the better proposition from every point of view.

The chemist is by his training eminently qualified to analyse such cases. He generally knows more of the theory of combustion and evaporation than the engineer, but often fails apparently to turn his knowledge to practical account. He may for example install an automatic carbon dioxide recorder, spend much time in keeping it in order, and treasure the records like bank notes, and all the time be letting his well-burnt gases go to the chimney at 700° temperature while he feeds his boilers with cold water.

I have seen some of the very best engineering in chemical works, and some of the very worst. To particularise :—

Boilers. with brickwork settings tumbling to pieces, once perhaps well covered but with the covering flaking off, grate surface too large or too small for normal output, and induced or forced draught apparatus absorbing an unknown but abnormal amount of the steam generated.

Steam and hot-water pipes. in long and straggling ranges improperly proportioned, and with lagging, if any, in condition worse than useless.

Small steam engines and steam pumps.—In the late Sir Frederick Bramwell's Presidential Address to the Institution of Civil Engineers (Vol. 80 trans.), Jan., 1885, will be found the following passage :—" You would be astonished to hear that, in an investigation instituted last year by the Corporation of Birmingham, when considering whether they should approve of a proposal to lay down power distributing mains throughout their Streets, it was found, on indicating some six non-condensing Steam Engines taken indiscriminately from among users of power and ranging from 5 N.H.P. up to 30 N.H.P., that the consumption in one instance was so high as 27·5 lbs., while it never fell below 9·6 lbs. and the average of the whole was as much as 18·1 lbs." (these figures represent coal per indicated horse-power).

One sees such engines to-day in chemical, bleach, and steel works ; 10 lb. of coal per 1 H.P. means £18 per horse power per year for fuel alone when coal is 12s. per ton. The generation of steam in nearly every chemical works represents a substantial portion of the works costs. Manufacturers will haggle with the coal merchant over 3d. per ton when making contracts but, having burnt the coal, can often only account for a small fraction of its potential heat.

The following is a simple method of carrying out continuous tests, already adopted by many, and valuable out of all proportion to their cost. They involve no new principles nor ideas but are, on the contrary, the ordinary boiler efficiency tests in simplified form. The only costly apparatus required is some form of water meter, which should be considered an essential part of every steam plant equipment. Procedure is fully indicated by the test sheet shown, which can be conveniently duplicated in book form.

BOILER TEST SHEET.

Test made at........................ Date........................ Test made by......................

Type of Boiler.................. Boiler No......... Maker's Name.................. Size of Boiler........

Time.	Gauge Press. in lb. per sq. in.	Temperature of		Chimney Draught. Inches.	Coal delivered.			British Thermal Units.	Moisture Loss per 10 lb. of Coal.	Ash.			Unconsumed Coal in Ash.	Water Meter Reading.	% CO_2 in Gases.	Remarks
		Feed Water.	Chimney.		Tons.	Cwt.	Qr.			Cwt.	Qr.	Lb.				
1	2	3	4	5		6		7	8		9		10	11	12	13

Columns 1, 2, 3, 4, 5, 11, may be filled in three times a day, to obtain fair averages, and are not beyond the abilities of a youth. Chimney temperatures and draught are advantageously read from thermometer and manometer attached permanently at the chimney base. Coal weights may be conveniently obtained from the check office. Ash should be weighed by the fireman and the moisture in coal tested at intervals by placing 10 lb. on a sack in a warm place over the boiler and re-weighing after four or six hours. Flue gases may be tested for carbon dioxide in the works laboratory, say, twice a week from a continuously working aspirator extemporised from old bottles or carboys. B.T.U. in coal may be obtained by occasional laboratory tests.

The important figure required is boiler efficiency. Assuming a normal and reasonably constant boiler pressure the B.T.U. per lb. of steam will be so nearly constant as to be permanently adopted. For example, steam at 100 lb. pressure from feed at 60 requires 1157 B.T.U. per lb. Thus if in one week 20 tons of coal be burned under the boilers, the coal having 12,000 B.T.U. value per lb., and if 30,000 gallons of water be evaporated the efficiency will be :—

$$\frac{300,000\times 1157\times 100}{20\times 2240\times 12,000}=64\cdot 5 \text{ per cent.}$$

This is not very good. First-class boiler plants have shown on test upwards of 80 per cent. efficiency, but one cannot expect to maintain this, and an average of 70 per cent. would be considered satisfactory.

Only columns 2, 3, 7, and 11 of the test sheet are utilised in this efficiency calculation, and so long as it leads to a reasonably good figure the other columns may be ignored. If and when a falling-off occurs it is obvious that the remaining columns offer excellent circumstantial evidence to locate the cause, for example careless stoking, dirty boilers or flues, faulty brickwork settings or the like.

Let me add two notes here. Be sure you are justified in crediting the boilers with dry steam and not mist. Scum, grease, or high alkalinity of the boiler water or hard firing with spasmodic steam withdrawals may lead to priming and to crediting the fuel with latent heat not actually transmitted. Also, so far as is possible, ascertain the amount of steam used in any forced draught arrangement that may be used. Some of these auxiliaries swallow a substantial amount of steam which is hard to gauge.

The points which constitute good practice in conducting steam from boilers to point of utilisation are well understood but too often ignored. Briefly they are : (1) Let the pipes take the shortest and most direct course possible. (2) Keep down the sizes so as to avoid condensing surface so far as is consistent with low friction and maintenance of pressure. (3) Lag the pipes well with good non-conducting composition and maintain the lagging in good, dry, and proofed condition. The watchful manager will have his hot pipes examined and the lagging repaired, and tarred or painted at frequent intervals. (4) Fit draining arrangements to steam pipes wherever water can accumulate.

I lean strongly to the belief that the ordinary boiler furnace does not provide a satisfactory means of burning coal to advantage and I am hoping for a general expression of opinion from those present upon the subject. The same chemical reactions are supposed to take place whether coal is burnt in a bed 9 inches deep on a boiler grate or 6 feet deep in a gas producer. The volatile constituents are distilled off by the heat and are consumed mixed with secondary air admitted above the grate. The incandescent and coked fuel is penetrated by the air from below the grate, the oxygen of which is converted first to carbon dioxide then in a higher zone to monoxide, and this is or should be burned also with secondary air. With the gas producer the gas is generated and burnt under conditions closely approximating theoretical accuracy. In the boiler furnace even in the best practice a very large amount of excess air is used which vitiates the results, while the maintenance of the correct conditions for combustion in a thin bed over an area of say 20 square feet is a matter of impossibility even with the most perfect mechanical stoking devices. In the boiler furnace, however, the radiant heat of combustion is usefully employed while in the producer it is generally dissipated. Numerous attempts have been made to adapt the principle of the gas producer to boiler firing, with greater or less success. Mr. E. C. Mills, of this city, is just now experimenting, with I believe considerable success, with a producer type of furnace attachable to boilers of the Lancashire and other types, in which the air for combustion is highly pre-heated through the agency of the radiant-heat of combustion.

Hitherto the firing of boilers by producer gas has only proved to be a paying proposition when by-products could be extracted from the gas previous to its combustion, and even then only on a large scale. The all-round efficiency of the apparatus is necessarily low, while the ordinary recovery producer requires a large amount of steam to be associated with the air blast, and this is only generated at considerable expense. Professor Bone has, however, demonstrated that very high gas efficiencies can be obtained from boilers specially designed for gas firing. His firm will, guarantee 90 per cent. and his system is probably not the only one by which such efficiencies will be attained. In the near future we shall probably have recovery gas producers capable of generating all the steam they need for blast from the heat in their outgoing gas. Then the use of the recovery gas producer in conjunction with special boilers will enable the plant as a whole to work at approximately the same efficiency as the normal hand fired boiler, and the resultant by-products, sulphate of ammonia and tar, will be a handsome set-off against fuel costs, or may in certain cases even exceed them and show a profit. The recovery of by-products from fuel used will become common practice in chemical works of any size. Several large chemical works in Lancashire and the Midlands already work on these lines, and the few figures in my possession indicating some actual results are confidential.

In modern producer recovery plant about 70 lb. of ammonium sulphate is obtained per ton of coal gasified for each 1 per cent. nitrogen in the coal, and about the same weight of tar, and as Lancashire slacks average about 1·3 per cent. nitrogen, the gross return will be between 11s. and 12s. per ton of coal. The few examples given at the end of this paper will roughly indicate how this works out in practice.

Producer gas provides a much more satisfactory means of transmitting heat through a straggling works than steam. The mains are probably less costly and there are no losses corresponding with steam condensation, while for furnace work, high temperature drying, and evaporating, it offers great convenience and an all round economy, which may be set down, from general experience, as equal to 30 per cent. over the direct burning of coal under such apparatus. Where steam is essential for process work it might often be better to generate it by gas firing at the point of utilisation. In works spread over a large area also gas can be advantageously carried to isolated gas engines, which, unlike small steam engines, do not fall off in efficiency in the small sizes.

As to motive power and its transmission, small non-condensing engines should be avoided. Power transmission by shafting, ropes, belts and the like is often inconvenient in chemical works of a scattered nature. Electrical transmission is generally to be recommended; the losses are small and conveniences very great. When cheap public supply is available it can be turned on just when and as required and is paid for as used, saving also in space and capital account. But as a rule it will pay in a large works to put down a private central plant for generating the works current, either by steam, gas, or Diesel engines.

For purposes of comparison the following is an approximate table showing the performance and cost of modern prime movers:—

(a) The most economical form of modern steam engine (for example the "Uniflow") in conjunction with modern boiler plant.

(b) A steam turbine of highest class with modern boiler plant.

(c) Gas engine with "bituminous" gas plant.

(d) Diesel oil engine.

Type.	B.T.U. per B.H.P. hour.	Fuel cost per B.H.P. hour.	Capital cost per B.H.P.
		penny.	
(a) Steam engine	19,000	·102	£7
(b) Steam turbine	21,000	·112	£6
(c) Gas engine . .	15,000	·08	£8
(d) Diesel engine	9,000	·18	£8

In the above 70 per cent. efficiency is assumed for boiler and gas plant.

Coal of 12,000 B.T.U. value at 12s. per ton.

Diesel oil of 18,000 B.T.U. value at 70s. per ton.

I cannot attempt in this paper to give data for full analysis of the comparative merits of different power schemes, but, primarily to outline how these comparisons may be made, and secondly to illustrate shortly how we stand to-day I close with a few examples. In each case a works is assumed requiring 2,000 brake horse-power, working full load day and night—say, 7000 hours per annum. I also assume the following:—

Electricity obtainable at ¾d. per unit.

Coal with 1·3 per cent. nitrogen and 12,000 B.T.U. value at 12s. per ton.

Diesel oil of 18,000 B.T.U. value at 70s. per ton.

Ammonium sulphate worth £12 10s. per ton.

Tar worth £1 per ton.

Air-dried peat 40 per cent. moisture, 9000 B.T.U. value 2·3 per cent. nitrogen (on sample from West of England recently tested).

Example 1.—2000 H.P. of purchased electricity at three-farthings per unit.

Cost per H.P. hour	·56 penny
Cost per H.P. year	£16 6s. 4d.
Cost per unit	·75 penny

Example 2.—A Steam Turbine Plant of high economy with condensing plant and modern Lancashire or water tube boiler plant.

Capital Costs.

2000 H.P. of Steam Turbines at £4	£8000
2000 H.P. of Steam Boilers at 35s.	3500
Buildings, foundations and chimney	2300
	£13,800

Running Costs.

10,720 tons of coal at 12s.	£6432
Oil and stores, say	643
Labour, 14 men at £70	980
Maintenance at 2 per cent.	276
Interest and Depreciation at 10 per cent.	1380
Total running cost per annum	£9711
Cost per H.P. hour	·166 penny
Cost per H.P. year	£4 17s. 1d.
Equivalent cost per unit at switchboard	·248 penny

Example 3.—Steam Turbine as in Example 2. Ordinary Lancashire boilers fired by Recovery Producer Gas with normal allowance for Producer Steam.

Capital Costs.

55 ton Recovery Plant at £250	£16,250
Boiler plant in proportion	7000
2000 H.P. of Steam Turbines at £4	8000
Buildings, foundations and chimney	4687
	£35,937

Running Costs.

Dr.	To 20,000 tons of coal at 12s.		£12,000
,,	800 tons of acid at 30s.		1200
,,	Oil and stores		800
,,	Bags and packing sulphate		270
,,	Labour of 27 men at £70		1890
,,	Maintenance at 2 per cent.		720
,,	Interest and depreciation at 10 per cent.		3600
			£20,480
Cr.	By 800 tons of sulphate at £12 10s. 0d.	£10,000	
,,	800 tons of tar at £1	800	10,800
	Net running cost per annum		£9680
	Cost per H.P. hour		·165 penny
	Cost per H.P. year		£4 16s. 9d.
	Equivalent cost per unit at switchboard		·246 penny

Example 4.—Plant as in Example 3, except that high duty gas fired boilers would be installed and producers designed to generate their own steam assuming these to be practicable.

Capital Costs.

2000 H.P. of Steam Turbines at £4	£8000
Bonecourt or like boilers, say	4000
40 tons Special Gas Recovery Plant, say......	10,800
Foundations, buildings and chimney	3420
	£26,220

Running Costs.

Dr.	To 12,000 tons of coal at 12s.		£7200
	.. 480 tons of acid at 30s.		720
	.. Oil and stores		750
	,, Rags and Packing sulphate		160
	,, Labour, 22 men at £70		1540
	,. Maintenance at 2 per cent.		524
	,, Interest and Depreciation at 10 per cent.		2622
			£13,516
Cr.	By 480 tons of sulphate at £12 10s. 0d.	£6,000	
	,, 480 tons of tar at 20s.	480	
			6480
	Net running cost per annum		£7036
	Cost per H.P. hour		·120 penny
	Cost per H.P. year		£3 10s. 2d.
	Equivalent cost per unit switchboard		·179 penny

Example 5.—2000 H.P. of Recovery Gas Plant with Gas Engines of 2000 B.H.P.

Capital Costs.

2000 H.P. of Gas Engines at £6	£12,000
27 ton gas recovery plant at £300	8100
Foundations and buildings	3000
	£23.100

Running Costs.

Dr.	To 8600 tons of coal at 12s.		£5160
	,, 348 tons of acid at 30s.		522
	,. Oil and stores		516
	,, Bags and packing sulphate		116
	,, Labour, 20 men at £70		1400
	,, Maintenance at 2 per cent.		462
	,, Interest and Depreciation 10 per cent. ..		2310
			£10,486
Cr.	By 348 tons of sulphate at £12 10s. 0d.	£4350	
	,, 348 tons of tar at 20s.	348	
			4698
	Net running cost per annum		£5788
	Cost per H.P. hour		·099 penny
	Cost per H.P. year		£2 17s. 11d.
	Equivalent cost per unit at switchboard		·148 penny

Example 6.—2000 H.P. of Diesel Oil Engines.

Capital Costs.

2000 H.P. of Diesel Engines and Auxiliaries..	£16,000
Buildings and Foundations	2400
	£18,400

Running Costs.

To 3125 tons of fuel oil at 70s.	£10,937
,, Oil and stores, say	600
,, Labour, 12 men at £70	840
,. Maintenance at 2 per cent.	400
,, Interest and depreciation at 10 per cent.	1840
	£14,617
Cost per B.H.P. hour	·251 penny
Cost per B.H.P. year	£7 6s. 2d.
Equivalent cost per unit at switchboard ...	·374 penny

Example 7.—Peat Gas Recovery Plant, Mond System with 2000 H.P. of Gas Engines.

Capital Costs.

2000 H.P. Peat Recovery Plant	£24,000
2000 H.P. of Gas Engines at £6	12,000
Foundations and buildings and auxiliaries	6000
	£42,000

Running Costs.

Dr.	To 33,000 tons of peat at 5s................		£8250
	,, 2140 tons of acid at 33s..................		3530
	., Oil and stores, say		700
	,, Bags and packing sulphate		713
	,, Labour, 27 men at £70		1890
	., Maintenance at 2 per cent.		840
	,, Interest and Depreciation, 10 per cent. ..		4200
			£20,123
Cr.	By 2140 tons of sulphate at £12 10s. 0d.	£26,750	
	,, 2140 tons of tar at 20s...........	2140	
			28,890
	Credit Balance		£8767
	Cost per H.P. hour		nil
	Cost per H.P. year		nil
	Equivalent cost per unit		nil

With a clear profit of 21 per cent. on capital outlay.

In regard to these examples, ideal conditions are assumed, namely a 100 per cent. load factor with no allowances for standby or breakdown. If working on day load only, or with variable and intermittent load, the power costs will obviously be less satisfactory and will, incidentally, show a better case for purchased current.

The examples are worked out for power load only. If heating processes are large in proportion to motive power required it is obviously greatly in favour of any of the gas recovery schemes.

The capital costs given are in some cases based upon actual costs and quotations, but in other cases are only roughly approximated, and should not be accepted too literally.

Much difference of opinion exists as to allowance to be made for interest, depreciation, and maintenance. The rates chosen appear to meet with general acceptance, though personally I would prefer them taken at a more liberal figure.

The main object has been to provide a general scheme for comparative analysis, and if those interested will take the trouble to substitute their own figures for my assumptions where necessary they will find these examples useful for comparative purposes.

Discussion.

Mr. E. G. **Hiller** said that broadly speaking most people would agree with the estimates given by the author. The question of power production, he presumed, was not one of the most important things chemists had to consider. He gathered from the Census of Production figures that the total power in chemical trades was 215,000 H.P., the total power of the United Kingdom being about ten millions. The gross output of the works included in those trades was £75,000,000, and 215,000 H.P. at £4 per H.P. per year for fuel represented £860,000, that was about 1·1 per cent. on the gross output, whilst in other trades in the country it was about 2 to 3 per cent., so, as one would naturally expect, in chemical works the power required was on a lower scale than it was in textile works, ironworks, etc. The figures given as to the production of steam from a steam boiler, viz., 20 tons evaporating 30,000 gallons (6·7 lb. of water per lb. of coal) was about the average result.

Mr. J. H. **Lester** did not quite understand the suggestion to use the recovery gas producer along with the burnt gases for steam production. If it was proposed to utilise heat from the producer which generally went in radiant heat and to use the burnt gases in addition to that, he was not quite sure that the author had taken into consideration the amount of water which had been already converted into steam and the enormous amount of loss thereby occasioned. A very large amount of water had to be evaporated to keep the producer going; that had to be condensed again, and the whole of it was lost so far as heat was concerned. The cost of oil for the Diesel engine was put at 70s., but he believed that it was considerably more and had been quoted as high as 90s.

Mr. **Mills** referred to the difficulty of working a fire properly by either hand firing or mechanical firing. Having tested many fires under various conditions he had come to the conclusion that, as in many metallurgical industries, the best method was to turn the fuel into gas and then burn it. It had been tried before without success, but with a furnace—really a gas producer—put on a double-flued Lancashire boiler, 30 by 8, a number of tests had showed a saving of from 18 to 24 per cent. as compared with other boilers, or the same boilers, burning the same fuel. The difficulties, both chemical and mechanical, had been considerable, but he thought they had been overcome.

Dr. J. **Grossmann** said he had always contended that the production of 7lb. of steam to 1lb. of coal was an excellent result which was seldom obtained in actual work, though fancy results might be produced in special tests. Producer gas, if it could be made cheaply enough, was an ideal fuel for boilers. The recovery of by-products from coal and similar fuel would have to be confined to very large works for some time at any rate; he did not think in smaller works the recovery processes had shown any advantage. The smaller the actual quantity of by-products obtained, the greater was the working expense. He could not agree with the author's absolute condemnation of non-condensing engines. In chemical works a great deal of heat was required, and the waste steam from non-condensing engines should not be lost. In nearly every works there were a great many drying operations to be carried out, and the waste steam could be utilised for that purpose. Where it was possible to have one central engine that was the best form of using power, but in many chemical works, especially old ones, it was not feasible. Mr. Wollaston had also mentioned the desirability of preventing steam losses by condensation by covering the pipes. He (Dr. Grossmann) had frequently suggested that a slight superheating of the steam, where it had to be carried for some distance, would be very advantageous.

Mr. R. H. **Clayton** remarked that the author stated that of 100 tons of coal only 20 went for power, which showed pretty well the condition chemical works were in; that although the small pumps and engines were very inefficient, yet, as the main volume of steam was used for boiling purposes, the loss through small inefficient pumps was not so great as it would be if all the steam were taken for power purposes.

It was rather difficult in chemical works to utilise the knowledge one got from the CO_2 recorder. If the men were dealt with too harshly in the matter of CO_2 analyses, it would be found that though a few pounds of coal might be saved, it was lost in other ways. The principal trouble they had had in connection with the CO_2 recorder was in the small pipe conducting the gases to the instrument. The ordinary filter supplied with it was so large that it rapidly condensed moisture and clogged the apparatus. When the recorder was not working properly it was probably due to some condensation water in the tube which caused it to register low. The question of the lagging of pipes was a very great problem in connection with chemical works. The action of the steam upon them was so very great, and they were put down and pulled up so often, that it was best to use very cheap material rather than high class, and that perhaps led to loss of heat. He thought the price of oil for the Diesel engine was excessive, and with regard to dried peat 9000 B.T.U., with 4 per cent. moisture, seemed very high to him. There was bound to be 10 or 15 per cent. of water in peat although it was dried. Was the figure of 5s. the price on the peat field or delivered at the works?

Mr. J. E. **Christopher** was surprised to see that the fuel cost per B.H.P. for steam turbines was put down as being greater than the cost for steam engines, which was scarcely his experience. He also enquired as to the applicability of producer gas for the Diesel engine.

Mr. F. H. **Terleski** said it was quite common to find the CO_2 recorder an hour and a half behind the chimney. With regard to the weighing of cinders, the combustible left in them would vary from 5 to 20 per cent. with different firemen, but a company had brought out a patent firebar and guaranteed that the combustible matter in cinders would not exceed 2·5 per cent. In his opinion, the use of draught recorders in chemical works should receive more attention than it had done in the past. It was quite a small matter to place one practically on the boiler front, behind the breeches, or in the side flues, and another at the chimney base; they would be found very effective. Comparing types of boilers, he observed that the Babcock boiler certainly steamed quickly, but there was no great reserve of steam. The Lancashire boiler was *par excellence* where a reserve of steam had to be relied upon. One matter which he should like to see taken up strongly by chemical manufacturers in the North of England—it was already done in the South, where coal was a more important item—was the buying of coal on a calorific and ash basis. Colliery owners would sometimes send coal which varied between 17 and 18 per cent. in ash, which meant a tremendous difference when the cleaning out of fires had to be taken into account. Nothing was said in the paper about the internal condition of boilers, which, to the steam user, was a most important point, especially when the life of the boiler had to be taken into consideration.

Mr. H. J. **Bailey** said it was a matter of national importance that the coal resources of the kingdom should be used with the greatest economy. There were hundreds of works where chemists were employed who were capable of testing coals, and if they took up the problem they would make their position more favourable. Where there was a high ash in coal there was almost invariably a high carbon content in the clinker. He had seen clinkers containing 25 per cent. of combustible matter when the ash had run anything from 18 to 20 per cent. High ash meant excessive clinker, which considerably reduced the efficiency of the coal.

Dr. G. J. **Fowler** was surprised at the figures given in the table dealing with the results from using peat. He asked to what extent the peat was dried and whether it underwent any preliminary process before being distilled. In a discussion on the subject some years ago, the general conclusion seemed to be that owing to the chemical composition of the peat the high expectations entertained of it were doomed to disappointment. Therefore he should like to know whether the figures were for peat in the ordinary air-dried state, and whether they were applicable to practically any description of peat. If such figures were obtainable on a large scale there were, no doubt, great possibilities in chemical development in that direction.

Mr. **Paton** thought the figure of 12s. for coal was very high. Coal had been available for chemical industries at somewhere nearer 2s., and there were thousands of tons lost every day in the Lancashire area without any attempt being made to get value out of it. Taking the country through the national loss must be from 20 to 30 millions. He thought Societies like theirs could make suggestions to those in power to the effect that taxes could be materially reduced by the application of scientific methods to the country's resources.

Mr. **Bramhall**, dealing with the question of loss in transmission, said that during the last year he had installed electric power in one case where they were transmitting steam about 500 yards, with the result that it was costing one-third of what it cost before, and in 18 months it had paid the whole cost of the plant. With regard to the use of peat he noticed that by burning the gas with the peat, a profit of about 21 per cent. was made, but if the gas was thrown away and the peat was burnt, the profit would be between 40 and 50 per cent.—assuming all the author's figures were correct—because instead of allowing a capital expenditure of £47,000, only about £28,000 would be needed. If those results could be guaranteed it was a very tempting proposition and money could easily be found to put down works for the purpose of simply destroying the peat and making the sulphate of ammonia. An enormous amount of dirty and inferior coal was wasted, and if it could be applied in the same way as the peat, the results would be very beneficial.

Would it be very costly to fix a gas-firing apparatus on an ordinary Lancashire boiler, because that had been the one thing against any sort of by-product treatment? If the gas was a waste product, a large part of the profit was blown away, but if it could be used economically with the ordinary Lancashire boiler, one of the main difficulties was got over.

Mr. **Hoseason** said that as electrical power was likely to take the place of other motive powers he would like to ask the author the average cost of that power as compared with those he had dealt with in the paper.

As regards gas-fired boilers, he had made a test on a big scale, and he thought the chief trouble would be the difficulty of producing a gas free from dust. That was one of the great drawbacks in gas engines, and would probably be a great drawback in connection with the gas-fired boiler.

Mr. E. Ardern considered that coal contracts should be based on actual composition. Very few works laboratories had the necessary instruments to determine the calorific value of coal, and he asked how far the estimates of the thermal value as determined from certain equations based on the ash value and the volatiles, etc., were in agreement, or how far they varied, from estimates determined by total combustion of the coal.

Mr. Terleski replied that the difficulty could easily be overcome by following the example of the wool manufacturers in Bradford, and establishing a "Coal Conditioning House" where tests could be made. He noticed, too, that Boiler Insurance Companies were willing to carry out coal analyses for their clients.

Mr. J. Baddiley suggested it might be profitable to burn peat for ammonia alone, and stated that on one of the islands off the coast of Sweden a large works had been started for that purpose.

Mr. Moffatt asked what the author considered was the smallest size of plant on which it would pay to install a recovery process. There was a good profit from the 2,000 H.P. plant running continuously, but would it pay to install it with, say, 100 H.P. He thought ¾d. a unit with 100 per cent. load factor was a very high figure for the cost of electricity; any power company would quote one-third of a penny with 100 per cent. load factor, and 2,000 H.P.

Mr. L. E. Vlies asked if the acid used for the recovery of ammonia would be the ordinary B.O.V. of commerce; if it was so, the price to-day was 42s. and not 30s.

Mr. Julius Hübner said that an enormous amount of heat was wasted continuously, especially in the smaller bleachworks, dyeworks, and printworks, and in no part of the works was it more apparent than in the different drying operations. Whilst drying in large chemical works was effected on more or less scientific principles, in the types of works mentioned it was carried on without consideration of loss of heat.

Mr Wollaston, replying to the discussion, said that one of the main objects of the paper was to try to induce chemical manufacturers and others not to think of efficiency in pounds evaporated per lb. of coal, but to think of it on the basis of efficiency in B.T.U.'s. Nowadays coal was bought at the lowest price without regard to the difference in value of coals. It was most misleading to say that 6 or 7 lb. was evaporated per lb. of coal. That meant nothing unless it was considered on the basis of the heat purchased in the coal, and the heat actually obtained in the steam got from that coal. Reference had been made to the use of high pressure engines and utilising the exhaust from those engines for heating purposes. He believed very excellent results were being obtained by that method in bleachworks, dyeworks, and paper works, but he had always looked with some suspicion upon that method, for this reason, that a certain amount of power and heat were wanted, each of which varied from time to time, and it was rather difficult to regulate the one to the other. It had always seemed to him preferable to generate power separately as economically as possible, and to generate the steam independently in separate boilers at low pressure. He offered that as a suggestion only, for he had not studied the question closely.

He was sorry he could not give any further details of peat plants. A firm with which he had been associated had three installations. At one in Italy, where peat was used, electricity was generated over a very large area and he believed it was produced for nothing, in fact he believed there was a credit balance. The peat which he had taken as the basis for his estimates was not being utilised at present, but there was a scheme on foot for doing so. It could be gasified in air-dried condition with a moisture content up to 50 per cent., but it was preferred to get it about 40, which, he understood, was comparatively easy.

He had based his figures for the comparative economies of steam turbines and steam engines on two sets of quotations he had received, one for a turbine, and one for a uniflow steam engine, and they showed about the rates of guaranteed economy he had given. He had heard it stated that with a turbine designed by Mr. Ferranti they were running on 6 lb. of steam per H.P. That was inconceivable to him: he had never heard of such a result previously. On the other hand he had been told of steam engines with very high superheat getting below 9 lb. of steam.

As to the application of gas to Lancashire and water tube boilers, he did not think the results were very different, but better results could be obtained by the application of producer gas to water-tube boilers than to Lancashire boilers becauses a very large amount of gas could be burnt through a Lancashire boiler, but there was not heating surface enough to take it up. Broadly speaking, he did not think it was a good proposition to burn producer gas in either of those types of boiler. They were not built for that, and if producer gas was to be largely used in boilers in the future they would be especially built to take that gas and utilise it to the best advantage.

As to the smallest size plant that could be used for a recovery process, that depended on many points. There was no reason why the ordinary yield of sulphate of ammonia should not be obtained from 100 H.P. gas plant, only the capital cost would be so high in proportion to the output that it would take away the profit. Working say 10 hours a day, it had been proved that it was not worth while putting down a recovery plant to work with gas engines under 2,000 H.P., but if they could get up to 100 per cent. load factor, 24 hours a day, and working continuously, it could be done on a great deal less.

He could not follow Mr. Bramhall's argument as to throwing the gas away, and getting a higher return. It must be taken into account that 2,000 H.P. for 7,000 hours per annum was being produced for nothing, with a profit of 21 per cent. The Directors of the Power Gas Corporation along with other people, had purchased a property in Natal, and floated a company to gasify outcrop coal. Experts had asserted that the coal could be fed to the producer at 1s. 8d. a ton. It contained about 2·2 per cent. of nitrogen, and according to the estimates there would be a handsome profit. The gas was burnt to waste because it was valueless at present, but they hoped soon it would be possible to utilise it profitably. If coal or peat rich in nitrogen could be obtained at a low price there was no doubt it was highly lucrative to put it through a producer and recover the by-products. In the case he had mentioned, it was proposed that the producer should be put down right by the side of the peat field, and the price of 5s. a ton was the price for delivery at the producer.

New York Section.

Meeting held on Friday, January 23rd, 1914.

PRESENTATION OF THE PERKIN MEDAL T MR. JOHN WESLEY HYATT.

In the condensed report of the proceedings of th above meeting (see this Journal, March 16th, 191 pp. 225—229), that portion of Prof. Chandler's speec which dealt with the priority of Mr. Hyatt's inventic of celluloid, was omitted.

Scottish Section.

Meeting held at Glasgow on Tuesday, 25th November, 1913.

DR. THOMAS EWAN IN THE CHAIR.

NOTES ON NAPHTHALENE IN COAL GAS.

BY JAMES MACLEOD, F.I.C., AND JAS. A. RUSSELL HENDERSON, D.SC.

The data contained in this paper were collected by the authors during last summer (1913) at the Gas Works, Greenock.

Stoppages owing to the deposition of naphthalene in the service pipes, induced the Greenock Corporation to introduce into their works a Livesey washer for the purpose of eliminating naphthalene from the gas. The washer was placed between the purifiers and the station meter so that by the time the gas reached the washer it was freed from its principal impurities (cf. J. of Gaslighting, 1913, **123**, 682).

Two oils were experimented with for use in the above washer; of these one was a shale oil (750 naphtha) and the other a coal tar distillation product, "Special solvent for naphthalene."

It is to be pointed out that these costs are based on the complete extraction of the naphthalene from the gas which is of course unnecessary as all that is required is to lower the naphthalene content sufficiently to prevent its deposition in the mains and service pipes.

Freezing experiments. "Special solvent for naphthalene." When a test tube filled with this oil was immersed in melting ice no naphthalene separated. When a sample of this oil saturated with naphthalene was treated in a similar way naphthalene began to separate in a few minutes and in a short time the contents of the test tube became solid.

From "750 naphtha" saturated with naphthalene large crystals of naphthalene separated after several hours' immersion in melting ice.

Taking all things into consideration it appears that the "Special solvent for naphthalene" is more suitable than the "750 naphtha." The following points may be noted:—The special oil is not so volatile and dissolves a larger quantity of naphthalene than the naphtha, and consequently when the special oil is used the work of renewing the oil in the washer is not required so frequently as when naphtha is used. The special oil, being a distillation product of coal tar, has little or no effect on the quality and nature of the tar when run into the tar well, whereas naphtha, being a paraffin product, alters the nature of the tar. There is not much difference in the relative costs of washing the gas per 1000 cub. ft.

	750 Naphtha.	Special oil.	
Colour	Water clear	Reddish	
Sp. gr. at 15° C.	0·750	1·000	
Distillation—Below 100° C.	17 per cent.	23·5 per cent. (1)	(1) Benzene, toluene.
100°—170°	66 per cent.	4·5 per cent.	
170°—185°	12 per cent.	63·5 per cent. (2)	(2) Phenols.
Residue	3 per cent.	6·5 per cent.	
Loss	2 per cent.	2 per cent.	
Naphthalene dissolved by 100 c.c. of oil	11 grains	20 grains	
Sp. gr. of saturated oil	0·780	1·009	
Amount of naphthalene dissolved by 1500 gallons (3)	11,573,888	21,043,434	(3) Capacity of washer at works is 1500 galls.
Cost of oil per gallon	9d.	18d.	
,, ,, 1500 gallons	13,500d.	27,000d.	
Vol. of gas saturated with naphthalene at 20° C. which can be washed by 1500 galls.	70,145,000 c. ft.	127,536,000 c. ft.	(4) According to Schlumberger (this J., 1913, 76) coal gas saturated with naphthalene at 20° C. and 15° C. contains 16·5 grains and 10·9 grains per 100 c. ft. respectively.
Vol. of gas saturated at 15° (4)	106,153,000 c. ft.	193,059,000 c. ft.	
Cost of washing gas per 1000 c. ft. when gas is saturated with naphthalene at 20° C.	0·154 (5)	0·188 (6)	(5) After allowing for oil run into tar well and sold as tar at 2·22d. per gall. and allowing a loss of 20 per cent.
Cost when gas is saturated at 15° C.	0·102 (5)	0·125 (6)	(6) Allowing for a loss of 15 per cent. and oil sold as tar.

Tests during July, 1913.

Date.	Naphthalene, grs. per 100 c. ft.		Make of gas per ton of coal.	Temp. at condensers.		Temp. of atmosphere.	Vacuum at exhauster.
	Inlet of washer.	Laboratory.		Inlet.	Outlet.		
7—8	13·9	4·3	9,819	122	67	59	12·5
10—11	24·7	5·6	10,923	97	61	59	8·3
11—14	18·1	5·4	11,102	101	63	63	10
14—15	22·9	11·9	10,709	93	62	63	10
15—16	24·7	5·7	10,527	103	65	66	9·6
22—23	14·4	6·1	10,480	123	67	63	12
23—24	18·3	9·1	10,555	122	69	65	13
24—25	21·2	5·5	9,805	117	65	64	10·1
Average	19·7	6·7	10,498	109·7	64·8	62·7	10·7

NOTE.—20 gallons of special oil were added to the naphthalene washer on 9th, 15th, 18th, 24th and 28th.

Tests during August, 1913.

Date.	Naphthalene. grs. per 100 c.f.		Make of gas per ton of coal.	Temp. at condensers.		Temp. of atmosphere.	Vacuum at exhauster.
	Inlet of washer.	Laboratory.		Inlet.	Outlet.		
1— 4	16·6	4·9	9,838	123	66	65	12·6
13—15	15·4	5·6	10,164	125	65	62	14
15—18	18·5	5·5	10,133	123	65	64	14
18—19	18·4	10·4	10,446	109	65	63	16
19—20	15·6	7·3	10,490	124	65	60	17
20—21	14·1	8·0	10.420	128	66	64	16·5
21—22	—	10·4	10,696	119	63	63	16·5
22—25	11·2	4·6	10,483	113	63	59	15·7
25—26	11·8	4·5	10,657	105	61	62	10
26—27	—	6·3	10,194	123	65	64	10·2
Average	15·2	6·7	10,352	119	64	62	14·2

NOTE.—30 gallons of oil were added to washer on 1st and 9th, 50 gallons on the 13th, 40 gallons on the 18th, 20 gallons of oil and some naphtha on the morning of the 22nd.

Average results of Tests.

Date.	Naphthalene. grs. per 100 c.ft.		Make of gas per ton of coal.	Temp. at condensers.		Temp. of atmosphere.	Vacuum at exhauster.
	Inlet of washer.	Laboratory.		Inlet.	Outlet.		
July	19·7	6·7	10,498	109	64	62	10·7
August	15·2	6·7	10,352	119	64	62	14·2
Average	17·45	6·7	10,425	114	64	62	12·4

The method the authors used for estimating the amount of naphthalene in coal gas is as follows :—The gas was passed at the rate of about 0·7 cub. ft. per hour through a saturated solution of citric acid and then through a ten-bulbed absorption tube containing 2·6 grams of re-crystallised picric acid and about 100 c.c. of water and finally through an experimental meter. The experiments were allowed to run overnight. The naphthalene picrate and picric acid in the absorption tube were washed into a 250 c.c. flask and heated to 40° C. on a water bath till all the picric acid had dissolved. After cooling the naphthalene picrate was filtered off and the amount of unused picric acid determined by titration with $N/10$ sodium hydroxide in 50 c.c. See Coleman and Smith (this Journal, 1900, **19**, 128), Dickenson Gair (this J., 1905, **24**, 1279), Jorissen and Rutter (this J., 1909, **28**, 1179), and Schlumberger (this J., 1913, **32**, 76).

Amount of naphthalene required to saturate a gas.

Temperature.	Grains per 100 cubic feet.	
°C.	I.	II.
0	6·0	2·0
5	9·8	3·2
10	14·1	6·7
15	19·0	10·9
20	24·6	16·5
25	30·9	24·7

I. According to Allen (this J., 1900, **19**, 209).
II. According to Schlumberger.

If the figures given by Schlumberger are correct then the coal gas entering the naphthalene washer must have been supersaturated with naphthalene on several occasions ; if, on the other hand, the figures obtained by Allen are accurate then the gas entering the washer has never been saturated.

On no occasion has the gas leaving the works been saturated with naphthalene. It was observed that on disconnecting the tube from the inlet of the naphthalene washer to the absorption apparatus some crystals of naphthalene had formed. It appears probable that Allen's figures are not quite accurate.

The greatest amount of naphthalene found in the gas entering the washer was 24·7 grains per 100 cubic feet, on July 15—16, and the lowest amount, 11·2 grains per 100 cubic feet, on August 22—25. The figures obtained for the naphthalene at the inlet of the washer during July were greater than those for August. The averages for these months were respectively 19·7 and 15·2 grains per 100 cubic feet.

The amount of naphthalene in the gas depends upon many factors and it is almost impossible to find any relations between the figures given in the tables. The amount of naphthalene depends first of all on the coal used in the retorts. Some coals especially the coking coals, seem to yield a gas rich in naphthalene. As naphthalene is a pyrogenetic substance the amount of it present in the gas will depend upon the temperature at which the coal is carbonized and also upon the time during which the gas remains in contact with the hot coke and walls of the retorts. The amount of free space in the retort has also a marked influence on the amount of naphthalene formed.

The rate at which the gas is cooled in the condensers seems to effect the naphthalene content of the gas. It is to be noted that during July the average cooling of the gas during its passage through the condensers was 44·9° F. and in August 55°, and during these months the amounts of naphthalene were 19·7 and 15·2 respectively. On July 7—8 the cooling amounted to 55° and the amount of naphthalene fell to 13·9 grains per 100 cubic feet. From the 9th to 22nd July the cooling at the condensers was not so efficient and there is an accompanying rise in the amount of naphthalene.

The dependence upon the rate of cooling is not general as is seen in the figures. However, the figures obtained seem to indicate that it would be well to let the gases enter the condensers as hot as possible and cool them there as effectively as possible.

An attempt has been made to correlate the amount of naphthalene in the gas with the vacuum at the exhauster. By keeping the exhaust low it was thought that perhaps less naphthalene would evaporate into the gas ; on the other hand a strong exhaust would draw the gases away from the retort more rapidly and so lessen the time during which the gas is in contact with the hot coke and the walls of the retorts.

One of the coals in use was considered to be the cause of some of the naphthalene trouble. Experiments were carried out in the coal testing plant with this coal with the following results.

The charge of coal consisted of 2 lb. of coal and the time of heating was one hour.

Temp. of retort	840° C.	960° C.	1040° C.
Vol. of gas per ton....	8,133 c. feet	9,327 c. feet	11,083 c. feet
Wt. of coke per ton ..	12·5 cwt.	12·25 cwt.	12·25 cwt.

In none of the above cases was there any indication of naphthalene on passing the gas through a solution containing picric acid in suspension. In these experiments the gas was not long in contact with the hot coke and the cooling was very efficient. Lime was used in the purifying box. No tar was present in the gas on arrival at the holder. This is striking evidence of the elusive character of naphthalene, as naphthalene was generally troublesome when this coal was in use in the works.

The figures given in the tables indicate that there is some relation between the amount of naphthalene in the gas leaving the works and the daily temperature provided account is taken of the efficiency of the washer for any particular day.

Oil has to be added to the washer every few days. The results of the experiments show that the day after the oil has been added to the washer there is a decrease in the amount of naphthalene per 100 cubic feet. Thus on July 14—15 the amount of naphthalene leaving the works was 11·9 grains per 100 cubic feet; on the 15th oil was added to the washer and on the 15th—16th the amount of naphthalene fell to 5·7. Similar results are to be observed on July 24th and 25th.

During the period of the tests in August the amount of gas passed through the washer was 23,172,000 cubic feet. The amount of oil added in the same period was 170 gallons. The average weight of naphthalene extracted by the oil was 8·5 grains per 100 cubic feet. This gives a total quantity of naphthalene extracted of 1,969,620 grains, or 11,586 grains per gallon of oil used. Experiments showed that the oil was capable of dissolving 14,000 grains per gallon. This extraction works out at an efficiency of 82·7 per cent.

It was meant to carry out experiments on the effect of back pressure or varying seal in the washer on the efficiency of the extraction, but this could not be undertaken although it is hoped to carry out tests at a future date. The naphthalene content of the gas has, as usual with the advent of colder weather, fallen to a very low figure and in any case tests would not have been exactly comparable with those done previously.

FIRST REPORT OF THE COMMITTEE ON THE NOMENCLATURE OF ALLOYS.

See under Class X. of the Journal and Patent Literature, page 318.

Obituary.

CHRISTOPHER CLARK HUTCHINSON.

The death occurred on March 7th from heart failure of Mr. C. C. Hutchinson, K.C., one of the founders of this Society.

Born in 1854, the second son of Mr. William Hutchinson of Burnside, Westmorland, he was educated at the Royal College of Science, Dublin, and soon afterwards became an engineer in partnership with the late Mr. S. H. Johnson. He served as an abstractor for the Society's Journal from 1885 to 1891, on the Publication Committee from 1891 to 1899, and on the Council from 1891 to 1895. He was called to the bar at the Middle Temple in 1896 and took silk in 1910. His experience as an engineer was of great service to him at the Parliamentary Bar, where he soon obtained a large practice. He drafted the Charter of Incorporation and By-laws of this Society.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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I.—GENERAL PLANT; MACHINERY.

"*Mammoth-pump*"; *Use of the —— in chemical industry.* K. Meerbach. Chem.-Zeit., 1914, 38, 274—275.

MAMMOTH or air-lift pumps are constructed in antimonial lead, stoneware, and ebonite, for lifting acid and alkaline liquids as well as for the transportation of guncotton suspended in liquids, and several have been installed for this purpose.—A. S.

Air; Moisture in compressed —— [for pneumatic tools]. A. Hofmann. Eng. and Min. J., 1914, 97, 366—367.

To avoid condensation of the moisture in it, when compressed air is utilised in pneumatic tools it is advantageous first to cool the compressed air, and then to reheat it before it enters the tool.—T. St.

PATENTS.

Cooling, cleansing and drying gases; Apparatus for ——. T. R. Wollaston, Manchester. Eng. Pat. 2114, Jan. 27, 1913.

THE gas passes downwards through a vertical conical chamber, the wide lower end of which terminates in a fluted comb partially immersed in a liquid seal. The washing liquid is sprayed into the top of the chamber. Owing to the increasing cross-sectional area of the chamber the speed of the gas steadily decreases, whilst that of the liquid particles remains almost constant. The washed gas passes between the teeth of the comb into an enclosing chamber, which may be provided with radial, vertical, fluted metallic strips, having ragged holes punched in them, or with other suitable means for separating liquid from the gas, which latter is finally discharged through a pipe in the upper part of the outer casing.—W. H. C.

Drying machines; Rotary ——. F. J. M. Millar, London. Eng. Pat. 2463, Jan. 30, 1913.

A continuously operating and discharging machine of the rotary type, consisting of a combined conical cylinder and automatic reversing gear; it is rotated within an outer casing by suitable machinery. A current of hot air is passed through the outer casing, and the material is fed into the smaller end of the drum and discharged from an opening in the side near the larger end.—W. H. C.

Drying by passage of hot air through the material and evaporation in vacuo; Process of ——. A. Blavinhac and H. D. N. Teisseire. Fr. Pat. 462,273, Nov. 18, 1912.

The material is passed downwards between two vertical perforated plates each of which forms one side of a chamber. A supply of heated air is delivered to the chamber on one side and passes horizontally through the layer of material to the chamber on the other side, which communicates with a suction device. The material is in this way exposed both to a partial vacuum and to a current of heated air.—W. H. C.

Filters. H. E. Hughes, London. Eng. Pat. 6958, March 22, 1913.

The flanged edges of an upper and a lower casing are clamped together with a cloth of felt or other suitable filtering material between. The liquid is fed into the upper vessel which has a removable cover and an internal inverted conical partition with a circular opening at the apex of the cone. A vertical perforated cylinder fits into this opening and serves to retain any coarser particles. The filtered liquid is withdrawn from the lower vessel through an opening at the side.—W. H. C.

Filtering, removing gases from, and distilling liquids; Apparatus for ——. M. Kirschner, geb. Wachsmuth. Ger. Pat. 268,880, Nov. 17, 1912.

The liquid is projected in the form of a fine shower over the filtering layers, which are disposed one above the other, and wide-mouthed pipes connected with an exhauster are disposed in several of the compartments between the filtering layers in such a manner that the liquid throughout its course remains under a practically constant degree of suction. In this way the speed of filtration is accelerated and gases are removed from the liquid.—A. S.

Separating solid substances contained in liquids or liquid masses; Process and apparatus for ——. H. Hencke. Fr. Pat. 462,288, Sept. 8, 1913.

A horizontal perforated drum covered with suitable filtering material is rotated partly immersed in a tank. The interior of the drum is divided into several compartments which are in communication with a vacuum pump so that as the drum rotates an increasing suction may be applied, whilst as successive portions of the periphery reach the discharge position the vacuum is cut off. The discharge of the cake is effected preferably by a roller carrying an endless band which works against the periphery of the drum and is rotated in the opposite direction.
—W. H. C.

Chemical reactions; Process for carrying out ——. Soc. Générale des Nitrures. Fr. Pat. 462,464, Nov. 22, 1912.

The solid or gaseous particles which are to react are projected through a chamber, heated to the necessary temperature, at such a speed that they pass out of the heated space before they have time to attain the temperature at which the products of the reaction are decomposed. The process may be applied to the manufacture of aluminium nitride, calcium carbide, cyanides, etc.—W. H. C.

Packing absorption or reaction towers. R. Moritz. Fr Pat. 462,877, Sept. 23, 1913.

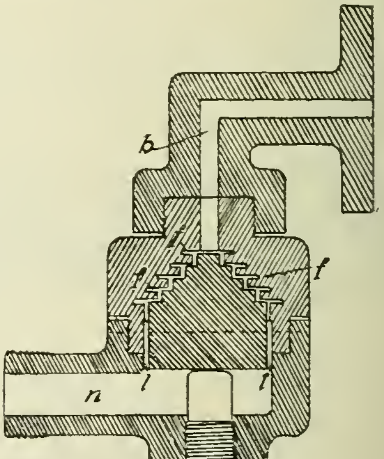
Vertical or horizontal partitions are provided so that although the liquid can pass freely downwards the gases are compelled to take any desired tortuous course. The partitions are supported entirely by the packing material.
—W. H. C.

Dialysing membranes; Preparation of ——. R. Hömberg, C. Brahm, and H. Mühsam, Ger Pat. 269,115, April 16, 1913.

Films of Norgine or other substance prepared from seaweed, preferably spread on suitable supports (metal wire gauze or the like, perforated plates, unglazed porcelain, etc.) are hardened by treatment with metallic salts, acids, or acid substances. The strength of the films may be increased by incorporating insoluble substances, such as barium sulphate, talc, kieselguhr, etc., with the Norgine or producing precipitates of such substances during the hardening process.—A. S.

Homogenising liquids; Method of ——. F. M. Berberich. Ger. Pat. 269,540, July 30, 1911.

The apparatus used is shown in the figure. The liquid enters under pressure through the channel, *b*, and after passing through the narrow passages shown, escapes by way of the grooves, *l*, and channel, *n*. The provision of the narrow annular channels, *f*, ensures that each portion of the liquid comes repeatedly in contact with another portion moving in the opposite direction The pressure on the liquid is greatest at the narrowest portion of the device.—A. S.



Solution of solid substances; Apparatus for the continuous ——, *especially for slaking lime with sugar juice or water.* H. Eberhardt, Maschinen- und Armaturenfabrik. Ger. Pat. 270,045, Nov. 3, 1912. Addition to Ger. Pat. 268,442.

The perforated cylinder through which the material descends, as described in the chief patent (this J., 1914, 127), is fixed eccentrically within the dissolving vessel, and below the cylinder but above the scraper which directs the undissolved material into the worm elevator, is an agitator which forces the solvent liquid upwards and laterally through the perforated cylinder.—A. S.

Agglomerating finely divided granular or friable materials; Processes of ——. V. A. M. Kroll, Luxembourg. Eng. Pat. 27,762, Dec. 2, 1912. Under Int. Conv., Dec. 9, 1911.

See Fr. Pat. 452,631 of 1912; this J., 1913, 757.—T. F. B.

Rectifying apparatus. A. Golodetz, Berlin, Assignor to B. Benedix, Hamburg. U.S. Pat. 1,086,452, Feb. 10, 1914.

See Eng. Pat. 18,711 of 1912; this J., 1913, 351.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal: Absorption of gases by ——. F. Leprince-Ringuet. Comptes rend., 1914, **158**, 573—576.

Gases (fire-damp, carbon dioxide, air, oxygen, and methane, at pressures ranging from 0·25 to 80 atmos.) were absorbed by coal to a much less extent than by charcoal, but the absorption in both cases was of the same general character; a state of equilibrium existed for each temperature and pressure, and the absorption markedly decreased as the temperature rose; the increased absorption with rise of pressure was rapid at first but gradually tended to a limit. Equilibrium was reached very slowly and, especially in the case of carbon dioxide, evolution of the absorbed gas, however slowly effected, was spasmodic. Results of the same order of magnitude were obtained with coals of widely different composition and size of grain; they afforded no explanation of the large evolution of fire-damp observed in very gassy mines. —F. Sodn.

Surface combustion. W. A. Bone. Roy. Inst., Feb. 27, 1914. J. Gas Lighting, 1914, **125**, 572—573. (See also this J., 1911, 527; 1912, 61, 524.)

Tests made with the 110-tube boiler at the Skinningrove Iron Works (see this J., 1912, 61) after it had run for 5 months showed that with a total evaporation of 5000 lb. of water from and at 212° F. (100° C.) per hour, the ratio of heat utilised to net heat supplied, was 0·927 : 1, and that the mechanical properties of the tubes were not in any way impaired. In a test of a "Bonecourt" boiler recently installed in connection with Krupp's coking plant in the Ruhr district, Westphalia, an evaporation of 6750 lb. of water per hour from and at 212° F. (100° C.), with an efficiency ratio of 0·925 was realised. In regard to surface combustion in a bed of granular refractory material for melting metals, etc., it is stated that without regeneration it should be possible easily to obtain temperatures up to 2000° C. with coal gas, coke-oven gas, or water-gas, or about 1500° C. with low-grade producer gas, such as Mond gas. Heating by means of diaphragms has been employed for more than a year for boiling and concentrating sugar solutions in a confectionery factory, the boiling being effected in a copper pan over a circular diaphragm of 13 ins. diam. Some of the diaphragms have been in continuous day use for about one year, and it is stated that the gas consumption is about one-half of that obtaining when ordinary flame burners were used. Very rapid and efficient evaporation of liquids can be effected by the use of overhead diaphragms. —A. S.

Hydrocarbon flames; Water-gas equilibrium in ——. G. W. Andrew. Chem. Soc. Trans., 1914, **105**, 444—446.

The equilibrium conditions of the reversible system $CO+H_2O \rightleftharpoons CO_2+H_2$ in hydrocarbon flames have been examined by exploding hydrocarbons with oxygen insufficient in quantity for complete combustion, but sufficient to prevent the deposition of carbon. The ratio $\frac{CO \times H_2O}{CO_2 \times H_2}$ was found to be practically constant and independent of pressure and of the maximum flame temperature, since the gases react during cooling and the equilibrium constant, "k," corresponds to some lower temperature at which the gases cease to react rapidly. This temperature lies between 1500° and 1600° C. at which "k" as determined by other investigators has a value of 4·0. This is in close agreement with the values obtained by exploding the following gaseous mixtures: CH_4+O_2, $k=3·98$; $2CH_4+3O_2$, $k=3·98$; $2C_2H_6+3O_2$, $k=4·12$; $2C_2H_6+5O_2$, $k=3·63$; $2C_2H_4+5O_2$, $k=3·47$. Even the deposition of carbon, or the recurrence of considerable quantities of methane had but little influence on the equilibrium.—G. F. M.

Soot: Products isolated from ——. E. Knecht and E. Hibbert. Proc. Manchester Lit. and Phil. Soc., 1913, **58**; Reprint, pp. 1—5.

Ten lb. of household soot from the Warrington district yielded, when extracted with benzene, 2 lb. of a semi-solid, pitchy mass. By extraction of this with petroleum spirit, and re-crystallisation from alcohol or methyl acetate, a hydrocarbon, $C_{27}H_{54}$, probably cerotene, was isolated in the form of white crystals, m. pt. 65 C. The same substance was isolated from soot derived from another source. The original pitch also contained an oxygenated compound, probably $C_{15}H_{16}O$, b. pt. 300° C. under reduced pressure, sparingly soluble in alcohol and benzene, more soluble in ether, chloroform and glacial acetic acid, $[a]_D = +8°$ in chloroform solution, and an organic acid, $C_{10}H_{10}O_2$, m.pt. 135 C. (See also this J., 1905, 818.) —W. P. S.

Asphaltum in dark petroleums; Determination of ——. D. Holde and G. Meyerheim. Chem.-Zeit., 1914, **38**, 241—244, 264—265.

Hot ethyl acetate, recommended by Kantorowicz (this J., 1914, 66) was found not to be a suitable reagent for precipitating asphaltum from petroleums. It did not precipitate the ceresin, and it dissolved both soft and hard asphaltums more readily than ether, and hard asphaltum more readily than petroleum ether. In a considerable number of cases, ethyl acetate precipitated no asphaltum from oils from which asphaltum was precipitated by petroleum ether. The quantity of asphaltum precipitated by ethyl acetate was not the same as that obtained by means of ether or petroleum ether after removal of ceresin. The use of ether or petroleum ether is recommended. —A. T. L.

Patents.

Washing apparatus [*for coal*] *with multiple ascending currents.* P. Habets and A. France. Fourth Addition, dated Aug. 6, 1913, to Fr. Pat. 435,720, Oct. 17, 1911.

In order to reduce the quantity of the water used in the apparatus described in the original patent, the shale compartments are arranged in direct or indirect communication with an overflow chamber provided with suitable valves by which the speed and level of the current may be regulated. (See also this J., 1914, 241.)—W. H. C.

Peat; Production of briquettes and of coke from ——. W. I. St. J. and J. R. H. Prioleau. Fr. Pat. 462,980, Sept. 25, 1913. Under Int. Conv., Sept. 12, 1913.

Peat is disintegrated and heated to about 30° C. in a steam-jacketed hopper arranged above a pair of hollow steam-heated rollers. These rollers feed the peat into a briquetting machine, which discharges it under slight pressure through suitable orifices. The compressed peat is cut into blocks, which are dried at 30° C. in chambers through which a current of air is passed. The briquettes may be carbonised in retorts for the production of coke, the distillation gases being used for heating the drying chambers.—A. T. L.

Fuel: Process of burning solid ——. O. B. Evans, Lansdowne, Pa., Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,085,806, Feb. 3, 1914.

The formation of clinkers during the combustion of a bed of fuel yielding a fusible ash is prevented by supplying the air in such a manner that there are produced in the mass of fuel superposed zones of temperature, one above and the other below the fusing temperature of the ash. Unconsumed carbon is fed through the hotter zone so as to prevent the agglutination of the fused ash therein, and is subsequently burnt out in the cooler zone.—H. H.

Combustion of gaseous mixtures. Bonecourt Surface Combustion, Ltd. Fr. Pat. 462,775, Sept. 19, 1913. Under Int. Conv., Sept. 21, 1912.

A combustible mixture is projected against the incandescent surface of a refractory mass, and burns at the hot surface, the products of combustion escaping through the pores of the material or through passages formed in it. The mixture is discharged through a passage of such cross-section that the flame cannot strike back through it, and the velocity of the gases is such that combustion does not take place until they spread out over the surface of the material.—A. T. L.

Gas producer. E. A. W. Jefferies, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,085,686, Feb. 3, 1914.

An annular cooling jacket surrounding the lower part of a gas producer contains a coil of pipe through which the water passing to the air and steam inlet pipe of the producer is conducted, so that it becomes heated by contact with the heated water in the cooling jacket.—H. H.

Retort oven for the production of lighting gas. Stettiner Chamotte-Fabrik Akt.-Ges., vorm. Didier. Fr. Pat. 461,685, Aug. 21, 1913. Under Int. Conv., Feb. 14, 1913.

In order to keep the whole of the retorts in work throughout the year, the gas generator for heating the retorts is thrown out of operation in the summer when the demand for gas is small, and a part of the retort gases is used for heating the retorts. The gas conduits for this purpose are formed in the upper part of the lateral walls of the generator.—A. T. L.

Gas for heating ; Production of ——. Athion Ges. m. b. H. Fr. Pat. 462,740, Sept. 18, 1913. Under Int. Conv., Sept. 21, 1912.

Carbon dioxide extracted from combustion gases in the known manner by means of alkali carbonate solution or water, is used in place of steam in generators for making producer gas. Gases rich in carbon monoxide are thus obtained, and nitrogen compounds as well as carbon dioxide can be recovered from the products of combustion of these gases. The surplus quantity of carbon dioxide not required to be passed again through the generators, is liquefied.—A. T. L.

Water-gas producer. A. Bormann, geb. Baeumcher. Ger. Pat. 269,349, March 16, 1913.

The producer shaft is divided by means of a partition into an upper distillation and gas-producing chamber and a lower combustion chamber. In the partition are openings through which part of the carbonised fuel falls from the upper chamber into the combustion chamber, and the combustion gases pass through other openings in the partition into heating tubes disposed within the upper distillation and gas-producing chamber.—A. S.

Gas-purifying material ; Process for the revivification of spent ——. H. Frank and K. Kallenbach. Ger. Pat. 269,764, June 4, 1912.

The mass is treated with compressed air, then passed on to a shaking screen, and the portion which passes through again treated with compressed air. The larger particles retained by the screen are ground in an edge-runner and then mixed with the finer portion.—A. S.

Fuel for explosion engines. J. de Cosmo and H. Quinaux. First Addition, dated Aug. 8, 1913, to Fr. Pat. 459,857, April 10, 1913 (this J., 1913, 1150).

A naphthalene mixture which remains liquid at ordinary temperatures consists of crude naphthalene, 400, refined mineral oil, 600, nitronaphthalene, 10, naphthylamine, 5, and cresol 5 grms. The naphthalene is mixed first with half of the oil, then with the nitronaphthalene and naphthylamine, and after heating to 23°—30° C., with the remainder of the oil. The mass is vigorously stirred, mixed with the cresol, allowed to stand, decanted and filtered.—A. T. L.

Alcohol for motors : Manufacture of ——. Mme. la Marquise Veuve de Ahumada, née M. Baratoff. Fr. Pat. 462,909, Dec. 3, 1912.

Denatured or pure alcohol, 840 grms., is mixed with 150 grms. of a mixture containing 2 parts of petroleum spirit and 1 part of ether, and with 10 grms. of a solution of white phosphorus (8 per cent.) in carbon bisulphide. —A. T. L.

Peat fuel or coke ; Process for producing —— and apparatus therefor. W. L. St. J. Prioleau, Boncath, South Wales, and J. R. H. Prioleau, London. Eng. Pat. 20,668, Sept. 12, 1913.

See Fr. Pat. 462,980 of 1913 ; preceding.—T. F. B.

Burning finely divided fuel ; Method of ——. *Apparatus for burning finely divided fuel.* D. J. Irish, New York, Assignor to The Babcock and Wilcox Co., Bayonne, N.J. U.S. Pats. 1,086,712 and 1,086,715, Feb. 10, 1914.

See Eng. Pat. 18,712 of 1911 ; this J., 1912, 864.—T. F. B.

Air-deflecting plate. Apparatus for burning finely divided fuel. D. J. Irish, New York, Assignor to The Babcock and Wilcox Co., Bayonne, N.J. U.S. Pats. 1,086,713 and 1,086,714, Feb. 10, 1914.

See Eng. Pats. 27,673 and 27,674 of 1911 ; this J., 1912, 1021.—T. F. B.

Ammonia and other products in gas producers ; Manufacture of ——. H. Wade, London. From "Montania" Brennstoffverwertung Ges. m. b. H., Berlin, Charlottenburg. Eng. Pat. 9499. April 22, 1913.

See Fr. Pat. 452,648 of 1912 ; this J., 1913, 648.—T. F. B.

Mineral hydrocarbons (petroleum and the like) ; Process for converting —— into oils having a lower boiling point. H. Zerning, Halensee, Germany. Eng. Pat. 731, Jan. 9, 1913.

See Fr. Pat. 452,919 of 1913 and Addition thereto ; this J., 1913, 781.—T. F. B.

Separation of the so-called acid tar formed in refining mineral oils or tar oils with sulphuric acid. Ger. Pat. 270,074. See III.

Treating waste acid and acid effluents from tin-plate works. Eng. Pat. 3505. *See* VII.

Hydrogen from iron and steam. Fr. Pat. 461,623. *See* VII.

Hydrogen by the alternate oxidation and reduction of a contact mass containing spongy iron, by means of steam and a reducing flame. Fr. Pat. 461,624. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Patents.

Wood ; Method of distilling ——. F. Pope, New York, and G. M. Pope, Mount Pleasant, Ga., Assignors to E. M. Pope, Boston, Mass, and Southern Manufacturing Co., Pittsburgh, Pa. U.S. Pat. 1,085,875, Feb. 3, 1914.

Wood is placed in a closed vessel and hot liquid pitch is caused to circulate upwards and over it ; the air is exhausted from the upper part of the vessel, whilst a current of steam is introduced in order to carry off the distillation products.—W. P. S.

Filaments for tungsten lamps; Manufacture of ——. G. P. Scholl, New York, Assignor to Westinghouse Lamp Co. U.S. Pat. 1,086,088, Feb. 3, 1914.

A paste of tungsten and casein is formed into filaments which are heated by means of an electric current in a non-oxidising atmosphere containing hydrogen in order to remove the carbonaceous material.—H. H.

Filaments; Process of treating incandescent lamp ——. R. H. Henderson, East Orange, N.J., Assignor to Westinghouse Lamp Co. U.S. Pat. 1,086,171, Feb. 3, 1914.

Metallic filaments are heated to a temperature in excess of the normal operating temperature in an atmosphere of phosphorus vapour whereby the surface of the filament is rendered compact and smooth.—H. H.

III.—TAR AND TAR PRODUCTS.

Tar; Use of —— *in the production of basic linings of steel furnaces.* J. Wagner. Rev. Mét., 1914, **11**, 211—220.

The constituents of coal tar which are beneficial in preparing furnace hearths of dolomite and tar are coal-tar acids, anthracene oils, and non-volatile pitch. The prejudicial constituents are light oils, naphthalene, free carbon in too high a proportion, and coal-tar bases. Tar intended for the purpose named should yield on fractionation, not more than 8 per cent. below 230° C., and not less than 30 per cent. between 230° C. and 350° C., and the loss on distillation should be about 3 per cent.—T. St.

Patents.

Mineral oils and tar oils; Process for the separation of the so-called acid tar formed in refining —— *with sulphuric acid.* A. Burkhardt. Ger. Pat. 270,074, May 25, 1912.

The reaction mixture after the treatment with sulphuric acid, is treated directly, or after separation of the acid tar, with a current of an inert gas at the ordinary temperature, until sulphur dioxide is no longer evolved. It is claimed that in this way the acid tar remaining dissolved in the oil can be removed in the cold and without the use of alkali or water, thus avoiding the formation of troublesome emulsions.—A. S.

Polynitro- and polyamino-carbazoles; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., G. m. b. H., Frankfort, Germany. Eng. Pat. 7882, April 3, 1913.

See Ger. Pat. 268,173 of 1912; this J., 1914, 193. The nitro compounds can be reduced to the corresponding polyamino compounds by the usual methods.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo; Solubility of —— *in dimethyl sulphate.* S. J. Peachey. J. Soc. Dyers and Col., 1914, **30**, 84.

Commercial dimethyl sulphate dissolves indigo freely, even in the cold, with production of a deep blue solution from which the indigo is completely precipitated by excess of alcohol. Prolonged heating at 100° C. causes decomposition and the blue solution turns brown. Commercial dimethyl sulphate contains a small quantity of free sulphuric acid which is necessary for its action upon indigo, since the pure reagent does not dissolve the dyestuff until it has been warmed for some time or about 0·5 per cent. of sulphuric acid has been added. No sulphonation in the indigo, however, takes place. A solution of indigo of 80 per cent. sulphuric acid is miscible with dimethyl sulphate, but on the addition of a little water the ester separates as a dark blue oil, removing a considerable portion of the dyestuff from the acid. Certain other vat-dyestuffs dissolve more or less freely in dimethyl sulphate. —J. F. B.

Indigo; Some new derivatives of ——. F. Kunckell. J. prakt. Chem., 1914, **89**, 324—328.

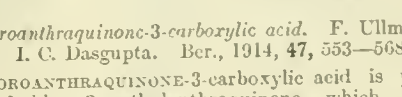
In continuation of previous work (this J., 1912, 1072) the author has succeeded in preparing indigo derivatives by reducing compounds containing a substituted benzene nucleus having a nitro-group and a chloroacetyl residue in the ortho position. 4-Acetamino-*p*-methyl-*o*-chloro-*m*-chloroacetophenone, $C_6H_4(CH_3)Cl(NH.CO.CH_3)(CO.CH_2Cl)$, was prepared by the action of aluminium chloride on a mixture of *m*-chloro-*p*-acetotoluide and chloroacetyl chloride in presence of carbon bisulphide, and was converted into 5-nitro-6-chloroacetyl-3-chloro-*p*-acetotoluide by nitration with fuming nitric acid. The nitro-compound when reduced with zinc and acetic acid on the water-bath yielded 4·4′-dimethyl-6·6′-dichloro-7·7′-diacetaminoindigo, a dark blue compound insoluble in alcohol, ether, benzene, petroleum spirit, and xylene. In a similar manner, 6-chloroacetyl-5-nitro-*m*-bromo-*p*-acetotoluide, obtained by nitration of chloroacetyl-*m*-bromo-*p*-acetotoluide, gave on reduction the dark blue 4·4′-dimethyl-6·6′-dibromo-7·7′-diacetaminoindigo. The latter when dissolved in cold concentrated sulphuric acid and the solution poured into ice water yielded the monosulphonic acid, which dissolved to a blue solution in water, alcohol, ether, and benzene. —A. S.

6′-Aminoquercetin. E. R. Watson. Chem. Soc. Trans., 1914, **105**, 338—349.

6′-Aminoquercetin was obtained by completely methylating quercetin, nitrating, reducing and de-methylating. It dyes on mordants almost the same shades as quercetin. The amino-group could not be converted into a hydroxyl-group by decomposing the diazo compound, although pentamethylquercetin-diazonium chloride combines with β-naphthol to give a crimson azo-compound. The salts of quercetin pentamethylether are intensely yellow coloured substances, which leads the author to assign to them a quinonoid structure (*i.e.*, oxonium salts).—J. B.

Quercetin; Dyestuffs derived from ——. E. R. Watson and K. B. Sen. Chem. Soc. Trans., 1914, **105**, 389—399.

The object of the authors was to obtain from the abundantly occurring quercetin, dyestuffs having deeper shades than the yellows of the parent substance. By the action of magnesium-ethyl iodide on pentaethylquercetin the crimson oxonium salt 3.5.7-triethoxy-2-*m*-*p*-diethoxyphenyl-4-ethyl-1.4-benzopyran anhydroiodide was produced, which on de-ethylating gave a dyestuff having the constitution :—



$$(HO)_2C_6H_2\begin{cases} OI\text{——}C.C_6H_3(OH)_2,H_2O. \\ \qquad\qquad\quad \| \\ (C_2H_5).C(OH) \end{cases}$$

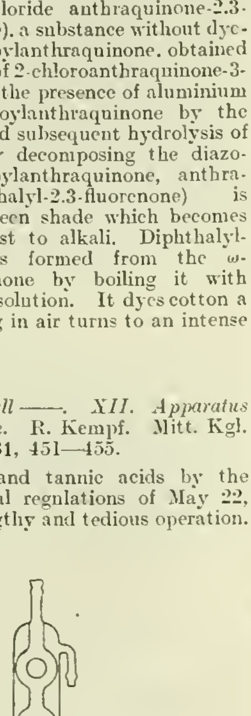
The free base dissolved in caustic potash with a blue colour and dyed a violet on chrome and alum and a crimson on tin mordants. A substance which dyed slaty-blue shades was obtained by condensing quercetin with dimethylaniline in the presence of phosphoryl chloride. It appears to be 3·5-dihydroxy-7-keto-4-*p*-dimethylaminophenyl-2-*m*-*p*-dihydroxyphenyl-1·4-benzopyran.—J. B.

2-Chloroanthraquinone-3-carboxylic acid. F. Ullmann and I. C. Dasgupta. Ber., 1914, **47**, 553—568.

2-Chloroanthraquinone-3-carboxylic acid is prepared from 2-chloro-3-methylanthraquinone, which, together with the more soluble 2.1-derivative is obtained from phthalic anhydride and *o*-chlorotoluene by the Friedel-Craft reaction, by converting it into 3-ω-dibromomethyl-2-chloroanthraquinone by treatment with bromine in nitrobenzene solution, hydrolysing to the aldehyde and oxidising this with sodium bichromate in acetic acid solution. The 2-chloro-3-carboxylic acid when condensed with aniline gives 2-anilinoanthraquinone-3-carboxylic acid, from which by the action of phosphorus pentachloride anthraquinone-2.3-acridone is produced, a substance which dyes cotton a brownish yellow. 2-β-Naphthylaminoanthraquinone-3-carboxylic acid is obtained in an analogous way and it forms an acridone which dyes cotton a greenish-yellow, becoming violet, however, in the presence of alkali. 1′.2-Dianthraquinonylimide-3-carboxylic ester is formed by condensing the ester of 2-chloroanthraquinone-3-carboxylic acid with α-aminoanthraquinone and it undergoes an acridone condensation to give 1.2-anthraquinonyl-2.3-anthracridone (diphthalyl-3.4.6.7-acridone), which dyes cotton a brown shade becoming orange on standing but changed to a violet by alkali. 2-Phenoxyanthraquinone-3-carboxylic acid results when the 2-chloro-3-carboxylic acid is condensed with phenol and from it is obtained by the action of phosphorus pentachloride anthraquinone-2.3-xanthone (phthalyl-2.3-xanthone), a substance without dyeing properties. 2-Chloro-3-benzoylanthraquinone, obtained by condensing the acid chloride of 2-chloroanthraquinone-3-carboxylic acid with benzene in the presence of aluminium chloride, gives 2-amino-3-benzoylanthraquinone by the action of toluenesulphamide and subsequent hydrolysis of the sulphamide-derivative. By decomposing the diazo-compound of 2-amino-3-benzoylanthraquinone, anthraquinone-2.3-fluorenone (phthalyl-2.3-fluorenone) is obtained. It dyes cotton a green shade which becomes on standing a weak yellow fast to alkali. Diphthalyl-4.5.4′.5′-dichloro-2.2′-stilbene is formed from the ω-dibromomethylchloroanthraquinone by boiling it with copper powder in nitrobenzene solution. It dyes cotton a brown shade, which on standing in air turns to an intense yellow not fast to light.—J. B.

Inks; Examination of iron-gall ——. XII. Apparatus for extraction with ethyl acetate. R. Kempf. Mitt. Kgl. Materialprüfungsamt, 1913, 31, 451—455.

The determination of gallic and tannic acids by the method proposed in the official regulations of May 22, 1912 (this J., 1913, 281) is a lengthy and tedious operation. Difficulties are also encountered in hot weather owing to the hydrolysis of the ethyl acetate and consequent extraction of other matters, principally the colouring matter of the ink. An automatic extraction apparatus, now approved, is illustrated in the figure. The liquid to be extracted (10 c.c. of ink and 10 c.c. of 20 per cent. hydrochloric acid) is placed in the cylindrical vessel, *e*, which is provided with a cooling-jacket, *e′*. The flask *a*, of a capacity of about 150 c.c., is charged with 100 c.c. of ethyl acetate which is kept in brisk ebullition. The vapours ascend through the tube, *b*, to the condenser, *c*, and the condensed drops fall into the funnel, *d*, which is connected with a spiral tube standing loosely in the cylindrical vessel. From the rose-shaped bottom of this tube, the solvent ascends in drops through the ink. The spiral form of the tube has the effect of cooling the solvent before it comes in contact with the ink and of presenting a hindrance to the upward passage of the drops through the ink. The extract overflows through the tube, *f*, into the flask, any traces of ink carried over being collected in the small trap in this tube. From time to time samples of the extract standing above the ink are tested in order to see whether the extraction is complete. It has been found that this apparatus performs the extraction four times as rapidly as the shaking method and the results are equivalent. An extraction lasting 1—1¼ hour is amply sufficient to exhaust the ink. —J. F. B.



1.4-*Chloromethylanthraquinone; Unusual behaviour of —— with concentrated nitric acid. Formation of* 1.2-*dihydroxy*-3-*nitro*-4-*methylanthraquinone.* O. Fischer and H. Rebsamen. Ber., 1914, **47**, 461—466.

Twenty grms. of 1.4-chloromethylanthraquinone of m. pt. 164° C., were treated with 160 grms. of nitric acid of sp. gr. 1·52, free from chlorine, added gradually, with shaking and cooling in water. After standing for some hours the mixture was heated for a short time to 60°—70° C., poured into water, and the orange precipitate separated and crystallised from its deep red solution in glacial acetic acid; a yield of 5 grms. of red needles, or leaflets, of m. pt. 217°—218° C. was obtained. The product was easily soluble in ether and alcohol and dissolved in dilute alkalis with violet-blue colour; it was a mordant dyestuff dyeing almost exactly like β-nitroalizarin, and analysis proved it to be 1.2-dihydroxy-3-nitro-4-methylanthraquinone.—G. H. F.

Patents.

Colouring matters; Production of new sulphur —— which dye cotton brown. J. Y. Johnson, London. From Badische Anilin u. Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 17,317, July 28, 1913.

Amino- or hydroxy- derivatives of acridines, or their leuco-compounds, for instance, Acridine Yellow (prepared from *m*-toluylenediamine and formaldehyde), are converted into fast brown sulphur dyestuffs by melting with sulphur and sodium sulphide or preferably by melting first with sulphur and subsequently treating with sulphide.—J. B.

1.4-*Di[hydr]oxy*-2-*nitroanthraquinone* [2 *nitroquinizarin*]; *Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,780, Aug. 2, 1913.

See Fr. Pat. 461,094 of 1913; this J., 1914, 19.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Wool: The development of the amido group in ——. M. Fort and L. L. Lloyd. J. Soc. Dyers and Col., 1914, 30, 73—77.

The potassium salt of β-naphthoquinone-4-sulphonic acid condenses with a variety of simple amido compounds with elimination of the sulphonic group, giving coloured products. This compound may be utilised as a colourimetric reagent for the free amido and amino groups developed in wool under various conditions. If wool scoured with benzene or slightly warm, neutral soap solution be boiled with a solution of the quinonesulphonate a faint permanent brown stain is produced, but in the case of wool boiled for a long time with alkaline scouring agents a deeper shade of brown is developed, corresponding to a more advanced condensation with amido groups. Treatment with boiling dilute alkalis increases the reactivity of the wool with the quinonesulphonate and this effect is not appreciably modified by subsequent treatment with warm acetic acid. Treatment with cold strong caustic soda produces some development of amido groups but not to so high a degree as boiling with dilute sodium carbonate. The effect of cold strong sulphuric acid is to suppress free amido groups and wool so treated is not stained by the reagent. A short treatment with a hot mixture of equal parts of sulphuric acid and water, followed by washing, greatly increases the staining capacity of the wool and more dilute solutions of acid produce a similar effect in a less degree. The reaction of wool with potassium naphthoquinonesulphonate is of the same order as with acid dyestuffs and both effects are due to the same cause, except that acid dyestuffs are capable of replacing sulphuric acid combined as an additive salt with the fibre, whereas sulphuric acid in this state partially hinders the condensation with the naphthoquinonesulphonate. The effect of severe steaming or decatising is to increase the staining effect with the reagent. The yellowing or browning of wool under the influence of various agencies appears to be accompanied by the development of free amido groups and long exposure to the action of light has a similar effect.—J. F. B.

Fibres ; Tests of the relative strengths of ——. C. Beadle and H. P. Stevens. J. Soc. Dyers and Col., 1914, **30**, 92—96.

Rope-making fibres generally show a considerable diminution in tensile strength in the wet state, as compared with their strength when dry, increasing with the time of steeping. Experiments with *Hedychium coronarium* in the green state, however, show a tensile strength equal to that of the fibre in the dry state thus : breaking length of fibre-vascular bundles, green plant, 58 kilom.: after extraction and drying, 57—59 kilom. ; after re-wetting for 24 hours, 29 kilom., all values being calculated on dry weights. Some of the measurements recorded for tensile strengths of various fibres are given in the following table :—

Fibre.	Calculated cross-sectional area.	Breaking strain per sq. mm. cross-section.	Breaking length.
	sq. mm.	kilos.	kilom.
Sisal	0·0240	57·3	38·2
Sanseviería (dressed) ..	0·0224	57·5	38·4
Manila (dressed)	0·0181	91·4	60·9
Hedychium (dressed) .	0·0093	89·3	59·1
Cotton	0·00026	31·4	22·8
Cellulose monofil	0·0140	21·0	14·0

—J. F. B.

Ropes and twines : Characteristics and properties of eight foreign fibres used for ——. F. Kœrner. Mitt. kgl. Materialprufungsamt, 1914, **31**, 405—436.

An account of the complete examination of 8 rope-making fibres obtained from foreign and colonial sources. The details of longitudinal and cross-sectional structures are described and the tensile strengths determined on filaments with a space of 20 mm. between the clips. The cross-sectional area of the filaments was calculated from the weight of the filament and the mean sp. gr. of 1·5. Tensile tests were repeated after exposure to the weather for 6 weeks in mid-winter and after immersion in sea water for 72 hours on two occasions, with intermediate drying in the air. The results are summarised in the table below ; the tensile strengths, as compared with that of Russian hemp = 83 kilos. per sq. mm., are relatively low but still practically useful.

Soda cellulose spent lyes ; Recovery of by-products from ——. A. Langlet. Papierfab., 1914, **12**, 212—215.

Further trials on a semi-industrial scale with Rinmann's process for the recovery of by-products from the black lyes (this J., 1912, 183, 279, 532, 812) have been carried out on lyes from the digestion of wood by the soda sulphate process. The hope that the lye could be regenerated to serve for two or three digestions, merely by precipitation and re-causticisation, was not realised, on account of the large proportion of impurities remaining unprecipitated. The lyes from the digester were treated with flue gases at 95°—100° C. and the humic substances precipitated in a sintered condition. The liquid was pressed through an externally cooled screw conveyor into a filter which separated the humic substances in a form containing 60—65 per cent. of dry substance and 7—8 per cent. Na_2O (referred to the dry substance). The humic substances were burnt in the smelting furnace with the addition of sodium sulphate. The filtered lye was concentrated *in vacuo* and mixed with about 1·5 times as much sodium hydroxide as was originally present in the lye and about half the equivalent of powdered lime. The solution was filtered, evaporated in the retort under a pressure of 2·5 atmos. and thrown by a centrifugal distributor on to the externally heated walls of a conical pan from which the dry mass was removed by a scraper. Destructive distillation was completed by passing the mass on through a heated cast-iron pipe. The distillation products (steam, acetone spirit, aldehydes, hydrocarbons) passed first through washers and were then condensed. The soda was recovered by lixiviating the charred residue. Acetone was the most important by-product. On rectification, there were obtained per ton of pulp : 18 kilos. of pure acetone, 27 of motor spirit, 11 of motor oil and 41 of inferior motor oil. These products were valued at about 20s., whilst the extra cost of materials, fuel and plant for obtaining them worked out at about 16s. 6d. per ton of cellulose. Laboratory trials however indicated that the yield of acetone spirit might be increased by 50 per cent. with improved apparatus. The process was hardly practicable with lyes from the sulphate process of digestion and the next trials will be made in Germany on pure caustic soda lyes from the digestion of straw.

—J. F. B.

Celluloid : Absorption of gases by ——. V. Lefebure. Chem. Soc. Trans., 1914, **105**, 328—337.

Films of celluloid absorb considerable quantities of gases, *e.g.*, carbon dioxide diffuses through such films quite rapidly. The effect is relatively specific as it is not shown by gelatin, viscoid, etc. Precipitated celluloid does not absorb much gas. Experiments are in progress on the rate of absorption and the equilibrium attained. Adsorption appears to be an important factor especially in the thinner films : this probably does not occur on the extreme outer surface but at the surfaces of a disperse system lying just below.—H. E. P.

Fibre.	Origin.	Mean length of filament.	Most frequent length of fibre.	Less frequent lengths of fibre.	Most frequent width of fibre.	Lumen.	Tensile strength per sq. mm. section.	Loss of strength on weathering	Loss of strength in sea water.
		metres.	mm.	mm.	μ		kilos.	per cent.	per cent.
Hibiscus cannabinus	Madras	1·06	1·6—2·5	1·1—1·5 ; 2·6—3·0	13—24	wide. follows fibre-walls	53	31	26
Hibiscus cannabinus	Cameroons	1·85	1·1—3·0	others rare	13—24	chiefly wide. irregular	60	23	15
Hibiscus cannabinus	Bombay	1·59	1·1—4·0	others rare	13—24	irregular	66	25	27
Hibiscus sabdariffa	Cameroons	1·73	1.6—4·0	others rare	13—30	irregular	58	20	33
[illegible] hemp	Madras	1·68	2·1—4·0	1·6—2·0 ; 4·1—4·5	13—24	chiefly wide regular	76	39	23
Hibiscus tiliaceus	Samoa	2·08	2·1—3·5	others rare	13—24	narrow. regular	47	15	21
tariya Jute (*corchorus capsularis*)	Cameroons	0·81	1·1—2·5	2·6—3·0	13—24	irregular	48	25	9
Jute	Amani	1·03	1·0—3·0	3·1—3·5	13—24	irregular	51	44	18

—J. F. B.

Hedychium paper; Effects of mineral loading on the physical qualities of ——. C. Beadle and H. P. Stevens. J. Soc. Dyers and Col., 1914, **30,** 89—92.

The strength of *Hedychium* papers is largely dependent on the peculiar glutinous qualities of the parenchyma cells and these cells possess extraordinary affinity for the particles of mineral matter, so that papers may be made containing as much as 40—50 per cent. of loading. In the case of the bursting strain per unit substance of paper the diminution is directly proportional to the decrease in percentage of fibre by weight. The diminution of bursting strain per unit volume of paper is also proportional to the decrease in percentage of fibre by volume.—J. F. B.

Paper; Microscopical examination of ——. L. Kollmann. Papierfabr., 1914, **12,** 241—246. (See also this J., 1912, 714.)

Experiments are described for the microscopic identification of the amorphous constituents of papers by staining them with selective dyestuffs and examining them *in situ.* Paper, after removal of the resin with ether, is stained first with a solution of Erganon Violet and subsequently with one of Capri Blue. The violet stain is absorbed by the amorphous particles of precipitated aluminium compounds of the sizing, while the blue is absorbed by the china clay, the two being easily distinguishable. With the correct concentration of the blue dyestuff (about 0·1 per cent.), not too prolonged action of the same and sufficient washing, it is possible to ensure that the fibres remain practically colourless. By drying the prepared specimen and examining after mounting in petroleum spirit, the fibres become more transparent and the stained particles easily visible.—J. F. B.

Patents.

Carbonisable material; Rendering acid-proof ——. G. G. M. Hardingham, London. From The Western Precipitation Co., Los Angeles, Cal., U.S.A. Eng. Pat. 8036, April 5, 1913.

Woven cotton fabric intended for the filtration of furnace gases is rendered proof against the acid contained in and the high temperature of such gases by heating to a high temperature, preferably in a closed vessel. For instance, a few minutes heating at 300° to 350° C. or a treatment for several days at 200° to 250° C. will suffice. Fabrics thus treated, and having lost 68 to 76 per cent. of their original weight, showed tensile strengths of "30 to 85 kilos. per metre" ("originally 2300 kilos. per m."). They resisted boiling sulphuric acid up to strengths of 50 to 64 per cent. The compounds obtained are possibly "pseudo-carbons," comparable with coal and asphaltum. Other carbonisable material than cotton can be used.—J. B.

Textile fibre from Epilobium angustifolium; Production of ——. K. Schumann. Ger. Pat. 269,350, Jan. 6, 1912.

By manuring the growing plants with, for example, ammonium salts, or gas liquor of 1°—2° B. (sp. gr. 1·007—1·014), the seed hairs are rendered stronger, longer and more elastic; and subsequently the surface of the seed hairs is roughened by subjecting them to the action of superheated steam.—A. S.

Concentrating, washing or bleaching cellulose-pulp, etc.; Apparatus for ——. G. Gunn, Heywood. Eng. Pat. 2629, Feb. 1, 1913.

The wet pulp is fed upwards between two revolving cylinders covered with wire cloth, whereby it is drained, and, after passing under a metal roller, it is removed by means of a doctor from the cylinder to which it is adhering, this cylinder being allowed to move transversely, whilst the other remains relatively fixed.—J. B.

Plastic fabric; Treatment of continuous sheets of ——. W. F. Fuller, jun., Fall River, Mass. U.S. Pat. 1,086,762, Feb. 10, 1914.

Dissolved plastic material is made to flow continuously on to a travelling belt on which it is first allowed to become partially solidified by evaporation of the solvent and finally hardened by complete evaporation of the solvent by a current of hot air in a chamber. The solvent is recovered from the air by condensation and the air then reheated and returned to the chamber.—J. B.

Furs, skins, and similar objects; Process for protecting —— against the attacks of moths or other insects or for killing these pests. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 19,688, Aug. 28, 1912. Under Int. Conv., Oct. 26, 1911.

See Fr. Pat. 442,719 of 1912; this J., 1912, 1026.—T.F.B.

Acetylcellulose; Manufacture of ——. Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 2491, Jan. 30, 1913. Under Int. Conv., Feb. 1, 1912.

See Fr. Pat. 453,835 of 1913; this J., 1913, 785.—T. F. B.

Paper suitable for security-cheques; Manufacture of ——. R. C. Menzies and J. E. Aitken, Musselburgh. U.S. Pat. 1,086,386, Feb. 10, 1914.

See Fr. Pat. 439,426 of 1912; this J., 1912, 714.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Bleaching agents; Action of —— on various natural colouring matters. R. L. Taylor. J. Soc. Dyers and Col., 1914, **30,** 85—88. (See also this J., 1912, 429.)

The colouring matter of raw linen cannot be bleached completely by solutions of free chlorine or hypochlorous acid; a hypochlorite must be present. The most rapid and complete bleaching effect is obtained when sufficient alkali is added to neutralise the chlorine or hypochlorous acid, almost but not quite, completely. The colouring matters of linen appear to exist in two varieties, one of which is bleached rapidly by chlorine or hypochlorous acid but very slowly by hypochlorites, whilst the other resists the acid reagents but is bleached by an alkaline hypochlorite. The colouring matters of cotton also exist in two varieties, similarly differentiated. The activity of bleaching liquors upon natural colouring matters therefore cannot be measured by their activity towards simple dyestuffs such as Turkey Red or Indigo. In the latter cases the bleaching activity is directly dependent upon the amount of free chlorine or hypochlorous acid present in the liquor and any agent which increases the degree of acidity would stimulate the bleaching; this is not the case with the bleaching of textile fibres. In both cases an excess of alkali exerts a powerful retarding influence on the bleaching. The author describes experiments which show that the optimum effect is produced when acid is added to the bleach liquor in quantity slightly in excess of that necessary to neutralise the free alkalinity of the solution.—J. F. B.

Sulphur blacks; Process for improving the tone of ——. G. Saget. Sealed note No. 1630, dated May 7, 1906. Report thereon by T. Stricker. Bull. Soc. Ind. Mulhouse, 1913, **83,** 803—804.

The difficulty of the bronzing of sulphur blacks is overcome by after-treating with a cold solution containing 15 c.c. of acetate of alumina of 16° B. (sp. gr. 1·125) per litre, rinsing, squeezing, padding with a 10 per cent. solution of Turkey red oil and drying without washing. The report states that this method gives a much better result than the usual one of simply oiling after dyeing.—J. B.

Para-red; A method of preventing the oxidation of the β-naphthol in dyeing ——. G. Saget. Sealed Note No. 1400, dated July 1, 1903. Report thereon by F. Binder. Bull. Soc. Ind. Mulhouse, 1913, **83**, 801—803.

The addition to the padding liquor of 10 per cent. of sodium sulphite crystals on the weight of the β-naphthol enables the pieces to be kept several days without becoming discoloured.—J. B.

Logwood Black; Production of —— applicable to silk, wool or cotton by direct oxidation on the fibre. A. Romann. Sealed Note No. 702, dated Oct. 4, 1892. Report thereon by J. Zubelen. Bull. Soc. Ind. Mulhouse, 1913, **83**, 807—808.

Logwood extract is printed directly on to the material which is then steamed for 30 seconds, and passed into a bath of bichromate, with or without the addition of ammonia, at 50° C. The white is cleared by means of bisulphite. The report states that the process gives good results on cotton and silk, but not on wool.—J. B.

Indigo discharges with the aid of bromine compounds. M. Freiberger. Sealed Notes Nos. 714 and 715, dated Dec. 19, 1892, and 1780 of Nov. 11, 1907. Bull. Soc. Ind. Mulhouse, 1913, **83**, 811—814.

Ammonium bromide is used in conjunction with chlorates (of aluminium, barium, etc.) and an agent to promote the oxidation, *e.g.*, chromium hydroxide, ferric chloride or copper salts. It can also be used in conjunction with the very active aluminium chlorate and sodium bichromate mixture, where it acts in preventing the burning of the piece during drying. This chromate discharge is greatly improved by the addition of lead sulphide and barium sulphate to the mixture, the colours being rendered more stable and the rollers less liable to attack. Lead sulphate is formed on steaming.—J. B.

Drying pieces after printing. Koechlin Frères. Sealed Note No. 726, dated March 22, 1893. Report thereon by L. Bloch. Bull. Soc. Ind. Mulhouse, 1913, **83**, 809—810.

The method of drying consists in presenting, during as great a part as possible of the passage of the piece through the hot flue, the printed side of the cloth to the heated surface. This constituted a reversal of contemporary practice, and had for its object the securing of clearer prints by a rapid drying of the surface of the colour, thus preventing running.—J. B.

Patents.

Dyeing of hair. C. Monnet. Fr. Pat. 462,577, Nov. 25, 1912.

The diamines used for dyeing are applied simultaneously with soap, thus avoiding intimate contact with, and their fixation on, the living tissue, and permitting the rapid removal of excess of colouring matter by washing with water.—B. N.

Dyeing of fur and hair. Act.-Ges. für Anilin-Fabrikation. Fr. Pat. 462,824, Sept. 20, 1913. Under Int. Conv., Dec. 11, 1912 and March 22, 1913.

The fur or hair is dyed with a mixture comprising an aromatic *m*- or *p*-diamine or a derivative thereof, *e.g.*, *p*-phenylenediamine, *p*-toluylenediamine, *p*-aminodimethylaniline, *p*-aminodiethylaniline, *p*-diaminodiphenylamine, *m*-toluylenediamine, with an aromatic dihydroxy compound, such as resorcinol, pyrocatechol, 1-methyl-3.5-dihydroxybenzene, dihydroxynaphthalene, etc., and an appropriate oxidising agent, such as hydrogen peroxide. —B. N.

Prints; Production of fast coloured ——. H. Levinstein and Levinstein Ltd., Manchester. Eng. Pat. 3427, Feb. 10, 1913.

A non-substantive dyestuff containing resorcinol as a component is printed together with a thickening agent and formaldehyde, or a substance capable of liberating formaldehyde when heated, such as, for example, hexamethylenetetramine. After steaming, shades are obtained which are fast to boiling soap solution. The mono-azo dyestuff from 2-amino-5-naphthol-7-sulphonic acid and resorcinol gives a brown, that from *p*-aminoacetanilide gives an orange shade.—J. B.

Printing sarees, scarves, shawls, etc.; Machines for ——. The Calico Printers' Association Ltd., Manchester, and J. Muir, Glasgow. Eng. Pat. 5278, March 3, 1913.

An improved mechanism for automatically arresting and re-starting in correct register the tappets and their tappet shafts in machines for intermittent printing, particularly such as are described in Eng. Pats. 22,678 of 1902, 25,088 of 1903 and 27,668 of 1907 (this J., 1904, 933).—J. B.

Flame-extinguishing material [for fibres and fabrics]. Fire-extinguishing compound. J. W. Aylsworth, East Orange, N.J., Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pats. 1,085,783 and 1,085,784, Feb. 3, 1914.

(1). Fibres or fabrics are impregnated with a solution in water of a higher halogen substitution product of a phenol and then treated to precipitate the body in an insoluble form, the material being thus rendered non-inflammable and water-repellent. (2). An aqueous solution of an alkali salt of a higher halogen substitution product of a phenol or an organic acid, capable of producing flame-extinguishing vapours at a temperature of from 400° to 700° F. (204° to 371° C.), together with a mineral salt having combustion-retarding properties.—H. H.

Fabrics incombustible and fire-resisting; Rendering ——. L. Böhler. Fr. Pat. 456,589, Feb. 20, 1913.

Tissues of all kinds are treated in a solution of alum, squeezed, dried, then soaked in a solution of ammonium sulphate and finally dried slowly.—J. B.

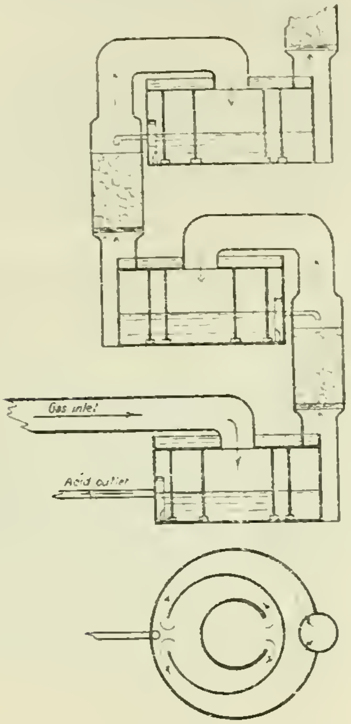
VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sicilian sulphur trade. Chem. Trade J., March 7, 1914. [T.R.]

According to the official report of the Compulsory Sicilian Sulphur Combine for the seventh working year from August 1, 1912, to July 31, 1913, the total production of sulphur in Sicily was 351,752 tons, against 366,457 tons in 1911—12 and 391,908 in 1910—11. The failure to reach a normal production of 400,000 tons is again attributed to the general conditions and to the closing, in 1913, of 7 mines in addition to the 16 mines closed in 1912. The total sales during 1912—13, including sales for future delivery, amounted to 497,246 tons, against 603,255 tons in 1911—12 and 816,818 tons in 1910—11. The total exports declined from 447,638 tons in 1911—12 to 434,473 tons in 1912—13. The most striking decline in the exports is that to France, which has always imported the largest quantity, and which took 32,970 tons less than during the preceding year. This decline is believed to be due to the establishment by the Union Sulphur Company of large refineries in that country. On the other hand, the exports to Germany increased by 6,222 tons, to Norway by 5,278 tons, to Russia by 4,520 tons, to Turkey by 4,352 tons, and to Sweden by 3,422 tons. The exports to the United States further declined from 7,125 tons in 1912 to 1,792 tons in 1913.

Hydrochloric acid; New apparatus for the condensation of ——. H. Friedrich. Chem. Apparatur, 1914, **1**, 38—39.

The apparatus comprises a combination of "tourilles" and absorption towers, extending in a vertical direction so as to economise ground space: for a daily output of 5000 kilos. of saltcake, the whole of the condensing plant does not require more than 4 sq. m. of ground space. The "tourilles" (see Fig.) consist of cylindrical vessels, 120 cm. diam. by 50 cm. high, filled with the absorbing liquid



to a height of 20 cm., and each having a layer (10 cm. high) of cooling water on the cover. Inside each "tourille" are 2 cylindrical partitions, with vertical slits on opposite sides, to cause the gas to take a tortuous path. The "tourilles" are connected by short towers with stoneware packing, over which the absorbing liquid trickles in passing from one "tourille" to the next lower one.—A. S.

Perchromic acid; Preparation of blue ——. Higher oxidation products of chromium. VI. E. H. Riesenfeld and W. Mau. Ber., 1914, **47**, 548—553.

PERCHROMIC acid was obtained as a dark blue crystalline mass by the oxidation of chromic anhydride, dissolved in methylic ether, with 97 per cent. hydrogen peroxide at —30° C. The composition of the acid was independent of the amount of peroxide used; the ratio of active oxygen : Cr : H_2O was 3·44 : 1 : 3·45, as compared with 3·5 : 1 : 3·5 required for $H_3CrO_8,2H_2O$. The water is not regarded as merely water of crystallisation, but of constitution, as expressed by the suggested formula, $Cr(OH)_4(O.OH)_3$. The acid decomposes at temperatures above —30° C.; it appears to be of about the same strength as acetic acid. —G. F. M.

Nickel sulphide and cobalt sulphide. A. Thiel and H. Gessner. Z. anorg. Chem., 1914, **86**, 1—57.

EXPERIMENTS in an atmosphere of nitrogen in a special apparatus showed that the anomalous behaviour of nickel sulphide to dilute mineral acids is due to its existence in three forms. The α-modification is dissolved by strong mineral acids of 0·01 *N* concentration and upwards, and is easily oxidised; glacial acetic acid rapidly, or water slowly, converts it into the β-modification, soluble in hot 2 *N* hydrochloric acid, and the γ-modification, soluble only with the aid of oxidising agents. The β- and γ-sulphides are formed chiefly or exclusively on precipitation from very dilute solutions; from hot, strongly acid solutions the γ-modification is formed, while all three occur in the precipitate obtained in ordinary analysis. The fall in solubility of fresh precipitates on exposure to air is due to the oxidation of the sulphide to compounds soluble with difficulty, and conversion of these by the hydrogen sulphide present to β-or γ-sulphides. The three modifications are polymerides, of which the first is amorphous, and the other two of different crystalline form. An apparently true equilibrium is reached with dilute hydrochloric acid and β- or γ-sulphide, but not on starting from a nickel salt and hydrogen sulphide.—O. E. M.

Bromination of manganese in ethereal medium. F. Ducelliez and A. Raynaud. Comptes rend., 1914, **158**, 576—578.

MANGANESE did not unite with dry bromine at the ordinary temperature, but in presence of anhydrous ether, two compounds, $MnBr_2.(C_2H_5)_2O$ and $MnBr_2.3(C_2H_5)_2O$, were obtained. The former, a deliquescent crystalline substance, yielded manganous bromide on heating.—F. SODN.

Gases; Influence of colloids and fine suspensions on the solubility of —— in water. IV. Solubility of nitrous oxide at pressures lower than atmospheric. A. Findlay and O. R. Howell. Chem. Soc. Trans. 1914, **105**, 291—298.

FROM the present results and those obtained previously (this J., 1910, 350) complete solubility curves for nitrous oxide in water in presence of colloids have been plotted for pressures varying from 250 to 1400 mm. of mercury. In all cases there was a minimum, well marked with solutions of gelatin, dextrin, and ferric hydroxide, but shallow with silicic acid solutions. (Cp. the solubility of carbon dioxide, this J., 1913, 486.) In starch solutions also distinct indications of a minimum solubility were obtained, though this was not observed in the case of the solubility of carbon dioxide. The solubilities obtained with suspensions of silica did not appreciably differ from those in pure water. With charcoal suspensions an ascending solubility curve was obtained throughout the whole range of pressures employed.—G. F. M.

Chlorine water; Decomposition of —— in the light. J. Milbauer. Z. physik. Chem., 1914, **86**, 564—566.

EXPERIMENTS with a considerable number of substances, showed that none of them, with the exception of bromine, notably accelerated the photochemical decomposition of chlorine water, when added thereto in small quantity (0·001 grm. per 10 c.c.). Mixtures of chlorine water and bromine water in all proportions decomposed more rapidly on exposure to light than either of the pure solutions. —A. S.

Formates; Decomposition of —— in relation to the technical production of hydrogen. M. G. Levi and A. Piva. Annali Chim. Appl., 1914, **1**, 1—24.

ONE of the processes proposed for the technical production of hydrogen from water-gas consists in passing the latter, together with steam, over lime heated to about 500° C., when, it is stated, hydrogen is produced according to the equation: $CaO+CO+H_2O=CaCO_3+H_2$. In view of the known analogous reactions with alkali hydroxides, the reaction may be regarded as proceeding in two stages, with intermediate formation of calcium formate:—

$$2CO+CaO+H_2O=(HCOO)_2Ca;$$
$$(HCOO)_2Ca=CaCO_3+CO+H_2.$$

The authors have studied the decomposition of anhydrous sodium and calcium formates by heat. In an atmosphere of nitrogen, decomposition of sodium formate began at 300°—310° C. and became vigorous at 400° C. Between 330° and 600° C. the gases produced consisted of carbon monoxide (22·9—40·2 per cent.) and hydrogen (53·4—77·1 per cent.), with a small proportion of carbon dioxide increasing with the temperature (up to 6·4 per cent.). The yield of hydrogen was highest at the lower temperatures (330°—370° C.). The residue consisted of carbonate and oxalate, the latter predominating at temperatures up to about 500° C., and a small quantity of carbonaceous matter, increasing with the temperature. Small quantities of condensable volatile products were also formed. Calcium formate in an atmosphere of nitrogen showed appreciable decomposition at 400°—410° C. and decomposed vigorously at 550° C. Larger quantities of volatile condensable products were formed, the gases contained more carbon dioxide and also notable quantities of methane, increasing with the temperature up to about 500° C. In an atmosphere of carbon monoxide, larger quantities of carbon dioxide were produced from sodium formate than in an atmosphere of nitrogen, and methane was also formed, whilst from both formates the yield of hydrogen was less. The gases were in all cases tested for unsaturated hydrocarbons by means of bromine water and fuming sulphuric acid, and with both reagents, a small diminution of volume occurred, but similar results were obtained in control experiments with test mixtures of pure carbon monoxide and nitrogen.—A. S.

Nitrogen: Oxidation of —— under the influence of the electric discharge. II. Activation of nitrogen and oxygen by the direct current arc. A. Koenig and E. Elöd. Ber., 1914, **47**, 516—522. (See also this J., 1913, 82, 194 and 288).

The experiments described show that nitrogen and oxygen can actually combine outside the path of the discharge at relatively low temperatures to give appreciable quantities of nitrogen peroxide. This points to an activation of one or both of the gases, the activity being retained after the gas has been removed from the effect of the discharge. (See also following abstract.)—W. H. P.

Nitrogen: The after-glow of ——. A. Koenig and E. Elöd. Ber., 1914, **47**, 523—529.

The after-glow in nitrogen will take place even after the most thorough removal of all traces of oxygen, provided that the gas is also free from metallic vapours (*e.g.*, mercury) (see Tiede and Domcke, this J., 1914, 76 and 254). A small trace of mercury vapour extinguishes the after-glow, but the addition of a little oxygen by oxidising the metal restores it, while a further addition of oxygen weakens and finally again extinguishes it. In experiments with Tiede and Domcke's apparatus the pump and the manometer were sufficient to provide the mercury vapour to extinguish the discharge if no oxygen was present. The authors' conclusions are strengthened by spectroscopic observations of the discharge.—W. H. P.

Nitrogen; Phenomena exhibited by highly rarefied ——. J. de Kowalski. Comptes rend., 1914, **158**, 625—627. (Compare this J., 1914, 76, 254; also preceding abstract.)

A repetition of Strutt's work on the production of "active nitrogen" has yielded results in agreement therewith, notwithstanding that the gas was carefully purified, with a special view to the elimination of the last traces of oxygen, by the methods of Rayleigh and Gehlhoff (see this J., 1911, 683). At pressures below 5×10^{-4} mm. and under the influence of an intense electric field a previously unnoticed preliminary phenomenon was remarked upon breaking the current: numerous minute explosions accompanied by an intense violet luminescence were visible for a brief period, after which the characteristic orange glow of the "active nitrogen" alone remained. The violet light gave the mercury spectrum, and the author attributes the phenomenon to the presence of an explosive nitride of mercury, the formation of which is due to the action of "active nitrogen" upon traces of mercury from the vacuum pump.—J. R.

Determination of free caustic alkali in commercial soda compounds and soaps by the barium chloride method. Kling and others. *See* XII.

Detection and determination of nitrates by means of diphenylbenzidine. Marqueyrol and Muraour. *See* XXIII.

Erratum.

This Journal, March 16, 1914, page 254, col. 1, lines 22 and 23 from the bottom should be transposed.

Patents.

Nitric acid; Process and apparatus for the manufacture of highly concentrated or of monohydrated ——. Verein Chemischer Fabriken in Mannheim. Fr. Pat. 462,290, Sept. 8, 1913. Under Int. Conv., Sept. 16, 1912.

Mixed nitric and sulphuric acids flow in a continuous stream (preferably not more than 3—4 cm. deep) through a still, in which a current of air or analogous gas passes over the mixture so as to carry the volatilised nitric acid towards the vapour exit. The still described is circular and very shallow; it is heated at the bottom only, and the mixed acids, introduced through a central pipe, are made to follow a protracted path by directing walls attached to the bottom plate. Dry air enters from an annular space near the periphery of the still, formed by a depending apron reaching to the surface of the acid, and passes out through the still head.—F. Sodn.

Nitric acid; Manufacture of —— from calcium nitrate. Traine und Hellmers, H. Weyer, and F. Brandenburg. Ger. Pat. 269,656, Oct. 22, 1912.

In the manufacture of nitric acid by igniting calcium nitrate and treating the resulting nitrous fumes with moist oxygen or air, an inert refractory substance such as burnt lime is added to the calcium nitrate before or during decomposition. The lime is added in such quantity that the fused calcium nitrate is absorbed by or envelops the pieces of lime; it can then be readily kept in motion by the stirring apparatus and does not remain in contact with the heating surface and form a crust thereon.—A. S.

Acid vapours; Apparatus for the condensation of [nitric and hydrochloric] ——. E. Leblanc. Fr. Pat. 462,712, Sept. 17, 1913.

Internal cooling of condensing plant is secured by arranging within the apparatus groups of tubes of glass or other acid-resisting material, so supported that the acid vapours may circulate around them. Each tube encloses an inner metal tube reaching almost to its lower end which is closed, the inner tube serving for the introduction of water which passes up the outer tube and thence to another member of the group. The upper ends of the tubes and the connecting pieces are exposed.—F. Sodn.

Atomiser for lead [sulphuric acid] chambers. J. Parent. Fr. Pat. 462,349, Aug. 1, 1913.

A channel, oblique to the axis, leads from the feed tube to the central passage of the atomiser, so that, when liquid is forced through under pressure, a very rapid rotary motion is acquired and a powerful spreading effect produced at the bowl-shaped nozzle.—F. Sodn.

Sulphuric acid; Construction for lead chambers in the manufacture of ——. Z. Littman. Fr. Pat. 462,668, Sept. 5, 1913.

The roofs are step-like in construction so that the height of the chamber diminishes in the direction of flow of the gases; also the end chambers are divided by diagonal partitions into compartments (communicating with each other) of decreasing section from entry to exit of the gases. In the principal chamber the cooling effect is increased by valved pipes above the roof, connecting the steps one with another, and a secondary system of gas passages (also valved) connects the floor of the principal chamber with the roofs of subsequent chambers, without disturbing the principal gas circulation.—F. Sodn.

Pyrites; Method of roasting —— whereby the accompanying metals, such as copper, zinc, and lead, are converted into sulphates. C. P. Debuch. Ger. Pat. 269,774, July 26, 1912.

Instead of the pyrites being transferred as usual from the first hearth to the second, from the second to the third, and so on, a portion is transferred from the first hearth to the third, from the second to the fourth, and so on. In this way the quantity of sulphur burnt per unit of time on each hearth, and hence the temperature, is diminished, whilst at the same time the material transferred carries with it sufficient heat to ensure the continuation and completion of the roasting of the partially roasted material. It is stated that by this means efficient oxidation of the pyrites and simultaneous conversion of the copper, zinc and lead into sulphates are attained. A similar result can be obtained by mixing inert material (*e.g.* pyrites cinder) with the raw pyrites.—A. S.

Waste [sulphuric] acid and acid effluents from tin-plate works and the like; Treatment of ——. F. A. Anderson, Newcastle-on-Tyne. Eng. Pat. 3505, Feb. 11, 1913.

The acid effluent is treated with excess of cream or milk of lime, thoroughly agitated for 2—3 hours, and the precipitate, containing ferrous hydroxide, calcium sulphate, and a little calcium hydroxide, settled, collected, and pumped into filter-presses. The resulting cakes are stored for a few days, until the ferrous hydroxide has been completely oxidised, and are then used for coal-gas purification or plaster of Paris manufacture, according as ferric hydroxide or calcium sulphate is the predominating constituent.—O. R.

Barytes from ores; Method of separating ——. C. J. Greenstreet, St. Louis, U.S.A. Eng. Pat. 16,273, July 15, 1913.

See U.S. Pat. 1,069,545 of 1913; this J., 1913, 871. Sodium chloride may be replaced by potassium, magnesium, calcium, strontium, or barium chloride, sodium, magnesium, or potassium sulphate, or potassium or sodium bisulphate.—T. F. B.

Chalk; Process of manufacture of [precipitated] ——. L. Negro. Fr. Pat. 462,329, June 21, 1913.

Gases produced during lime burning are passed, after purification, into milk of lime (made from the quicklime or lime residues), and the resulting calcium carbonate is filtered off and dried.—F. Sodn.

Alkali and alkaline-earth chlorides; Means for the electrolysis of ——. A. Clemm, Mannheim, Germany. Eng. Pat. 21,462, Sept. 23, 1913. Under Int. Conv. Dec. 3, 1912.

In the electrolysis of alkali and alkaline-earth chloride solutions by processes using vertical diaphragms and circulating electrolytes, a powder, such as barium sulphate, which is proof against chlorine, hydrochloric acid, and caustic alkali, is interposed in the diaphragms between an alkali-resisting material, such as asbestos fabric on the cathode side, and an arrangement of acid- and chlorine-resisting material, such as glass, ebonite, stoneware, or the like, on the anode side. With such diaphragm arrangement, high yields of concentrated hydroxide lyes and very high current efficiency can be obtained.—O. R.

Aluminium nitride; Process and electric furnace for the manufacture of ——. G. Coutagne. Fr. Pat. 462,462, Nov. 22, 1912.

A mixture of carbon and alumina (or material containing alumina, such as bauxite), travelling slowly through a furnace, is heated, in one zone, to a temperature (not necessarily uniform) sufficiently high to reduce the alumina more or less completely, whilst nitrogen (as producer gas, for example) slowly passes in the opposite direction, so as to meet the deoxidised material beyond the zone of irregular temperature. The process may be carried out in a vertical tubular furnace, of which the carbon lining constitutes one electrode; the second electrode is suspended axially, and the surrounding space is filled with the material to be treated, this being heated directly by the passage of a low-tension current

—F. Sodn.

Ammonia; Process of synthesis of —— by means of carbon. A. Serret. Fr. Pat. 462,683, Nov. 27, 1912.

A mixture of nitrogen, hydrocarbons, and steam is brought into contact with alkalinised carbon ["charbon alcalinisé"], at a temperature ensuring the formation of ammonia from the nascent hydrogen produced, but below that at which ammonia is decomposed.—F. Sodn.

Salt similar to light cooking salt; Production of —— from fused sodium chloride. G. Bergen and L. Stolz. Ger. Pat. 269,427, Dec. 10, 1912.

Compressed air or other gas or steam is blown into the molten salt, and after solidification of the salt the blowing is continued to cool the solid salt.—A. S.

Chlorides of the rare earths; Preparation of anhydrous —— free from oxychlorides. Deutsche Gasglühlicht A.-G. (Auerges.). Ger. Pat. 268,827, Nov. 24, 1912.

A mixture of anhydrous chloride and oxychloride, obtained by heating the hydrous chloride to a high temperature, is treated with alcohol, the solution separated from the insoluble residue containing the oxychloride, and the anhydrous chloride recovered by evaporating the solution. In order to free it from traces of organic matter, it is heated in a current of hot dry air.—A. S.

Mesothorium and radium; Separation of salts of —— in the extraction of thorium from minerals containing it. K. Schwab. Ger. Pat. 269,541, April 23, 1911.

Barium salts are added to the concentrated sulphuric acid used for decomposing the mineral (*e.g.* monazite sand), the reaction product is worked into a sludge with water, and is then treated with a large quantity of water to which has been added a quantity of barium salts sufficient to ensure the complete retention of radioactive substances in the insoluble residue. It is stated that without this second addition of barium salts, up to 60 per cent. of the radium and mesothorium may pass into solution, barium-radium mesothorium sulphate being considerably more soluble in dilute solutions of cerium and didymium salts than in water.—A.S.

Radiothorium or substances containing it; Process for obtaining —— for the preparation of solutions containing thorium X. Deutsche Gasglühlicht A.-G. (Auerges.). Ger. Pat. 269,692, March 22, 1912.

The solution of the material freed as far as possible from impurities, especially barium, calcium, iron, lead, phosphoric acid, and if practicable, cerite earths, is treated with pure ammonia, the precipitate washed, dissolved in dilute nitric acid, evaporated to dryness to expel the excess of acid, the residue dissolved in distilled water, and the solution treated with excess of pure ammonia. The precipitated hydroxides, containing radiothorium, are evaporated to dryness together with the solution of ammonium salts, and the ammonium salts are removed from the residue by repeated washing with distilled water or a dilute solution of sodium chloride free from carbon dioxide. For the preparation of solutions containing thorium X, the residue obtained as described above is left in contact with pure distilled water or a dilute solution of sodium chloride free from carbon dioxide until a sufficient quantity of thorium X has passed into solution.

—A. S.

Aluminium sulphite; Oxidation of —— to aluminium sulphate by means of air. C. A. Beringer. Ger. Pat. 269,794, Feb. 11, 1913.

The aluminium sulphite solution is treated with air under a high pressure (5 atmospheres) and at a high temperature (130° C.), whereby a quantitative yield of aluminium sulphate is stated to be obtained.—A. S.

Peroxide of hydrogen; Compound for making ——. C. B. Jacobs, Port Chester, N.Y. U.S. Pat. 1,076,039, Oct. 21, 1913.

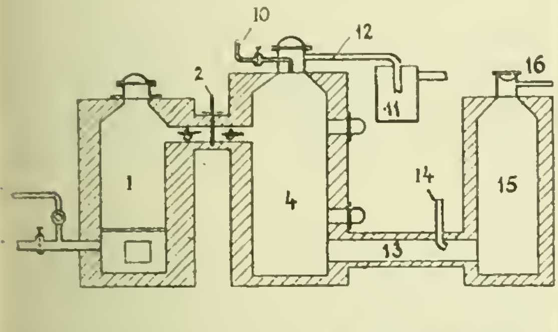
An anhydrous peroxide salt of an alkali metal, especially metaborate of sodium peroxide, made by adding sodium peroxide to a solution of metaboric acid at 5°—10° C., crystallising at 0° C., and dehydrating over sulphuric acid. The compounds are quite stable and may be made up into tablets, suitable for preparing, with water, alkaline non-caustic solutions of hydrogen peroxide, of known strength, for medicinal and other purposes.—F. Sodn.

Bromine; Process for the recovery of ——. A. E. Schaefer, Saginaw, Mich. U.S. Pat. 1,085,914, Feb. 3, 1914.

A solution of ferrous bromide is brought into contact with gases containing bromine, and the resulting ferric bromide solution, after reduction by metallic iron, is again exposed to the gases, the process being continued until a solution of desired strength is obtained.—F. Sodn.

Hydrogen from iron and steam; Process for the production of ——. A. Messerschmitt. Fr. Pat. 461,623, Aug. 4, 1913.

The contact mass of iron, is heated, directly or indirectly, by means of a gas of low calorific value, whilst reduction takes place with a gas of high calorific power. In this way reduction is completely and rapidly effected, whilst overheating of the contact mass in the other stages of the operation is avoided. Thus, in the first or heating stage, a gas of low calorific value passes from the producer, 1, into the contact chamber, 4, into which a current of air is simultaneously directed through the conduit, 10, the hot gases traversing the contact mass downwards, and escaping by way of the conduit, 13, into the superheater, 15. In the reducing phase, steam is admitted into the producer to form a gas rich in carbon monoxide and hydrogen, which, following the same course as in the first stage, reduces the contact mass, and is burnt in the superheater, with the help of air admitted through the conduit, 14. In the oxidising phase, the damper, 2, is closed, and steam, admitted by way of the conduit, 16, passes through the superheater, 15, into the contact chambor, 4. The hydrogen, which is generated, passes through the conduit, 12, into the collector, 11. When several reaction chambers are employed, one set can be employed as superheaters for the other set, the gases, escaping from the first set in the reducing phase, being mixed with air and burnt in contact with the reaction masses contained in the second set, and then reversed, after the first set have passed through the oxidising stage.—O. R.



Hydrogen; Process for the preparation of —— *by the alternate oxidation and reduction of a contact mass containing spongy iron, by means of steam and a reducing flame.* A. Messerschmitt. Fr. Pat. 461,624, Aug. 4, 1913.

The simultaneous heating and reduction of the contact mass is effected by mixing a certain amount of air with the reducing gases, and burning a definite proportion of the latter in a preliminary mixing chamber, before passing the excess of reducing gases and products of combustion into the reaction chamber. The composition of the mixture, and the temperature at which it is admitted to the contact mass, are kept as constant as possible, and the gases issuing from the reaction chamber are mixed with an excess of air and completely burnt in a regenerator, the reaction chamber being preferably annular in form and the regenerator disposed inside it. Using a pair of such appliances, the gases are passed first in one direction and then reversed, the regenerator of one system after one operation serving to pre-heat the mixture of air and reducing gases before these enter the mixing chamber of the second system for the next operation. The mixing chamber may take the form of an annular space outside and near the bottom of the reaction chamber, or the regenerator of one system may at the same time act as preliminary mixing chamber for the twin system.—O. R.

Hydrogen; Process for the production of —— *by means of hydrocarbons and steam.* Badische Anilin und Soda Fabrik. Fr. Pat. 463,114, Sept. 30, 1913. Under Int. Conv., Nov. 30, 1912.

A mixture of hydrocarbons and steam is passed over an inactive, refractory oxide, such as magnesia, which is covered with a catalyst, such as nickel or a nickel oxide, and heated above a dark red heat, say to 800°—1000° C. The resulting gaseous mixture is freed from carbon monoxide and dioxide, leaving substantially pure hydrogen, suitable for the catalytic production of ammonia.
—O. R.

Oxygen; Process for preparing ——, *especially for baths, from peroxides or per-salts, by catalytic decomposition.* F. Michel. Ger. Pat. 269,852, Oct. 26, 1912.

The decomposition of the peroxides or per-salts is effected by compounds of elements of the chromium group, such as molybdenum, tungsten, uranium, chromium, and vanadium, in combination with iodine-compounds. It is stated that the action of the two classes of compounds used together is many times more powerful than that of the components. The method may be applied to the decomposition of residual peroxides, in bleaching works, etc., in cases where the usual reagents, such as permanganate, cannot be used.—A. S.

Nitric acid; Manufacture of —— *from nitrates and sulphuric acid.* C. Uebel. Heidelberg, Germany. Eng. Pat. 19,881, Sept. 2, 1913. Under Int. Conv., March 11, 1913.

See Fr. Pat. 461,452 of 1913; this J., 1914, 200.—T. F. B.

Iron in liquids; Process for the oxidation and separation of ——. Bayerische A.-G. f. Chemische und Landwirthschaftlich-Chemische Fabrikate, H. Hackl, and H. Bunzel, Heufeld, Upper Bavaria. Eng. Pat. 4371, Feb. 20, 1913. Under Int. Conv., June 25, 1912.

See Fr. Pat. 459,576 of 1913; this J., 1913, 1156.—T. F. B.

Nitrides such as that of aluminium; Process for the manufacture of ——. Soc. Générale des Nitrures, Paris. Eng. Pat. 11,091, May 10, 1913. Under Int. Conv., May 13, 1912.

See Fr. Pat. 457,723 of 1913; this J., 1913, 1010.—T. F. B.

Process for the execution of chemical reactions. Fr. Pat. 462,464. *See* I.

Element for the electrolysis of water. Fr. Pat. 462,394. *See* XI.

VIII.—GLASS; CERAMICS.

Clays and kaolins; Causes of plasticity and allied properties of ——. P. Rohland. Silikat-Zeits., 1914, 2, 30—33.

The author contends, in opposition to the views of Brown and Montgomery (Technol. Paper, Bureau of Standards, Washington, 1913), that all clays lose their plasticity when heated to a temperature at which combined water begins to be evolved (590—620 C.). Above about 950° C., when the combined water has been driven off, the amount of heat absorbed by clays corresponds with the contraction, which increases progressively with the temperature, well-defined contraction taking place only in the cases of substances of marked colloidal nature. The plasticity, however, is dependent not on the combined water, but on the free water, which develops the colloidal properties latent in air-dry clays. The contraction on drying of clays is also a function of their colloidal nature, and therefore of their plasticity, this contraction not taking place with crystalloids. In many cases the colloids of clays are of organic nature, but some clays, which contain practically no organic matter, owe their plasticity to the formation of the colloidal hydroxides of aluminium, silicon, or iron, when the clays are brought into contact with water. The well known effects of caustic alkalis on the plasticity, not only of clays, but also of cements, trass, zeolites, and the like, are due to the development of colloidal properties by hydroxyl ions, every substance of a plastic nature requiring a definite concentration of hydroxyl ions to produce the maximum proportion of colloidal constituents.—O. R.

Leadless glazes in commerce. L. Petrik. Sprechsaal, 1914, **47**, 147—148.

Further work on the lead problem for the Hungarian Ministry of Commerce (see this J., 1914, 80) has comprised the examination of powders sold for the production of leadless glazes. A sample proved on analysis to have the molecular formula : 0·26 BaO, 0·23 CaO, 0·14 K_2O, 0·36 Na_2O, 0·04 Al_2O_3, 2·15 SiO_2, 0·5 B_2O_3. Its barium oxide content was 14·78 per cent., all of which was found soluble by the official test which approximates to the conditions of digestion (*loc. cit.*). The author points out that barium is as poisonous as lead.—H. H. S.

Patents.

China-clay ; Apparatus for washing and separating ——. W. J. Gee, London, and M. Coulson and Co., Ltd., Spennymoor. Eng. Pat. 5442, Mar. 4, 1913.

The material is fed together with a suitable supply of water into an inclined, rotary cylinder provided with spiral ribs. Light material is washed down by the current of water, whilst heavier and coarser particles are caught by the ribs and conveyed in the reverse direction. A trough extends centrally through the cylinder, and an endless conveyor belt, fitted with prongs or scrapers, continuously delivers raw material from a feeding hopper into the trough, subjecting it at the same time to a raking and disintegrating action. The bottom of the trough is formed of removable plates, one or more of which may be removed at any point at which it is desired to discharge the raw material into the cylinder.—O. R.

Enamels, particularly zircon enamels ; Clouding agent for the manufacture of white ——. Vereinigte Chem. Fabr. Landau, Kreidl, Heller und Co. Fr. Pat. 462,587, Sept. 16, 1913. Under Int. Conv., Oct. 1, 1912.

A clouding agent, consisting of an alkali metal salt, especially a zirconate, to which has been added an acid possessing a weak capacity for electrolytic dissociation, especially an organic acid, which is eliminated on heating. —O. R.

IX.—BUILDING MATERIALS.

Wood ; Preservation of ——. A. J. Wallis-Tayler. J. Roy. Soc. Arts. 1914, **62**, 286—315.

Wood should be seasoned for at least 6—12 months before treatment. (1). *Kyanising* consists in steeping timber in a 1 per cent. solution of mercuric chloride for 7—11 days. (2). *Burnettising* comprises preliminary steaming, followed by impregnation in a 2—2½ per cent. solution of zinc chloride under a pressure of 7—8 atmospheres. In the *zinc-tannin* or *Wellhouse* process, treatment in a partial vacuum follows the preliminary steaming, a small percentage of glue is added to the zinc chloride, and after impregnation for 2½—6 hours at 100—125 lb. per sq. in., the timber receives a final treatment with a 0·5 per cent. solution of tannin under the same pressure for two hours. (3). *Creosoting* usually involves steaming of the dried timber, heating under reduced pressure, and treatment with creosote oil under a pressure of 100—180 lb. per sq. in. The amount of creosote absorbed by the timber varies from 7 to 20 lb. per cb. ft., and the temperature of treatment should be between 100° and 130° C. In the *Curtis-Isaacs* process, the timber and creosote are heated to above the boiling point of the sap at ordinary pressure, in a retort having vents open to the air ; the vents are then closed and the creosote is forced into the wood under pressure. The *Rueping* process consists in forcing, first compressed air at a pressure of 80—100 lb. per sq. in. into the pores of the wood, and then at a higher pressure creosote oil, without relieving the air pressure. In the *Lowry* process, treatment with creosote oil at 77°—82° C. under a pressure of 180 lb. per sq. in. is followed by draining and a rapid vacuum treatment. In the *zinc-creosote* or *Rutger* process, an emulsion of ½ lb. of "dry zinc" and 1·5—4 lb. of creosote oil per cubic foot of timber is used, the emulsion being kept continuously agitated, *e.g.*, by means of a centrifugal pump. The *Hasselmann* process makes use of a solution containing cupric, aluminium, and potassium sulphates, heated to 118°—126·6° C., under a pressure of 35 lb. per sq. in. In the *creo-resinate* process (specially suitable for wood paving-blocks), air at 121° C. under a pressure of about 100 lb. per sq. in. is substituted for steam ; the antiseptic agent consists of 50 parts of creosote oil, 48 of resin, and 2 of formaldehyde, and impregnation is followed by a treatment with lime water at 100° C. and under 150 lb. pressure. The *Guissani* process makes use of a mixture of anthracene and pitch heated to 140° C., in which wood is submerged until it is free from moisture and sap, after which it is successively treated with cold, heavy tar oil, and cold zinc chloride solution. In the *saccharine solution* or *Powellising* process, suitable for the treatment of green wood, a solution consisting mainly of sugar with a small percentage of arsenic, is used. The *vulcanising* or *Haskinising* process consists in roasting wood, which has been previously dried by steaming, to a temperature high enough to coagulate its contained albumins (71°—94° C.), and to resolve some of the fibre and sap with the production of wood creosote. In addition to the use of definite antiseptics and of a large number of metallic salts for wood preservation, mineral oils, preferably mixed with asphaltum, can be used to stop up the open wood cells, thus protecting timber from the action of heat, moisture, and air. By the zinc chloride process the life of wood is more than doubled ; creosoted wood lasts 25—50 per cent. longer than wood treated with zinc chloride, but costs three or four times as much. The amount of preservative injected into 1 cb. ft. of various classes of timbe ranges from about 3 lb. of mercuric chloride in the cas of hard woods, to about 6 lb. for moderately hard woods and 10 lb. for soft woods, the corresponding amounts o creosote oil being 3, 10, and 20 lb. respectively. Th average costs of preserving timber with zinc chloride creosote oil, and mercuric chloride, are approximatel 1·25d., 5d., and 8d. per cb. ft. respectively.—O. R.

Lime-silica bricks ; Action of heat and furnace gases on —— E. Damour. Rev. Mét., 1914, **11**, 203—210.

Lime-silica bricks of the composition, CaO 14·1, SiO_2 78· H_2O+CO_2 6·8 per cent., were heated for two hours in muffle at temperatures ranging from 100° C. to 1000° and the loss of weight, and the strength after heatin determined. The loss of weight increased with t temperature up to 550° C., when it remained practical constant, showing that at this temperature the mo complete decomposition of the hydrates or hydrosilicat forming the cement of the bricks took place. The crushi strength decreased comparatively slowly as the temper ture increased up to 500° C., but at higher temperatu the strength fell rapidly. At a temperature approachi that of the dissociation of calcium carbonate, the bric fell to dust. When the bricks were heated at 300 and 400° C. for varying lengths of time, and exposed directly to the muffle gases, the maximum loss in weight occurred between 2 and 6 hours' heating. Absorption of carbon dioxide thus began to take place rapidly after the third or fourth hour. After the heated bricks had been exposed to the air for several days, they regained a part of the weight lost on heating. The longer the exposure to the hot gases at a given temperature, the weaker the bricks became. Tho bricks heated to the same temperatures inside a muffle, and thus protected from the action of carbon dioxide, had an average strength nearly three times that of the bricks which had been exposed to the heating gases. The author considers that the tests demonstrate the unsuitability of lime-silica bricks for the construction of chimneys and furnaces.—T. St.

Portland cement clinker ; The compound, $8CaO,Al_2O_3,2SiO_2$, *and the alite of* ——. H. Kühl. Tonind.-Zeit., 1914, **38**, 365—368.

Janecke's compound, $8CaO,Al_2O_3,2SiO_2$, was prepared at a sintering temperature (compare this J., 1912, 491). It was found to be extraordinarily quick-setting and to have low tensile and crushing strengths ; its specific gravity, when ground so as to leave a residue of 15 per cent. on a sieve with 4900 meshes per sq. cm., was 2·91. The view that it constitutes the alite of Portland cement clinker is rejected, in favour of the hypothesis that alite is a solid solution of which this compound forms the basis.
—F. Sodn.

Ultramarine ; Behaviour of —— in cement ware. O. Jordan. Tonind.-Zeit., 1914, **38**, 450—451.

The decomposition of ultramarine in cement (see Haerting, this J., 1914, 81) was artificially stimulated by prolonged gentle heat and continuous moistening in a series of experiments on eight kinds of cement, four ultramarine blues and one green, and eight varieties of silica such as quartz, kieselguhr, trass, etc. The results showed that decomposition occurs when carbon dioxide is lacking, and that atmospheric carbon dioxide plays a part in preventing surface decomposition (*loc. cit.*). The addition of silica (*e.g.*, the residue obtained in the manufacture of aluminium sulphate from kaolin and termed "Kaolinkieselsäure") as recommended also by Rinne (Tonind.-Zeit., 1913, 1656), is suggested as the remedy which can be used in tropical as well as in temperate climates.
—H. H. S.

Patents.

Wood ; Apparatus for impregnating ——. H. L. Galloway, Kilmacolm, Renfrew, and W. J. Frame, Glasgow Eng. Pat. 25,029, Nov. 1, 1912.

A number of cylindrical containers are mounted round a central axis, about which they can revolve and intermittently occupy a number of operative positions. In the course of rotation, each cylinder in turn is submerged in a tank containing the impregnating liquid, the latter flooding the cylinders through their open ends, and being forced through the material in the cylinders by means of a pump. Means are provided for charging and discharging the cylinders with the material to be treated, and for subjecting the contents of the cylinders to the action of a vacuum and of hydraulic pressure, each process taking place as the cylinders in their turn reach suitable, successive, operative positions, provision being made for the formation of fluid-tight joints, when the ends of the cylinders register with valve-controlled pressure and vacuum chambers.—O. R.

Portland and similar cement ; Method of treating [preparing for testing] ——. H. J. Force, Scranton, Pa. U.S. Pat. 1,085,977, Feb. 3, 1914.

In preparing cement bodies for testing, they are boiled under a pressure exceeding 50 lb. (preferably about 285 lb.) per sq. in.—F Sodn.

Cement and the like ; Drying apparatus for ——. Buhler Frères. First Addition, dated Aug. 19, 1913, to Fr. Pat. 392,743, July 27, 1908 (this J., 1909, 21).

A number of additional conduits for the hot gases are provided, of which at least one serves as an extra drying chamber ; by means of dampers this chamber is sealed both from the gas conduits and from the moisture-collecting chamber, when its doors open for the admission or the withdrawal of the trucks, the current of drying gases then passing through an auxiliary conduit.—O. R.

Asphalt ; Process of the manufacture of —— for compressed asphalt pavements. R. Wallbaum. Fr. Pat. 462,658, Sept. 1, 1913. Under Int. Conv., Dec. 4, 1912.

Limestone, chalk, trass, or the like, is moistened and incorporated with an emulsion of asphaltum and water.
—O. R.

Calcareous stone ; Process for the manufacture of synthetic ——. A. Venturi. Fr. Pat. 463,004, Sept. 26, 1913. Under Int. Conv., Oct. 18, 1912.

Calcareous material is calcined, slaked, ground, mixed with filling or colouring material, moistened, moulded, dried and hardened in an autoclave by means of carbon dioxide under pressure and steam.—O. R.

Treating waste acid or acid effluents from tin-plate works. Eng. Pat. 3705. *See* VII.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Titanium and vanadium ; Determination of —— in iron alloys. H. König. Stahl u. Eisen, 1914, **34**, 405—409

Investigation has shown that although the volumetric determination of titanium is not entirely satisfactory, yet it is more rapid in presence of elements which interfere in precipitation processes. Details are given of a modified form of Cain's volumetric process for the estimation of vanadium (this J., 1911, 658). There is an extensive bibliography.—J. L. F.

Molybdenum in cyanide solutions. J. E. Clennell. Eng. and Min. J., 1914, **97**, 363—364.

Samples of ore and solution from a mine in Central America were found to contain molybdenum and tellurium. In tests molybdic acid and ammonium molybdate acted like acids towards the cyanide, but not in presence of excess of alkali.—T. St.

Silver and cuprous oxide. C. H. Mathewson and C. H. Stokesbury. Int. Zeits. Metallog., 1914, **5**, 193—212.

Cuprous oxide dissolves freely in molten silver but is practically insoluble in the solidified metal. The authors describe the thermal characteristics and microstructure of alloys containing Cu_2O up to 20 per cent., the constitutional relations of which are similar to those of the Cu—Cu_2O system. When a silver-copper alloy poor in copper is melted and solidified with free access of air, cuprous oxide is found between the grains of silver.—W. R. S.

[Copper] Converting ; Selective ——. A. P. Selby-Davidson. Eng. and Min. J., 1914, **97**, 357—358.

Copper produced at the O.K. mine in northern Queensland assayed Au 0·16 to 0·79 oz., and Ag 6·42 to 12·23 oz. per ton. About 50 per cent. of the gold and 15 per cent. of the silver were obtainable in 10 per cent. "bottoms." The charge was converted into blister copper. The "bottoms" melted up weekly with added matte, yielded second "bottoms" when a total concentration of 86·6 per cent. of the gold and 23·67 per cent. of the silver was effected.—T. St.

Copper; Metallurgy of —— in the basic (Peirce-Smith) converter. B. de Saint-Seine. Rev. Mét., 1914, **11**, 145—164.

Basic differ from acid converters in the character of the lining, but in either the same matte yields a similar product. Basic converters are those generally employed in America, producing 1000 tons of copper monthly (40 tons per charge), and are 25 ft. long and 10 ft. in diameter. The lining of magnesite bricks is only very slightly attacked and the action is independent of the nature of the slag; 6000 tons of copper have been produced without any repairs being necessary. In the basic converter, mattes with copper ranging from 8 to 70 per cent. can be treated economically with a yield of 90 to 95 per cent. of the copper introduced. The temperature should not exceed 2100° F. (1145° C.). It is this comparatively low temperature which, by reason of the correspondingly long life of the lining, makes the Peirce-Smith converter practicable, and differentiates it from the Knudsen converter. In the latter the temperature is raised to the melting point of the added ores, whilst in the former the additions are brought into fusion by the solvent action of the charge.—T. St.

Zinc; Assay of —— by ferrocyanide methods. Min. and Eng. World, 1914, **40**, 55—57. From Report of Assay Sub-Committee of Australasian Inst. of Min. Eng. *Determination of zinc by ferrocyanide in acid solutions.* R. T. D. Williams. Trans. Australasian Inst. Min. Eng., 1911, **15**, 629—644.

Sufficient of the ore to require about 25 c.c. of the ferrocyanide solution (32·5 grms. per litre) is decomposed with nitric acid, potassium chlorate added and the mixture evaporated just to dryness; oxidised ores are dissolved in hydrochloric acid, evaporated to dryness, and boiled with nitric acid before the addition of chlorate. The residue is treated with 100 c.c. of boiling water, 7 grms. of ammonium chloride, 15 c.c. of ammonia (sp. gr. 0·880) and 0·5 grm. of sodium peroxide, the liquid boiled for 5 mins., filtered, the precipitate washed twice with a boiling 1 per cent. solution of ammonium chloride, redissolved in 5 c.c. of hydrochloric acid, re-precipitated by addition of 3 grms. of ammonium chloride, 15 c.c. of ammonia and 2—5 grms. of sodium peroxide, and washed 3 times with the ammonium chloride solution. *Titration in alkaline solution:* The combined ammoniacal filtrates (about 300 c.c.) are heated to 70° C., 30 c.c. of tartrate emulsion (200 grms. of cream of tartar, 2 c.c. of neutral ferric chloride solution containing 10 per cent. Fe, and 1 litre of water) added, and the solution titrated with ferrocyanide until a faint blue colour is obtained by adding a drop of the liquid to a drop of glacial acetic acid, with 0·2 per cent. or more copper in the ore, the ammoniacal solution is acidified with hydrochloric acid and 1 c.c. excess added, the liquid boiled with 20—30 grms. of pure granulated lead, decanted, and titrated after addition of 30 c.c. of tartrate emulsion and 8 c.c. of ammonia. With very low grade ores the excess of ammonia may prevent precipitation of the zinc by ferrocyanide, hence acetic acid is added until a precipitate commences to form, before the titration; but the solution must not become acid. *Titration in acid solution:* To the combined ammoniacal filtrates, whether copper be present or not, 3 grms. of sodium thiosulphate and 5 c.c. of hydrochloric acid in excess of that required to make the solution just acid to methyl orange are added, the solution boiled to expel most of the sulphur dioxide and coagulate the precipitated copper sulphide and sulphur, cooled to 70° C. and titrated (without removing the precipitate) using uranium acetate as external indicator as usual. In either method of titration the ferrocyanide solution is standardised against chemically pure zinc under similar conditions to those of the assay, a blank test being made to determine the volume of ferrocyanide required to produce the end-point in the absence of zinc. Results with the acid method on Broken Hill ores or concentrates, are accurate; results for a concentrate containing 50 per cent. Zn should agree to within 0·5 per cent. The alkaline method is preferred by the Sub-Committee as although the end-point is less sharp the process is more rapid than the acid method and equally accurate.—W. E. F. P.

Muntz metal. The correlation of composition, structure, heat treatment, mechanical properties, etc. J. E. Stead and H. G. A. Stedman. Inst. of Metals, March 1914. [Advance proof.]

Bars of metal containing about 60 per cent. Cu and 40 per cent. Zn was heated for 48 hours at temperatures between 470° and 860° C.; one set was cooled in air, the other quenched in cold water. The bars were submitted to mechanical tests and microscopic examination. Annealing between 750° and 800° C. develops in all brittleness. Heating to 800°—830° C., followed by quenching, leaves the metal as homogeneous β-constituent, tenacity 29 tons per sq. in.; heating to 800°—833° C. and cooling in air gives a tenacity of 25·5 tons. Bars were annealed at 430° C. for 3 months, and this treatment gave the most ductile metal. At about 773° C. a critical or brittle point exists, and brass heated to that temperature has been described as "burnt"; the term is inappropriate, for, on higher heating, the material again becomes ductile. Brass oxidises much less readily than copper, and the scale detached from heated bars consists of zinc oxide free from copper. Brass can be tinted in a few seconds by blowing air containing traces of ammonium sulphide upon the heated specimens; this method is stated to be more delicate than etching.—W. R. S.

Brass; Vanadium in ——. The effect of vanadium on the constitution of brass containing 50—60 per cent. of copper. R. J. Dunn and O. F. Hudson. Inst. Metals, Mar. 1914. [Advance proof.]

The pure vanadian brasses employed were prepared by adding to molten copper a mixture of vanadic acid with a known excess of powdered aluminium and fluxes containing cryolite, oxidising the excess of aluminium by copper oxide, removing the slag from the surface of the metal, and finally adding the zinc. Brasses prepared by the use of commercial cupro-vanadium containing Al 19—25, and Fe 4—6, per cent. were also investigated. The authors are of opinion that if any structural resolution of β into α and γ is effected by the addition of cupro-vanadium, the result is due to the relatively large aluminium content of the commercial alloy rather than to the small vanadium content of the resulting brass.
—W. E. F. P.

Bronze. J. Dewrance. Inst. Metals, March, 1914. [Advance proof.]

At atmospheric temperature, bronze containing Cu 88 Sn 10 and Zn 2 per cent. had a maximum stress of 16·3 tons per sq. in. and an elongation of 11 per cent. on 2 in. at 400° F. (204° C.) and 700° F. (371° C.) the correspondin figures were respectively 9·5 tons and 1 per cent., an 7 tons and 0·25 per cent.; the alloy commenced to los strength above 350° F. (177° C.). When ½ per cent. the copper was replaced by lead, the maximum stress of th alloy at atmospheric temperature was 16·5 tons per sq. i and the elongation 8 per cent., the corresponding valu at 550° F. (288° C.) and 700° F. (371° C.) being 15·8 to and 18 per cent., and 8·25 tons and 2 per cent., respe tively; the critical temperature in this case was abo 600° F. (316° C.). No further advantage resulted wh larger proportions of lead were introduced into the all at the expense of the copper; but with an alloy containi Cu 72, Sn 10, Zn 2 and Pb16 per cent. the maximum str at 500° F. (260° C.) was 12½ tons per sq. in. The results w in no way due to the absorption of atmospheric oxyg by the molten alloys. Further research on similar li is advocated for the purpose of producing a bronze whi can be used with safety at 700° F. (371° C.), *i.e.*, w superheated steam.—W. E. F. P.

Copper-aluminium alloys; Influence of nickel on some — A. A. Read and R. H. Greaves. Inst. of Metals, Mar, 1914. [Advance proof.]

Alloys were prepared containing 10 and 5 per cent. and varying amounts of Ni (1, 2·5, 5, 7·5, 10, and 15 cent.), the balance being made up of copper. The all were submitted to tests similar to those illustrating influence of phosphorus on Cu-Al alloys (see this J., 1 3, 914). *Rolling:* With the exception of the difference in hardness, which increased with the Ni-content, all the alloys tested (1—7·5 per cent. Ni) behaved similarly, yielding perfectly sound rods. *Wire-drawing:* All the wires were sound and smooth. Nickel increased the ductility of the 5 per cent. Al-alloy. *Specific gravity* was increased by the presence of nickel, while the *conductivity* was diminished. *Corrosion* by fresh water was very slightly increased; with sea-water, nickel up to 10 per cent. greatly reduced the corrosion of the alloys. Descriptions and reproductions of micrographs are given. Other tests are tabulated below.

Treatment of alloys.	Effects of Nickel.
Aluminium 10 per cent.	*Tensile tests.*
Cold-rolled	Maximum stress rises considerably, with no reduction in ductility.
Annealed and slowly cooled	Great improvement up to 5 per cent.; above 5, elongation fell off.
Quenched	Maximum stress slightly reduced.
Air-cooled	Properties intermediate between quenched and annealed series.
Chill-castings	Increased maximum stress and yield point up to 10 per cent.; decrease above.
Aluminium 5 per cent.	
Cold-rolled	Maximum stress and yield point raised and above 5 per cent. was more rapid.
Annealed and slowly cooled	
Quenched	
Air-cooled	
Chill-castings	Elongation and reduction of area greatly improved, with maximum stress and yield point unaffected up to 5 per cent. above the latter properties were improved, the former decline of area decreased correspondingly.
Aluminium 10 per cent.	*Alternating stress tests.*
Cold-rolled	Reduced resistance.
Annealed	5 per cent. diminished detrimental effect of annealing.
Quenched	Results irregular (metal coarsely crystalline).
Aluminium 5 per cent.	
Cold-rolled	Diminished resistance.
Annealed	Above 1 per cent. diminished resistance.
Quenched	Quenching increased resistance stress.
	Hardness.
Aluminium 10 per cent.	Diminished hardening capacity.
Aluminium 5 per cent.	
Annealed	More than 5 per cent. rapidly increased.
Cast	More than 7·5 per cent. rapidly increased.
	Melting point.
Aluminium 10 per cent.	Slight fall at first, followed by a rise at about 5 per cent.
Aluminium 5 per cent.	Immediate and considerable rise.

—W. R. S.

Lead; Brittleness of ——. O. Bauer. Mitt. kgl. Materialprüfungsamt., 1913, **31**, 357—369.

The lead covering of an insulated cable had become extremely brittle in course of use: fractures showed an unusually coarse granular structure. There was nothing abnormal in the composition of the metal. Experiments on lead plates showed that when the flexibility was tested at various temperatures by bending to and fro, to an angle of 90° on each side, until the plates broke, there was a slight fall in flexibility up to a temperature of 160° C., above which, up to 260° C., there was a rapid increase. Above 200° C., the flexibility was higher than at the ordinary temperature. Tests carried out at the ordinary temperature, after the lead had been exposed to the influence of various higher temperatures for several days, showed that at 100° C. the flexibility markedly decreased only after 24 days' heating, the original value of about 22 then falling to 17·8—17·1 and remaining at that on further heating. At 145° C. a considerable loss of flexibility was noted after 6 days, the value falling to 12·6; heating, up to 51 days, produced no further perceptible change. At 260° C. a similar behaviour was observed but the minimum value recorded was slightly lower (11·6). The size of the crystalline granules steadily increased with the time and temperature of heating. The average linear dimensions of the granules had increased fivefold after heating for 35 days at 260° C.

—J. F. B.

Type-metal; Cause of the oxidation of ——. R. Meyer and S. Schuster. Z. angew. Chem., 1914, **27**, 121—127.

The results of the examination of ten samples of type, some of which were new and others from forty to seventy years old, indicated that corrosive oxidation does not depend upon the chemical composition of the metal but rather upon:—faults in the founding, the methods adopted for cleaning and imperfect conditions of storage. It is commonly believed that corrosion is due to the presence of arsenic in the metal, but a metal having a porous and irregular fracture will corrode under certain conditions even though it contains as little as 0·1 per cent. Whereas a solid casting containing more than twice as much will remain perfectly sound under similar treatment. Oxidation is mainly to be attributed to the entrance of moisture into the porous body of the type and it is suggested that turpentine or petroleum spirit should be used instead of water for cleaning purposes. The type should also be stored under perfectly dry conditions. The presence of tin in the metal seems to exert a protective influence under conditions which otherwise would bring about corrosion, but type which is free from tin may be kept quite sound if properly treated.—J. A.

Pure metals [titanium and vanadium]; Preparation of ——. M. Billy. Comptes rend., 1914, **158**, 578—580.

Titanium and vanadium were prepared in a state of purity, suitable for physico-chemical determinations, by reducing the vapour of the tetrachloride (made to boil in a current of hydrogen) by contact with sodium hydride, heated to 400°—420° C. The hydride was contained in porcelain boats, lined with fused salt, and could be made *in situ* by enclosing the boats in an apparatus of soft glass. The reaction was accompanied by incandescence, but was not violent. Titanium was obtained as a grey crystalline powder which was purified by treatment with alcohol, 10 per cent. hydrochloric acid, and water, Vanadium was dried in a current of carbon dioxide. The method appears to be capable of general application. —F. Sodn.

First Report to the Beilby Prize Committee of the Institute of Metals on the solidification of metals from the Liquid State. Cecil H. Desch, D.Sc., Ph.D. Offices of the Institute of Metals, Caxton House, Westminster, London. 1914.

The subject is subdivided as follows:—I. Cellular structure of metals. II. Crystallisation from centres and the formation of crystallites on crystal skeletons. III. Foam-structures and Quincke's hypothesis. IV. Cellular structures in cooling liquids. V. Liquid crystals. VI. Influence of surface tension. VII. Undercooling and the existence of a meta-stable limit. VIII. Changes of volume on solidification. IX. The thrust exerted by growing crystals.

Electrolytically deposited metals; Adhesion and alloying of ——. M. Schlötter. Chem.-Zeit., 1914, **38**, 289—291

The degree of adhesion is satisfactorily determined by Burgess's method, in which a copper disc is soldered to the surface of the deposit, the force required to detach the latter from the underlying metal being measured with a spring balance. Several factors influence the degree of adhesion, such as nature and hardness of the deposit and of the cathode metal; generally speaking, a soft metal adheres more firmly to rough surfaces than to smooth ones. The molecular attraction between cathode and electrolyte is increased by the addition of alcohol, which improves some deposits. Several metals occlude hydrogen during electrolysis, part of which is given off subsequently as gas, which accumulates under the deposit and decreases the degree of adhesion. In some cases the deposit alloys with the cathode, and the two cannot be separated. Zinc on being copper-plated first becomes yellow; the thin coating of brass is subsequently covered with copper.—W. R. S.

Surface film produced in polishing metals [copper]; Transparence or translucence of the ——. G. T. Beilby. Roy. Soc. Proc., 1914, A **89**, 593—595.

Copper was polished so as to leave as thin a surface film as possible (see this J., 1901, 992; 1903, 1166) and high-power photomicrographs in natural colours of the surface, before and after treatment with a 10 per cent. solution of ammonium persulphate (which dissolved the surface film) were prepared. Before treatment the small pits under the surface film appeared as blue spots on a pale rose-coloured ground, but with red patches on the blue. After treatment with ammonium persulphate bright spots appeared instead of the red patches. These results show that the surface film is transparent or highly translucent, and that it extends over the smaller pits without any support from below, for the red patches on the blue must have been caused by reflection from the inner concave surface of the pits, which hence must have been practically empty.—A. S.

Alloys; First report of the Committee on the nomenclature of ——. Inst. of Metals, March, 1914. [Advance proof.]

The Committee included representatives of the Inst. of Metals, Inst. of Elect. Engineers, Inst. of Mech. Engineers, Inst. of Naval Architects, Inst. of Eng. and Shipbuilders in Scotland, N.E. Coast Inst. of Eng. and Shipbuilders, and Soc. of Chem. Industry. The retention of existing names, sanctioned by long usage, for use in industrial and commercial practice is advocated, but the coining of new names, adoption of recently coined names, and use of Latin or foreign names or chemical or other symbols is discouraged. As the basis of a system of nomenclature it is recommended that an alloy be denoted by the names, in English, of its component metals, arranged in order of increasing percentage by weight, *eg.* Zn 30, Cu 70 per cent. would be termed zinc-copper, and Sn 1, Zn 29, Cu 70 per cent., tin-zinc-copper. In the case of alloys containing more than three metals, the names of the three metals present in the largest proportions should be used for the name of the alloy, with the prefix "comp." or "complex," but if a small quantity of a metal added intentionally to give the alloy a distinctive character be present, this may be named first; *e.g.* Al 75, Sn 15, As 4, Co 3, Fe 2·75, In 0·25 per cent., might be named "indium complex tin-aluminium, if the indium were regarded as imparting special qualities to the alloy. If the component metals of an alloy be present in practically equal proportions, the names should be arranged in alphabetical order. For ordinary usage the term "brass" is used as an abbreviation of the systematic name zinc-copper, *i.e.* for alloys of zinc and copper containing more than 50 per cent. of copper, and "bronze" as an abbreviation for tin-copper, the presence of additional metals being indicated as in the case of the systematic names; *e.g.*, Sn 1, Zn 29, Cu 70 per cent., would be termed "tin-brass."—A. S.

Use of tar in the preparation of basic linings of steel furnaces. Wagner. *See* III.

Use of the aluminium alloy, duralumin, for the manufacture of domestic and cooking utensils. Fendler and Stüber. *See* XIXb.

Patents.

Cast-iron and process for producing same. R. Anderson, Middlesbrough, Yorks. Eng. Pat. 3354, Feb. 10, 1913.

Cast-iron containing approximately C 2·50, Si 2·00, S 0·03, P 0·05 and Mn 1·00 per cent., is produced by mixing molten, finished, mild steel with molten, hæmatite cast-iron direct from the blast-furnace.—W. E. F. P.

Iron; Process for the manufacture of —— particularly applicable for use in dynamo machines and for like purposes. W. Rübel, Berlin-Westend, Germany. Eng. Pat. 3445, Feb. 10, 1913.

To iron containing not more than 0·5 per cent. of impurities, sufficient aluminium and silicon are added to produce an alloy containing Al 1·3—2·0 and Si 0·8—1·2 per cent. Boron may be substituted for silicon, and beryllium or calcium for aluminium.—W. E. F. P.

Steel and iron; Method of treating ——, in the manufacture thereof. C. R. Gostling, Eustis, Fla., U.S.A. Eng. Pat. 17,869, Aug. 5, 1913.

To remove dissolved gases, the molten metal (in the mould, etc.) is brought into contact with infusorial earth and allowed to solidify in the presence of the same. —W. E. F. P.

[Iron and steel.] Furnaces; Continuous ingot-heating ——. F. K. Siemens, London. Eng. Pat. 17,955, Aug. 6, 1913.

The hottest portion, or finishing hearth, of the furnac is made removable and interchangeable.—W. E. F. P.

Steel; Treating —— in electric furnaces with basic hearths W. R. Walker, New York. U.S. Pat. 1,086,489, Feb. 10 1914.

To refine iron or steel in an electric furnace wit a basic hearth, a practically neutral slag of lime an silica is used in which the proportion of silica whils sufficiently low to avoid serious scorifying of the hearth high enough to avoid notable formation of fumes of lim in the furnace and to provide reduced silicon for inco poration with the metal, whilst the quantity of lime sufficient to ensure elimination of sulphur. For instanc the silica may amount to 25—35 per cent. of the tot weight of the slag.—A. S.

Steel; Special —— of high resistance, and improvemen in the method of manufacture of special steels. Thuaud. Fr. Pat. 462,463, Nov. 22, 1912.

The finished steel has the following composition: C 0· to 0·50 (preferably 0·30—0·35), Ni 11·50 to 17, Mn 0·

to 0·60, Cr 1·70 to 3·25, Si 0·30 to 0·45, V 0·25 to 0·40, Ti 0·40 per cent. The additions are made in a Martin or electric furnace in the following order: 0·25 to 0·30 per cent. of ferrotitanium containing 15 to 20 per cent. Ti, nickel, ferrochrome, ferrosilicon, ferrovanadium; manganese is added as a deoxidiser after addition of the nickel and ferrotitanium after the ferrosilicon.—T. St.

Iron and steel; Welding powder for welding ——. E. Eisengräber, Frankfurt a M., Germany. Eng. Pat. 17,046, July 25, 1913.

A MIXTURE of red hæmatite (previously reduced to the lower oxide) 70, pulverised coal 22, and flux (sodium phosphate) 8, parts by weight.—W. E. F. P.

Iron-silicon-manganese-aluminium alloys; Process for improving the magnetic qualities of ——. R. A. Hadfield, Sheffield. U.S. Pats. 1,086,765 and 1,086,766, Feb. 10, 1914.

To increase the magnetic permeability and electric resistance and reduce the hysteresis of an iron alloy containing Si 2—4·5, Mn not exceeding 0·7 and Al not exceeding 1·3 per cent., it is heated above the γ-critical point (about 900° C. for pure iron) and then cooled slowly, or heated to 900°—1100° C., cooled slowly, reheated to 700°—800° C., and again cooled slowly.—A. S.

Ferromanganese, ferrosilicon, and other alloys: Lining for electric furnaces for the production of ——. Ges. für Elektrostahlanlagen m. b. H. and W. Rodenhauser. Ger. Pat. 269,298, July 26, 1912.

To prevent the penetration of the ferro-alloy into the lining of the furnace walls, the portion of the lining which would otherwise be directly in contact with the molten charge is faced with a mass rich in carbon, *e.g.* a mixture of coke or retort carbon and tar. In working with induction furnaces, when introducing the first charge consisting of the material to be smelted and wrought iron heating rings, sufficient carbon is added to saturate the iron as it melts, so that carbon will not be taken up from the facing material.—A. S.

Iron-nickel-copper alloy; Process of making an ——. G. H. Clamer, Philadelphia, Pa. U.S. Pat. 1,086,314, Feb. 3, 1914.

THE matte obtained by smelting ore containing iron, nickel and copper sulphides is completely oxidised by roasting, and subsequently reduced to metal.—W. E. F. P.

Zinc furnaces; Apparatus for manufacturing receivers for ——. B. Möhring, Dillingen-Saar, Germany. Eng. Pat. 30,061, Dec. 31, 1912.

IN a press for the manufacture of receivers from "dry" clay or loam, the "matrices" containing the latter are made in two parts hinged together, and supported upon a pivoted table, the arrangement being such that the "core" is successively introduced into each by mechanical means. (Reference is directed to Eng. Pats. 1098 of 1880 and 11,316 of 1893.)—W. E. F. P.

Zinc furnace; Electric —— with integral compound resisters and compound condensers. J. Thomson, New York. U.S. Pats. 1,086,414 to 1,086,418, Feb. 10, 1914.

(1) THE furnace, containing a carbon resister bed, comprises an enclosed reaction chamber provided with a series of openings in the side walls, through which the charge is stoked to and upon the upper surface of the resister in transverse ridges alternating with troughs. (2) The carbon resister bed is provided with a series of superimposed spaced bars, forming galleries or slots through which the charge is fed to portions of the upper surface of the resister. The latter is supported upon a spaced grating, through which the products gravitate into a sump, and from which the fumes pass through ports to the condenser. (3) The charge is located between a rod resister and a broken carbon resister, the former acting upon the upper portion of the charge by radiated heat, and the latter upon the lower portion by conducted heat. (4) The charge is supplied to the vertical faces of parallel porous carbon resister beds, the condensing system being disposed along the opposite vertical face of each resister. Each resister is supported upon a perforated hearth above the sump. The charging space between the resisters is divided longitudinally and transversely by electrically non-conducting walls. (5) The furnace is provided with parallel porous resisters and parallel charging pockets, with ports in the furnace side walls for the removal of ash or sinter. Gratings support the resisters above the sumps, and the resisters are connected electrically in series by a carbon connection located above and spanning the sumps. A sump extending longitudinally is filled with granulated refractory material, and has an open tap-end enclosed by a separate refractory plate thrust against an abutment by an outer block.—B. N.

Tungsten; Manufacture of ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 1915, Jan. 23, 1913.

POWDER for the manufacture of ductile tungsten is prepared by incorporating a solution of thorium nitrate with purified tungstic oxide, moulding the mixture before or after drying, firing the mouldings under oxidising conditions and then reducing them with hydrogen. The product should contain not more than 5 per cent. of thorium oxide.—W. E. F. P.

Ores and other substances; Machine for concentrating and separating ——. G. F. Wynne, Wrexham, N. Wales. Eng. Pat. 2564, Jan. 31, 1913.

BY means of a combination of adjustable, rotary and vibratory crank-shafts and cranks, the table of the apparatus, which is carried upon inclined, resilient supports, receives a quick forward motion starting from rest and gradually increasing in velocity, a sudden stoppage and reverse return motion, and also a vertical movement. The apparatus is stated to be specially suitable for the concentration of ores containing both slime and coarser material.—W. E. F. P.

Magnetic separators. Bowes, Scott and Western Ltd., and I. S. Dalgleish, London. Eng. Pat. 3046, Feb. 5, 1913.

THE separator has two converging poles fixed one above the other between which a pulsating or alternating field is set up. The descending material is separated into two streams by the upper pole, the more magnetic portion being deflected, by the influence of the lower pole, to one receptacle, and the less magnetic part falling vertically on to a shoot leading to another receptacle. Direct contact of the material with the poles is prevented by a removable, curved, non-magnetic sheet attached to both poles and bridging the gap between them. The magnet may be removably attached to the wall of a tank for effecting the separation of materials in water.—W. E. F. P.

Ores and the like; Mills for grinding, crushing and pulverising ——. E. S. King, London, and Head Wrightson and Co., Ltd., Thornaby-on-Tees, Yorks. Eng. Pat. 22,476, Oct. 6, 1913.

A PAN mill of the disc type provided with a circumferential overflow for slime and, below the grinding zone, with a central outlet, or series of outlets, for the intermittent discharge of concentrate: the bed of the pan may be of conical shape to facilitate the passage of the concentrate towards the outlets.—W. E. F. P.

[*Lead and zinc.*] *Metallic sulphides; Method for the separation of* ——. L. Bradford. Fr. Pat. 462,580, Sept. 16, 1913. Under Int. Conv., Sept. 19, 1912.

AN aqueous solution containing about 10 per cent. of common salt, and 0·1 to 0·2 per cent. of sulphuric acid, and heated to 48°—71° C., is used to effect a flotation separation of galena from blende and pyrites, the former mineral being left as a residue with the gangue, from which it is subsequently separated; or, as is preferable, the gangue may first be separated from the mixed sulphides. In order to cause a better separation, the action may be retarded by the addition of alkali sulphites or thiosulphates, or sulphurous acid.—T. St.

[*Lead and zinc*] *Metallic sulphides; Separation of ores containing* ——. Minerals Separation, Ltd. Fr. Pat. 462,757, Sept. 18, 1913.

Zinc and lead sulphides are separated by flotation at atmospheric temperature, in neutral or alkaline solutions containing sulphates, chlorides or nitrates of calcium, potassium and sodium, and a froth-producing agent such as eucalyptus oil. Natural mineral waters may also be used. The zinc sulphide, which is left with the gangue, may be separated from the latter by continuing the action with the same solution, or preferably with fresh water. Suitable apparatus for carrying out the process, and for making preliminary laboratory tests, are described, and the compositions of various solutions which have been employed are given.—T. St.

[*Gold and silver.*] *Metals; Process of precipitating and separating* —— *from solutions.* R. S. Towne, New York, and C. Robinson, Mount Vernon, N.Y., U.S.A. Eng. Pat. 2807, Feb. 3, 1913.

A mixture of the solution (*e.g.* cyanide) with a finely divided precipitant (*e.g.* zinc) is passed along a zigzag pipe, to effect mixing and agitation, and conducted into a relatively large volume of solution (cyanide) contained in a vessel of the spitzkasten type. The end of the delivery pipe is situated nearer the bottom than the top of this vessel, in which the precipitate settles by gravity and the solution overflows at the top. A screen supporting a layer of zinc is disposed across the upper part of the vessel to ensure complete precipitation and filtration of the liquid immediately before discharge.—W. E. F. P.

Silver ores; Metallurgical treatment of ——. O. Dyckerhoff, Karlsruhe, Germany. U.S. Pat. 1,085,675, Feb. 3, 1914.

The ore, containing silver, cobalt, nickel and arsenic, is roasted with common salt, clay and pyrites to produce soluble compounds of the metals which are subsequently extracted by leaching with appropriate solvents. —W. E. F. P.

[*Lead pipes, etc.*] *Pumping apparatus for the manufacture of products of indefinite length from molten lead or other metals or alloys.* H. Debauge, Paris. Eng. Pat. 3944, Feb. 15, 1913. Under Int. Conv., Feb. 17, 1912.

A continuously acting apparatus in which the operating mechanism (kept at a low temperature) and the pump proper (immersed in the molten metal) are disposed separately and independently, each piston being connected to its rod by means of spherical bearing surfaces to obviate lateral stresses and consequent friction between piston and cylinder. The suction and pressure valves of the apparatus operate without springs, the necessary pressure on the seats being obtained solely by the difference in density between the molten metal and that of which the valves are composed. An air-bell provided with a safety valve is employed to regulate the delivery pressure of the molten metal.—W. E. F. P.

Slag and the like; New process for pulverising blast-furnace ——. E. A. Bagley and M. E. Feilmann, London. Eng. Pat. 4018, Feb. 17, 1913.

A thin stream of the molten slag is poured on to the upper surface of a smooth, internally-cooled, metal drum rotating at high speed, with the object of producing a very thin, continuous solidified sheet which is subsequently pulverised by projection against a metal plate or slowly-rotating metal cylinder.—W. E. F. P.

Furnace; Muffle ——. E. Curran, Cardiff. Eng. Pat. 6165, March 12, 1913.

In a muffle furnace having alternative paths for the heating gases, the flues and dampers are so arranged that the heat can be uniformly distributed or concentrated at the top, bottom or sides of the muffle.—W. E. F. P.

Furnace; Reverberatory ——. Soc. Française d'Exploit. de Fours Speciaux à Haute Temperature, Paris. Eng. Pat. 11,390, May 15, 1913. Under Int. Conv., June 18, 1912.

A furnace having a fireplace, a reversible regenerator and a draught chimney at each end of the rectangular fusion-chamber, the hearth of which—separated from the sole of the furnace by blocks of refractory material—is formed into a number of basins by transverse, hollow partitions. A lateral chamber, communicating with the regenerators and the fusion-chamber, is situated upon each side of the middle of the furnace, the flow of gases through the apparatus being directed by means of dampers, etc., operated from the exterior.—W. E. F. P.

Blast-furnace. J. Reis, Montclair, N.J. U.S. Pat. 1,086,220, Feb. 3, 1914.

An annular, perforated screen is disposed between the feed hopper and the wall of the furnace to prevent the discharge of coarse, solid material into the gas outlet. The lining of the furnace is provided with shoulders upon which the screen is supported so as to be easily removable. —W. E. F. P.

Metallurgical furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 1,086,494, Feb. 10, 1914.

The furnace comprises a series of superposed treating chambers with intermediate air-heating chambers, all of which are connected by means of a flue. The air passes from the air-heating chambers over electrical heating devices in the flue on its way to the treating chambers. The electrical heating devices are mounted on plugs which fit into openings in the wall of the flue.—A. S.

Casting-furnace. I. Hall. Fr. Pat. 462,568, Sept. 16, 1913. Under Int. Conv., Sept. 16, 1912 and May 21, 1913.

The furnace has an automatic device for regulating the gas supply and indicating the temperature, and a water-cooled mould which can be emptied by tilting.—W. R. S.

Tin or other ores; Automatic process for the recovery of ——, *from rivers, waste sands, and the like.* W. J. Hocking, Camborne, Cornwall. Eng. Pat. 10,936, May 9, 1913.

By means of a centrifugal pump, the material is transferred from a pit (in the river) to an elevated launder provided with a horizontal sieve through which the sand passes to a series of spitzkasten having a peripheral discharge and arranged in parallel. From the bottoms of these vessels the thickened pulp passes to separate concentrating tables.—W. E. F. P.

Detinning; Process of ——. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N.J., Assignors to Columbia-Knickerbocker Trust Co. U.S. Pat. 1,086,921, Feb. 10, 1914.

A mixture of dry chlorine gas and air is passed through a series of tanks containing tin scrap in various stages of detinning, the temperature being kept below that at which iron is attacked. The chlorine comes into contact first with scrap which is almost completely stripped and then progressively with scrap containing increasing proportions of tin, so that finally air free from chlorine is discharged from the last tank containing fresh scrap.—A. S.

Wires; Process and apparatus for the subsequent treatment of drawn or rolled ——. W. Frese, Dortmund, Germany Eng. Pat. 19,277, Aug. 25, 1913.

The wire is passed through a receptacle or brush filled with chalk, then wound on a drum, annealed on the latter and placed in an acid bath, unwound, passed in succession through a water-trough, a drying device, one or more alkaline solutions, a second drying apparatus, and finally wound into coils. Several wound drums (of conical shape to facilitate unwinding) may be placed in the acid bath together and the separate wires conducted through the various stages at one operation.—W. E. F. P.

Smelter-fumes; Apparatus for arresting ——, and recovering their values. C. S. Vadner, Salt Lake City, Utah. U.S. Pat. 1,085,712, Feb. 3, 1914.

The fumes are passed upwards through a tower filled with "pieces of insoluble solid material," supported by a perforated, arched partition disposed above the side inlet, and agitated by the rotation of a vertical shaft to which horizontal arms are attached. The chamber beneath the partition is provided with an inclined bottom from which the filtered particles are periodically removed.—W. E. F. P.

Slimes; Apparatus for roasting ——. R. T. Wales, Chrome, N.J. U.S. Pat. 1,085,831, Feb. 3, 1914.

A series of flue-like roasting chambers "arranged in multiple" is heated by gases which, after being mixed with a regulated quantity of air, are passed from a common distributing flue, through the chambers, to a common outlet. The operation of any chamber may be suspended (for inserting or removing trays containing the slimes) without retarding that of the others.—W. E. F. P.

Metals; Extraction of volatile ——. H. Pape. First Addition, dated Sept. 23, 1913, to Fr. Pat. 449,480, Oct. 16, 1912 (see Eng. Pat. 22,715 of 1912; this J., 1913, 1073).

To avoid the partial solidification of molten products below the grate of the furnace described in the principal patent, flame is directed on to the surface of the molten collector which may be used for separating products of different specific gravity.—W. R. S.

Alkali metals by electrolysis. B. Loisel and A. Nacivet. First Addition, dated Nov. 14, 1912, to Fr. Pat. 456,688, June 24, 1912 (this J., 1913, 1074).

The apparatus comprises a metallic vessel with two rows of electrodes separated by a porous diaphragm, each row being connected with an arrangement for reversing the current at predetermined intervals, so that it may serve alternately as anode and cathode. The metal collects in a metallic frame, from which it is ladled out when sufficient has collected.—B. N.

Alkali metals or alloys of the same; Production of ——. Chem. Fabr. von Heyden A.-G. Ger. Pat. 269,712, Nov. 19, 1912.

Fused alkali carbonates, to which salts capable of lowering the melting point but not participating in the electrolysis may be added, are electrolysed with the use of carbon as a soluble anode material. The reactions given are :—

$$Na_2CO_3 \rightarrow 2Na + CO''_3;$$
$$2CO_3'' \rightarrow 2CO_2 + O_2; \; C + O_2 \rightarrow CO_2.$$

—A. S.

Zinc, lead, copper, silver and gold; Method for the extraction of —— from complex sulphide ores. H. E. L. Fiévet. First Addition, dated Nov. 20, 1912, to Fr. Pat. 457,707, July 18, 1912 (this J., 1913, 1018).

The sulphurous acid arising from the pyrites in the ore, or from added iron sulphide, and recovered by washing the escaping gases in coke scrubbers, is utilised to separate the mixed oxides of lead and zinc which are obtained by the process described in the original patent. After the removal of the insoluble lead compounds, the solution is heated to precipitate the zinc as sulphite, which is afterwards calcined. In hot climates, the coke scrubbers may be supplied with a solution of common salt, which reacts with the sulphurous acid in presence of air with the formation of hydrochloric acid and sodium sulphate. With this solution zinc is dissolved as chloride and after separating the solution from lead sulphate is precipitated with lime or magnesia.—T. St.

Mercury, tin, antimony, and arsenic; Extraction of ——. B. Szilard. Fr. Pat. 463,039, Sept. 27, 1913.

The ore is heated under pressure with a solution of sodium and barium sulphides and calcium hydroxide. The metals are recovered from the filtered liquor by precipitation with an acid or sodium bisulphate, or ammonium salts, or by electrolysis, or by addition of a few crystals of the metallic sulphide to be obtained along with ammonium nitrate. Solution of the ore and electrolysis of the liquor may be carried out simultaneously.—W. R. S.

Graphite and metals; Manufacture of electrical conductors composed of ——. G. Preuss. Fr. Pat. 463,132, Oct. 1, 1913. Under Int. Conv., Oct. 2, 1912.

Suitable powdered metals or alloys are mixed with graphite powder, compressed in the cold to reduce the amount of included air and then heated under pressure, to form a homogeneous alloy completely enclosing the particles of graphite.—W. R. S.

Cement steel; Art of manufacturing ——. G. H. Benjamin, New York City. Eng. Pat. 3554, Feb. 11, 1913.

See U S.Pat.1,054,817 of 1913; this J.,1913, 430.—T. F. B.

Armour-plates; Process for the manufacture of —— A. Lucertini, Sampierdarena, Assignor to Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co., Genoa, Italy. U.S. Pat. 1,086,459, Feb. 10, 1913.

See Fr. Pat. 442,299 of 1912; this J, 1912, 929.—T. F. B.

Tungsten and other metals in malleable form; Process and apparatus for producing ——. J. Canello, Paris. Eng. Pat. 5150, Feb. 28, 1913.

See Addition of June 11, 1913, to Fr. Pat. 444,878 of 1912; this J., 1913, 1160.—T. F. B.

Metallic powders or coatings; Furnaces for producing ——. M. U. Schoop, Zürich, Switzerland. Eng. Pat. 5510, March 5, 1913. Under Int. Conv., March 8, 1912.

See Fr. Pat. 441,100 of 1912; this J., 1912, 822.—T. F B.

Retort furnaces [for use in smelting zinc, etc.]. G. Londress and W. Worley, Grafton, W. Va., U.S.A. Eng. Pat. 11,900, May 21, 1913. Under Int. Conv., June 25, 1912.

See U.S. Pat. 1,048,420 of 1912; this J., 1913, 93.—T. F. B.

Reheating furnaces. F. K. Siemens, London. Eng. Pat. 28,048, Dec. 5, 1913.

See Ger. Pat. 268,379 of 1913; this J., 1914, 144.—T. F. B.

Furnaces for heating ingots; Continuous ——. F. K. Siemens. Fr. Pat. 461,937, Aug. 27, 1913.

See Eng. Pat. 17,955 of 1913; preceding.—T. F B.

Reduction furnaces; Muffle for ——. A. Roitzheim, Duisburg-Ruhrort, Germany. U.S. Pat. 1,086,939, Feb. 10, 1914.

See Fr. Pat. 456,636 of 1913; this J., 1913, 1018.—T. F. B.

Treating waste acid and acid effluents from tin-plate works. Eng. Pat. 3505. *See* VII.

XI.—ELECTRO-CHEMISTRY

Patents.

Insulating materials; Manufacture of electric ——. W. Boehm. Fr. Pat. 462,857, Sept. 23, 1913.

Insulators for high-tension work are prepared by impregnating porous porcelain or earthenware with paraffin, oils, lac, mica powder, etc., and then treating, *e.g.*, with ozone, to effect a hardening of the oils in the pores. The powdered ceramic material, before firing, is mixed with a substance, which by combustion or evaporation produces the necessary porosity, and the porous material is first submitted to a reduced pressure, and afterwards impregnated under pressure.—B. N.

Electrical insulation and other purposes ; Manufacture of a material suitable for ——. The British Thomson-Houston Co., Ltd. From General Electric Co., Schenectady, N.Y. Eng. Pats. (1) 3271, Feb. 7, and 22,358, April 9, 1913. (2) 3566, Feb. 11, 1913.

(1) A fusible intermediate reaction product is prepared by slowly heating phthalic anhydride and a polyhydric alcohol, and a clear infusible product free from cavities is obtained from this by heating for some time to about 85° to 135° C., afterwards heating to a higher temperature further to harden and toughen the resin. (2) One part by weight of a polyhydric alcohol, such as glycerol, is heated with two parts by weight of succinic, tartaric or pyrotartaric acid to about 220° C. until the mass becomes viscous, and the heating is continued at about 85° C., until the mass forms an insoluble, infusible, elastic product. Part of the acid may be advantageously replaced by a polybasic aromatic acid.—B. N.

Insulating and fusible powder for electrical applications. H. Grossmann. Fr. Pat. 462,992, Sept. 25, 1913.

A resinous substance of low melting point, such as rosin, pitch, asphaltum, etc., is intimately mixed with a substance, such as glass, porcelain, marble, sand, talc, barytes, etc. The tendency of the powder to brittleness after fusion and solidification may be diminished by mixing with a fusible and malleable substance, such as paraffin, carnaüba or other wax.—B. N.

Electrode ; Storage battery —— and process of making same. H. C. Hubbell, Newark, N.J. U.S. Pat. 1,086,666, Feb. 10, 1914.

Alternate thin layers of iron and a metal like cadmium are arranged closely together face to face, so as to form a plate with the layers disposed edgewise to the faces of the plate. The cadmium is removed by distillation, and the iron layers are formed with electrolytically-active iron compounds on the surface, by making the plate the anode in an aqueous solution of phenol containing an alkali phenolate (phenoxide).—B. N.

Accumulators ; Solution for cells of lead ——. P. Rabbidge. Fr. Pat. 462,663, Sept. 2, 1913. Under Int. Conv., Sept. 2, 1912.

A concentrated solution of potassium permanganate, equal to about 10 per cent. of the electrolyte, is mixed with the latter for the purpose of desulphating or preserving the plates.—B. N.

Cell ; Electrolytic —— for generating hydrogen and oxygen gases. J. B. Burdett, Assignor to Burdett Manufacturing Co., Chicago, Ill. U.S. Pat. 1,086,804, Feb. 10, 1914.

The cell is provided with an electrode-supporting element, comprising a casing with partitions forming gas-tight compartments, and with a continuous diaphragm attached to the partitions so as to form extensions of the compartments. The parts of the diaphragm attached to the partitions form separating walls for the cathode and anode compartments, through which, and the outer cell, electrolyte is automatically circulated. Gas conduits communicate with the compartments, and an adjustable conduit projects into the electrolyte, in order to regulate the pressure of the evolved gas.—B. N.

Water ; Element for the electrolysis of ——. Maschinenfabrik Sürth G. m. b. H. Fr. Pat. 462,394, Sept. 3, 1913.

Each element comprises an iron frame, forged or soldered by autogenous soldering to the electrode, and the upper edge of each element contains two chambers, to collect the gases and separate entrained electrolyte. The sheets of metal forming the electrodes are corrugated, or may be provided with transverse ribs soldered to them, and the diaphragms, separating the electrodes, comprise two series of alternating metallic bands between which is disposed a thin metallic perforated sheet or wire gauze of fine mesh.—B. N.

Anodes of antimonial lead for electrolytic purposes. Siemens und Halske A.-G. Ger. Pat. 270,191, Oct. 6, 1912.

The anode consists of a number of rods, the cross-section of which is circular, oval, or other form free from sharp corners. The rods are fixed at one end to a common conducting and supporting bar, so that they are free to expand in the direction of their axes. The use of anodes of this kind obviates the difficulty experienced with sheet or plate anodes of antimonial lead due to the frequent formation of short circuits owing to bending of the sheets or plates within the bath.—A. S.

Electrolysis of alkali and alkaline-earth chlorides. Eng. Pat. 21,462. *See* VII.

Manufacture of electrical conductors composed of graphite and metals. Fr. Pat. 463,132. *See* X.

XII.—FATS ; OILS ; WAXES.

Cod liver oil [Oleum Jecoris Aselli] ; Content of unsaponifiable matter in ——. H. Thaysen. Ber. Deutsch. Pharm. Ges., 1914, **24**, 136—140.

A number of specimens of cod liver oil were tested by mixing five drops with one drop of sulphuric acid, when a violet colour developed which soon changed to brownish-red. Six of these gave a colour the same depth as that of a mixture of 100 c.c. of water with 2 c.c. of *N*/10 potassium bichromate solution. The acid value of these samples varied between 1·2 and 2·3 and the unsaponifiable matter between 0·70 and 1·02 per cent. The other samples had an acid value varying between 9·0 and 59·0, and unsaponifiable matter 0·64 to 2·30 per cent. The oil with the highest acid value had the darkest colour.
—F. Shdn.

Kickxia elastica and Manihot Glazcovii ; Oil from the seeds of ——. H. Sprinkmeyer and A. Diedrichs. Z. Unters. Nahr. Genussm., 1914, **27**, 120—124.

Kickxia elastica :—The crushed seeds yielded, when expressed and extracted with ether at about 70° C., 28·16 per cent. (54·8 per cent. on the kernels) of a golden yellow oil with a characteristic odour and bitter taste. It had drying properties (9·53 per cent. increase in weight in Livache's test), and yielded 0·48 per cent. of an insoluble bromide. It had the following characters :—Sp. gr. at 15° C., 0·9327 ; refraction at 40° C., 68·8 ; at 25° C., 77·3 ; acid value, 3·33 ; sapon. value, 179·6 ; Reichert-Meissl value, 0·66 ; Hehner value, 95·95 ; iodine value, 130·9 ; Polenske value, 0·30 ; optical rotation (200 mm.) +0·8°. *Fatty acids* :—Refraction at 40° C., 57·3 ; at 25° C., 66·0 ; m. pt. 25·2° C. ; solidif. pt. 23·0° C. ; neutralisation value, 183·0 ; iodine value, 139·7 ; and mean molec. equiv., 312·0. The oil would be suitable for varnishes and paints, whilst the seed hair could be utilised as upholstery material. *Manihot Glazcovii* :—The seed-kernels yielded 50·16 per cent. of a yellow oil with a pleasant nutty aroma and taste. It dried well (Livache test, 7·69 per cent.), and could be used for varnishes, etc. With Bellier's reagent it gave a deep blue colouration. The oil yielded no insoluble bromide, but the fatty acids gave a deposit of linolic acid tetrabromide. The following values were obtained :—Sp. gr. at 15° C., 0·9242 ; refraction at 40° C., 61·8 ; at 25° C., 70·2 ; acid value, 1·74 ; saponif. value, 192·5 ; Reichert-Meissl value, 10·66 ; Hehner value, 95·65 ; iodine value, 117·6 ; Polenske value, 0·50. *Fatty acids* :—Refraction at 40° C., 47·3 ; at 25° C.

55·4; m. pt. 25·8; solidif. pt., 23·5 C.; neutralisation value, 202·6; iodine value, 131·6; and mean molec. equiv., 280·9. (See also Rideal and Acland, this J., 1913, 704.) —C. A. M.

Glycerides and their fatty acids; Applications of the method of determining the difference in the melting points of ——. A. Bömer. Z. Untersuch. Nahr. Genussm., 1914, **27**, 153—172.

Lard:—It is possible to detect 5 per cent. of beef fat in lard containing cocoanut oil, arachis oil or cottonseed oil by the author's m. pt. method (this J., 1914, 38). Any deviation from the normal figures for lard which might be caused by fats such as shea butter could be checked by the phytosteryl acetate test. In the case of hydrogenated arachis and sesamé oils the m. pts. of the least soluble glycerides were very high (70·6° C., and 71·5° C. respectively) whilst the corresponding fatty acids melted at 68·6° C. and 68·5° C.; hence these glycerides apparently consisted of tristearin. Hydrogenated cottonseed oil, however, yielded a mixture of glycerides (m. pt. 61·3° C.), containing fatty acids melting at 38° C. The m. pt. differences ranged from 0° to 0·8° C. for hydrogenated arachis and sesamé oils, and reached 2·8° C. in the case of the cottonseed oil. These hardened fats added to lard depressed the difference in the m. pts. to a greater degree than beef fat, from which however they could be distinguished by the phytosteryl acetate test. The least soluble glycerides of sucking-pigs' fat and of the fat of pigs fed abnormally upon cocoanut, maize, sesamé and cottonseed oil-cakes differed from those of normal lard in containing a smaller proportion of α-palmitodistearin and more stearodipalmitin, but no new glycerides had been produced. Such abnormal feeding did not prevent the detection of beef fat by the author's method.

Detection of lard and tallow in cocoanut oil:—The glycerides of cocoanut oil separated by crystallising 50 grms. of the fat from 50 c.c. of acetone at 10° C. melted at 47·3° C., whilst their fatty acids melted at 44·3° C. In the case of palm-kernel oil the glycerides obtained in two crystallisations melted at 39·9 (I.) and 45·2 (II.), and gave differences of 5·8 and 4·1° C. respectively. Cocoanut oil containing 5 per cent. of lard yielded glycerides melting at (I.) 61·3° C. and (II.) 63·3° C., and showing differences of 7·5° and 7·0° C. respectively. Analogous results were obtained with mixtures of cocoanut oil and beef-fat. A commercial sample of mowrah fat yielded glycerides of m. pt. 61·3 to 66·3° C., with m. pt. differences of —0·7° C. to +2·1° C.

Detection of lard in butter fat:—The palmitodistearin of butter fat melts at 62·9° to 63·1° C. (fatty acids, 62·4° to 63° C.), whilst lard stearodipalmitin melts at 58·0° C. (fatty acids, 55·2° C.). Additions of lard to butter cause the difference between the m. pts. of the more insoluble glycerides and their fatty acids to be greater than normal. In the case of four samples of pure butter the differences in the m. pts. in the last five of eight crystallisations ranged from —0·2° C. to 3·3° C., whilst butter containing 10 to 20 per cent. of lard showed differences of 2·3° to 5·8° C. for the more insoluble glycerides.

Detection of lard in goose-fat:—The most insoluble glyceride melted at 62·4° C. and contained fatty acids of m. pt. 58·2° C. The glycerides separated from mixtures of goose-fat with 20 and 30 per cent. of lard melted at higher temperatures, but the m. pt. differences between glycerides and fatty acids did not differ materially from those given by the pure goose-fat.—C. A. M.

Fatty acids; Catalytic reduction of unsaturated —— by means of nickel and nickel oxide. W. Meigen and G. Bartels. J. prakt. Chem., 1914, **89**, 290—301.

The hydrogenation of fats proceeded much more rapidly at first, and at a lower temperature (180° C.), when finely divided reduced nickel was used as catalyst than when nickel oxide (obtained by ignition of the nitrate) was employed, in which case a temperature of 250° C. was necessary. The view of Bedford and Erdmann (this J., 1913, 611) that a suboxide of nickel (Ni_3O) is formed during the reduction is rejected, and the opinion expressed that metallic oxides do not act as catalysts in the hydrogenation of unsaturated fatty acids but only the metal reduced therefrom. In experiments with nickel oxide, the presence of metallic nickel in the catalyst after use was proved by chemical analysis (the nickel content was higher than corresponded to a suboxide), by its electrical conductivity, and by the formation of nickel-carbonyl on treatment with carbon monoxide. In these tests, it was necessary carefully to exclude air, which very readily oxidised the finely divided reduced nickel.—A. S.

Fatty acids; Decomposition of —— by mould-fungi. A. Spieckermann. Z. Unters. Nahr. Genussm., 1914, **27**, 83—113.

One grm. of each of the pure fatty acids representing saturated, unsaturated, hydroxy- and keto-acids was mixed with 5 to 25 grms. of kieselguhr and 7·5 to 37·5 grms. of nutrient nitrogenous broths, and the mixture inoculated with cultures of *Penicillium glaucum*, *Aspergillus*, *Monilia*, etc. After periods of 2 to 5 weeks the residual fatty acid was recovered. In each case absorption of the fatty acid had occurred, ranging from 3·4 per cent. (arachidic acid) to 91·3 per cent. (myristic acid). The neutralisation values of the recovered acids were invariably lower by a few units, the decrease depending upon the extent of the decomposition. The iodine value of oleic acid was invariably reduced, whilst, on the other hand, the saturated fatty acids frequently showed an increased iodine value, particularly in the case of lauric acid (*e.g.*, 16·6). As a rule, the m. pts. were somewhat lower than before. Lauric acid was completely oxidised to water and carbon dioxide. Oleic, elaidic and erucic acids were decomposed by the moulds more slowly than lauric or myristic acids, but more rapidly than stearic and arachidic acids, whilst brassidic acid was decomposed more rapidly than fatty acids containing 12 to 18 carbon atoms.—C. A. M.

Olive oil; Rancidity of —— and oxidation of oleic acid in presence of sunlight. F. Canzoneri and G. Bianchini. Annali Chim. Appl., 1914., 1914, **1**, 24—32.

Samples of the same olive oil were respectively exposed to air and sunlight, exposed to air under similar conditions in the dark, and exposed to sunlight in a sealed tube from which the air had been exhausted. The first sample became rancid but the other two remained unaltered, indicating that the effect is due not to micro-organisms but to the action of air accelerated or determined by the action of light (see also Scala, this J., 1898, 359; 1908, 819). The action of air and oxygen on oleic acid was also studied. After exposure to air and light for 5 months, there were detected in the reaction product a white solid (m. pt. 50°—51° C.), probably stearolactone, nonylic, formic, azelaic, and dihydroxystearic acids, nonylic aldehyde, and the acids A and B obtained by Molinari by the decomposition of oleic acid ozonide. After exposure to oxygen and light for one week, the presence of nonylic and semi-azelaic aldehydes and azelaic, nonylic, di- and mono-hydroxystearic acids was detected. These results indicate that the decomposition of oleic acid by air or by oxygen in presence of light proceeds along similar lines to the decomposition by means of ozone (see Harries, this J., 1906, 1055, 1158; 1909, 250; Molinari, this J., 1906, 1055; 1908, 1073), the action taking place at the double linkages with a tendency to the formation of peroxides, aldehydes and acids of the type of nonylic compounds and their oxidation products, the latter becoming more complex the more the oxidation is prolonged.—A. S.

Soap solutions; Studies of the constitution of ——. The electrical conductivity of potassium salts of the fatty acids. H. M. Bunbury and H. E. Martin. Chem. Soc. Trans., 1914, **105**, 417—435.

The electrical conductivities of the potassium salts of the saturated fatty acids with an even number of carbon atoms in the molecule, from the stearate to the hexoate, were determined at 90° C.: they were generally higher than those of the sodium salts (this J., 1911, 222), but there was a general resemblance between the curves representing the variation of the conductivity with the concentration of the solution. The maxima and minima were more pronounced in the case of the potassium salts and to a greater extent than could be accounted for by the difference in the mobility of sodium and potassium ions. In the case of potassium palmitate the conductivities found were much lower than those predicted from the values for sodium palmitate. The differences between the maximum and minimum conductivity values were much more marked in the case of the potassium soaps, this being most strikingly seen in the case of the laurates. Potassium hexoate had the characteristic properties of a soap in concentrated solution but these at once disappeared on dilution. Potassium octoate behaved in a similar manner, whilst the decoate was the first to produce a typical though thin lather. The densities of the soap solutions increased very much less rapidly than the concentration. Thus, the excess of density of 2 N potassium laurate over that of water was only two-thirds of that predicted from the density of the 0·5 N solution.—J. A.

Caustic alkali; Determination of free —— in commercial soda compounds and soaps by the barium chloride method. A. Kling, V. Genin and D. Florentin. Bull. Soc. Chim., 1914, **15**, 200—205.

Precipitated barium silicate or borate is soluble in dilute aqueous solutions of barium chloride with the result that the method of determining free caustic alkali in soda compounds or in soaps which contain soluble silicates or borates, by precipitation of their aqueous solutions with barium chloride and subsequent titration of the clear liquid with $N/10$ acid gives inaccurate results. These salts, however, are insoluble in 50 per cent. alcohol and if, after the precipitation, a sufficient quantity of strong alcohol is added to the liquid to bring the alcohol concentration to 50 per cent., accurate results are obtained except in the case of soaps containing oleic acid, since barium oleate is slightly more soluble in 50 per cent. alcohol than in water.—J. A.

Patents.

Wool-grease; Process of treating —— and product thereof. C. Ellis, Montclair, N.J. U.S. Pat. 1,086,357, Feb. 10, 1914.

Wool-grease is heated with hydrogen free from arsenic, at a pressure of about 10 lb., and at a temperature above the temperature of decomposition of nickel soap, in the presence of a nickel catalyst.—E. W. L.

Unsaturated fatty acids, their glycerides and other esters: Process for the conversion [hydrogenation] of —— into corresponding saturated compounds. F. Bedford and C. E. Williams. First Addition, dated Aug. 19, 1913 (under Int. Conv. Aug. 21, 1912), to Fr. Pat. 436,295, Nov. 11, 1911 (see Eng. Pat. 29,612 of 1910; this J., 1912, 398).

A suboxide of nickel is used as the catalytic agent. It may be produced by heating a mixture of nickel oxide or an organic salt of nickel with the oil in a current of hydrogen.—C. A. M.

Unsaturated fatty acids and their esters; Process for converting [hydrogenating] —— into saturated compounds. De Nordiske Fabriker De-No-Fa Aktieselskap. Fr. Pat. 462,905, Sept. 24, 1913.

The basic salt of a heavy metal (*e.g.*, nickel or copper) with a fatty acid of high mol. weight is dissolved in the fatty acids, fat or oil, in the proportion of, say, 0·4 per cent., and the mixture hydrogenated at 100° to 180° C.—C. A. M.

Whale oil or fish oils; Process of removing the disagreeable odour from the fatty acids of ——. W. H. Hofmann. Fr. Pat. 462,763, Sept. 18, 1913. Under Int. Conv., Sept. 28, 1912.

The fatty acids are mixed with a resin and sulphonated at a temperature not exceeding 120° C. The product is repeatedly heated with water (with the addition of salt to prevent emulsification), and is then neutralised and distilled *in vacuo* or with superheated steam.—C. A. M.

Oil; Process for extracting —— from oil seeds and the like. Harburger Oelwerke Brinckman und Mergell. Ger. Pat. 269,195, May 12, 1912.

Before or during the extraction of the oil, preferably by means of solvents, the oil seeds are treated with aliphatic oxygenated compounds containing a methylene group, especially formaldehyde. For example, 2—3 per cent. of formaldehyde or other suitable compound may be added to the solvent used for extracting the oil. It is stated that the oil is extracted more rapidly and is less liable to spoil on keeping. The suitability of the residue for use as fodder is not impaired.—A. S.

Fat for use in the perfume and soap industries and for other purposes. P. de Baudicour and E. Cadoret de la Gabinière. Fr. Pat. 462,794, Nov. 30, 1912.

The resins of indiarubber, gutta-percha or analogous products (*e.g.*, jelutong, almedina) are mixed with castor oil, and subsequently with other resins, to form preparations suitable for soap, lubricants, polishing wax, extraction of perfumes, etc.—C. A. M.

Floating soaps; Process of manufacturing compact —— and products thereof. C. Muller. Fr. Pat. 462,502, Sept. 12, 1913.

A mixture of saponifiable fats (90 per cent.) with wax (10 per cent.) is saponified at about 75° C., and a small proportion of oxygen then introduced to make the soap porous and cause it to float in water.—C. A. M.

Soaps; Preparation of highly antiseptic soluble ——. Schülke und Mayr Nachf. Dr. Raupenstrauch. Fr. Pat. 462,724, Sept. 18, 1913.

p-Chloro-o-cresol or a mixture thereof with m-chloro-o-cresol is dissolved in the soap and water, with the subsequent addition of an alcohol (ethyl alcohol, glycerin or a mixture of the two). Or the antiseptic is mixed with the oil, fat, resin acids, etc., prior to saponification.—C. A. M.

Sulphonated oils and fats; Manufacture of ——. R. Russ, Rumburg, Austria. Eng. Pat. 21,853, Sept. 27, 1913.

See U.S. Pat. 1,081,775 of 1913; this J., 1914, 91.—T. F. B.

Treatment of effluents. [Recovery of grease.] Eng. Pat. 5754. *See* XIXb.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Oil from seeds of Kickxia elastica and Manihot glaziovii. Sprinkmeyer and Diedrichs. *See* XII.

Patents.

Oils; Drying ——. L. H. Dyke Acland, London. Eng. Pat. 5347, Mar. 3, 1913.

The drying of linseed oil is accelerated by the addition of ceara or funtumia rubber seed oil either in place of a portion of, or in addition to, the ordinary manganese or lead driers. The proportions recommended are 10—30 per cent. of ceara oil or 50—80 per cent. of funtumia oil. Rapid drying is also obtained by using a mixture of ceara and funtumia oils without linseed oil.—E. W. L.

Varnishes and paints; Antifouling ——. L. Collardon, West Bromwich. Eng. Pat. 9040, April 17, 1913.

A base for use in the manufacture of poisonous antifouling varnishes and paints consists of a compound of the condensation product of a phenol and an aldehyde with arsenic, mercury or copper. It may be prepared by heating together 100 grms. of crystallised phenol, 100 c.c. of 40 per cent. formalin, and 92 grms. of arsenious acid or 50 c.c. of a saturated solution of mercuric chloride. Sulphur dioxide (25 to 50 c.c. of a 10 per cent. solution) or an equivalent agent such as aluminium or magnesium chloride, or urea (25 c.c. of a 10 per cent. solution) may be added. The product is preferably boiled in water for an hour or more, in order to free it from excess of arsenic, or mercury, etc. The poisonous substance may be combined with the phenol first, and the product heated with formaldehyde. The final products are almost colourless, melt at about 90° C., and when heated to about 120° C. are converted into transparent resinous substances. —E. W. L.

Lac; Method of and means for treating ——. J. D. Morrison, Glasgow. From W. A. Freymuth, Umaria, Central India Eng. Pat. 18,563, Aug. 15, 1913.

The lac is placed in a bag and subjected to pressure between rotating buffer-heads; the buffer heads may be heated internally and radiant heat may be applied to the bag by means of a lamp, reflector, or electric radiator. The melted lac passing through the sides of the bag falls into a water-bath and is lifted and replaced on the buffers and bag, being manipulated subsequently until the desired plastic condition is attained.—W. P. S.

Coating composition; Protective ——. L. H. Baekeland, Yonkers, N.Y., Assignor to General Bakelite Co., New York. U.S. Pat. 1,085,100, Jan. 27, 1914.

The composition consists of a solution of a phenolic condensation product which is capable of transformation by heat into an insoluble and infusible body, in water containing the minimum proportion of alkali hydroxide requisite for the preparation of a stable solution. An inert filling material may be added.—E. W. L.

Resinous condensation product. E. S. Dawson, jun., Assignor to General Electric Co., Schenectady, N.Y. U.S. Pat. 1,085,112, Jan. 27, 1914.

Citric acid, a polyhydric alcohol such as glycerol, and an aromatic compound, *e.g.* *m*-dinitrobenzene, having insulating properties, are dissolved in alcohol, and heated to 125°—200° C. to produce a flexible, insoluble and infusible material.—E. W. L.

Wood; Process of extracting products [turpentine and rosin] from ——. W. B. Harper, Lake Charles, La., Assignor to The Castona Improved Process Co., Laino, Miss. U.S. Pat. 1,085,416, Jan. 27, 1914.

The wood is first steam distilled at a low temperature to drive off the turpentine, which is condensed and separated from the water. It is again steam distilled at a higher temperature and pressure sufficient to distil off the oils but not high enough to injure the wood or the rosin. The hot wood is then extracted in the still with a suitable hydrocarbon solvent and the rosin recovered from the solution by evaporation.—W. H. C.

Lacquers and varnishes; Process for the preparation of ——. S. H. Cohn. First Addition, dated Sept. 5, 1913, to Fr. Pat. 441,703, March 25, 1912 (this J., 1912, 886). Under Int. Conv., Oct. 5, 1912.

Oxidised oil of turpentine, pine oil, etc., crude or refined, may be employed as an addition to wood oil for the preparation of lacquers or varnishes, instead of the oils or terpenes of high boiling point referred to in the original patent.—E. W. L.

Frescoes, aquarelles, stereochromes, pictures painted with casein colours or in tempera, photographs, or the like; Process for cleaning or restoring ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 17,531, July 30, 1913. Under Int. Conv., May 15, 1913. Addition to Eng. Pat. 17,523, March 1, 1913.

See Fr. Pat. 459,922 of 1913; this J., 1913, 1163.—T.F.B.

Oil-varnish substitutes from animal oils; Process for the manufacture of ——. W. Kaempfe, Grossenhain, Germany. U.S. Pat. 1,087,064, Feb. 10, 1914.

See Fr. Pat. 445,565 of 1912; this J., 1913, 34.—T. F. B

Manufacture of a material suitable for electrical insulation and other purposes. Eng. Pats. 3271 and 3566. *See* XI.

Fat for use in the perfume and soap industries and for other purposes. Fr. Pat. 462,791. *See* XII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc; Synthetic —— *from isoprene.* C. Harries. Ber., 1914, **47**, 573—577.

The author dissents from Steimmig's statement (this J., 1914, 267) that all synthetic caoutchoucs differ from the natural product. The synthetic product examined in 1909 by the author (see this J., 1910, 502) certainly was an approximately pure polymeride of 1.5-dimethylcyclooctadiene. The product of hydrolysis of the ozonide gave phenylmethyldihydropyridazine almost pure and in high yield. Probably Steimmig's results were due to the use of impure isoprene. It is very difficult to obtain the pure substance, and the polymerisation is very much affected by the manner in which it is performed (cf. the sodium method) and also by factors at present inexplicable. The author obtained different results in parallel experiments with pure isoprene. Steimmig's results certainly explain the apparent loss of hydrolysis-products observed by the author when examining polymerisation-products of isoprene from other sources.—H. E. P.

Oil from seeds of Kickxia elastica and Manihot glazcovii. Sprinkmeyer and Diedrichs. *See* XII.

Transformation of dimethylallene into isoprene. Kutscherow. *See* XX.

Patents.

Rubber latex; Process and apparatus for coagulating and/or curing ——, *and for the antisepticising and drying thereof.* E. J. Byrne, London. Eng. Pats. 3707, Feb. 13, and 5160, March 1, 1913.

Latex passes downwards from a container into a funnel whence it drips on to the upper surface of a dome-topped vertical cylindrical drum, which may be heated by internal steam pipes. Pairs of annular pipes surround the drum, the upper pipe of each pair being designed to direct coagulating and/or curing vapours on to the downward-flowing latex, through horizontal jets, whereas the lower pipe has jets inclined downwards and is used for directing a spray of liquid coagulant on to the latex. The whole is enclosed in an outer casing or jacket. Latex which escapes coagulation falls with excess of acid on to the bottom of the chamber whence it is drained away. The sheet of rubber is removed by lowering the drum and cutting down one side with a knife.—E. W. L.

Rubber latex; Process for the coagulating, and/or curing of ——. E. J. Byrne, London. Eng. Pat. 26,199, Feb. 13, 1913.

Rubber latex is sprayed with a liquid coagulant such as acetic or pyroligneous acid, as it spreads itself or is spread in a thin layer over a surface. Smoke or coagulating (or curing) vapours or gases may be applied simultaneously or otherwise.—E. W. L.

India-rubber; Process for devulcanising and regenerating ——. M. Capel and J. Thiberville. Fr. Pat. 462,328, June 18, 1913.

Ground vulcanised rubber is heated in an autoclave with a mixture of two chemical reagents, one of which dissolves the rubber, whilst the other removes the combined sulphur, converting it into volatile sulphides, and the mass is finally treated with steam.—E. W. L.

Composition of matter [resilient or elastic masses] and method of preparing same. H. A. Gardner, Washington, D.C. U.S. Pat. 1,086,361. Feb. 10, 1914.

A finely-divided, insoluble, inorganic filling material is suspended in wood-oil which is then polymerised. The product, which is insoluble in all ordinary oil and varnish solvents, may be granulated.—E. W. L.

Caoutchouc; Process for promoting the vulcanisation of natural or artificial ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,615. May 19, 1913. Addition to Eng. Pat. 11,530 of 1913, dated Nov. 15, 1912.

See Ger. Pat. 266,619 of 1912; this J., 1914, 94.—T. F. B.

Indiarubber substitute; Process for the manufacture of ——. Soc. Thomas, Bazin, Casanova et Cie., Bordeaux, France. Eng. Pat. 19,871, Sept. 2, 1913. Under Int. Conv., Sept. 2, 1912.

See Fr. Pat. 447,904 of 1912; this J., 1913, 245.—T. F B.

India-rubber, gutta-percha, and other crude gum-resins; Process for the treatment of —— in order to obtain pure rubber. P. de Baudicour and E. C. de la Gabinière. Fr. Pat. 462,793, Nov. 30, 1912.

See Eng. Pat. 17,582 of 1913; this J., 1913, 1078.—E. W. L.

Fat for use in the perfume and soap industries and for other purposes. Fr. Pat. 462,794. *See* XII.

XV.—LEATHER; BONE; HORN; GLUE.

Gelatin; The equilibrium of dilute hydrochloric acid and ——. H. R. Procter. Chem. Soc. Trans., 1914, **105**, 313—327.

The swelling of gelatin or other amphoteric protein in dilute acid solutions depends on the osmotic pressures and equality of products of a di acid ionisable salt of the protein as a base and of the external acid with which it is in equilibrium. If the ionisation-constants and the molecular weight are known, all the other quantities are fixed. The ionic-concentrations in the jelly are all functions of that of the equilibrium acid, and independent of the chemical nature of the protein. The theory assumes that the jelly in equilibrium with the acid is a molecular solution, and discards the view of Bütschli and van Bemmelen that it is a two-phased structure. (See also this J., 1911, 226, 818.)—G. F. M.

Patents.

Hides; Method of treating —— before tanning. C. C. Moore and W. Trantom, Lymm, Cheshire. Eng. Pat. 18,890, Aug. 20, 1913.

Sodium chloride free from calcium and magnesium compounds and sulphates is used for preserving hides before tanning. With impure salt the hide-acid and hide-alkali substances react with calcium and magnesium salts present to give complex neutral salt reactions, whereby insoluble protein compounds are formed with the result that the yield of leathers is less, the filling, fatting, etc., of the leather is uneven and there is a liability to stains.
—D. J. L.

Hides and skins; Preparing —— for tanning and dyeing. E. d'Huart, Luxembourg. Eng. Pat. 23,841, Oct. 21, 1913.

The alkaline-earth used for unhairing hides and skins is removed by treatment with the glycerol ester of phosphoric acid or an alkali or alkaline earth salt of the same. The process is particularly applicable when strontium or barium hydroxide has been used as a depilatory. By using either free glycerophosphoric acid or the glycerophosphate of sodium, potassium or ammonium, bating may be carried out either in an acid or alkaline medium or the two may be used in succession. The acid treatment is more suitable for heavy hides containing much alkaline-earth. The action of the compounds of glycerophosphoric acid, which have at the same time a solvent action on albumin, may be increased by the addition of peptone, glue, glycerin, malt extract, bran drench, alkali bicarbonate, ammonium nitrate or ammonium salts of volatile fatty acids. When baryta or strontia has been used, the spent glycerophosphate bath may be revivified by the addition of sulphuric acid and removal of the insoluble sulphates. Glycerophosphoric acid may also be used in the preparation of tanned skins for dyeing where foul urine has formerly been used for the purpose of removing adhering residues of the tanning process and the prevention of penetration of the dyestuff. Particles still adhering to the skin after dyeing are mostly of a starchy nature and may be dissolved by diastase or malt extract.—D. J. L.

Skins; Process for degreasing ——. J. Filhol. Fr. Pat. 462,280, Nov. 18, 1912.

The skins are treated with tetrachloroethane either alone or with the addition of water, at a temperature of 35°—40° C., when the fat passes rapidly into a state of colloidal solution and is coagulated and deposited from the liquid separated from the skins, on cooling. The solvent is recovered by decantation and filtration. Raw skin may be degreased by the process, the solvent penetrating the tissues and facilitating the later penetration of tanning materials. Other solvents which may be used, are di-, tri-, and perchloroethylene and pentachloroethane. Exposure of the solvent to strong light should be avoided.
—D. J. L.

Skins; Treatment of —— with the wool or hair on. L. Beaudry and A. Grenouillet. Fr. Pat. 462,314, Nov. 19, 1912.

The wool-skins after washing are immersed in a bath yielding nascent sulphurous or thiosulphuric acid which may be produced electrolytically. If the wool or hair is required perfectly white, the skin is treated on that side with salts of the alkaline earths, particularly those of calcium, which will fix the acids liberated and cause them to bleach the wool or hair. The skin is then split with a machine specially designed for giving a uniform thickness when used for skins in the wool or hair and then softened, brushed and the wool or hair shaved to an equal and appropriate length.—D. J. L.

Tanning hides; Process of ——. G. S. Kimball, Camden, Ark., Assignor to M. W. Borders, Chicago, Ill. U.S. Pat. 1,086,538, Feb. 10, 1914.

The hides after preparation in the usual manner are immersed in the liquor produced by the destructive distillation of Ouachita cretaceous lignite effected at a temperature of 300°—450° F. (149°—232° C.).—D. J. L.

Tanning; New method of ——, new tanning products and processes for their manufacture. Badische Anilin und Soda Fabrik. Fr. Pat. 462,635, July 30, 1913. Under Int. Conv., Feb. 22, 1913.

Skins are treated with solutions of aromatic sulphonic acids, soluble in water, of amorphous character, not containing a phenolic hydroxyl group and capable of precipitating solutions of glue and gelatin. Such conditions are fulfilled by compounds of high molecular weight containing in the molecule several benzene or naphthalene nuclei and particularly those in which the nuclei are joined by intermediate carbon atoms. Soluble condensation products of formaldehyde and naphthalene are specially mentioned and may be obtained by treating the sulphonic acids of naphthalene or its homologues, in presence or absence of condensing agents, with formaldehyde or products capable of yielding the same. The conditions must be such that products soluble in water are produced. The products, insoluble in water, resulting from the condensation of naphthalene or its homologues with formaldehyde may also be treated with sulphonating agents.—D. J. L.

Leather; Treatment of —— for waterproofing and other purposes. W. C. Matthews, Stafford. Eng. Pat. 3563, Feb. 11, 1913.

The leather is heated or dried by placing on a hot surface and melted wax brushed upon it. Pressure may be applied, if desired, and the wax may be applied to the leather while on a block in the process of shaping.—D. J. L.

Skins; Process for hardening and rendering degrained —— impermeable. K. Hartmann. Fr. Pat. 462,690, Sept. 11, 1913.

The skins prepared in the usual manner are immersed according to their thickness for ½—1 hour in a bath of 4 parts by vol. of formalin to 20 parts of water. They are then immersed, without drying, for ½—1 hour in a bath of 4 parts by vol. of 40 per cent. nitric acid in 20 parts of water. After drying and smoothing it is stated the skin has the appearance of horn and will preserve its important qualities.—D. J. L.

Glue, gelatin, and the like; Process for the manufacture of ——. A. Löw, Vienna, and E. Fischer, Charlottenberg, Germany. U.S. Pat. 1,086,149, Feb. 3, 1914.

Bones are treated for 15 mins. with steam under a pressure of 3 atmospheres and then cooled rapidly under reduced pressure, a quantity of steam being meanwhile admitted so that sufficient condensed water is produced to dissolve the glue.—W. P. S.

XVI.—SOILS; FERTILISERS.

Influence of colloids on microbiological processes. Söhngen. *See* XVIII.

Patents.

Fertiliser from silicious, potassium-bearing rocks and minerals containing phosphoric acid; Process of producing a ——. Chem Fabr. Rhenania and A. Messerschmitt. Fr. Pat. 462,357, Aug. 13, 1913. Under Int. Conv., Aug. 14, 1912, Jan. 31, and June 17, 1913.

The rocks and minerals are mixed with calcareous material containing a quantity of free lime equal to at least two-thirds of the weight of the silicious rock, and are heated to not less than 1100° C. The raw materials should be very finely ground, made into a mud with water, formed into briquettes with a binding material, such as clay, plaster of Paris, or the like, and calcined in the damp state in rotary kilns. The resulting product is a fertiliser containing a high percentage of citric acid-soluble potash and phosphoric acid.—O. R.

Insecticide for plants. U.S. Pat. 1,085,898. *See* XIXb.

XVII.—SUGARS; STARCHES; GUMS.

Table syrup; Manufacture of —— in the West Indies. H. A. Tempany. West Indian Bulletin, 1913, **13**, 324—332.

For some years past table syrup or "fancy molasses" for consumption in Canada and the United States has been manufactured to a considerable extent in the West Indies, chiefly in Barbadoes. The requirements of the product are as follows: The density should not be less than 40° B. (sp. gr. 1·383); the direct polarisation should lie between 32° and 48° V.; it should not ferment or crystallise on prolonged standing; and it should be bright, free from suspended impurities, of a light golden colour when viewed in thin layers, and free from any flavour of acidity, and from all traces of mineral acid. In order that no crystallisation may occur, it is necessary that a certain proportion of invert sugar be present, and this is best ensured by inverting some of the sucrose. As the use of mineral acids contravenes the Pure Food Laws of the United States and Canada, in practice hydrolysis is effected by heating with a definite amount of fermented juice, which is added to the raw juice contained in the clarifier, heating and eliminating being then effected as in making Muscovado sugar. On heating, the proteins are coagulated, and according to the author, this renders unnecessary the addition of lime usually made in manufacturing sugar. While boiling down the acid liquor to the required density in the open pans employed in West Indian factories, more impurities separate, and these are carefully removed by fine mesh wire gauze "skimmers." The syrups should not contain any iron, and on this account the use of iron vessels for heating and concentrating should be avoided. Analyses of the syrups thus made in West Indian factories show the following limiting values: sucrose, 42·1—51·0; reducing sugars 20·0—32·8; ash, 1·3—3·3; water, 19·7—27·1 per cent.; direct polarisation, 35·0°—47·5° V.; density, 39·0°—41·5° B. (sp. gr. 1·370—1·404).—J. P. O.

Starch and the products of its hydrolysis. Behaviour of starch dextrins to different yeasts. Synthetic isomaltose. Von Friedrichs. *See* XVIII.

Patents.

Dextrin; Production of —— from starch of cassava root (Manihot utilissima). E. Riboud and C. Ahnert. Fr. Pat. 462,451, Sept. 11, 1913.

The dried and decorticated roots are powdered and roasted whilst the mass is moistened with water from time to time. The poisonous substances of the root are thus destroyed.—J. H. L.

Apparatus for the continuous solution of solid substances, especially for slaking lime with sugar juice or water. Ger. Pat. 270,045. *See* I.

XVIII.—FERMENTATION INDUSTRIES.

Starch and the products of its hydrolysis. O. v. Friedrichs. Arkiv för Kemi, Min. och Geol., 1913, **5**, Nr. 2. Chem. Zentr., 1914, **1**, 760—762.

Since the starch molecule consists exclusively of maltosans, and maltose is a glucose-α-glucoside, it follows that alternate linkages connecting two glucoside-forming residues in the starch molecule must correspond to the α-configuration. In similar manner the other linkages must correspond to the β-configuration, for starch is hydrolysed only to maltose by amylases and the saccharifying amylase is a β-enzyme. If this conception be correct there should be present three different sugars, viz., dextrose, a glucose-α-glucoside (maltose) and a glucose-β-glucoside in the product of the incomplete hydrolysis of starch by acids, as the action of the latter is not specific and fission could take place at any of the linkages. (See also this J., 1905, 1246.) Potato starch paste (300 grms. per litre) was hydrolysed by means of oxalic acid (0·05*N*) and in the resulting solution, after fractional precipitation and extraction with alcohol, destruction of dextrose and maltose by fermentation with brewer's yeast, and purification by dialysis, the presence of a disaccharide other than maltose was detected. It yielded a phenylosazone, m. pt. 146° C., slightly soluble in ethyl acetate, had $[\alpha]_D = 59 \cdot 1°$, was not fermented by yeast, but was hydrolysed by emulsin with formation of dextrose. It was thus characterised as a glucose-β-glucoside and is considered by the author as being identical with Fischer's isomaltose.

From the products of hydrolysis there were isolated also, by fractional precipitation with alcohol of different concentrations, three achroodextrins, two erythrodextrins

and an amylodextrin. The first achroodextrin ($[\alpha]^{18}_D=162{\cdot}6^\circ$, R=58, mol. wt. 683) was probably identical with Grüter's maltodextrin γ (see this J., 1904, 875). The second ($[\alpha]_D=172{\cdot}8^\circ$, R=42, mol. wt. 1021) was probably identical with Ling and Baker's maltodextrin β (this J., 1897, 154) and Prior's achroodextrin III. (this J., 1900, 549). The third ($[\alpha]^{18}_D=179^\circ$, R=30, mol. wt. 1061) was identical with Ling and Baker's maltodextrin α. The erythrodextrin II. had $[\alpha]_D=193{\cdot}1^\circ$, R=10, mol. wt. 2080; erythrodextrin I. had $[\alpha]^{18}_D=196^\circ$, R=3·6, mol. wt. 3286; and the amylodextrin had $[\alpha]^{18}_D=196$, R=0·6—0·9, mol. wt. 13,630 (*cf.* Baker, this J., 1902, 1087).
—A. S.

Starch dextrins; Behaviour of —— to different yeasts. O. v. Friedrichs. Arkiv. för Kemi, Min. och. Geol., 1913, **5**, Nr. 3. Chem. Zentr., 1914, **1**, 762—763.

The behaviour of the starch dextrins isolated by the author (see preceding abstract) to different yeasts is shown in the following table, in which the numbers indicate roughly the relative amounts of fermentation in the different cases: where no figures appear, no fermentation occurred :—

Kind of yeast.	Achroodextrin, $[\alpha]_D=162{\cdot}6^\circ$.	Achroodextrin, $[\alpha]_D=172{\cdot}8^\circ$.	Achroodextrin, $[\alpha]_D=179^\circ$.	Erythrodextrin, $[\alpha]_D=193{\cdot}1^\circ$.	Erythrodextrin, $[\alpha]_D=196^\circ$.
Mucor Rouxii	3	3	3	2	2
Sacchsia suaveolens	3	3	2	?	?
Schizosaccharomyces Pombe	3	3	3	2	1
Yeast Sinner II...........	2	1	?	?	?
Saccharomyces thermantitonum	1	1	1	—	—
,, *fragilis*......	—	—	—	—	—
,, *exiguus*	?	?	—	—	—
,, *Marxianus* ..	—	—	—	—	—
,, *ellipsoideus II.*	—	—	—	—	—
,, *Pastorianus I.*	?	?	?	—	—

The achroodextrins were fermented more rapidly than the erythrodextrins. The behaviour to *Sacchsia suaveolens*, which, according to Lindner, decomposes β-methylglucoside, indicates the probable presence of β-linkages in the molecules of the dextrins. Yeasts which ferment α-methylglucoside had little action on the dextrins. The achroodextrin with $[\alpha]_D=162{\cdot}6^\circ$ was fermented to the extent of 21·2 per cent. in 60 hours by bottom fermentation beer yeast.—A. S.

Isomaltose; Synthetic ——. O. v. Friedrichs. Arkiv. för Kemi, Min. och Geol., 1913, **5**, Nr. 4. Chem. Zentr., 1914, **1**, 763—764.

A 25 per cent. solution of dextrose in concentrated hydrochloric acid was saturated with hydrochloric acid gas, allowed to stand for 24 hours at 10° C., the acid removed by treatment with lead carbonate and silver carbonate, and the solution neutralised with hydrochloric acid. Experiments with different yeasts and with emulsin indicated that the reaction product contained approximately: dextrose 68, isomaltose 18, maltose 8 and unknown polysaccharides 6 per cent. After removing the dextrose and maltose by fermentation with brewers' yeast, the isomaltose was finally obtained as a glassy solid insoluble in absolute alcohol: its rotatory power was $[\alpha]^{18}_D=72{\cdot}76^\circ$. It was not hydrolysed by the enzyme of kephir, but was more or less rapidly fermented by *Sacchsia suaveolens* and *Sacch. fragilis* and *exiguus*. When hydrolysed by emulsin, in most cases the optical rotation increased instead of diminishing, indicating that emulsin probably contains an enzyme capable of transforming isomaltose into maltose.—A. S.

Yeast cells; Plasmolysis of ——. H. Euler and B. Palm. Biochem. Zeits., 1914, **60**, 97—111.

Yeast is capable of growth in solutions possessing a decidedly higher osmotic pressure than that within the cells. On keeping bottom-fermentation beer yeast for 2 hours in a 25 per cent. solution of glycerol, 71 per cent. of the cells were found to have undergone plasmolysis (complete separation of the plasm from the cell wall); in a 10 per cent. solution, 17·1 per cent. of the cells were plasmolysed. When the yeast was kept in a nutrient solution containing 15 per cent. of glycerol, the cells became acclimatised to the osmotic pressure of the solution, probably owing to a change in the permeability of the cell membrane; the young cells were much more readily acclimatised than the old ones. The rate of plasmolysis of the yeast in a 25 per cent. solution of glycerol approximately followed a logarithmic curve. The yeast employed grew more rapidly in nutrient solutions containing sucrose than in presence of dextrose.—L. E.

Fermentation; Significance of water in the processes of alcoholic —— and respiration of plants. W. Palladin. Biochem. Zeits., 1914, **60**, 171—201.

The actions of zymase, carboxylase, and reductase were retarded or even arrested by partial or complete substitution of other solvents (glycerol, ethyleneglycol, formamide, pyridine, ethyl alcohol) for water. In absence of water, neither the enzymes of alcoholic fermentation, nor those concerned in the anaërobic stage of respiration, exerted any action. In regard to the rôle of water in plant respiration, it is concluded that during this process, water is assimilated, and that in the anaërobic oxidation of the carbon of the sugar (dextrose), half of the requisite oxygen is derived from the sugar and half from the assimilated water, the whole of the carbon dioxide liberated being formed anaërobically. The hydrogen set free from the water assimilated by higher plants combines with respiration pigments (hydrogen acceptors; cp. Wieland, this J., 1913, 1132) which result from the oxidation of chromogens (see this J., 1913, 955). The whole of the oxygen assimilated by the plant during respiration is used in oxidising this combined hydrogen, and the water formed is of aërobic origin; the withdrawal of this combined hydrogen and its oxidation is effected by the agency of peroxydases. Wieland's experiments on the biological conversion of alcohol into acetic acid (*loc. cit.*) indicate that the oxidation is effected by oxygen derived from water, and many, if not all, cases of formation of highly oxidised compounds by plants are also probably due to oxidation at the cost not of atmospheric oxygen but of water, the atmospheric oxygen assimilated at the same time acting only as a hydrogen-acceptor.—L. E.

Alcoholic fermentation. VI. The nature of the reduction of acetaldehyde by living yeast. S. Kostytschew. Z. physiol. Chem., 1914, **89**, 367—372. (See also this J., 1912, 553, 741; 1913, 207.)

In the conversion of acetaldehyde into alcohol by living yeast, equimolecular proportions of ethyl alcohol and acetic acid are produced (*e.g.*, 0·557 grm. of alcohol and 0·729 grm. of acetic acid from 2 grms. of aldehyde in a suspension of 150 grms. of pressed yeast in 1500 c.c. of water). This confirms the hypothesis of a Cannizaro transformation,

$$2CH_3CHO+H_2O=CH_3.CH_2OH+CH_3COOH,$$

first made with respect to alcoholic fermentation by the author, and since included in a scheme of fermentation suggested by Neuberg and Kerb (this J., 1914, 37) who assume that it takes place between acetaldehyde and methylglyoxal.—J. H. L.

Yeast; Rôle of glycogen in fermentation by living ——. H. Euler. Z. physiol. Chem., 1914, **89**, 337—344.

A study of the change in the glycogen-content of yeast during fermentation of dextrose solutions, afforded no definite support for the hypothesis that glycogen is an intermediate product of fermentation. On the contrary, the author concludes that the difference (Δ—C) between the percentage fall in rotatory power of the liquid and the percentage production of carbon dioxide (see this J., 1912, 246, 1142) cannot be due to the formation of glycogen. This difference is independent of the amount of yeast employed for fermentation and is almost the same whether the sugar fermented is dextrose, lævulose or mannose.—J. H. L.

Colloids; Influence of —— on microbiological processes. N. L. Söhngen. Chem. Weekblad, 1914, **11**, 42—59. Chem. Zentr., 1914, **1**, 691.

The fixation of nitrogen by azotobacter was promoted by addition of colloids (colloidal silica, alumina, iron oxide, crude humus) to the nutrient solution. The decomposition of starch by *Bac. ochraceus*, which secretes an amylolytic enzyme very similar to the amylase of malt, was increased by addition of colloidal silica and humus, but diminished by colloidal ferric oxide and alumina. The oxidation of alcohol by acetic bacteria was accelerated by addition of blood charcoal, peat, and filter-paper. Colloids had no perceptible influence on the action of denitrifying organisms. The oxidation of petroleum by micro-organisms was accelerated by blood charcoal and colloidal ferric oxide and silica. (See also this J., 1913, 762.)—A. S.

Brewing; Improved process of ——. A. R. Ling and H. B. Wooldridge. J. Inst. Brew., 1914, **20**, 81—102.

In the process described (Wooldridge, Eng. Pat. 16,744 of 1910) all the brewing operations between mashing and fermentation are conducted in one closed vessel, and the danger of infection associated with the use of wort coolers and refrigerators is thus eliminated. After the mashing process, which is conducted as usual, the wort is run into a closed copper vessel provided with a steam jacket or coil, a false bottom on which the hops can rest, a sparger and the necessary valves, manholes, etc. The cover of the vessel is preferably dome-shaped to avoid loss of wort by "fobbing" during boiling, and from the top of the dome an outlet pipe, which can be closed, communicates with an exhaust pump. The necessary quantity of hops having been introduced, together with sugar or caramel when these are used, the wort is boiled in this vessel under a pressure of 6 lb. per sq. in. In order to maintain the liquid in ebullition during this operation, a small amount of steam is allowed to blow off, but the pressure must be maintained by passing steam through the jacket or coil. After boiling has continued for 15—20 mins. the pressure is reduced to about ½ lb. per sq. in. and the vessel is connected with a vacuum pump, so that the wort is boiled, cooled and concentrated under continuously diminishing pressure. The cooling may be accelerated by passing cold water through the jacket or coil. When the wort has been cooled to the pitching temperature it is run directly into the fermentation vats, the hops remaining in the copper, on the false bottom. For several years the process has been carried out weekly, in a vessel of 10 barrels' capacity. In this case the time required for the cooling of the wort to 60° F. (15·5° C.) by vacuum concentration alone is 4—5 hours, but this period can be reduced to less than 2 hours by running cold water through the coils. Sufficient concentration of the wort to arrive at turning-out gravity and to allow for at least a 10 per cent. hop sparge, is attained within half an hour of starting the vacuum pump. The extraction of resins from the hops is quite as complete as in the ordinary copper, and possibly more complete, provided always that the wort is kept in ebullition as described above. The process is equally suitable for the preparation of running ales, pale ales and stouts. The worts "break" better than those boiled in the ordinary way, the beers rack equally bright, respond much more readily to finings, and are lighter in colour and quite as stable as those prepared in the usual way. They also possess more palate-fulness and appear to be characterised by a somewhat higher content of dextrin. The new process makes no provision for the so-called hot aeration of the wort, which, according to Pasteur, is necessary to ensure proper flocculation or "break." The authors consider, however, and cite H. T. Brown in support of their view (see this J., 1913, 442), that the main condition which determines flocculation of a hot wort is mechanical agitation between certain critical limits of temperature during its cooling, *viz.*, between 120° and 80° F. (49° and 27° C.), and this condition is fulfilled by the vacuum concentration in the new process. The satisfactory character of the beers prepared by the process confirms the authors' view.—J. H. L.

Stout; Use of secondary fermentation yeasts in the preparation of —— and its practical results. W. Rommel. Woch. Brau., 1914, **31**, 88—89.

According to Claussen, the secondary fermentation and characteristic flavour of English stouts is due to certain torulæ, *e.g.*, *Brettanomyces* (this J., 1906, 709). Experiments in the "Versuchs- und Lehranstalt fur Brauerei," Berlin, have confirmed the presence of a number of secondary yeasts (which in form and appearance, however, do not much resemble the better known torulæ) in English stout yeasts. The use of mixed cultures of some of these organisms in the preparation of stout on the practical scale has proved very successful. The organisms are first grown in sterile stout, and then transferred to a few litres of sterilised dark beer wort. After about 8 days, the wort is added to the stout to be treated, which has already been kept in cask for 2—4 months; it is best to add to the stout at the same time, 3—6 per cent. of hopped fresh wort from the cooler. The process has been adopted in a number of breweries in Germany and elsewhere.—L. E.

Ethyl and methyl alcohols; Detection of ——. J. J. Blanksma. Chem. Weekblad, 1913, **11**, 26—29. Chem. Zentr., 1914, **1**, 574.

The method is based on the reaction of sodium methoxide or ethoxide with 1.2.4-chlorodinitrobenzene:

$$C_6H_3Cl(NO_2)_2+C_2H_5ONa=C_6H_3(OC_2H_5)(NO_2)_2+NaCl.$$

The alcoholic liquid is neutralised with magnesia or calcium carbonate, treated with a small quantity of *p*-nitrophenylhydrazine, 25 c.c. are distilled with the aid of Hahn's fractionating device (this J., 1910, 300, 842) and the proportion of total alcohol calculated from the density of the distillate in order to ascertain the quantity of chlorodinitrobenzene required. The remainder of the liquid is brought to an alcohol concentration of 90—95 per cent. by repeated distillation, treated with 12 mgrms. of sodium and 100 mgrms. of chlorodinitrobenzene, warmed, diluted with water, and the precipitated 1.2.4-dinitrophenetol (m. pt. 85·2° C.) or 1.2.4-dinitroanisol (m. pt. 86·9° C.) separated, dried, and its composition determined by mixing with one of the pure components and determining the melting point of the mixture:—

Mols. per cent. of dinitroanisol.	M. pt. of mixture.	Mols. per cent. of dinitroanisol.	M. pt. of mixture.
	° C.		° C.
0	85·2	61·6	61·5
19·5	75	72·4	76
34·4	66·2	90·8	81·8
43·6	54	100	86·9
53·8	53		

—A. S.

Patents.

Amyl alcohol; Manufacture of ——. J. Scheckenbach. Fr. Pat. 462,472, Sept. 11, 1913. Under Int. Conv., Sept. 21, 1912.

Materials such as starch, carbohydrates, or cellulose, saccharified if necessary, are subjected to the action of bacteria resistant to heat (capable of withstanding a temperature of 100° C. for half an hour). Other organisms may first be destroyed by sterilising the material, and pure cultures of the bacteria resistant to heat may be added subsequently.—J. H. L.

Fermentation of juices from beetroots, molasses or grains in presence of sulphurous acid; Process of —— for augmenting the yield of alcohol. V. Martinand. Fr. Pat. 462,967, Sept. 24, 1913. Under Int. Conv., Oct. 28 and Nov. 25, 1912.

The saccharine juices are maintained aseptic before fermentation by addition of sulphurous, thiosulphuric or hydrosulphurous acid or compounds thereof. At the commencement of fermentation ketoses, aldoses or aldehydes are added to combine with the small quantity of free sulphurous acid, whereby it becomes innocuous towards yeast, whilst retaining its antiseptic power towards bacteria, or it may be oxidised to sulphuric acid by addition of peroxides, phenols or polyphenols. Instead of adding to the juice invert-sugar, glucose or other aldehydic or ketonic compounds (*e.g.*, some previously fermented juice), hydrolytic agents such as mineral acids or invertase which will produce aldoses or ketoses from the sucrose present, may be used (cp. this J., 1913, 921).—J. H. L.

Beer; Process of charging ——. O. M. Lamsens, Detroit, U.S.A. Eng. Pat. 11,189, May 13, 1913.

See Fr. Pat. 457,789 of 1913; this J., 1913, 1026.—T. F. B.

XIXa.—FOODS.

Milk; Determination and significance of ammonia in ——. J. Tillmans, A. Splittgerber, and H. Riffart. Z. Unters. Nahr. Genussm., 1914, 27, 59—76.

Fresh milk contains from 3 to 4 mgrms. of ammonia per litre and the quantity increases as the milk undergoes decomposition on keeping. The ammonia-content is not altered by heating, but substances containing ammonia are formed which are precipitated together with the ammonia when the latter is determined by the magnesium chloride precipitation method (see below); these substances do not affect the results obtained by the vacuum distillation process. When heated milk is kept for some time, the quantity of ammonia present increases. The addition of cow-dung to milk does not immediately increase the ammonia-content, but on keeping the quantity of ammonia increases more rapidly than it does in clean milk. Although the amount of ammonia in milk affords no evidence of the presence of added impure water in milk, a large quantity of ammonia indicates that the milk contains an undesirable number of bacteria and, on this account, the authors are of the opinion that any milk containing more than 10 mgrms. of ammonia per litre cannot be considered to be fresh milk. The ammonia may be determined by distilling the milk serum (obtained by treating the milk with mercuric chloride and hydrochloric acid or with basic lead acetate and sodium phosphate) under reduced pressure in the presence of magnesia, or by treating the serum with magnesium chloride and sodium phosphate with the addition of a slight excess of sodium hydroxide, collecting the magnesium ammonium phosphate formed, and separating the ammonia by distillation with magnesia.—W. P. S.

Application of the method of determining the difference in the melting points of glycerides and their fatty acids. Bömer. *See* XII.

Patents.

Milk cultures; Apparatus for preparing ——. F. O. Mott, P. Price, and E. W. Jodrey, London. Eng. Pat. 3138, Feb. 6, 1913.

For the cultivation of lactic acid bacteria in milk an apparatus is employed consisting of a receptacle divided into two compartments; one of these contains the heating liquid (warm water) and the other the milk. This receptacle is enclosed in a casing having heat-insulating walls. A small vessel is provided at the top of the hot-water container for the purpose of reserving a quantity of the milk culture with which the next batch of fresh milk introduced may be inoculated.—W. P. S.

Milk; Method of stabilising —— *and product thereof.* G. W. McMullen, Picton, Ontario, Canada. U.S. Pat. 1,086,385, Feb. 10, 1914.

Milk is subjected to a temperature below 140° F. (60° C.) in an atmosphere saturated with water vapour, the treatment being sufficiently prolonged to render stable the milk without coagulating its proteins. Afterwards the cream is separated, two stable products being obtained.—W. P. S.

Corn, grains, and the like; Process and apparatus for the treatment of ——. J. C. A. Pointe, Dijon, France. Eng. Pat. 8381, April 9, 1913.

The grains are steeped first in sodium chloride solution, then in water at a temperature not exceeding the coagulating point of albumin, and the softened grains are delivered on to a rotating drum covered with perforated sheets. The grains pass between rubber rollers and the perforated surface of the drum, the softer portions passing into the interior whilst the husk is carried off by an exterior perforated travelling band. The material collecting in the drum is transferred to a helical kneader surrounded by a heating jacket and the paste is mixed with other suitable substances, for use in bread-making, etc.—W. P. S.

Flour and grain products; Treatment of ——. B. I. Levin, Manchester. Eng. Pat. 9539, April 23, 1913.

Potassium chlorate, or potassium perchlorate, is incorporated with the flour; other salts may be added simultaneously or separately. It is stated that the presence of potassium chlorate or perchlorate in the flour imparts "a slight and desirable astringency" to the water used in making the dough.—W. P. S.

Fruit and vegetable dust; Manufacture of ——. H. Friedenthal, Berlin. Eng. Pat. 17,723, Aug. 1, 1913. Under Int. Conv., Aug. 14, 1912.

Fruit or vegetables, dried and ground to a powder, are subjected to a current of air whereby the finer particles are separated and removed. The remaining coarser particles are again ground and subjected to a current of air, and the process is repeated until the whole, with the exception of a small quantity of woody tissue, has been converted into a fine powder.—W. P. S.

Tomatoes; Manufacture of an extract, similar to meat extract, from ——. G. Frerichs. Ger. Pat. 269,813, March 23, 1913.

Tomato juice is fermented with yeast, and then concentrated in the usual way. Or, tomato pulp may be fermented, and the fermented juice separated and concentrated.—A. S.

Flour; Method of improving the condition of ——. J. A. Wesener, Chicago. Eng. Pat. 16,938, July 23, 1913.

See U.S. Pat. 1,071,977 of 1913; this J., 1913, 957.—T.F.B.

XIXb.—WATER PURIFICATION; SANITATION.

Permutite; Water softening by ——. A. Bahrdt. Chem. Ind., 1914, 37, 122—130.

Experience at Moscow in the use of permutite for removing the hardness of water, showed that sometimes there was more magnesium in the filtered water than in the untreated water, and that the reactions between the alkaline earth metals and the permutite were reversible; also that calcium could displace magnesium from the magnesium permutite previously formed. When water containing magnesia, but free from calcium, was used in a boiler, the magnesia was deposited as mud without any scale formation. The sodium content of boiler-feed water may be allowed to increase to 5 grms. per litre without harm. Although the permutite process is simple to work and supervise, it is not necessarily the most suitable for use in every case, for with very hard waters the cost of the installation is high and varies with the hardness, whereas in the soda-lime process the cost varies with the quantity of water to be treated. The author recommends a combination of the two processes, in which temporary hardness and most of the magnesium are first removed by lime, and then the permanent hardness, by a permutite filter. Thus a water was obtainable of very slight alkalinity and with but little dissolved solids.—J. H. J.

Water; Removal of manganese from ——. J. Tillmans and O. Heublein. Z. Unters. Nahr. Genussm., 1914, **27**, 253—264.

The removal of manganous salts from drinking water by filtering the latter through material containing manganese dioxide depends on the combination of the manganese dioxide with the manganous oxide with the formation of a mangano-manganite; the acid radical of the manganous salt is, at the same time, liberated. In practice, this acid is always carbon dioxide since, even when manganous sulphate is present, the sulphuric acid reacts with the bicarbonates contained in all natural waters and liberates an equivalent quantity of carbon dioxide.—W. P. S.

Duralumin; Use of the aluminium alloy —— for the manufacture of domestic and cooking utensils. G. Fendler and W. Stüber. Hygien. Rdsch., 1914, **24**, 59—62. Chem. Zentr., 1914, **1**, 693.

Duralumin did not yield recognisable traces of copper to boiling 6 per cent. acetic acid or 2 per cent. sodium chloride solution, or when subjected to the action of these solutions for 4 days at the ordinary temperature. Tea, coffee, cocoa, milk and soup when boiled for ½ hour, or allowed to stand for 4 days at the ordinary temperature, in contact with duralumin, had no greater action than tap water on the alloy.—A. S.

Detection and determination of nitrites by means of diphenylbenzidine. Marqueyrol and Muraour. *See* XXIII.

Patents.

Lime-water, or the like: Apparatus for preparing —— for use in softening or purifying water. F. A. Anderson, Newcastle-on-Tyne. Eng. Pat. 3504, Feb. 11, 1913.

Lime is slaked in a perforated receptacle arranged in a small tank; water is then admitted and is mixed with the slaked lime by stirrers. The "lime cream" is conducted to a tray situated at the top of a cylindrical vessel having a conical lower end, and passes down a tube reaching nearly to the bottom of the vessel. Water is also admitted to the vessel by means of a pipe discharging on to the tray, a regulated proportion of this water being caused to pass down a narrow pipe extending to the bottom of the vessel in order to stir up the lime settling at the bottom. The clear lime-water is withdrawn from the top of the vessel.—W. P. S.

Hardness of water; Compound for removing the ——. Vereinigte Seidenfärbereien C. A. Langenbeck and I. P. Lohe. Fr. Pat. 463,044, Sept. 27, 1913. Under Int. Conv., Jan. 9, 1913.

The compound is prepared by mixing 100 litres of a 10 per cent. solution of sodium phosphate with 1 litre of a solution of sodium silicate, and heating the mixture to boiling; the precipitate obtained is washed, dried at 65° C., ground and sifted.—J. H. J.

Boiler-feed water or other water; Method of and apparatus for treating —— particularly for preventing incrustation. H. Genssen and W. Wiebelitz, Rostock, Germany. Eng. Pat. 5949, March 10, 1913.

The water is passed through an electrolytic tank and then through a number of tubes made of an alloy of copper, zinc, and nickel; these tubes may be inclined so that the rate of flow of the water through them is about 13 feet per second.—W. P. S.

Oxygen; Removal of —— from water which is to be used for industrial and household purposes. R. Gans. Fr. Pat. 462,446, Sept. 11, 1913. Under Int. Conv., Sept. 11, 1912.

A reducing compound of sulphur, such as a sulphite, a thionate or a sulphide is added to the water, with or without a catalyst, for example a salt of iron or copper. When the treated water is caused to boil, it is claimed that there is no corrosion of the iron of the containing vessel by the disengagement of oxygen.—J. H. J.

Effluents; Treatment of ——. [*Recovery of grease.*] E. V. Chambers, T. C. Hammond, and G. G. Jarmain, Huddersfield. Eng. Pat. 5751, Mar. 8, 1913.

The effluent is treated with washed flue gases until all carbonates present are converted into bicarbonates, and is then aerated in an open tank. A greasy scum rises to the surface and is removed by travelling scrapers and delivered into tanks, where it is heated and treated with sulphuric acid in the usual way for the recovery of the grease. The liquid from which the scum has been removed is heated under reduced pressure, or is treated with lime or sodium hydroxide, to convert the bicarbonates into carbonates, and is then again suitable for washing wool, etc.—W. P. S.

Sludge from waste waters; Fermentation and mixing of ——. Comp. Claricite. Fr. Pat. 462,573, Nov. 25, 1912.

Air or other gas is passed under pressure continuously or discontinuously through blowers disposed in the sludge tank in any desired position. The process is applicable to sludge which is capable of undergoing bacterial action, and the complete fermentation of which is desired.—J. H. J.

Insecticide for plants and process of making the same. K. Fischer, Schweinfurt, Germany. U.S. Pat. 1,085,898, Feb. 3, 1914.

Schweinfurt green is mixed with ammonium carbonate and heated until the mixture assumes a blue colour; the ammonium-copper-arsenic compound formed is soluble in water.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Ipecacuanha; The alkaloids of ——. II. O. Keller. Arch. Pharm., 1913, **251**, 701—713. (See also this J., 1911, 1332.)

Methylemetine hydriodide was produced by gently warming emetine with methyl iodide and allowing the mixture to stand. The solid which separated was dissolved in methyl alcohol and precipitated by means of ether. When trimethylemetine hydriodide, or the corresponding quaternary base, was subjected to dry distillation above 300° C., trimethylamine and tetramethylammonium hydroxide were isolated from the basic products by means of their gold salts. Emetine and the quaternary trimethylemetine base were distilled in a current of hydrogen with zinc dust at about 340° C. Guaiacol, ammonia, trimethylamine and another base were produced, the latter giving a gold salt melting at 244°—248° C.
—F. Shdn.

Tetrahydrostrychnine; Some experiments with ——. (*Strychnine alkaloids. XXI.*) H. Leuchs. Ber., 1914, **47**, 536—540.

By the acetylation of tetrahydrostrychnine a colourless crystalline diacetyl derivative was obtained (m.pt. 142°—143° C.). This yielded on saponification with alcoholic potassium hydroxide a N-monoacetyl derivative, and on oxidation in acetone solution with potassium permanganate a small quantity of diacetylhexahydrostrychninonic acid was isolated in crystalline form (m.pt. about 140° C.).
—G. F. M.

Medicinal waters; Changes which take place in distilled —— and method of sterilising them to ensure stability. A. Juillet. Bull. scient. et ind. de la maison Roure-Bertrand fils 1913, [3], **8**, 22—34. Chem. Zentr., 1914, **1**, 569.

The diminution in the content of hydrocyanic acid in distilled cherry-laurel water on keeping is attributed to the action of micro-organisms; it is not observed in the case of sterile preparations. Sterile cherry-laurel, orange-blossom, lime-blossom and rose waters can be obtained by using apparatus which has been previously sterilised, or by sterilising the waters prepared in the usual way, *e.g.* by passing them through a Chamberland filter.—A. S.

Phenol bases. II. J. v. Braun. Ber., 1914, **47**, 492—505. (See this J., 1912, 1051.)

WITH regard to phenol bases homologous to hordenine, it appears that neither methylation of the nitrogen atom nor increasing the length of the side chain alters the principal pharmacological action. When benzoylphenylbutylamine was nitrated, the nitro group entered the *para* position. On reducing the nitro-product with tin and hydrochloric acid and splitting off the benzoyl group by careful heating with hydrochloric acid under pressure, [*d*-*p*-hydroxyphenyl]-butylamine, $OH{\cdot}C_6H_4{\cdot}(CH_2)_4{\cdot}NH_2$, was obtained. After crystalling from ether and light petroleum it melted at 106°—108° C. The hydrochloride melted at 194°—195° C., and the platinum double salt at 212° C. The pharmacological action of *m*-hydroxytetrahydroquinoline and *m*-hydroxydihydromethylketol was similar to that of hordenine but less pronounced. The former base, $C_9H_{11}ON$, was prepared by a series of reactions from 1-benzoyl-7-nitrotetrahydroquinoline. It boiled at 200°—202° C. at 16 mm., and melted at 94°—95° C.; the hydrochloride melted at 159° C. and the picrate at 174° C. Starting from *m*-nitro-N-benzoyldihydromethylketol, *m*-hydroxydihydromethylketol, $C_9H_{11}ON$, was prepared. This distilled at 186°—188° C. at 16 mm., and melted at 86°—87° C. after crystallising from ether and light petroleum. The hydrochloride melted at 165° C. and the picrate at 174° C. *p*-Aminobenzoylhordenine, $NH_2.C_6H_4.CO.O.C_6H_4.(CH_2)_2.N(CH_3)_2$, obtained by careful reduction of the *p*-nitrobenzoyl compound of hordenine (m pt. 89°—90° C.) melted at 156°—157° C. and yielded a picrate m.pt. 204°—205° C. It had an anæsthetic as well as a pronounced toxic action.—F. SHDN.

Galactite and α-ethylgalactoside; Identity of ——. E. Fischer. Ber., 1914, **47**, 456—459.

GALACTITE obtained from lupins by Ritthausen (Ber., 1896, **29**, 896) yielded ethyl alcohol and galactose when hydrolysed with dilute sulphuric acid at 100° C. The results obtained by elementary analysis agreed better with the formula $C_8H_{16}O_6$ (ethylgalactoside) than $C_9H_{18}O_7$, given by Ritthausen. The substance had [*α*]D = +185·2°—+186·2° in aqueous solution, melted at 141° C., and was undoubtedly identical with *α*-ethylgalactoside. It was probably formed in Ritthausen's experiments by the interaction of sulphuric acid, ethyl alcohol, and galactose. —F. SHDN.

Mustard seed; Oil content of black ——. *Localisation of certain alkaloids. The alkaloid of Vasconcellea hastata. Hydrocyanic acid content of cherry laurel leaves.* D. H. Wester. Ber. deutsch. Pharm. Ges., 1914, **24**, 123—131.

SMALL comparison cultures of black mustard showed that manuring with a mixture of ammonium sulphate, potassium nitrate and calcium phosphate produced plants with more flowers, and larger fruits containing more seeds. Seeds from plants grown on manured soil contained 1·18 and 0·89 per cent. of mustard oil, whilst seeds from plants grown on unmanured soil yielded 0·82 and 0·80 per cent. of oil.

A number of plants were examined microscopically for alkaloids. The latter were detected by the precipitate produced with a weak solution of iodine in potassium iodide, confirmed by proof of its solubility in an alcoholic solution of tartaric acid. The alkaloids were located in the parts named of the following plants: *Buxus sempervirens*, epidermis; *Ruta Graveolens*, epidermis of leaves, principal vein and leaf-stalk; *Carica Papaya*, leaf epidermis and to a lesser extent in the underlying parenchyma, epidermis of leaf-stalk; *Vasconcellea hastata*, epidermis of the leaf, principal vein, and leaf-stalk; also in the pith of the leaf-stalk, epidermis of flowering head, the fruit and the seeds (the alkaloid present in this plant is undoubtedly carpaine); *Pilocarpus Jaborandi*, epidermis of leaves; *Erythroxylon coca*, upper and lower epidermis of leaves, epidermis of leaf-stalk.

The hydrocyanic acid content of young cherry laurel leaves falls from 0·172 to 0·213 per cent. down to 0·110 to 0·159 per cent. as the season advances from the summer to the autumn. Third year leaves contain less hydrocyanic acid than first year leaves. Manuring with ammonium sulphate, potassium nitrate and sodium phosphate raises the hydrocyanic acid content.—F. SHDN.

Japanese mint oil. J. C. Umney. Perfum. and Essent. Oil Rec., 1914, **5**, 41.

"DEMENTHOLISED mint oil" is the trade name for Japanese peppermint oil from which the menthol has been partially removed by freezing; it contains from 45 up to sometimes even 55 per cent. of menthol (see this J., 1913, 306; 1914, 159). Recently much larger proportions of menthol have been extracted from the oil in Germany by a more efficient process, and since the residue from this treatment, very poor in menthol, is being sold as dementholised Japanese mint oil, the author draws attention to the need of purchasers insisting on a guaranteed percentage of menthol (not less than 45 per cent., free and combined).—A. S.

Ylang-ylang oil; Valuation of ——. J. C. Umney. Perfum. and Essent. Oil Rec., 1914, **5**, 37.

THE results of the examination of a large number of samples of ylang-ylang oil of different origin are shown in the following table:—

	Manila.	Bourbon.	Madagascar.	Mayotte.
Sp. gr. at 15° C.	0·927—0·969	0·964—0·967	0·961—0·981	0·947
Optical rotation	—38° to —51°	—39° to —41°	—30° to —42°	—48°
Refractive index at 20° C.	1·494—1·505	1·5130	1·5122	1·5070
Ester value	99·6—153·2	142·6—160·1	123·2—171·2	114·7
Non-volatile (after drying for 2 hours on water-bath	4·3—16·4%	25·1—40·3%	16·9—29·3%	14—19%

The characters of pure samples of the inferior cananga oil fell within the following limits: sp. gr. at 15° C., 0·910—0·940; optical rotation, —17° to —55°; refractive index at 20° C., 1·495—1·505; ester value, 45—100. (See also Bacon, this J., 1908, 875; 1909, 906)—A. S.

Essential oils from W. Africa. Roure-Bertrand fils. Bul. scient. et ind. de la maison Roure-Bertrand fils, 1913, [3], **8**, 16—22. Chem. Zentr., 1914, **1**, 541—542

THE leaves of *Popowia Capea*, a native of the Ivory Coast, yielded 0·59 per cent. of oil by steam distillation. About two-thirds of the oil was heavier and one-third lighter than water. The characters of the two portions and of the total oil are shown in the following table:—

	Total oil.	Heavy oil.	Light oil.
Sp. gr. at 20° C.	1·0042	1·0081	0·9960
Optical rotation	+76° 56′	+90° 54′	+51° 26′
,, ,, after acetylation	+13° 48′	+18° 4′	+ 5° 12′
Acid value	2·8	1·5	3·7
Saponif. value	166·1	192·3	123·2
,, ,, after acetylation	239·9	248·3	218·4

The total oil and the light oil dissolved in ½ vol. and the heavy oil in 1 vol. of 95 per cent., and all three were soluble in an equal volume of 80 per cent. alcohol; the solutions became turbid on standing. The oil contained esters and alcohols (one with an odour resembling that of cinnamyl alcohol) and about 6 per cent. of substances which combined with bisulphite.

Oil of the leaves of *Ocimum Canum*, Sims. At the ordinary temperature the oil (yield 0·65 per cent.) consisted of a white crystalline mass permeated by a slightly yellowish oil, and containing about 87 per cent. of methyl cinnamate. The characters were: sp. gr. 1·0330 at 32° C., optical rotation —2° 30′ at 30° C., acid value 0, saponif. value 301·4, soluble in 2½ vols. of 75 per cent. and gave a slightly turbid solution with 5½ vols. of 70 per cent. alcohol. The liquid portion of the oil appeared to consist of strongly lævo-rotatory hydrocarbons insoluble in 95 per cent. alcohol.

Oil of Ocimum gratissimum was a clear golden-yellow liquid containing 44 per cent. of thymol; sp. gr. 0·9105 at 15° C., optical rotation —0° 58′; it dissolved in 1·2 vols. of 80 per cent. alcohol but the solution became turbid on standing.—A. S.

Terpenes and essential oils. Part 116. *Reduction of carvoxime and eucarvoxime by means of palladium and hydrogen.* O. Wallach. Annalen, 1914, **403**, 73—96.

By reduction with hydrogen in presence of colloidal palladium, carvoxime was converted into a crystalline substance, m. pt. 66°—67° C., which proved to be a mixture of carvoxime and carvotanacetoxime. On allowing the reduction to proceed further, ammonia, carvacrylamine and tetrahydrocarvone were produced. Carvotanacetone took up hydrogen in the presence of palladium chloride nearly twice as fast as either *d* or *l*-dihydrocarvone. Treated in the same way eucarvoxime yielded a new crystalline tetrahydrocarvoxime, m. pt. 56°—57° C. This was converted into the semicarbazone, which could be resolved into two modifications melting at 161°—163° C. and 200°—201° C. The tetrahydroeucarvone regenerated from the semicarbazone boiled at 207° C., had the sp. gr. 0·906 at 20° C., and n_D=1·4553. It gave a nitroso compound m. pt. 104°—105° C. Partial reduction of eucarvoxime under similar conditions led to the formation of a new β-dihydroeucarvoxime, m. pt. 122°—123° C. β-Dihydroeucarvone prepared through the semicarbazone was a yellowish liquid boiling at 213°—214° C., sp. gr. 0·9325 at 21° C., n_D=1·4790. This ketone differed in its properties from the α-dihydroeucarvone obtained by a series of reactions from α-dihydroeucarveol which had been produced by reducing eucarvone with sodium.

—F. Shdn.

Phenylacetaldehyde: A new method of preparing —— and its derivatives. P. Jehl. Sealed Note No. 1374, dated Jan. 17, 1903. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1913, **83**, 805—806.

Sixteen grms. of methyl cinnamate are dissolved in 20 grms. of methyl alcohol and 10 grms. of bromine slowly added. The liquid solidifies on cooling. 12 grms. of caustic soda in 24 grms. of water are then added with agitation, the temperature not being allowed to rise above 40° C. After two hours sufficient sulphuric acid is added to neutralise all the alkali employed, whereupon the flocculent precipitate dissolves and an oil separates. After diluting to 250 c.c., 5·5 grms. of sodium carbonate are added, the phenylacetaldehyde distilled with steam and extracted from the distillate with ether. The yield is 75 per cent. of the theoretical. Nitrocinnamic acid treated in the same way gives an aldehyde smelling of cinnamon. The report explains the process by the formation first of the dibromide of the cinnamic ester, then its hydrolysis to phenylglyceric ester, which gives the lactone, and then, by loss of carbon dioxide, the phenylacetaldehyde. This method avoids the necessity of isolating any intermediate products, in which it differs from that of Erdmann described in Ger. Pats. 107,228 and 107,229 of Nov. 20, 1898 (see Eng. Pat. 5248 of 1899; this J., 1900, 273.)—J. B.

Isoprene; Transformation of dimethylallene into ——. Isomeric transformations of hydrocarbons with two double linkages. L. Kutscherow. J. Russ. Phys.-Chem. Ges., 1913, **45**, 1634—1654. Chem. Zentr., 1914, **1**, 753—754.

Dimethylallene $(CH_3)_2C:C:CH_2$, was obtained from trimethylbromoethylene, $(CH_3)_2C:CBr.CH_3$, with a yield of 45 per cent., by heating with alcoholic potassium hydroxide for 2½—3 hours at 135°—140° C. and 11—13 atmospheres pressure: to prevent oxidation it was distilled over in a current of nitrogen or carbon dioxide from the reaction product. When dimethylallene was heated with a 15—20 per cent. solution of quinoline hydrobromide in quinoline in a sealed tube for 10—12 hours at 130°—135° C., it was largely converted into isoprene (yield 50—55 per cent.), isopropylacetylene, $(CH_3)_2CH.C⋮CH$, being also formed. The crude isoprene was converted into a mixture of bromides, $C_5H_{11}Br$ and $C_5H_{10}Br_2$, by Ipatiew's method, the dimethyltrimethylene bromide separated by fractional distillation, and converted into isoprene (yield 75—80 per cent.) by heating to 150°—160° C. with powdered potassium hydroxide.—A. S.

Formic acid; Catalytic synthesis of —— under pressure. G. Bredig and S. R. Carter. Ber., 1914, **47**, 541—545.

By the action of hydrogen under high pressure on bicarbonates, or of a mixture of hydrogen and carbon dioxide under pressure on carbonates or other salts of weak acids, in the presence of a catalyst such as finely divided palladium, considerable quantities of formic acid can be produced. The following table gives a summary of the results obtained:—

Weight of palladium in grms.	200 c.c. solution used containing	Temperature	Pressures of gases in atmosphere.	Duration of experiment (hours).	Yield of formate, per cent.
		°C.			
0	10 grms. $KHCO_3$	70	H_2 60	24	0·6
1·5	10 grms. $KHCO_3$	70	H_2 60	23	74·7
1·5	10 grms. $KHCO_3$	95	H_2 50	26	66·3
1·5	0·4 grm. $CaCO_3$	70	H_2 20 + CO_2 20	4·5	100
1·5	9·5 grms. $Na_2B_4O_7.10H_2O$	70	H_2 30 + CO_2 30	16	21·7
1·5	10·6 grms. Na_2CO_3	70	H_2 60	7	0·4

—W. H. P.

Formic acid and benzene; Mutual solubility of ——, and the system: benzene-formic acid-water. A. J. Ewins. Chem. Soc. Trans., 1914, **105**, 350—364.

Pure formic acid was prepared by repeated fractionation in a distillation apparatus specially constructed to avoid contact of the vapour or liquid with cork, and recrystallisation by allowing the cooled acid to melt slowly under such conditions that the liquid portions could drain away, atmospheric moisture being always carefully excluded owing to the hygroscopic nature of the acid. The recrystallisation was continued till the melting point remained constant at 8·39° C. The critical solution temperature of the acid obtained in this way in pure benzene was 73·2° C., whilst that of the purest acid obtained by fractionation (b. pt. 100·5°—100·55° C., at 760 mm.) was 77° C. The sp. gr. of the pure acid was 1·2258—1·2260 at 18°/4° C. The benzene used was purified by recrystallisation and distillation over sodium in apparatus constructed entirely of glass. Varying weights of the two liquids were sealed in glass bulbs which were slowly heated, and the temperatures at which the liquids mixed were observed. The curve obtained by plotting solution temperatures against percentages of formic acid in the mixture showed a maximum critical solution temperature of 73·2° C., at a concentration of 48 per cent. of formic acid, the curve in the neighbourhood of the critical temperature being very flat. Determinations of the critical solution temperature of a given sample of formic acid in pure benzene gave a more trustworthy indication of the presence of water than determinations of the melting point. For instance 0·099 per cent. of water depressed the freezing point by 0·16° C., but raised the critical solution temperature from 73·2° to 75·8° C.—F. SHDN.

Formaldehyde and formaldehyde compounds; Detection of small quantities of —— by means of fuchsin-sulphurous acid-hydrochloric acid. H. Fincke. Z. Unters. Nahr. Genussm., 1914, **27**, 247—253.

THE reagent is prepared by dissolving 1 grm. of rosaniline hydrochloride in 500 c.c. of water, adding 25 grms. of crystallised sodium sulphite and 15 c.c. of hydrochloric acid (sp. gr. 1·124), and diluting the mixture to 1 litre. Ten c.c. of the liquid to be tested for formaldehyde are acidified with 2 c.c. of hydrochloric acid and 1 c.c. of the reagent is added; if formaldehyde is present, a red-violet colouration appears within a period varying from a few minutes to 12 hours. The presence of the hydrochloric acid prevents other aldehydes from giving a colouration with the reagent. It is advisable to apply the test directly to the solution or liquid without submitting the latter to a previous distillation; coloured liquids, such as wines, etc., may be treated with hydrochloric acid and animal charcoal before being tested. In the case of vegetable substances, there is a tendency for any formaldehyde present to enter into combination and escape detection; this combined formaldehyde is not liberated when the substance is treated with a mineral acid. Urea also combines with formaldehyde. Milk combines with formaldehyde to a small extent, but the greater part of the aldehyde is obtained when the milk is distilled with the addition of phosphoric acid. The test will detect the presence of 1 part of formaldehyde in about 400,000 parts of liquid. The reagent is also useful for the detection of hexamethylenetetramine when this has been decomposed by hydrochloric acid, but formaldehyde, or hexamethylenetetramine, when combined previously with sulphurous acid yields but little, if any, colouration with the reagent, even after treatment with hydrochloric acid.—W. P. S.

Chemical action of light. XXVIII. Autoxidations. VII. G. Ciamician and P. Silber. Atti R. Accad. dei Lincei, Roma, 1914, **23**, I., 113—119.

DIFFERENT organic acids in aqueous solution or in presence of water, in large flasks filled with oxygen were subjected to prolonged exposure to sunlight. Among the reaction products were detected: formic acid from acetic acid; formaldehyde and carbon dioxide from glycollic acid; carbon dioxide from oxalic acid (a 2 per cent. solution was completely oxidised in 7 months); carbon dioxide, formaldehyde and acetic acid from malonic acid; carbon dioxide, acetaldehyde, acetic and propionic acids and glyoxal from succinic acid; carbon dioxide, formaldehyde, and glyoxal from glyceric acid; carbon dioxide and formic acid from saccharic acid; salicylaldehyde, the dihydrocoumarin of Dyson, and salicylic acid from coumarin; formic acid, nonylic acid and other lower fatty acids, azelaic acid, and dihydroxystearic acid (m. pt. 133° C.) from oleic acid.—A. S.

Arsenic compounds; A new class of aliphatic ——. E. Fischer. Annalen, 1914, **403**, 106—117. (See also this J., 1913, 549.)

PURE behenolic acid was heated with 1¼ times its weight of arsenic trichloride to 140° C. for 6 hours. The excess of arsenic trichloride was removed by distillation under reduced pressure, or the mixture obtained was dissolved in ether and shaken with water. The product was converted into chloroarsinosobehenolic acid by dissolving the ethereal residue in strongly cooled $N/1$ potassium hydroxide solution. The alkaline salt was decomposed by hydrochloric acid and the oily arsenic compound taken up with ether. Prepared in this way the substance was mixed with some behenolic acid which could be removed to a great extent by cooling to —50° C. Chloroarsinosobehenolic acid undoubtedly contains the grouping —C(AsO) : CCl—. The neutral solution of the potassium salt can be kept for a few hours, but in the presence of excess of alkali, decomposition readily takes place with the production of potassium arsenite and behenolic acid. The free acid was methylated, treated with bromine and then with water, when the methyl ester of chlorobehenolarsinic acid was produced. The corresponding acid prepared through the strontium salt had the composition, $C_{23}H_{44}O_5AsCl$, and was fairly stable when heated with aqueous alkaline solutions.—F. SHDN.

PATENTS.

Tobacco leaves; Process of bleaching ——. T. Oelenheinz, Karlsruhe, Germany. U.S. Pat. 1,086,306, Feb. 3, 1914.

THE leaves are treated with water at a temperature of from 75° to 100° C., and then subjected to the action of an aqueous solution containing hydrogen peroxide and ammonia.—W. P. S.

Unsaturated aliphatic hydrocarbons; Treatment of mixtures containing ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 29,961, Dec. 30, 1912.

SEE Fr. Pat. 453,165 of 1913; this J., 1913, 767.—T. F. B.

Unsaturated aliphatic hydrocarbons; Separation of ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 29,962, Dec. 30, 1912.

SEE Fr. Pat. 453,164 of 1913; this J., 1913, 767.—T. F. B.

Monochlorhydrin; Production of ——. H. Wade, London. From Sprengstoffwerke R. Nahnsen und Co., A.-G. Hamburg, Germany. Eng. Pat. 15,093, June 30, 1913.

SEE Ger. Pat. 269,657 of 1912; this J., 1914, 278.—T. F. B.

Glycollic acid esters of 2-phenylquinoline-4-carboxylic acid. C. Zöllner, Charlottenburg, Assignor to Chem. Fab. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,086,881, Feb. 10, 1914.

SEE Eng. Pat. 16,483 of 1913; this J., 1913, 1128.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Colour photography. R. Fischer, Berlin-Steglitz, Germany. Eng. Pat. 2562, Jan. 31, 1913. Under Int. Conv., Feb. 6, 1912.

SEE Ger. Pat. 253,335 of 1912; this J., 1913, 47.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Acids from nitrocellulose manufacture; Source of error in the analysis of waste ——. T. Chandelon. Bull. Soc. Chim. Belg., 1914, **28**, 58—62.

BY either the method of Lunge or of Griesheimer (Chem. techn. Untersuchungsmethoden, Aufl. 6, I., 407) the nitric and nitrous acids are determined together; the nitrous acid is then found by titration with permanganate, and the nitric acid by difference. Oxalic acid which may be present in small quantities as an oxidation product of cellulose, would cause high values for nitrous acid and low values for nitric acid to be obtained. It would accumulate in repeatedly used baths, and render a correction necessary. It may be determined by neutralising the acid with ammonia, boiling until nitrous acid is destroyed, and titrating in the cold with permanganate.
—O. E. M.

Explosives in coal mines. Chem. Trade J., March 14, 1914 [T.R.]

AN amending Explosives in Coal Mines Order (No. 17 adding to the new list of permitted explosives certai explosives which have passed the Rotherham Test, has been issued by the Home Secretary. The names and composition of the new explosives are as follows :—

Ingredients	Parts by weight.	
	Not more than	Not less than
Bellite No. 4 (Lancashire Explosives Company, Ltd.)		
Nitrate of ammonium	68	64
Di-nitro-benzol	15	13
Chloride of sodium	21	19
Moisture	1	—
Faversham Powder No. 2 (Cotton Powder Company, Ltd.)		
Nitrate of ammonium	48·5	45·5
Nitrate of potassium	25	23
Tri-nitro-toluol	11	9
Chloride of ammonium	19·5	17·5
Moisture	1	—
Kent Powder (Cotton Powder Company, Ltd.)		
Nitro-glycerine	25	23
Nitrate of potassium	33·5	30·5
Wood-meal (dried at 100° C.)	31	28
Oxalate of ammonium	11	9
Moisture	6	3
Monarkite (Kyaoch-Arklow, Ltd.).		
Nitro-glycerine	13	11
Nitro-cotton	0·5	—
Nitrate of ammonium	51	48
Nitrate of sodium	8·5	6·5
Chloride of sodium	26	23
Starch	5	3
Mineral jelly	2·5	1·5
Moisture	2	0
Monobel No. 1 (Nobel's Explosive Company, Ltd).		
Nitro-glycerine	9·5	7·5
Nitrate of ammonium	70	66
Wood-meal (dried at 100° C.)	9	7
Chloride of sodium	16	14
Moisture	2	—
Swale Powder (Cotton Powder Company, Ltd.)		
Nitro-glycerine	20	18
Nitro-cotton	1·5	0·5
Tri-nitro-toluol	5	3
Perchlorate of potassium	38·5	36·5
Wood-meal (dried at 100° C.)	10	8
Oxalate of ammonium	29	27
Moisture	2	—

The usual stipulations are made in each case as to quality, markings, packing, etc. (See also this J., 1914. 103.)

Use of the "Mammoth-pump" in chemical industry. Meerbach. *See* I.

Patents.

Nitration of cellulose or its derivatives by means of nitric acid vapours. Deutsche Celluloidfabrik. Ger. Pat. 269,246, Feb. 10, 1912.

The cellulose is exposed to nitric acid vapour in a high vacuum at a temperature not exceeding 50° C. Uniform products of any desired nitrogen content can, it is stated, be obtained with quantitative yields.—A. S.

Explosive priming compositions. C. Claessen, Berlin. Eng. Pat. 6057, March 11, 1913.

See Fr. Pat. 455,369 of 1913 ; this J., 1913, 960.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Mechanical precipitation in the determination of sulphuric acid, sulphates, calcium and potassium. L. Ledoux. Bull. Soc. Chim. Belg., 1914, **28**, 51—52.

Potassium is first precipitated as the chloroplatinate. This is dissolved in 150 c.c. of water, 5 c.c. of concentrated hydrochloric acid, is added in the shaker and 0·5 grm. of chemically pure magnesium. The agitation is continued, with 20 c.c. of concentrated hydrochloric acid, for 30 minutes. The reduced platinum is filtered off, washed, and ignited.—O. E. M.

Nitrites ; Detection and determination of —— by means of diphenylbenzidine. Marqueyrol and H. Muraour. Bull. Soc. Chim., 1914, **15**, 186—197.

The authors confirm Wieland (Ber., 1913, **46**, 3296) that in the diphenylamine reaction for the detection of nitrites and other oxidising agents the first step in the production of the blue colour is the formation of diphenylbenzidine, which is then converted by the oxidising agent into a quinonoid derivative, the principal constituent of the blue solution. Diphenylbenzidine is hence a much more delicate reagent for nitrites than diphenylamine. It may be prepared by adding a solution of 8 grms. of diphenylamine in 20 c.c. of acetic acid to 50 c.c. of sulphuric acid (sp. gr. 1·842) previously diluted with 150 c.c. of water and cooled. To this mixture a solution of 4·7 grms. of sodium bichromate in 200 c.c. of water and 29 c.c. of sulphuric acid (1 : 4) is added, constant stirring being maintained for about five minutes. The liquid is added to 100 c.c. of sodium bisulphite solution (sp. gr. 1·231) and 400 c.c. of water and the mixture heated on a water-bath until the dark green precipitate first formed changes to a light brown. After cooling, the precipitate is filtered off, washed with water and alcohol, dried, and the diphenylbenzidine extracted with boiling toluene. A yield of about 60 per cent. of the theoretical is obtained. —J. A.

Copper, cobalt, and nickel ; A new reaction for ——. G. Malatesta and E. Di Nola. Boll. Chim. Farm., 1913, **52**, 819—823, 855—860. Chem. Zentr., 1914, **1**, 820—821.

The reaction of copper with 1.2-diaminoanthraquinone-3-sulphonic acid, described by Uhlenhuth (this J., 1910, 1085), is intensified by addition of ammonia, and the reagent can also be used for the detection of cobalt and nickel. All three metals give a blue colouration or precipitate with the reagent : on addition of excess of ammonia the blue colour is intensified in the case of copper and cobalt, but changed to red in the case of nickel. The colourations due to cobalt and copper may be distinguished by adding ammonium chloride : there is no change in the case of cobalt, but with copper, the colour changes to red. In presence of ammonia 0·0000002 grm. Co or 0·000005 grm. Ni in 1 c.c. can be detected.—A.S.

Nickel ; Colourimetric determination of ——. V. Lindt. Z. anal. Chem., 1914, **53**, 165—172.

The red colouration produced when an ammoniacal nickel solution is treated with potassium thiocarbonate solution is compared with that produced under similar conditions by a solution containing a known amount of nickel. The solution to be tested and the comparison solution are both diluted with dilute ammonia to a volume of 20 c.c. and treated with 0·5 c.c. of a 4 per cent. potassium thiocarbonate solution. The nickel-concentration should be between 0·017 and 0·012 mgrm. per c.c., and the thiocarbonate solution employed must be not more than 7 days old. Metals of the hydrogen sulphide group, and manganese, cobalt, and zinc should not be present. —W. P. S.

Selenium ; Gravimetric determination of ——. J. Meyer. Z. anal. Chem., 1914, **53**, 145—154.

Solutions containing selenium lose appreciable quantities of selenium dioxide by volatilisation when evaporated on the water-bath ; the loss is very considerable when free hydrochloric acid is present and may, by repeated evaporation of the solution with hydrochloric acid, amount to upwards of 80 per cent. of the weight of the selenium. The addition of potassium or sodium chloride does not prevent this loss. To determine selenium in a nitric acid solution by reduction to the metal, the solution should be neutralised with ammonia, then rendered slightly acid with hydrochloric acid, and the boiling solution treated with hydrazine hydroxide solution. The flask in which the reduction is carried out should be provided with safety-bulbs containing water in order to retain fine particles of selenium which escape from the flask with the evolved gases.—W. P. S.

Mineral waters; Determination of gaseous hydrocarbons dissolved in [natural] ——. E. Hauser. Comptes rend., 1914, **158**, 634—637.

A KNOWN volume (V) of the water is rendered alkaline, in order to fix the acid gases, and then shaken for 15 mins. with about the same volume (v) of air. A test for methane, etc., may then be made by applying the combustion method to the resulting gas; further, from Henry's law, the volume (x) of gaseous hydrocarbon originally dissolved in the volume (V) of water is given by

$$\frac{w^2}{w-w_1}$$

where w and w_1 represent the volumes of combustible gas obtained from the same specimen of water by two successive extractions with air in the manner already described. For waters containing very small amounts of dissolved hydrocarbons only one extraction is necessary. The maximum and minimum values of x are then given, respectively, by

$$\frac{wv}{v-\sqrt{wv}} \quad \text{and} \quad \frac{uv}{v-w}$$

The method has been applied to the determination of the solubility of methane in water, with results intermediate between those obtained by Bunsen and by Winkler.—J. R.

Determination of asphaltum in dark petroleums. Holde. *See* IIA.

Examination of iron gall inks. XII. Apparatus for extraction with ethyl acetate. Kempf. *See* IV.

Microscopical examination of paper. Kollmann. *See* V.

Nickel sulphide and cobalt sulphide. Thiel and Gessner. *See* VII.

Determination of titanium and vanadium in iron alloys. König. *See* X.

Assay of zinc by ferrocyanide methods. Report of Assay Sub-Committee of Australasian Inst. Min. Eng. *Determination of zinc by ferrocyanide in acid solutions.* Williams. *See* X.

Applications of the method of determining the difference in the melting points of glycerides and their fatty acids. Bömer. *See* XII.

Determination of free caustic alkali in commercial soda compounds and soaps by the barium chloride method. Kling and others. *See* XII.

Detection of ethyl and methyl alcohols. Blanksma. *See* XVIII.

Determination and significance of ammonia in milk. Tillmans and others. *See* XIXA.

Formaldehyde; Detection of small quantities of —— by means of fuchsin-sulphurous acid-hydrochloric acid. Fincke. *See* XX.

Source of error in the analysis of waste acids from nitrocellulose manufacture. Chandelon. *See* XXII.

PATENTS.

Density of gases: Apparatus for measuring the ——. K. Bomhard and G. König. Ger. Pat. 269,862, Feb. 23, 1913.

THE density is measured by determining the power required to set a device in rotation or other motion, in the gas; or two similar devices may be set in motion, one in the gas and the other in air, and the density of the gas calculated from the ratio of the power required in the two cases. In the apparatus described two tubular members are mounted loosely on a hollow shaft and are caused to revolve at the same time, one in the gas under examination and the other in air, by a cross-piece connected with the shaft and mounted so that it can rotate. According to the relative resistance offered by the gas under examination and by the air, one member revolves faster than the other, thus causing the cross-piece to rotate. The latter is connected with a pointer which moves over a scale.—A. S.

Method of treating [preparing for testing] Portland and similar cement. U.S. Pat. 1,085,977 *See* IX.

Trade Report.

Patent Law. Resolution of Association of Chambers of Commerce.

THE Association of Chambers of Commerce of the United Kingdom, at its annual meeting on March 11th, passed the following resolution, submitted by the Manchester Chamber:—

"That in view of the fact that Mr. Justice Parker's comments in Hatschek's case in the year 1909 as to the extent of the onus devolving upon any applicant who seeks revocation of a patent for non-working under Section 27 of the Patents and Designs Act, 1907, have deprived the section of its effectiveness, this association urges upon the Government to amend the rules in such terms as will place the burden of proof on the patentee, while adequately safeguarding him from vexatious and frivolous applications—an effect which was the object of those who drafted the Act of 1907; and that a deputation be appointed to interview the President of the Board of Trade on the subject."

Book Received.

CHEMISTRY AND ITS BORDERLAND. By ALFRED W. STEWART, D.Sc., Lecturer on Organic Chemistry in the Queen's University of Belfast, etc. Longmans, Green and Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. 1914. Price 5s. net.

THIS volume (8 by 5½ ins.) contains frontispiece, 306 pages of subject-matter, with 11 illustrations and 2 plates and an alphabetical index of subjects. The arrangement of the text is on the following lines:—I. The ramification of chemistry. II. The allies of chemistry among the sciences. III. Relations between Chemistry and Industry. IV. Immuno-chemistry and some kindred problems. V. Colloids and the ultra-microscope. VI. The work of the spectroscope. VII. Chemistry in space. VIII. The inert gases and their place among the elements. IX. Radium. X. Niton. XI. Transmutation. XII. Nature of the elements. XIII. Chemical problems of the present and future. XIV. Methods of chemical research. XV. Organisation of chemical research. Appendix A. Scheme for better utilisation of the research capacity of the country. B. Regulations for scholars, fellows, and grantees of the Carnegie Trust for the Universities of Scotland. C. Regulations for scholars and bursars of the Royal Commission for the Exhibition of 1851.

Journal of the Society of Chemical Industry.

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Official Notice.

HEAT TEST COMMITTEE.

The Departmental Committee of the Home Office, having submitted its first report, is now prepared to examine any supplementary test or tests which may be submitted, and asks if any members of this Society have any test which they are disposed to put forward. Up to the present, the Committee has received no suggestions in regard to a supplementary test of explosives containing nitroglycerin. Communications should be addressed to Major H. Coningham, Secretary of the Committee, Home Office, Whitehall, S.W.

London Section.

Meeting held at Burlington House, on Monday, March 2nd, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

BLASTING GELATINE: SOME NOTES AND THEORIES.

BY W. A. HARGREAVES, M.A., B.SC., B.C.E., F.I.C.,

Chief Inspector of Explosives, South Australia.

Blasting gelatine is the most powerful explosive in general use for mining purposes, and it forms a base for a general class of high explosives called "gelatines." It is officially defined as consisting of nitro-cotton, carefully washed and purified, combined with thoroughly purified nitroglycerin in such proportions that the whole shall be of such character and consistency as not to be liable to liquefaction or exudation, and with or without calcium or magnesium carbonate not exceeding two parts by weight in every 100 parts by weight of the finished explosive. In actual practice blasting gelatine consists only of nitroglycerin and nitro-cotton.

The ordinary process of manufacture is to add to nitro-cotton of known gelatinizing power the calculated quantity of nitroglycerin in the cold and mix roughly by hand: then after standing for some hours the temperature is raised and more complete incorporation is made, usually in a mixing machine. Since different lots of nitro-cotton may appear to have different gelatinizing powers and since the tendency to exudation of nitroglycerin from the finished blasting gelatine appears to depend in some way on the nitro-cotton, manufacturers have used varying percentages of nitro-cotton which have been as low as 7 per cent. and as high as 9 per cent. in blasting gelatines brought to South Australia.

Over 14 years' experience as an Inspector of Explosives has shown me that manufacturers, even the best, have not been able to arrive at a definite quantity of nitro-cotton to use, and also have not been certain of producing every time a blasting gelatine that will comply with the official definition given above. So far as nitroglycerin is concerned there has been no trouble for many years, owing to the fact that it is a homogeneous liquid and can be thoroughly washed free of all the impurities which are liable to make it unstable. In the case of nitro-cotton the difficulties are great, owing to its physical condition, and there is always the possibility of small impure particles remaining in the cotton surrounded and protected from the washing liquid by the colloidal matter of which the nitro-cotton is composed. The particles may be only the size of pin points, but they may serve as centres of instability, so that when the blasting gelatine is subsequently submitted to the "heat test" a low result may be obtained. It is quite a common experience in the case of blasting gelatine which has been condemned on account of low heat test to find that one portion of a cartridge will give a low test, when other parts of the same cartridge may pass the test. Apart from the difficulty of low test, which can be minimised by extra care in the preparation of the collodion cotton, there is also the more common trouble of exudation of nitroglycerin. This, indeed, may be regarded as the chief difficulty that manufacturers have to face, for no brand of blasting gelatine imported to Australia is free from liability to exude nitroglycerin when subjected to the trials of the voyage and the storage after arrival. Time after time shipments of blasting gelatine have to be condemned, wholly or in part, on account of this exudation.

It is evident, therefore, that either the true nature of blasting gelatine has not been understood or else the means of avoiding this defect have not been known. The usual and accepted remedy has been to increase the proportion of nitro-cotton, but this is open to several grave objections. In the first place, if the percentage of nitro-cotton is too high the risk of getting a low heat-test explosive is increased; secondly, the blasting gelatine is likely to be insensitive to detonation by the ordinary No. 6 detonator; thirdly, the balance of oxygen is likely to be upset, so that owing to the reduced percentage of nitroglycerin the generation of carbon monoxide is increased; and fourthly, the cost of the explosive is greatly increased. The last is by no means the least important from a manufacturer's point of view.

To find what is the real nature of blasting gelatine is, therefore, a problem of importance. Direct experiment and observation can teach much, but the difficulties of arriving at knowledge by pure deduction are very great, and one is perhaps justified in erecting on the foundation of a few observed facts an hypothesis which can be tested by subsequent observations and experiments. As my hypothesis has stood the test of four or five years' careful observation by those who are well qualified to form an opinion, I am now publishing it in the hope that it will help manufacturers to overcome some of their difficulties, and that it will be of assistance to those who, like myself, frequently have the grave responsibility of dealing with explosives which do not completely satisfy the official definition referred to above.

The theory is that blasting gelatine, instead of being a solution of a small quantity of nitro-cotton in a relatively large quantity of nitroglycerin, is in reality a colloidal solution of a certain quantity of nitroglycerin in nitro-cotton intimately mixed with some free ungelatinized nitroglycerin.

Bütschli has described a hydrogel as having a fine webbed micro-structure. This description has not been unanimously endorsed, but it conveys an idea of the mechanical condition of a jelly which explains some facts. Assuming for the present that a hydrogel has some such structure, it may take up in the meshes proportions of water which will vary with the size of the meshes, with the size of the threads or fibres constituting the structure, and possibly with the nature of these jelly "fibres," their power of adsorption, etc. It has been shown that silicic acid and other colloidal substances may be obtained with varying amounts of water of hydration. It may be assumed that a similar thing occurs in the case of blasting gelatine, where a solution of nitroglycerin in nitro-cotton or *vice versa* produces a gel having apparently the properties of a finely webbed structure, which adsorbs or otherwise entangles liquid nitroglycerin in the meshes. The proportion of nitroglycerin so held will vary chiefly with the size of the meshes and the size of the filaments or "fibres" of the gel. Hence blasting gelatines apparently similar in all outward respects may be obtained with varying ratios of nitro-cotton to nitroglycerin and they may lose varying quantities of nitroglycerin by exudation without making any apparent change in the appearance of the jelly. We have assumed that a portion of the nitroglycerin has "dissolved" in the nitro-cotton. As this is not quite the same thing as a chemical combination, the quantity of nitroglycerin so dissolved will be subject to some amount of variation without making much change in the appearance of the jelly. Assuming that a given quantity of a certain nitro-cotton can "dissolve" a certain quantity of nitroglycerin, but that owing to mode of manufacture it has dissolved or combined with a less quantity and formed a jelly of quite satisfactory appearance, then it is reasonable to suppose that the nitro-cotton will go on "dissolving" more nitroglycerin at a diminishing rate till it is saturated. The saturation point will probably depend on the temperature and on climatic conditions. There will, however, be a difference in this action from the original solution in so much as, while in the first instance nitroglycerin is in contact with nitro-cotton, now nitroglycerin is in contact with a jelly, and owing to the physical nature of this jelly in impeding contact of nitroglycerin with the nitro-cotton unacted upon or not saturated, the final stages of solution will be very slow, and only likely to occur on prolonged storage of the explosive. It seems reasonable to suppose that if a manufacturer has calculated a quantity of nitro-cotton based on its observed gelatinizing power as determined in the laboratory, but that owing to the fact of exudation having occurred with a similarly made blasting gelatine, he is tempted to increase the percentage of nitro-cotton, it may happen that on prolonged storage the whole or almost the whole of the free nitroglycerin goes into solution. The result is that there is produced a blasting gelatine which is either wholly a jelly or is such that the minute particles of free nitroglycerin in the interstices are far apart and separated by walls of jelly.

The second part of my hypothesis is that in blasting gelatine the explosive wave following detonation is transmitted by the free nitroglycerin, and only imperfectly or not at all by the jelly. If there is no free nitroglycerin or the particles of it are too far apart, the blasting gelatine becomes "insensitive." It has been shown by Dr. Comey and others that the nitroglycerin contained in 75 per cent. dynamite transmits the explosive wave at a velocity of between 6,000 and 7,000 metres per second, and nitroglycerin in an iron tube of large enough bore will give a rate of over 7,000 metres per second, but for a 10 per cent. dynamite the rate is only 2,000 metres per second, which is about the rate for gelignite unless the wave gets a greater impetus from the explosion of a dynamite primer. Even then the wave slows down as it progresses, inversely as the percentage of nitroglycerin in the gelignite. It appears therefore, that if the amount of free nitroglycerin in a gelatine is small, and the particles are far apart, or the connecting threads or surfaces have small sectional area, or if there is no free nitroglycerin at all, the rate becomes that of the jelly itself. From its physical nature it presents a buffer to the initial shock and deadens the subsequent wave. Hence the blasting gelatine in these circumstances is "insensitive" and inert and requires a stronger detonator or even a primer to get proper explosion. Such blasting gelatines are condemned by the miner and are dangerous to use on the score of misfires and incomplete detonation producing noxious gases, and are wasteful in failing to do the required work. The hypothesis therefore explains some facts which are common knowledge, namely that some gelatines on prolonged storage become insensitive, that the harder the jelly the more likely it is to be insensitive, and such gelatines require more powerful detonators than those in common use, and even then may not give satisfactory explosions.

Mr. C. Napier Hake, late Chief Inspector in Victoria, made the observation that if an insensitive gelatine is "remade" by mixing it with a large percentage of a fresh batch of gelatine, it will infect the mass and the re-made blasting gelatine will soon undergo change and become more or less insensitive. This is explained by the above hypothesis, since the free nitroglycerin of the new batch is added not to nitro-cotton but to an existing jelly having probably excess of nitro-cotton, and the initial trouble is perpetuated because the gelatinization at the time of re-making is thus interfered with, and goes on slowly during storage, and in the end the particles of free nitroglycerin are either separated too far apart or are absent altogether.

The theory assumes the fact of there being free nitroglycerin in blasting gelatine. It is difficult to get direct proof of this, but it is obvious that, since liquid nitroglycerin can be obtained from blasting gelatine merely by pressure, and also by means of blotting paper, the nitroglycerin is not chemically combined with the nitro-cotton. Neither could the nitroglycerin which is thus removed have been in solution, or in the collodial state. Hake has shown (this J., Sept. 15th, 1905) that porous wrappers will cause exudation even in the case of blasting gelatines that show no tendency to exude when in ordinary wrappers. The probability is therefore, that there is generally some nitroglycerin in the "free" or liquid state in the explosive. If the free nitroglycerin is near the limit, the tendency to exudation will be greater than when the nitroglycerin is smaller in quantity.

A sponge can take up a certain amount of water, but if the quantity is near the extreme limit, slight conditions such as gentle pressure will cause some of the water to drip out. By continued pressure all water, but that adsorbed on the fibres of the sponge, can be removed, and even then more water may be removed by contact with blotting paper. Further, the finer the meshes of a sponge and the greater the surface of the fibres, the greater the amount of water adsorbed, and the less is likely to drip out; so also with the blasting gelatine the more complete the jelly the less free nitroglycerin is likely to exude. On the hypothesis that the jelly itself is made by solution of some nitroglycerin in nitro-cotton, the more jelly formed in this way within limits, the more free nitroglycerin will be adsorbed, and the less enmeshed or entangled nitroglycerin there will be, and hence the less tendency to exudation. The particles or "fibres" of the jelly being "wetted" by nitroglycerin by surface action or capillary attraction, the free nitroglycerin can flow or move through the jelly. Suppose the surface of the cartridge is in contact with blotting paper or porous wrappers, the flow of nitroglycerin can continue in the meshes of the paper. The same sort of action occurs at the fold of the cartridge paper, where one thickness of paper overlaps the margin of the first fold, forming a small longitudinal tube attached along one side to the gelatine. The flow of free nitroglycerin is "attracted" by capillary action into this tube. Thus many gelatines show a line of free exuded nitroglycerin along the fold, and exudation does not proceed any further. Again, if this flow is checked by placing an impervious layer round the outside of the cartridge, exudation may be stopped or at any rate considerably reduced. Such a layer might be obtained by the action of a coagulant on the jelly of the cartridge. Absorbents of the nature of French chalk are apt to increase the capillary attraction, although they soak up the exuded nitroglycerin for a time, but substances like magnesium oxide appear to coagulate the jelly surface and thus check exudation. It may be possible to find a surface coagulant which will effectively stop exudation. Blasting gelatine exuding badly has been placed in fresh wrappers and in a few days' time exudation has been as bad as ever, but if the cartridges were dusted with light magnesium oxide before they were placed in fresh wrappers, in some instances there has been practically no furthe exudation for several weeks. In the meantime th explosives could be put to their legitimate use.

The theory of the constitution of blasting gelatine ha already rendered great assistance in elucidating th perplexing behaviour of gelatine explosives.

The extent of exudation that occurs at any given tim with different cartridges, possibly of the same lot of blastin gelatine, may vary considerably. To have ready means reference various scales have been proposed, but the on adopted in South Australia consists of five degrees bas on actual cartridges. According to the theory we assum that excessive exudation represents an unbalanc explosive, and that probably gelatinization has not be complete. Acting on this assumption, one favours lengt storage under observation of such an explosive, and frequently happens that when it is subsequently re-wrapp so as to remove the exuded nitroglycerin, no furth exudation takes place. It sometimes happens th re-wrapping is unnecessary, the exuded nitroglyce having been re-absorbed, possibly by capillary action, the stronger gel produced by the secondary gelatinizati On the other hand, if such material is placed in n wrappers at first there is every probability of furt exudation taking place before the secondary gelatinizat has made any progress, and the condition of the explosive may be soon as bad as it was at first. In these circumstanes re-wrapping is not recommended unless the material is to be consumed at once.

In his report on the "Composition of the Gases caused by blasting in mines" (see this J., 1911, 447, 128t), E. A. Mann has drawn attention to the fact that unaltered fragments of nitro-cotton can be seen in blasting gelatine. He further says that the general experience in Western Australia is that an explosive which, on landing from Europe, is soft and plastic, will after a lengthy storage in a magazine become stiff and more rigid to the touch, while the common experience is that such explosives explode only under excessive stimulus, and are very apt to leave unexploded portions in the bottom of the bore holes in mines. This is also the experience in South Australia. I suggested to Mr. Mann that the theory outlined above would explain these phenomena, and his study of the question led him to believe that it was a "rational and convincing explanation for some of the problems involved."

S. Soddy in "Arms and Explosives" (February, 1912), referring to the decrease of sensitiveness of gelatines on prolonged storage, gives the results of lead block tests, which showed that blasting gelatine with a No. 6 detonator which gave a volume of 570 to 600 c.c. when first tested, at the end of twelve months' storage gave only from 420 to 430 c.c. On repeating the experiments with No. 7 detonators all gave normal results. He sees in the theory I have suggested an explanation of these results. It seems to me that Soddy's results might be explained as follows. Assuming that during manufacture the usual plan was followed, by which a preliminary mixing of the nitro-cotton and nitroglycerin would be made, an imperfect gel would be produced. On standing overnight the excess of nitroglycerin would slowly act on the already formed gel and some enclosed nitro-cotton, and at the final mixing more action would take place, but in would not be so complete as it would have been, had the nitroglycerin been thoroughly incorporated with the nitro-cotton in the first instance. The reaction would continue slowly when the explosive was put in store for twelve months. If enough nitro-cotton had been used to prevent exudation at the time the explosive was sent out from the factory, it would in reality have too much nitro-cotton and consequently all the free nitroglycerin would be turned to the gel form, or at any rate the remaining particles of free nitroglycerin in the "meshes" of the gel would be too small in number or too far apart to transmit the explosive wave set up by the No. 6 detonator at sufficient velocity to get complete detonation. A No. 7 detonator, on the other hand, might give sufficient stimulus to reach from one particle of nitroglycerin to another and so normal results would be obtained.

In this connection it is interesting to revert to Comey's experiments on rate of detonation. In determining the rate with nitroglycerin, when ¼ inch bore glass tubes were used for holding the nitroglycerin, the explosive wave was not transmitted. The column could only be detonated for a few inches from the detonator. The velocity of detonation when ¾ inch glass tubes were used was only 654 metres per second, while with 1 inch light sheet iron tubes two kinds of explosive wave were obtained, one with a velocity of only 1451 metres, while the other was about 7690 metres, which is comparable with the rate given by nitroglycerin in No. 1 dynamite. With wrought iron tubes of 1¼ inch diameter a 24 grain cap gave a velocity of 8527 metres while a 12 grain cap gave only 2019 metres. Where paper tubes were used the rate was lower probably on account of the smaller confinement of the nitroglycerin charge. Applying the theory, we see that if the particles of free nitroglycerin are in continuous "threads" or surfaces sufficiently large in diameter or area and thickness, the explosive wave should be transmitted in blasting gelatine at a rate which would be directly comparable with that of nitroglycerin. If, however, the surfaces are thinner or the threads finer, the rate would be less, and may be interfered with and brought as it were to a lower octave of vibration by the buffer action of the gel. Two or more separate rates of detonation may be obtained.

When testing explosives imported into Western Australia, Mann found that some blasting gelatines gave rates of from 3759 to 4225, averaging 4063 metres per second, whereas others gave from 2400 to 2553, averaging 2457. The last figures suggest that very little free nitroglycerin remained in these blasting gelatines, or that such particles as remained were not in contact, but were effectively screened by the intervening gel.

The late W. R. Quinan was of opinion that a maximum rate of detonation implied a perfect detonation, whereas an abnormally low rate denoted insensitiveness and probably incomplete metamorphosis. In America generally, according to Soddy, a sharp detonation is preferred, which means a high rate of detonation. If one desires a lower rate one uses some other explosive than blasting gelatine. It is, therefore, now suggested that the blasting gelatine which has the most free nitroglycerin, has the greatest rate of detonation, and that it is not the extra gelatinization which takes place on storage that makes a blasting gelatine inert, but the lack of free nitroglycerin. Consequently that blasting gelatine is the best which—

(1) Has the most free nitroglycerin, provided that the free nitroglycerin is so held by the gel (by adsorption or otherwise) that the finished explosive is free from all liability to liquefaction or exudation; and

(2) Has all its nitro-cotton completely gelatinized, so that there will not be any reduction of the amount of free nitro-glycerin on storage by secondary gelatinization.

The question now arises as to what use the manufacturer can make of the hypothesis. In my opinion it should at least serve as the basis of carefully conducted experiments. In 1909 and 1910 I suggested to the representatives of several manufacturers that experiments should be carried out by *thoroughly* mixing in the cold, nitro-cotton with quantities of nitroglycerin much short of the total required to form ordinary blasting gelatine, and then after gelatinization, the further quantities of nitroglycerin to make up the total should be mixed with the existing jelly. I also suggested that the *thoroughness* of the preliminary mixing should be varied. My own experiments with wheat flour and water indicated that it is one thing to add water to flour, and a different thing to add water to a dough. Hence in determining the water absorption of flour it is necessary by preliminary trials to ascertain approximately the amount of water required to make a standard dough, and then to make the actual determination by adding the whole of the water to the flour in one operation. This is not the usual method, which is to add some water and make a dough; if this dough is not the right consistency more water is added little by little until it is right. This gives a fallacious result because the small lots of water being added in this way are added to a dough, and remain as free water in the interstices of the dough for a considerable time. Where the water is added all at once every particle of flour gets its quotum of water before the gel is formed. From analogy with the action of flour and water, assuming the presence of free (ungelatinized) nitroglycerin in blasting gelatine, the remedy for exudation is therefore not to add more nitro-cotton, but to get a larger amount of gelatinization during the initial mixing of the nitro-cotton and nitroglycerin. To obtain this result more thoroughness is necessary in the preliminary mixing, and also immediate and thorough working in a machine is required. I suggest that the remedy for insensitiveness is to reduce the quantity of nitro-cotton and make up for this by more complete mixing, especially in the preliminary stage. One of the manufacturers took the matter up with enthusiasm. There had been trouble on account of exudation. My suggestions respecting thoroughness of the initial mixing were acted upon and the result was a surprising success. It was not known here that any change in the method of manufacture had been made, but the improved quality of the blasting gelatine excited questions and the reply was that "most of the success of the last shipment is due to modified methods of mixing during manufacture, the benefits of which were first brought to our notice by you."

Another manufacturing company discussed the question with me in 1910, and subsequently made a trial of the new direct method of obtaining gelatinization. This year the company reports that "at one time it was not thought possible to manufacture a satisfactory gelatine without overnight standing and final hot gelatinization, but we have been able for some little time to obtain exceedingly good results by direct gelatinization after mixing nitroglycerin with the nitro-cotton."

It is still too early to say that this modification in manufacture will cure the exudation trouble, but the results so far obtained are very encouraging.

Discussion.

Mr. G. W. **Macdonald** said that most manufacturers had probably tried experiments on the lines suggested by Mr. Hargreaves, but in the speaker's opinion it was very difficult to arrive at any definite conclusion as to the influence of the temperature of gelatinisation and the time of incorporation on the liability of exudation. Pressure on the cartridges, increase of temperature, rapid alterations of temperature, humidity and previous freezing of the cartridge were all factors likely to produce exudation. As to the theory of free nitroglycerin, his own experience was that cartridges which were freely exuding had not a higher velocity of detonation than cartridges from the same batch which were not exuding, so he could not agree with the author's view that the increase in the collodion cotton content was associated with a fall in the heat test.

Dr. E. **Weiskopf** held that the sensitiveness of blasting gelatin was largely controlled by the physical state of the explosive. A blasting gelatin which contained a small amount of nitro-cotton was less elastic than blasting gelatin which contained a large amount of collodion cotton, and the propagation of the explosive wave in a material like blasting gelatin was very greatly counteracted by the elasticity of the substance itself. He had proved that point by adding to blasting gelatin which contained say 7 per cent. of collodion cotton (perhaps the lowest practical limit to which it could be made), a comparatively small amount of camphor, which had no other effect than making the substance more elastic, more horny, and less suitable to transmit the initial explosion, the result was that the blasting cartridge made of such a mixture was rendered so inert that it would only partly explode when it was detonated. He thought the question of the "liquid nitroglycerin" could be left out of account, because it was well recognised that nitroglycerin itself was insensitive to transmit explosion, so he thought it was quite contrary to accepted ideas that it was necessary to have "liquid nitro-glycerin" present in blasting gelatin in order to have a sensitive explosive. He thought one point had been overlooked in the question of the correct proportion of collodion cotton in blasting gelatin, that was in connection with the fact that nitroglycerin in exploding yielded a certain amount of free oxygen, whilst collodion cotton in exploding left a certain amount of carbon monoxide. The endeavour of every explosive manufacturer should be to produce an explosive which on detonation yielded no carbon monoxide or other noxious gases. Blasting gelatin, which was almost perfect from a physical point of view, consisting of about 8 per cent. of collodion cotton and 92 per cent. of nitroglycerin—yielded explosion gases which contained no free carbon monoxide, but a small excess of free oxygen.

The **Chairman** agreed with the last speaker in regard to the relation between the amount of the nitro-cotton and nitroglycerin.

Obituary.

ROBERT KENNEDY DUNCAN.

Robert Kennedy Duncan was born in Canada in 1868, and educated in the University of Toronto. He was appointed in 1905 to the chair of Chemistry in the Washington and Jefferson College, and in 1906 he became professor of industrial chemistry in the University of Kansas, where he initiated a promising scheme of industrial fellowships and bursaries. Both at Kansas and Pittsburgh the success of the scheme has been remarkable. Professor Duncan gave a full account of it in 1909 in the course of a "Discussion on Industrial Fellowships" before the London Section of this Society (see this Journal, 1909, 685—690). In 1910 he was appointed professor of industrial chemistry in the University of Pittsburgh and subsequently to the directorship of the Mellon Institute of Industrial Research.

Professor Duncan edited the "New Science Series," and was the author of "The Chemistry of Commerce," "The New Knowledge," and other works. He concludes his chapter in "The Chemistry of Commerce" on Industrial Fellowships with the following words :—"Everywhere, wherever man deals with material, there are unsolved, important manufacturing problems, best solved by combining the practical knowledge and large facilities of the factory with the new and special knowledge of the Universities, and with the aid of young men who will find therein the opportunity for success. An Industrial Fellowship affords to a young man every incentive to lay his hands on Science and make it serve the practical needs of the human race."

Professor Duncan died at Pittsburgh, Pa., Feb. 18, 1914.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

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I.—GENERAL PLANT; MACHINERY.

Aluminium apparatus ; Destruction of —— by the galvano-catalytic action of copper. P. Pikos. Z. angew. Chem., 1914, **27**, 152.

Many liquids, especially conductors of the second class, such as glycerin, formaldehyde, methyl, ethyl and allyl alcohols, acetone, acetic acid, tannin solutions, etc., whilst having no action on pure aluminium, even at high temperatures, rapidly attack that metal if small quantities of copper salts be present : copper, or a mixture of copper and copper oxide is deposited, and exerts catalytic action, resulting in the evolution of hydrogen and formation of aluminium hydroxide.—A. S.

Patents.

Measuring vapours, gases and liquids ; Apparatus for —— H. M. Liese, Hamburg. Eng. Pat. 2597, Jan. 31, 1913.

In the apparatus described in Eng. Pat. 27,467 of 191 (this J., 1912, 761) a slide-valve is provided which put the conduit successively in connection with a series measuring openings, and the expansion chamber is loade so that by adjustment of the loading the apparatus will still measure in whichever direction the fluid passes through it.—W. H. C.

Filtering or dehydrating machines. C. Robinson, Mount Vernon, N.Y. Eng. Pat. 2806, Feb. 3, 1913.

In rotatable drum filters in which arc-shaped filter elements are attached to the surface of the drum, two revoluble hollow rings, having suitable valves, are provided to put the filter elements alternately in connection with the apparatus producing suction and pressure. The pulp or liquid is fed on to the surface of the drum at the highest point, the filter elements in that position being under suction. As the drum rotates the cake formed is washed by immersion in water, and is then stripped from the drum by a roller scraper, the vacuum being at the same time shut off and pressure applied. The surface of the filter is then washed with water before it returns to the highest position to receive a fresh charge.—W. H. C.

Pressure-filter. E. J. Sweetland, Montclair, N.J. U.S. Pat. 1,083,305, Jan. 6, 1914.

A number of flat circular filter elements, covered with filter-cloth, are arranged within a horizontal cylindrical casing, the interiors of the elements being connected with a common discharge pipe at the upper side of the cylinder. The casing is formed of two longitudinal halves with flanges, bolt holes, slots, and swing bolts by which they are fastened together. The pulp is forced into the closed casing under pressure and the filtrate passes through the filter-cloth into the interior of the elements and escapes through the discharge pipe. The opening and closing of the casing is effected by a lever worked by a hydraulic cylinder and ram and the bolts are swung into and out of position and tightened up by a series of levers and cams operated by a second hydraulic cylinder. When the press is full the cakes are washed with water introduced through the inlet pipe and then the cylindrical casing is opened and the cakes are forced off the filter elements by air or water under pressure delivered into the interior of the elements.—W. H. C.

Raising water and other liquids: Apparatus for ——. P. H. J. Paindavoine, Paris. Eng. Pat. 3295, Feb. 8, 1913.

The apparatus consists of two hollow reciprocating pistons working side by side immersed in water in a casing. By means of ports in the hollow pistons, closed by discs which slide along the piston rods, the two pistons are balanced.—W. H. C.

Raising or forcing liquids; Methods of —— and apparatus therefor. B. C. Joy, London. Eng. Pat. 3653, Feb. 12, 1913.

The descent of a column of liquid in a long pipe under the action of gravity, first causes steam or other condensable vapour to enter a chamber and then operates a spray in the chamber which causes the steam or vapour to be condensed, whereby a vacuum is produced and the flow of liquid reversed. The stoppage of the motion of the column of liquid when it reaches the end of the pipe raises the pressure sufficiently to drive some of the liquid past a delivery valve.—W. H. C.

Separating solid matter from smoke; Apparatus for ——. J. D. Jackson, Kensington, Victoria, Australia. Eng. Pat. 4636, Feb. 24, 1913. Under Int. Conv., July 24, 1912.

The smoke issues from the flue into a vertical chamber where it is washed by a series of water sprays; an adjustable baffle-plate is disposed above the end of the flue. The washing liquid flows into a tank at a lower level provided with baffle-plates to separate the solid particles, which are drawn off.—W. H. C.

Firing furnaces and kilns with pulverised fuel. E. Brunner, Manchester. Eng. Pat. 7267, March 27, 1913.

The pulverised fuel is fed into the furnace without admixture with air by several screw conveyors of small diameter and is projected into a powerful current of highly heated air which is delivered vertically upwards from ports in the floor of the furnace and which keeps the pulverised fuel in suspension until it is consumed.—W. H. C.

Liquids and gases; Apparatus for effecting intimate contact of ——. Kirkham, Hulett and Chandler, Ltd., and S. Hersey, London, and E. W. Blake, Thornton Heath. Eng. Pat 7958, April 4, 1913.

In the gas washing apparatus described in Eng. Pat. 18,129 of 1908 (this J., 1909, 873) the curved pipe scoops are perforated or slotted on their outer sides and provided with wings or vanes so that a continuous body of spray is provided for the gas to pass through between the surface of the liquid and the level of the upper edge of the trays.—W. H. C.

Condensers for distilling apparatus and the like. R. Oekel, Bonn, Germany. Eng. Pat. 8110, April 7, 1913.

Two sets of coils, one of larger diameter than the other, are arranged in the same cooling tank. Condensation takes place first in the larger coils and is completed in the smaller coils. (Reference is directed to Eng. Pats. 1939 of 1886 and 18,667 of 1905; this J., 1886, 384; 1906, 188). —W. H. C.

Distilling apparatus. C. E. Molesworth, Portland, Oreg., Assignor to The Refrigerator Corporation, New York. U.S. Pat. 1,086,684, Feb. 10, 1914.

A cylindrical insulated distillate container is located in the upper part of the still and is provided with a condensing coil. The vapours from the still pass first through a mass of inorganic fibrous material the temperature of which is controlled by a cooling coil and which is contained in a chamber mounted above the distillate container.—W. H. C.

Distilling apparatus. P. Publicker, Philadelphia, Pa. U.S. Pat. 1,087,907, Feb. 17, 1914.

The apparatus comprises a kettle in which the liquid is distilled, a condenser at a higher level, connected at the upper end by a pipe with the still and at the lower end by a pipe with a tank situated at a lower level than the still, a second condenser connected with the tank by a pipe which enters the condenser at its lower end in the form of a goose-neck, a second tank connected by a pipe with the lower end of the second condenser, a third tank connected by a pipe with the upper end of this condenser, a suction pump connected with the last-mentioned pipe, a water column and a discharge pipe from the pump projecting below the surface of the water-column.—J. F. B.

Distilling crude oil and other substances; Apparatus for continuously ——. C. B. Forward, Urbana, Ohio. U.S. Pat. 1,088,693, March 3, 1914.

The distillation products are fractionated in a system of vertical condensers of different lengths, each formed of a top and a bottom section provided with inlet and outlet connections and of one or more interchangeable intermediate sections.—W. H. C.

Column apparatus for distillation, absorption, or the like. K. Kubierschky. Ger. Pat. 269,995, May 16, 1913. Addition to Ger. Pat. 194,567.

The apparatus described in the chief patent was designed for vapours which became specifically heavier after treatment with the washing liquid, but it can also be used for gases or vapours which become specifically lighter.—A. S.

Drying machines with rotary heating devices. R. Simon and Sons, Ltd., R., W. G. and F. R. Simon, Basford, Notts. Eng. Pat. 12,237, May 26, 1913.

Two sets of rotary tubular heating systems are so arranged, end on, in the trough of the drying machine that they may be driven independently.—W. H. C.

Dryer. H. Wilson, Assignor to Pacific Kelp Co., San Francisco, Cal. U.S. Pat. 1,087,478, Feb. 17, 1914.

Stationary hoppers are arranged one above the other inside a cylindrical casing, which carries an exhaust pipe at its upper end. A hollow, vertical shaft extends centrally through the casing and carries a series of flat discs, one above the other, one disc being provided near the top of each hopper. An inner shaft is mounted inside the hollow shaft and carries at its upper end a ventilating fan, which creates an upward current of air through the casing, when operated by gearing situated at the lower end of the inner shaft.—O. R.

Drying machine; Centrifugal ——. A. Cassirer, Munich, Germany. U.S. Pat. 1,087,528, Feb. 17, 1914.

A perforated receptacle is rotated within a casing and is provided at its upper open end with an annular flange projecting inwards. A current of air enters the casing through a number of air inlets in the top, is deflected into the perforated receptacle by cups mounted on the annular flange, and leaves through a central outlet at the bottom. —A. S.

Drying apparatus. C. A. Wenborne, Chicago, Ill., Assignor to The Wenborne-Karpen Dryer Co. U.S. Pat. 1,087,563, Feb. 17, 1914.

A drying chamber is provided with an air conduit down one side and along the floor. Immediately above the lower air duct there are disposed in the order given, a screen, a heating device, and a support for the material to be dried, all extending across the chamber. The screen and the heating device have distributed throughout their area a number of air passages, those in the screen following a tortuous course. Air rises from the lower duct through the screen and heating device and over the material to be dried and passes from the drying chamber through an opening near the top into the air duct at the side, where it passes through a condenser to remove moisture, descends to the lower air duct and again rises through the drying chamber.—A. S.

Mixer, retort and digester. O. T. Zinkeisen, New York, and R. N. Riddle, Rahway, N.J. U.S. Pat. 1,086,432, Feb. 10, 1914.

A drum is rotatably mounted on hollow axial trunnions through which the material is fed into and discharged from the apparatus. The axial pipes terminate immediately after their entry into the chamber, and a diverging spreader is supported from the end wall of the drum in front of but distinct from the inlet pipe. In front of the outlet pipe a screen is similarly supported, which allows the escape of fluids but not solids from the drum, the interior of which is left clear.—W. H. C.

Separating liquids and solids and washing or otherwise treating the separated solids; Process of ——. J. J. Berrigan, Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm, Sweden. U.S. Pat. 1,087,094, Feb. 10, 1914.

The solids are separated from the liquid by a centrifugal machine and are then passed successively through one or more centrifugal machines which contain the washing liquid or liquids.—W. H. C.

Gas furnaces; Regenerative ——. F. K. Siemens. Fr. Pat. 461,938, Aug. 27, 1913.

Improvements in the gas furnace described in the second addition to Fr. Pat. 409,650 (see Eng. Pat. 10,824 of 1912; this J., 1912, 972; also Eng. Pat. 23,534 of 1909; this J., 1910, 701), the conduit for conducting gas to the furnace passing centrally through an air chamber the lower part of which is divided by a vertical partition into two chambers communicating respectively with two regenerative chambers. Small holes on opposite sides of the gas conduit allow a small amount of air from one regenerative chamber to pass into the gas conduit, thus forcing a corresponding amount of gas out of the opposite hole into the passage leading into the other regenerative chamber, where it burns in contact with air passing round the top of the air chamber. The regenerative chambers are thus heated by gas which has not passed through the furnace. No additional valves are needed for reversal of the direction of flow of the gas through the regenerative chambers. The main body of air passes from the air chamber into the furnace through a passage arranged above the gas conduit.—H. H.

Furnaces for melting glass, metals, and minerals; Process for heating —— *by liquid fuel.* R. G. and K. H. Siegwart. Fr. Pat. 462,684, Sept. 9, 1913. Under Int. Conv., Feb. 17, 1913.

Liquid fuel for heating smelting furnaces, etc., is caused to drop from supply pipes into one or other of two open trays of refractory material situated centrally in air supply passages admitting air from recuperative chambers at opposite sides of the furnace. These passages are arranged above sills at opposite sides of the furnace and act alternately for the admission of air and vaporised fuel and for the outlet of burnt gases passing to the recuperative chambers. The liquid fuel becomes heated in passing through the supply pipe, which contains a small tank in proximity to the roof of the furnace, and is vaporised in the trays by heat radiated from the walls and interior of the furnace.—H. H.

Colloidal substances; Dehydration of ——. Richter und Richter. Ger. Pat. 270,061, Nov. 29, 1912.

Colloidal materials such as brewers' grains, vinasses, yeast, etc., are intimately mixed with lime and simultaneously treated with atomised air, oxygen, or ozone, before the water is removed by pressing.—A. S.

Reactions in gases by means of contact substances Apparatus for effecting ——. A. Wilhelmi. Ger. Pat. 270,062, Nov. 17, 1912.

The contact chamber is heated externally and is so mounted that it can be easily removed for filling, emptying, repairing, etc. It is annular in form and is disposed above the annular furnace chamber and enclosed by a removable cover formed in two parts. The furnace gases rise through the annular space between the cover and the contact chamber and then descend through the central conduit on their way to the stack. The contact chamber is made with welded joints and the cover has upturned edges which are welded to the inner wall of the chamber.—A. S.

Crystals; Apparatus for obtaining large well-formed —— *from hot-saturated solutions.* V. Schütze. Ger. Pat. 270,396, Aug. 27, 1912.

The solution flows through a jacketed vessel, a liquid acting as a heat-insulator being passed through the jacket. Vertical partitions are disposed in the jacket at distances appropriate to the solubility of the salt being crystallised, so that the velocity of the heat-insulating liquid decreases with the solubility of the salt as the solution cools.—A. S.

Evaporation of liquid and apparatus therefor. Soc. d'Exploitation de Procédés Évaporatoires, Système Prache et Bouillon, Paris. Eng. Pat. 4515, Feb. 21, 1913. Under Int. Conv., Feb. 21, 1912.

See Fr. Pat. 453,995 of 1913; this J., 1913, 858.—T. F. B.

Filtering material and process for producing same. F. Pott, Friedenau, Germany. Eng. Pat. 18,119, Aug. 8, 1913.

See Fr. Pat. 461,386 of 1913; this J., 1914, 187.—T. F. B.

Filtering material; Process of manufacturing ——. F. Pott, Friedenau, Germany. U.S. Pat. 1,089,346. March 3, 1914.

See Fr. Pat. 461,386 of 1913; this J., 1914, 187.—T. F. B.

Filtering machine. J. Drage, Boulder, Western Australia. U.S. Pat. 1,087,647. Feb. 17, 1914.

See Fr. Pat. 424,857 of 1911; this J., 1911, 879.—T. F. B.

Liquid films; Apparatus for treating ——. C. V. Boys, London. U.S. Pat. 1,088,202. Feb. 24, 1914.

See Eng. Pat. 22,886 of 1912; this J., 1913, 809.—T. F. B.

Drying articles formed from plastic masses; Apparatus for ——. O. Eberhard, Heidenau, Germany. U.S. Pat. 1,088,555, Feb. 24, 1914.

See Fr. Pat. 455,959 of 1913; this J., 1913, 933.—T. F. B.

Drying paste goods; Apparatus for ——. O. Müller, Plüderhausen, Germany. U.S. Pat. 1,089,944, March 10, 1914.

See Fr. Pat. 434,758 of 1911; this J., 1912, 321.—T. F. B.

Distilling, cooling, heating, and similar purposes; Column apparatus for ——. H. A. Gasser, Wiesbaden, Germany. U.S. Pat. 1,089,831, March 10, 1914.

See Fr. Pat. 434,323 of 1911; this J., 1912, 321.—T. F. B.

Gases; Disintegrator apparatus for washing, purifying, and cooling ——. H. E. Theisen. Fr. Pat. 462,437, Sept. 10, 1913. Under Int. Conv., Dec. 20, 1912, April 10 and May 19, 1913.

See Eng. Pat. 21,427 of 1913; this J., 1914, 241.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Combustible and explosive mixtures of gases and air; Lower limits of ——. E. E. Somermeier. J. Ind. Eng. Chem., 1914, **6**, 191—198.

Published data relating to the combustion and explosion of gaseous mixtures are often incomplete and misleading owing to lack of precision in the definition of the terms employed. The ignition temperature of a gaseous mixture is defined as the temperature to which it must be raised to bring about an appreciably rapid chemical reaction. The ignition temperature of combustion, or of explosion, is the temperature to which a portion of the mixture must be raised so that a combustion or an explosion may be propagated throughout the entire mixture. If the heat of the reaction, ignition temperature, and thermal capacities of the reacting gases and products of combustion be known, the lower limits of combustible and explosive mixtures of gas can be calculated. The values obtained are lower than those found experimentally, as the amounts of heat required to compensate losses by radiation and conduction are not taken into account, but they are of considerable practical value, since mixtures containing such proportions of gas must be regarded as potentially explosive and hence dangerous, for in mines, etc., the conditions (presence of combustible dust, etc.) may change them into actually explosive mixtures. Taking the ignition temperatures of combustion of mixtures of hydrogen and air and methane and air as 600° and 700° C. and the ignition temperatures of explosion as 700° and 850° C. respectively, and assuming combustion as occurring at constant pressure and explosion at constant volume, the lower limits of combustible mixtures were calculated to be: H_2 6·8, and CH_4 2·8 per cent., and of explosive mixtures: H_2 5·9, CH_4 2·4 per cent. Natural gas and gas in coal mines frequently contain 10—15 per cent. of ethane, and a 2 per cent. mixture of such gas would be at least as explosive as a 2·4 per cent. mixture of methane. —A. S.

Petrol-store in the Osthafen, Berlin; Safety ——. T. Rosenthal. Chem. Ind. 1914, **37**, 150—151.

The plant, constructed on the Martini-Hüneke system, has a total capacity of 1,000,000 litres in 36 cylindrical tanks of various sizes lying 1 metre underground upon a concrete bed surrounded by concrete walls. The safety arrangements include: displacement of the petrol by a mixture of carbon dioxide and nitrogen under a pressure of half an atmosphere; devices to prevent access of air by diffusion when pipes or fittings leak; pipes, valves, and fittings which prevent escape of petrol at damaged places; prevention of rusting, access of flame, etc., by burying the containers. The tanks are filled from railway tank-wagons by siphons, the gas being simultaneously exchanged, or from barges by an electrically-driven centrifugal pump; they are emptied through pipes brought to lock-up iron cupboards provided with cocks, meters, gauges, etc. Any petrol spilt flows to special drains, and thence to an underground container; admixed water is separated and diverted to the sewers.—O. E. M.

Hydrocarbons; Separation of —— *by means of liquid sulphur dioxide.* L. Edeleanu. Petroleum, 1914, **9**, 862—864.

On shaking a petroleum distillate with liquid sulphur dioxide at a low temperature the aromatic and cyclic unsaturated hydrocarbons are dissolved, whilst the paraffin and naphthene hydrocarbons remain practically unaffected. A quantity of sulphur dioxide equal to twice the weight of the distillate is used; sufficient of this to form a separate layer after shaking, is first added, and the remainder in three portions, shaking and drawing off the liquid sulphur dioxide after each addition. In the case of distillates of high b. pt., such as gas oil or lubricating oil, the sulphur dioxide may be removed by evaporation, and the residual hydrocarbons weighed or their sp. gr. determined, but with products of low b. pt. such as benzine and lamp oils, the sulphur dioxide is neutralised with alkali, water added, and the volume and sp. gr. of the hydrocarbons ascertained.—C. A. M.

Petroleum prospects in the Union of South Africa: Report on the ——. E. H. C. Craig. Board of Trade J., March 19, 1914. [T.R.]

Petroleum.—There is little likelihood of any extensive oil-fields being found anywhere in the Union of South Africa. Favourable geological structure exists only in Cape Colony, and there only in a narrow strip at the southern edge of the Karroo. No petroleum prospecting has apparently been carried out in this district, but the conditions are not favourable for large productions. It is suggested that the area south of Aberdeen, near Jansenville, Saxony, and Klipplaat Station, should be examined. Though it is by no means certain that petroleum will be found, such a well, if successful, would open up a wide area, and, if unsuccessful, would set at rest all hopes of striking oil in the Union. Certain areas in north-eastern Natal, which were not inspected, may perhaps furnish favourable geological structures.

Natural Gas.—There are areas in the coal measures in the Transvaal and Natal where natural gas can be struck in fair quantity. Supplies of gas under sufficient pressure to supply distant towns are improbable, but the gas may possibly be used locally at a profit.

Oil Shale.—None of the shales examined, with the exception of that at Kikvorschfontein, are comparable with the best Scotch shales, but the laboratory tests prove that very fair quantities of shale oil can be produced. The seams are thin as a rule, but might prove quite profitable in South Africa, on account of the great demand and high price of oil. The Kiksvorschfontein, Moorfontein, Waaihoek, and Hlatimbe-Umkomaas areas are all worth consideration, especially the last area, which lies within 100 miles of Durban, and because it seems probable that shale deposits may be found near the projected railway to Himeville. Prospecting of the folded belt of the Karroo system for crude petroleum and natural gas is of less importance than the development of the shale industry. All the evidence leads to the belief that an oil-shale industry has good prospects of proving successful.

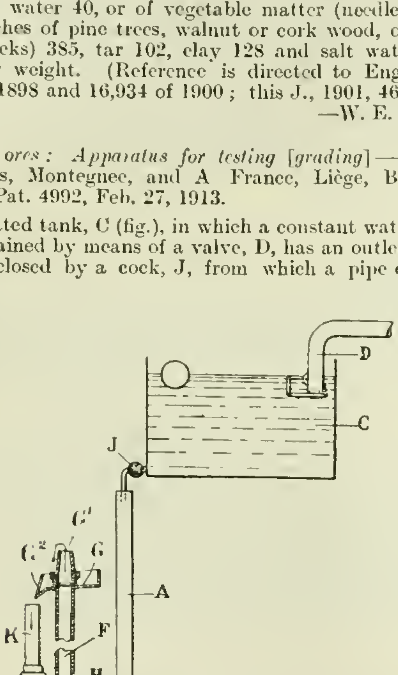
PATENTS.

Fuel; Manufacture of artificial ——. R. Blumberg, Lisbon. Eng. Pat. 4909, Feb. 26, 1913. Under Int. Conv., Feb. 29, 1912.

BRIQUETTES composed of pine needles 540, tar 380, clay 40, and salt water 40, or of vegetable matter (needles, bark or branches of pine trees, walnut or cork wood, or dried vine stocks) 385, tar 102, clay 128 and salt water 385, parts by weight. (Reference is directed to Eng. Pats. 8723 of 1898 and 16,934 of 1900; this J., 1901, 462.)
—W. E. F. P.

Coal or ores: Apparatus for testing [grading] ——. P. Habets, Montegnee, and A France, Liège, Belgium. Eng. Pat. 4992, Feb. 27, 1913.

AN elevated tank, C (fig.), in which a constant water level is maintained by means of a valve, D, has an outlet at the bottom closed by a cock, J, from which a pipe extends into the longer arm of a metal U-tube, A, the other arm of the latter having a glass tube, F, secured to it at E. The glass tube is "closed" at the bottom by copper wire gauze of very fine mesh, and prolonged at the top by a tapering nozzle-piece, G^1, provided with an annular tray, G, having an outlet, G^2. I is a cock for emptying the tube, F; and H a graduated reservoir (end view) carrying a number of collecting-tubes, K, having wire gauze bottoms. A weighed quantity of the coal, etc., is placed in the tube, F, and the cock, J, opened so as to produce in F, water currents of successively increasing velocities, the overflow at each rate being collected in a separate tube, the product dried and weighed and the quantity of water measured. The cock, J, is provided with an indicator disc marked to show the degree of opening necessary to produce any required velocity in F.
—W. E. F. P.



Fuel; Process of burning solid ——. A. G. Glasgow, London. Eng. Pats. 16,910 and 16,911, July 23, 1913.

THE formation of clinker (in gas-producers, etc.) is prevented by dividing the air and steam blasts and distributing the same within the combustion chamber so that, in the fuel bed, superposed horizontal zones are maintained, one (at a relatively high temperature) in which agglomeration of the fused ash is prevented by an excess of carbon, and the other (at a relatively low temperature) in which this carbon is finally consumed without fusion of the ash.—W. E. F. P.

Coke ovens; Process of and apparatus for charging ——. W. Puschmann. Eng. Pat. 22,763, Oct. 8, 1913. Under Int. Conv., Nov. 22, 1912.

THE use of a single large motor truck, of the same capacity as the oven, for charging the latter, cannot be adopted in many existing installations owing to the extensive alteration of plant required. According to the present patent, several motor trucks are used, which run on the existing tracks, and are automatically brought to rest above the oven to be charged or below the filling tower, for example by stops or levers, fitted on the track and adapted to stop the motor and, if desired, also set a brake in operation.—A. S.

Retorts for use in the manufacture of gas or for like purposes. Drakes Ltd. and W. A. Drake, Halifax. Eng. Pat. 4104, Feb. 18, 1913.

VERTICAL retorts for use in the manufacture of gas, distillation of shale, etc., are provided, at the lower end, in the known manner, with extensions open to the atmosphere. Each extension is encircled by a wall, an annular space being left, open at the bottom, for the entry of cold air, which is preheated by the hot coke or the like leaving the retort, and then passes through suitable passages to cavities in the structure surrounding the retort, where it is used for burning the gases used for heating.—A. S.

Gas; Purification of ——. L. Bergfeld. Ger. Pat. 270,204, Dec. 19, 1911.

THE gas passes first through a solution of a feebly or partially saturated compound of an alkali, such as a metaborate or the like, to remove acid impurities, including hydrogen sulphide, and then through a solution of a partially saturated compound of an acid, *e.g.* primary potassium phosphate, bifluoride, polyborate, or citrate, or esters of weak acids, to remove ammonia. By heating to about 100° C., the absorbed impurities are expelled and the absorbents regenerated.—A. S.

Fuel; Liquid —— specially applicable for internal combustion engines. T. Terry, New Ferry, Cheshire. Eng. Pats. 7807 and 7808, April 3, 1913.

CRUDE petroleum (1 gal.), or a mixture of crude or refined petroleum and benzol in equal proportions, is agitated, hot or cold, with a mixture (4 to 6 oz.) of crystallised sodium carbonate and "Montreal ash" (a wood ash used in the alkali and other industries) in equal quantities, and then separated for use. The sodium carbonate may be replaced by caustic soda, and the Montreal ash by potash or sodium nitrate.—W. E. F. P.

Asphaltum from crude mineral oil or residuum thereof; Process for the manufacture of ——. C. B. Forward, Urbana, Ohio. U.S. Pat. 1,088,692, March 3, 1914.

THE volatile light and heavy constituents are distilled off by forcing the crude mineral oil or residuum, under pressure, and in an atomised condition, through a still heated to a temperature below that at which coking takes place. The distillation residue is mixed with a larger or smaller proportion of the heavy distillate according to the quality of asphaltum required and the mixture heated in an open vessel until the desired adhesive and cohesive condition has been attained.
—W. H. C.

Petroleum oils; Treating —— with ultra-violet light. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,089,359, March 3, 1914.

THE oils are exposed in thin layers and at a temperature below that at which decomposition takes place to ultraviolet light of high voltage to destroy fluorescence and polymerise gum-forming constituents.—W. H. C.

Autoclave apparatus for the transformation of petrol and similar hydrocarbons. G. Renard. Fr. Pat. 462,286, Sept. 8, 1913.

The hydrocarbon is forced under a pressure of 40 or 50 atmospheres through a tube having two serpentine coils arranged in series, the first being at a temperature of from 400°—450° C. and the second being immersed in a cooling liquid. The hydrocarbon remains in a liquid state throughout, but is broken down into fractions of lower boiling point in the process.—H. H.

Heavy hydrocarbons; Treatment of ——. H. M. Hyndman. Fr. Pat. 462,481, Sept. 11, 1913.

The hydrocarbon is forced by means of a high-pressure steam jet through a long coil of pipe maintained at a cherry-red heat, and the lighter hydrocarbons produced are condensed in a series of condensers. The furnace surrounding the tube is automatically maintained at different temperatures at different parts so as to compensate for varying heat absorption by the hydrocarbon at different parts of the tube and thus maintain the temperature of the tube uniform throughout. The presence of magnetic iron oxide in the tube facilitates the action. The proportion of steam mixed with the hydrocarbon is adjusted by observation of the colour of a test flame of the hydrocarbon produced, the proportion of steam being increased slightly above that at which the flame is yellowish.—H. H.

Oils; Processes and apparatus for refining —— by distillation. R. A. Dornès, New York. Eng. Pats. 27,615, Nov. 30, 1912, and 1269 of 1914, date of appl., Nov. 30, 1912. Under Int. Conv., Dec. 1, 1911.

See Fr. Pat. 448,658 of 1911; this J., 1913, 415.—T.F.B.

Sulpho-acids from crude petroleum hydrocarbons and acid residues; Process for extracting and separating ——. G. Petroff, St. Petersburg. U.S. Pat. 1,087,888, Feb. 17, 1914.

See Fr. Pat. 448,207 of 1912; this J., 1913, 415.—T. F. B.

Apparatus for continuously distilling crude oil and other substances. U.S. Pat. 1,088,693. *See* I.

Manufacture of volatile hydrocarbons. Fr. Pat. 462,935. *See* III.

Manufacturing sulphuric acid from the sulphur compounds of ammonia-freed coal-gas. Eng. Pat. 4770. *See* VII.

Detectors of combustible gases. Eng. Pat. 5467. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Hardwood distillation in the United States. R. C. Palmer. Oil, Paint, and Drug Rep., March 9, 1914. [T.R.]

The number of plants in the United States engaged in the distillation of hardwoods for the production of products besides charcoal were as follows:—1880, 17; 1890, 53; 1900, 93; 1907, 100; 1909, 116; 1910, 117; 1911, 105.

The production and values of various primary and secondary products are given below:—

Production of charcoal.

Year.	Production. Bushels.	Value.
1880*	54,000,000	$3,678,000
1890*	67,000,000	4,523,000
1900	17,154,000	726,000
1906	45,657,000	2,966,000
1907	50,772,000	3,838,000
1908	37,286,000	2,644,000
1909	53,000,000	3,299,000
1910	56,000,000	3,762,000

* Includes charcoal from softwood and from charcoal kilns producing no other products.

The figures subsequent to 1890 do not include those for the production of charcoal for pig-iron alone, which are as follows:—

Year	No. of plants	Value of product.
1900	183	$1,134,000
1904	74	1,292,000
1910	76	872,000

Production of crude wood alcohol.

Year.	Gallons.	Value
1880	130,000*	$86,000
1890	1,116,075	688,000
1900	4,945,000	1,977,000
1906	7,871,494	2,676,191
1907	7,741,645	1,153,307
1908	6,285,678	1,084,223
1909	8,468,083	2,082,253
1910	8,691,525	2,226,768
1912	9,500,000*	2,660,000*

* Estimated.

Production of acetate of lime

Year.	Pounds.	Value.
1880	6,593,000	$156,000
1890	26,000,000	315,000
1900	86,826,000	981,000
1906	96,376,000	2,017,000
1907	133,375,000	2,566,000
1908	106,099,000	1,636,000
1909	148,769,000	2,203,000
1910	152,772,000	2,467,000

Production of acetic acid.

Year.	Production. Pounds.	Value.	Proportion of acetate for acetic acid.
			per cent.
1900	26,660,000	$427,000	25
1904	27,001,000	537,000	25
1909	51,963,000	1,136,000	27

Production of acetone.

Year.	Production. Pounds.	Value.	Proportion of acetate for acetone.
			per cent.
1900	1,638,715	$178,000	10
1904	1,300,000	161,000	8
1909	6,928,000	719,000	23

French manufacture of transparent quartz and its applications. Mercury vapour lamps. Gallois. *See* VIII.

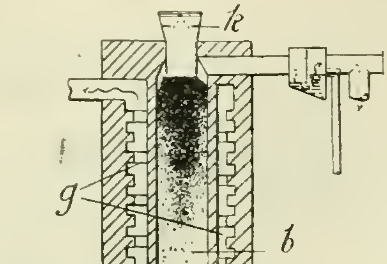
Patents.

Oils from coal, cannels and shales; Production of —— A. Rollason, Long Eaton, Derbyshire. Eng. Pat. 19,697, Sept. 1, 1913.

Coals, cannels and shales containing a high proportion of oxygen are ground, mixed with 3—5 per cent. of ground limestone or other suitable carbonate, and the mixture slowly heated in retorts to about 500° C. The carbon dioxide given off from the limestone tends to prevent the combination of oxygen and hydrogen and favours the production of oils.—W. H. C.

Distilling and gasifying solid carbonaceous matter. G. P. Lewis, Tal-y-Cafn, Denbighshire. Eng. Pat. 4572, Feb. 22, 1913.

The coal or other carbonaceous material is charged through the hopper, *k*, into the upper retort, *b*, the axis of which is out of line with that of the lower chamber or generator, *a*. The fuel passes downwards by gravity, part of the coke is withdrawn through the branch, *d*, and the remainder is gasified in the producer, *a*. Part of the producer gas is withdrawn through the port, *e*, and is burned with air which is admitted through the port, *p*, in the flues, *g*, to heat the upper retort. The remainder of the producer gas is passed through the retort, *b*, and serves to assist in the removal of the distillation gases —W. H. C



Peat; Utilisation of ——. T. Rigby, Dumfries, N. Testrup and Wetea bonizing Ltd., London. Eng. Pat. 25,146, Nov. 2, 1912.

The peat is first subjected to heat treatment (wet carbonisation) as described in Eng. Pats. 17,427, and or 17,428 of 1912 (this J., 1913, 1099, 861) and the water is separated by a filter-press or other suitable filter. The hot filtrate serves to preheat the incoming peat pulp and the press cakes of partially dehydrated peat are in part gasified (with "recovery of nitrogen") to provide the fuel and power for the process and in part converted into solid or gaseous fuel as desired.—W. H. C.

Peat; Process for obtaining volatile liquids from ——. P. P. Pease. Fr. Pat. 463,104, Sept. 30, 1913.

Partly dried peat mixed with about 1 per cent. of sulphur is introduced into a distillation chamber having a perforated plate at the bottom through which hot air is forced after ignition of the mass, the temperature being raised to a white heat. The distillation gases pass through a condenser which removes tar, etc., and then through a purifier to a gasometer which is weighted to maintain a pressure of about 70 kilos. per sq. cm. throughout the apparatus. The gas which consists of methane and higher hydrocarbons, methyl alcohol, and other volatile substances is drawn from the gasometer by a pump and forced at a pressure of about 225 kilos. per sq cm. into a reservoir, where it may be cooled and pumped at a still higher pressure into a vessel where it is stored in the liquid state.—H. H.

Distillation of liquids or of substances dissolved or suspended in liquids [*e.g., waste lyes from cellulose manufacture*]*; Destructive* ——. E. L. Rinman. Ger. Pat. 269,994, Jan. 28, 1913.

Distillation is effected in an annular furnace in which an annular hearth is mounted. The material is distributed over the hearth and heating gases are passed through an annular space below the hearth, the latter being rotated in the opposite direction to the flow of the heating gases. The heating chamber is closed against the space above the hearth by liquid- or sand-seals, and the conduit through which the distillation residue is discharged is connected with a vertical pipe of such height that the column of residue therein is sufficient to provide a gas-tight seal.—A. S.

Gas from sewage sludge; Process for obtaining ——. F. Berghauer. Ger. Pat. 270,338, Feb. 18, 1913.

The sludge is dried in a chamber in the upper part of the oven and is then carbonised in retorts in the lower part. Pipes open at both ends extend through the heating chamber, alongside the retorts, and open into the drying chamber, and air is drawn through these pipes by natural draught from the carbonising house, thus ventilating the latter, and delivered into the drying chamber.—A. S.

Heating solid, liquid, or gaseous bodies by the heat generated in the formation of sulphur compounds, principally metallic sulphides. A. Lang. First Addition, dated Sept. 10, 1913, to Fr. Pat. 395,536, Oct. 21, 1908 (this J., 1909, 591).

A mixture of sulphur and metal according to the principal patent is mixed with sulphites and an adhesive, and employed for coating wood strips which can be lit like matches and the gases evolved used for destroying parasites.—H. H.

Arc-light carbons. H. Ayrton, London. Eng. Pat. 1775, Jan. 22, 1913.

A negative carbon is formed with a hard core, a softer or more readily combustible shell and an outer casing of sheet copper or other suitable metal. The metal sheath melts and drops away at such a distance from the burning tip that it does not contaminate the arc.—W. H. C.

Charcoal; Method of making ——. L. Félizat, Assignor to La Soc. Savonnerie et Huilerie de Lurian, Bouches-du-Rhône, France. U.S. Pat. 1,087,486, Feb. 17, 1914.

See Fr. Pat. 409,916 of 1909; this J., 1910, 806.—T. F. B.

Coal, oil shale, and similar substances; Process and apparatus for treating —— *in vertical retorts.* A. Waddell. Fr. Pat. 463,440, Sept. 13, 1913. Under Int. Conv., Sept. 27, 1912.

See Eng. Pat. 21,991 of 1912; this J., 1913, 690.—T. F. B.

Metallic bodies [*tungsten*] *for use in making incandescence lamps; Preparation of refractory* ——. Comp. Française pour l'Exploitation des Procédés Thomson-Houston. First Addition, dated Oct. 6, 1913 to Fr. Pat. 433,131, Aug. 10, 1911.

See Eng. Pat. 1915 of 1913; this J., 1914 319.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Phenol; Determination of —— *in the presence of hexamethylenetetramine and formaldehyde.* L. V. Redman, A. J. Weith, and F. P. Brock. J. Ind. Eng. Chem., 1914, 6, 205—206.

The bromination method for the determination of phenol described previously (this J., 1913, 591) gives good results in presence of hexamethylenetetramine but not in presence of formaldehyde. In the latter case ammonia should be added up to a concentration of 2*N* (to convert the formaldehyde into hexamethylenetetramine) and the solution allowed to stand for 5 mins. before proceeding with the determination.—A. S.

Hydrogenation of diaryl-ketones and aryl-alcohols; Direct catalytic ——. Preparation of poly-aryl-hydrocarbons. P. Sabatier and M. Murat. Comptes rend., 1914, **158**, 760—764

THE vapour of the compound to be reduced was carried, by means of a current of hydrogen, over the nickel heated to the desired temperature. At 300 C., using nickel obtained by reduction of the oxide at 400 C., benzophenone yielded diphenylmethane, whereas at 160—170 C., with very active nickel obtained by reduction at 350 C., it yielded dicyclohexylmethane, $C_6H_{11}.CH_2.C_6H_{11}$ (b. pt. 250°—251 C.). Desoxybenzoin (phenylbenzylketone) and phenylbenzylcarbinol at 350—360 C., yielded *symm.* diphenylethane (dibenzyl); dibenzylketone at 400 C. and phenylbenzoylethane at 360° C., yielded *symm*-diphenylpropane (b. pt. 300 C., corr.); benzyl alcohol at 370 C. yielded toluene (yield 90 per cent.): phenylethyl alcohol at 380° C. and phenylmethylcarbinol at 350° C. gave ethylbenzene. Diphenylcarbinol at 380° C. was quantitatively converted into diphenylmethane, and this affords an economical method of preparing the latter compound. Phenyl-*p*-cresylcarbinol at 350°—380° C. gave phenyl-*p*-cresylmethane, and triphenylcarbinol at 400° C. gave triphenylmethane.—A. S.

PATENTS.

Hydrocarbons; Manufacture of volatile ——. R. Hense. Fr. Pat. 462,935, Sept. 4, 1913.

MIXTURES of heavy hydrocarbons, mineral oils, tar distillates, benzene, alcohols, resinous products, etc., are distilled in presence of an oxygenating body for the purpose of obtaining light oils suitable for use as engine fuels. The mixture is first purified by successive treatment with alkali and acid and the residue of the washing water removed by means of a hygroscopic salt such as sodium sulphate or by freezing. The oxidising substance may be a nitro-compound such as picric acid, a peroxide such as magnesium peroxde, or an organic compound such as hydroxybenzoic or pyrogallic acid. It is advantageous in certain cases to add a small proportion of turpentine or an ester such as ethyl acetate. The distillate may be saturated with ozone more particularly for the purpose of giving high illuminating value when the liquid is used for lighting or enriching gas.—H. H.

Phenols Process for the manufacture of polyvalent —— from the corresponding chlor-substitution products of aromatic hydrocarbons. C. Torley, Brussels, and O. Matter, Troisdorf Germany. Eng. Pat. 9450, April 22, 1913.

SEE Fr. Pat. 458,136 of 1913; this J., 1913, 1060.—T.F.B.

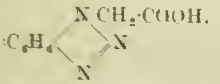
Petroleum and tar; Manufacture of nitro-products from ——. A. S. Flexer, Vienna. Eng. Pat. 16,031, July 11, 1913. Under Int. Conv., July 13, 1912.

SEE Fr. Pat. 460,280 of 1913; this J., 1914, 17.—T. F. B.

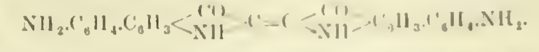
IV.—COLOURING MATTERS AND DYES.

Indigo. Preparation of substituted ——. A. Reissert. Ber., 1914, **47**, 672—681.

THE author's aim was to prepare indigo derivatives in which the nitrogen atoms would be involved in a second ring external to the indigo structure. 1-Benztriazylacetic acid,



was prepared but it gave on fusion with sodamide only a small quantity of ordinary indigo, two nitrogen atoms evidently having been split off. The author, however, succeeded in preparing an indigo from benzidinoacetic acid $NH_2.C_6H_4.C_6H_4.NH.CH_2.COOH$, prepared by condensing benzidine with free chloroacetic acid in aqueous solution. The new indigo derivative has the constitution:



$$NH_2.C_6H_4.C_6H_3{<}^{CO}_{NH}{>}C{:}C{<}^{CO}_{NH}{>}C_6H_3.C_6H_4.NH_2.$$

It dyes wool in shades similar to those of ordinary indigo, which become redder on treatment with acid.—J. B.

Saffron: The detection of adulterants in —— by means of phosphomolybdic acid. A. Verda. Chem.-Zeit., 1914, **38**, 325—327.

SAFFRON is distinguished from its usual vegetable adulterants by its green colour-reaction with phosphomolybdic acid. The reagent is prepared by dissolving 25 grms. of sodium phosphomolybdate in 90 c.c. of water and 20 c.c. of pure nitric acid, allowing to stand 8 days and then filtering. The test is carried out like the older one with sulphuric acid, over which it has the advantage of giving a more permanent colouration. On this account it is especially suitable for microscopic analysis. The sulphuric acid test is improved by the addition of phosphomolybdic acid, *e.g.*, by mixing 40 c.c. of a 10 per cent. solution of sodium phosphomolybdate with 60 c.c. of concentrated sulphuric acid. The blue colour which this solution gives with saffron remains for over a day. The new colour reaction is ascribed to the crocin in the saffron, this substance having the character of a glucoside.—J. B.

PATENTS.

[Azo] dyestuffs; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 4058, Feb. 17, 1913.

THE tetrazo-compound of a diaminotriarylmethanesulphonic acid (*e.g.*, that from benzaldehyde-*m*-sulphonic acid and aniline) is combined with two mols. of the same or of different arylmethylpyrazolone derivatives. Greenish-yellow wool dyestuffs are obtained.—J. B.

Anthraquinone derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8030, April 5, 1913.

SEE Fr. Pat. 459,043 of 1913: this J., 1913, 1100.—T F.B.

Quinizarin; Process of producing ——. O. Unger and E. Molineus, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,087,412, Feb. 17, 1914.

SEE Ger. Pat. 255,031 of 1912; this J., 1913, 189.—T.F.B.

Azo dyes; Basic ——. A. Blank and M. Latten, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,087,427, Feb. 17, 1914.

SEE Fr. Pat. 456,236 of 1913: this J., 1913, 938.—T. F. B.

Dyes derived from aminotrisazo compounds. A. Blank and M. Latten, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,087,428, Feb. 17, 1914.

SEE Eng. Pat. 9267 of 1912: this J., 1913, 418.—T. F. B.

Azo dyes. A. Blank and W. Bergdolt Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,087,429, Feb. 17, 1914.

SEE Fr. Pat. 456,432 of 1913: this J., 1913, 1004.—T. F. B.

Cotton [azo] dyestuffs. A. Blank, C. Heidenreich, and J. Jansen, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,087,430, Feb. 17, 1914.

SEE Eng. Pat. 8767 of 1913: this J., 1913, 905.—T. F. B

Blue [azo] dyestuff. H. Schweitzer and A. Zart, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,088,735, March 3, 1914.

See Addition of June 25, 1913, to Fr. Pat. 442,697 of 1912; this J., 1914, 19.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 463,844, Oct. 20, 1913. Under Int. Conv., Nov. 5, 1912.

See Ger. Pat. 269,213 of 1912; this J., 1914, 247.—T. F. B.

Colouring matters and lakes therefrom; Manufacture of [bisulphite compounds of azo] ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 8065, April 5, 1913.

See Fr. Pat. 456,614 of 1913; this J., 1913, 1005.—T. F. B.

Anthracene series; Manufacture of compounds and colouring matters of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,584, May 29, 1913.

See Fr. Pat. 458,949 of 1913; this J., 1913, 1101.—T. F. B.

Anthraquinone colouring-matters and process of making them. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,089,221, March 3, 1914.

See Ger. Pat. 241,805 of 1911; this J., 1912, 119.—T. F. B.

Chromium compounds of [hydr]oxyanthraquinonesulphonic acids and process of making same. R. Bohn, Mannheim, and C. Immerheiser, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,090,123, March 10, 1914.

See Eng. Pat. 7892 of 1912; this J., 1913, 226.—T. F. B.

Vat dyestuffs of the benzanthrone series. Badische Anilin und Soda Fabrik. First Addition, dated Aug. 25, 1913, to Fr. Pat. 462,576, Nov. 25, 1912. Under Int. Conv., Jan. 22, 1913.

See Eng. Pat. 5248 of 1913; this J., 1914, 194.—T. F. B.

Sulphurised [sulphide] dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 9559, April 23, 1913. Addition to Eng. Pat. 25,457, Nov. 15, 1911.

See Addition of April 28, 1913, to Fr. Pat. 436,373 of 1911; this J., 1913, 1061.—T. F. B.

Anthraquinone series; Dyestuffs of the —— *for wool, and process for making them.* Act.-Ges. f. Anilinfabr. First Addition, dated July 15, 1913, to Fr. Pat. 440,303, Jan. 31, 1912. Under Int. Conv., July 23, 1912.

See Eng. Pat. 16,827 of 1913; this J., 1914, 19.—T. F B.

Colouring matter and process for dyeing furs, hairs, feathers, and other articles. Act.-Ges. f. Anilinfabr. Fr. Pat. 463,167, Oct. 2, 1913. Under Int. Conv., June 14, 1913.

See Eng. Pat. 61 of 1914; this J., 1914, 252.—T. F B.

Selenazine series; Coloured compounds of the —— *and process of making same.* P. Ehrlich and H. Bauer, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,087,157, Feb. 17, 1914.

See Eng. Pat. 5710 of 1913; this J., 1913, 821.—T. F. B.

Vat [anthracene] dyestuffs; Yellow ——. M. Iljinsky, Uerdingen, and R. Tschunke, Breslau, Assignors to R. Wedekind und Co. m. b. H., Uerdingen, Germany. U.S. Pat. 1,087,293, Feb. 17, 1914.

See Ger. Pat. 257,832 of 1912; this J., 1913, 481.—T. F. B.

Sulphide dyestuffs for cotton; Process for producing yellow and brown ——. L. Cassella und Co. G. m. b. H. First Addition, dated Dec. 26, 1912, to Fr. Pat. 460,256, Sept. 30, 1912;

See Eng. Pats. 22,453 and 29,970 of 1912; this J., 1912, 862.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Straw-board pulp. B. Haas. Papierfab., 1914, 12, 305—310.

In the manufacture of straw-board pulp, oat-straw is digested with 10 per cent., wheat-straw with 13—15 per cent. of lime; the capacity of the digesters ranges from 900 to 2000 kilos. but considerable differences occur among different mills in the quality of lime, the manner of slaking, the composition and quantity of water and the dryness and pressure of the steam. The industry is devoid of any general scientific control and the quality of the product varies considerably. In many cases, too much lime is employed, with the result that the pulp becomes "greasy" and drains very slowly, clogging up wires and felts. The lime should be slaked slowly and completely and used in the freshly slaked condition. By adjusting the chaff-cutting machine, running in the liquor at the time of charging, and steaming gently at the same time, the capacity of a digester may be increased 10 per cent. The charged digester should be rotated for a short time without steam, to distribute the liquor uniformly; then stopped and the steam admitted with release-cock open to expel the air. After this, the full pressure of steam (4 atmos.) should be admitted, with the digester rotating. Digestion may be continued for 2½—3 hours, but towards the end of the period the digester should be stopped and steam shut off temporarily to allow the material to settle down, the digestion being then carried to completion as before. By observing these rules and increasing the quantity of water where necessary, satisfactory results may be obtained with 2—3 per cent less lime than formerly, the pulp will be brighter in colour and run far more easily on the machine. Wheat straw was satisfactorily digested by the author's method with only 6 per cent. of lime.—J. F. B.

Patents.

Wood refuse; Treatment of —— *for the recovery of valuable products therefrom.* A. Zimmermann, Bromley, Kent. Eng. Pats. 3963, Feb. 15, 8359, April 9, and 13,746, June 13, 1913.

The waste product obtained by the treatment of wood sawdust with acids for the production of sugar or alcohol may be digested with an alkali for the preparation of cellulose. The alkaline extract, whether separated from the cellulose or not, when concentrated, yields a product suitable for use as a fertiliser. On treatment with acid the alkaline extract drained off from the cellulose gives a precipitate of "lignon body." The lignon body is soluble in caustic soda or potash and the evaporated solution yields a perfectly soluble, flaky product, which may be used as a colouring matter or fertiliser. The alkali salts of the lignon "body" are precipitated from solution in the form of double salts on treatment with a salt of a heavy metal; these double compounds of the lignon may be employed as anti-fouling pigments, preservatives or fertilisers.—J. F. B.

Sulphite cellulose; Process of producing ——. E. Oman, Stockholm. Eng. Pat. 1145, Jan. 15, 1914. Under Int. Conv., Feb. 6, 1913.

Waste liquor from the digestion of sulphite cellulose is used instead of water for the preparation of fresh liquor by dissolving therein lime, magnesia or alkali and sulphur dioxide. Preferably also a suitable quantity of the dilute

liquors obtained in the washing of the pulp is incorporated with the waste digester lye for the preparation of fresh liquor. When the waste liquor has attained, by repeated use, the desired concentration in respect to useful by-products, it is treated for the recovery of the latter.
—J. F. B.

Waste sulphite cellulose lyes or similar liquids; Method of removing organic constituents from residues obtained in producing alcohol from ——. P. G. Ekström, Skutskär, Assignor to Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. U.S. Pat. 1,087,356, Feb. 17, 1914.

Alcohol is first produced from the lye in the usual manner and the residual lye treated with a basic reagent, *e.g.*, caustic lime, and then oxidised by aeration. Humus-like calcium compounds are precipitated; alternatively, aeration may be performed in the presence of an oxidising catalyser.—J. F. B.

Sulphite pulp digester liquor; Process and product of treating ——. O. Grothe, Jersey City, N.J. U.S. Pat. 1,087,911, Feb. 17, 1914.

The neutral liquor, after the removal of the free sulphurous acid, is concentrated and the sulphur-bearing groups of the organic compounds are removed by subjecting the liquor to the action of a cyanide- or cyanamide-compound under heat and pressure. The product of the reaction is diluted with water and an organic cyanogen- or cyanamide-compound precipitated by a mineral acid; the precipitate is filtered off and dried at the ordinary temperature.—J. F. B.

Cellose; Method of producing ——. Converting of cellose into fermentable sugar. P. G. Ekström, Skutskär, Sweden. U.S. Pats. 1,087,743 and 1,087,744, Feb. 17, 1914.

Cellose is produced by the action of concentrated acid upon cellulosic material for a suitable time and at a temperature adapted to the nature of the reacting substances, maintaining during the treatment a vacuum sufficient to allow the organic acids produced to distil off. In converting concentrated solutions of cellose into fermentable sugar, the solutions are diluted with waste sulphite cellulose lyes and the mixture is boiled under atmospheric pressure.—J. F. B.

Blotting and absorbing materials. M. A. Halle, London. Eng. Pat. 4610, Feb. 24, 1913.

Raw cotton, cotton or linen fabric, etc., is purified by repeated boiling in water before being treated with an alkali and a bleaching agent. The material may be further treated by a solution of ammonia and soap, dyed, and finished by boiling in several changes of water containing acetic acid. If desired, the material may be boiled in water containing acetic acid after the treatment with boiling alkali and before the treatment with a bleaching agent; after bleaching it may be subjected to the action of hydrochloric acid or hydrogen peroxide, or both.
—J. F. B.

Paper; Coated —— and process of making the same. H. Wrede, Berlin, and Corn Products Co., Ltd., London. Eng. Pat. 4706, Feb. 24, 1913.

About 17½ lb. of starch, preferably of the modified variety known as "thin-boiling," are boiled with 4 galls. of water, and the clear mobile solution is treated with 2 quarts of a 10 per cent. solution of alum, and then mixed with about 40 lb. of fine china clay uniformly suspended in a mixture of about 2 quarts of syrupy sodium silicate ("water glass") and 3 galls. of water. The colloidal precipitate of starch and mineral matters thus obtained is employed as a coating for paper by the usual brushing-on method. The sodium silicate in the mixed preparation should be slightly in excess and not completely neutralised by the precipitating agent. Precipitation may also be effected by borax, calcium, barium, strontium or magnesium chloride or even by acids, but alum is preferred.—J. F. B.

Cellulose; Process for the manufacture of organic acid esters of ——. Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 4353, Feb. 20, 1913. Under Int. Conv., Feb. 21, 1912. Addition to Eng. Pat. 2491 of 1913, dated Feb. 1, 1912.

See Fr. Pat. 453,835 of 1913; this J., 1913, 785.—T. F. B.

Films or bands from materials [celluloid] dissolved in volatile solutions; Apparatus for the production of ——. B. Borzykowski, Berlin. Eng. Pat. 4601, Feb. 22, 1913.

See Fr. Pat. 454,692 of 1913; this J., 1913, 865.—T. F. B.

Artificial silk; Manufacture of ——. H. Timpe, Assignor to Naamlooze Vennootschap Hollandsche Zijde Maatschappij, Amsterdam. U.S. Pat. 1,087,700, Feb. 17, 1914.

See Ger. Pat. 236,908 of 1910; this J., 1911, 1050.—T. F. B.

Cellulose; Compounds or derivatives of —— and process of obtaining the same. E. Knoevenagel, Heidelberg, Germany. U.S. Pat. 1,090,074, March 10, 1914.

See Fr. Pat. 369,123 of 1906; this J., 1907, 91.—T. F. B.

Wood or other elastic material; Method of compressing —— [in boilers] F. Ziebarth, Frankfort, Germany U.S. Pat. 1,089,687, March 10, 1914.

See Eng. Pat. 10,548 of 1912; this J., 1913, 19.—T. F. B.

Destructive distillation of liquids or of substances dissolved or suspended in liquids [e.g., waste lyes from cellulose manufacture]. Ger. Pat. 269,994. *See* IIb.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing; The theory of —— II. W. D. Bancroft. J. Phys. Chem., 1914, **18**, 118—151. (Compare this J., 1914, 197.)

The author continues the discussion of his conception of the adsorption theory of dyeing, in connection with basic dyestuffs, relying mainly on the published literature, especially Pelet-Jolivet's "*Die Theorie des Färbeprozesses,*" for confirmation of his generalisations. He concludes in regard to a basic dyestuff that the dye is most readily taken up in alkaline solution, the presence of a readily adsorbed anion increasing the amount taken up, a readily adsorbed cation decreasing it. The views of Hantzsch, Baeyer and others on the ammonium base → carbinol → quinonimine base tautomerism of certain basic dyestuffs are extensively quoted in connection with the form in which these dyestuffs are fixed by charcoal, and the assumption of Freundlich that a condensation product of the imine base is formed is considered unnecessary. Green's observation that Aniline Black in the presence of the fibre is no longer soluble in 80 per cent. acetic acid is considered to indicate a phenomenon analogous to that of the insolubility in water of the basic dyestuffs after adsorption by charcoal.—J. B.

Patents.

[Bleaching] Treating vegetable fibres, yarns, and fabrics; Process of ——. J. Hirschberger, Jersey City, N.J., Assignor to H. A. Metz, New York. U.S. Pat. 1,087,584, Feb. 17, 1914.

Before bowking the goods are treated with a substance containing a fatty sulpho-acid radical and a volatile solvent and then with a weak solution of a mineral acid, afterwards washing, whereby the resistant impurities of the fibre are rendered easily removable.—J. B.

Dyeing machine. J. M. Payne, Sommerville, Ala., Assignor to Perfection Dyeing Machine Co., Columbus, Ga. U.S. Pat. 1,088,617, Feb 24, 1914.

The periphery of a warp beam consists of a number of fixed slats, with intermediate slats provided with mechanism for moving them reciprocally, either outwards to form a skeleton beam of greater diameter than that of the fixed slats, or inwardly within the periphery of the cylinder formed by the fixed slats, the motion being provided through wedges on the movable slats acting against cam faces on spiders which are caused to slide longitudinally on the axis of the beam by reciprocating mechanism.—J. B.

Dyeing machine. T. Allsop and W. W. Sibson, Assignors to The Philadelphia Drying Machinery Co., Philadelphia, Pa. U.S. Pat. 1,089,102, March 3, 1914.

THE machine consists of an outer drum constructed in two sections, the upper section of which is provided with a hinged door, and an inner rotatable drum, together with a circulating pump, dye-liquor reservoir, etc.—J. B.

Printing textile fabrics. H. Levinstein and Levinstein Ltd., Manchester. Eng. Pat. 4316, Feb. 20, 1913.

FAST prints are obtained after the manner described in Eng. Pat. 3427 of 1913 (this J., 1914, 309) by using any non-substantive dyestuff capable of forming an insoluble compound with formaldehyde, with the exception of the dyestuffs already claimed (*loc. cit.*). Suitable dyestuffs are, for example, mono-azo compounds containing as end-components derivatives of resorcinol, *e.g.*, chlororesorcinol, phloroglucinol, *m*-aminophenol, aminonaphthols, dihydroxynaphthalenes, etc.—J. B.

Wool cleansing apparatus. A. Thibeau et Cie., Tourcoing, France. Eng. Pat. 8689, April 12, 1913. Under Int. Conv., April 20, 1912.

SEE Fr. Pat. 442,930 of 1912; this J., 1912, 1028.—T. F. B.

Bleaching fibrous material. A. G. Bloxam, London. From Luftbleiche Ges. m. b. H., Eilenburg, Prussia. Eng. Pat. 13,902, June 16, 1913.

SEE Ger. Pat. 262,047 of 1912; this J., 1913, 824.—T. F. B.

Yarn-mercerising machine. P. Hahn, Niederlahnstein-on-Rhine, Germany. U.S. Pat. 1,087,442, Feb. 17, 1914.

SEE Eng. Pat. 21,539 of 1912; this J., 1913, 422.—T. F. B.

Cellulose esters; Coating materials with ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 21,015, Sept. 17, 1913. Under Int. Conv., Nov. 15, 1912.

SEE Fr. Pat. 461,058 of 1913; this J., 1914, 20.—T. F. B.

Viscose: Printing —— on textile fabrics. E. A. Fourneaux, Assignor to Calico Printers' Association, Ltd., Manchester. U.S. Pat. 1,087,938, Feb. 24, 1914.

SEE Eng. Pat. 15,080 of 1912; this J., 1913, 284.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Hydrofluoric acid and fluosulphonic acid. O. Ruff and H. J. Braun. Ber., 1914, **47**. 646—656.

IN preparing aqueous hydrofluoric acid from calcium fluoride and sulphuric acid the best yields (up to 81 per cent.) with the theoretical quantity of sulphuric acid are obtained when it contains about 10 per cent. of water. With 97—100 per cent. sulphuric acid, a 60 per cent. yield of 95—96 per cent. hydrofluoric acid can be obtained, but not the anhydrous compound. In any case the residue will contain some calcium fluosulphonate. With fuming sulphuric acid and fluorspar fluosulphonic acid is obtained, the yield increasing with the anhydride content of the sulphuric acid, and becoming practically theoretical with acid containing 60 per cent. of anhydride (*i.e.*, a little more than the theoretical amount). Fluosulphonic acid boils at 163° C., is not easily decomposed on heating, and is converted by reducing agents into sulphur dioxide and hydrofluoric acid.—W. H. P.

Fluosulphonic acid. O. Ruff. Ber., 1914, **47**. 656—660. (See also Traube, this J., 1913, 1008, and preceding abstract.)

SODIUM fluosulphonate was prepared by heating sodium chloride and fluosulphonic acid in a platinum retort and crystallising the residue from alcohol. Fluosulphonic acid could be heated to 900° C. without decomposing, to form sulphuryl fluoride in the manner suggested by Thorpe and Kirmann (Z. anorg. Chem., 1893, 3, 63). By the reaction of fluosulphonic acid on potassium bichromate and chromium trioxide a gaseous compound containing chromium and fluorine was evolved along with hydrofluoric acid. Attempts to condense the former gave a complex product and the author was not able to decide if this contained chromyl fluoride. With potassium permanganate a violet gas of an explosive character was evolved, probably either manganyl fluoride or permanganic anhydride.—W. H. P.

Sodium carbonate deposits in South Africa; Working of ——. Board of Trade J., March 19, 1914. [T.R.]

A COMPANY has recently been formed for the purpose of working a valuable deposit of crude carbonate of soda, situated about 25 miles from Pretoria. Some 3,000 tons of the soda have already been mined and sold in Johannesburg. The company also has a complete plant at Ophirton, Johannesburg, for the manufacture of washing soda, with a capacity of about 10 tons per day.

Ammonia; Electrolytic oxidation of ——. G. Oesterheld. Z. anorg. Chem., 1914, **86**, 105—142. (See also this J., 1905, 279, 280 and 550; 1906, 185; 1909, 704 and 1910, 21.)

IN the electrolysis of ammonia the gases at the anode always contain appreciable quantities of nitrous oxide (which can be isolated in the liquid state), as well as nitrogen and oxygen. When a solution of ammonium carbonate containing ammonia is electrolysed, practically the whole of the current can be accounted for from the oxygen, nitrogen and nitrous oxide evolved and the nitrate left in solution. The distribution of the current effect among these products varies with the anode material, the temperature, the current density and the ammonia concentration. Hydroxylamine, hyponitrite and nitrite are probably formed as intermediate products between the ammonia and the nitrate. These may escape further reduction by decomposition or interaction, *e.g.*, ammonium nitrite gives nitrogen, hyponitrite gives nitrous oxide, hydroxylamine and nitrite give hyponitrite. The course of the oxidation of the intermediate products, in the presence of varying quantities of ammonia may be observed by noting the anode potential at various current densities. Of all the successive changes the highest anode potential is required by the first reduction of the ammonia to hydroxylamine; hence the intermediate products will not tend to accumulate, and the predominating end product will be ammonium nitrate, the proportion of which can be appreciably reduced only by careful choice of concentration, current density, and temperature. To obtain a comparatively large current yield of oxidised products in the absence of a catalyst, an anode with a high oxygen over-voltage (*e.g.*, platinum or palladium) must be used, with iron, the tendency for oxygen to be evolved is very much greater. As the concentration of ammonia is raised the oxygen disappears: the nitrate increases and also the nitrogen and nitrous oxide. After a certain point the nitrate yield diminishes and the nitrogen and nitrous oxide (particularly the former) continue to increase. This is due to the fact that the anode potentials of nitrite and ammonia do not differ very greatly in equivalent solutions. If the ammonia concentration is increased the rate of oxidation of the nitrite diminishes, so that it is mainly decomposed. If a catalytically active anode is used the ammonia oxidation may be so much favoured that good yields of nitrite can be obtained as final product. Rise of temperature has an effect somewhat similar to that of increasing ammonia concentration, *i.e.*, the oxygen disappears, nitrate increases and then diminishes, and nitrogen and nitrous oxide steadily increase. Increasing current density increases the extent of oxidation.—W. H. P.

Ammonium sulphate; The colouration of ——. K. Leo. Stahl u. Eisen, 1914, **34**, 439—445.

The causes of the colouration of commercial ammonium sulphate were investigated by determining the impurities present in coloured samples, and by preparing tho salt on a small scale using sulphuric acid containing known amounts of impurities. A gray colour resulted from the presence of traces of tar, or of sulphides of lead or copper; blue and red from the presence of cyanides; yellow from the presence of the sulphides of arsenic and cadmium. Markedly coloured products were obtained with acid containing from 0·01 to 0·07 per cent. of the metallic impurities.—T. St.

Sulphur and calcium hydroxide; Reaction between —— *in aqueous solution.* H. V. Tartar. J. Amer. Chem. Soc., 1914, **36**, 495—498.

When an aqueous solution of calcium hydroxide was heated with sulphur in presence of air, decomposition of the thiosulphate produced into sulphite and sulphur always occurred even at temperatures much below 100° C. Experiments under varying conditions in an atmosphere of hydrogen showed that the primary reaction was:

$$3Ca(OH)_2+10S \rightarrow 2CaS_4+CaS_2O_3+3H_2O.$$

When excess of sulphur was used, it combined with the calcium tetrasulphide to form pentasulphide. (See also this J., 1910, 837; 1914, 74.)—A. S.

Fluorspar; Valuation of ——. E. Bidtel. J. Ind. Eng. Chem., 1914, **6**, 265.

The method described previously (this J., 1912, 332) is modified as follows:—After treating with acetic acid, instead of filtering, the mixture is evaporated to dryness, treated with 50 c.c. of water, heated to boiling to precipitate any iron dissolved as basic acetate and then filtered. (Calcium fluoride is less soluble in water than in acetic acid, and a correction of 0·001 grm. instead of 0·0015 grm. is sufficient.) After volatilising the silica as described earlier, and weighing the residue, 2 c.c. of hydrofluoric acid and 10 drops of nitric acid are added, the covered crucible warmed for 30 mins., the contents evaporated to dryness, and the residue evaporated with 2 c.c. of hydrofluoric acid. A correction of 0·002 grm. is made for loss of weight in the treatment with mercuric oxide and hydrofluoric acid and one of 0·001 grm. for loss in the treatment with ammonium acetate (*loc. cit.*).—A. S.

Chlorides of lead and sodium; Equilibrium between ——, *in aqueous solution.* N. Demassieux. Comptes rend., 1914, **158**, 702—703.

Isotherms at 13°, 15° and 100° C. are represented graphically. The solubility of lead chloride diminishes slightly till the solution contains about 3 grms. of sodium chloride per 100 grms.: after which the solubility increases, owing to the formation of a labile double salt, until the attainment of the transition point, at which the corresponding amount of sodium chloride is about 27 grms. at each temperature, while that of lead chloride varies from about 2 grms. at 13° to 12 grms. at 100° C. (See also this J. 1914, 254.)—J. R.

Ferrous and chromous metaphosphates. A. Colani. Comptes rend., 1914, **158**, 794—796.

Ferrous metaphosphate, $Fe_3(PO_3)_2$, was prepared by the action of fused metaphosphoric acid on metallic iron or ferrous chloride, oxalate or phosphate in an atmosphere of carbon dioxide under similar conditions to those prescribed for molybdenum metaphosphate (this J., 1914, 253). It was obtained as a white powder, slightly greenish in mass, insoluble in hydrochloric and nitric acids, and oxidised by hot concentrated sulphuric acid, with liberation of sulphur dioxide. Attempts to prepare chromous metaphosphate failed, the chromic salt, $Cr(PO_3)_3$, being always produced owing to oxidation by water evolved from the metaphosphoric acid.—A. S.

"Infusible white precipitate"; Constitution of ——. H. Saha and K. N. Choudhury. Z. anorg. Chem., 1914, **86**, 225—229.

Cold hydrochloric acid acts on the compound, H_2NHgCl, to give ammonium and mercuric chlorides in molecular quantities. Hydrobromic and hydriodic acids act similarly, giving a mixture of bromides and iodides respectively. Hydrofluoric acid gives mercuric chloride, mercuric fluoride and ammonium fluoride, indicating that in the original compound the chlorine is attached to the mercury and not to the nitrogen. The formula $H_2N.Hg.Cl$ is further supported by the composition of the yellow crystalline precipitate $NH_2HgCl.PtCl_4$, obtained from an ammoniacal solution of the "white precipitate" on addition of chloroplatinic acid, and by the formation of the "white precipitate" by the action of sodamide on mercuric chloride.—W. H. P.

Nickelous oxide; Reduction of ——, *and existence of a suboxide.* P. Sabatier and L. Espil. Comptes rend., 1914, **158**, 668—675. (Compare Meigen and Bartels, this J., 1914, 323.)

Carefully purified hydrogen was passed over a known weight of heated nickelous oxide, the extent of the progressive reduction being ascertained by weighing the water produced during observed intervals of time. The velocity of reduction depends upon the nature of the oxide, the rapidity of the hydrogen current, and the temperature. Oxide prepared at a high temperature is reduced far more slowly than that prepared at a low temperature, especially when the reduction is effected at a low temperature. Results are quoted for reduction temperatures between 155° and 250° C. with hydrogen currents varying from 6 to 24 c.c. per min. and times from 1 to 163 hours. The velocity of reduction is an exponential function of the temperature; and the results show further that fairly rapid reduction first occurs to a suboxide, which is then reduced to the metal at a much slower rate. The probable formula of the suboxide is Ni_4O, corresponding to the compound $Ni_4(NO_2)_2$. The reduction is retarded by traces of moisture.—J. R.

Phosphides of manganese: The higher ——. S. Hilpert and T. Dieckmann. Ber., 1914, **47**, 780—784.

A mixture of 2 grms. of manganese and 2·4 grms. of red phosphorus was heated in an exhausted sealed tube first for 48 hours at 400° C. and then for 48 hours at 600 C. The product was triturated with benzene, separated by filtration, washed with alcohol and ether, and dried over sulphuric acid. It had a composition corresponding to MnP_2. When heated in hydrogen for 13 hours at 290° C. (the boiling point of phosphorus) it remained unaltered, but at 400° C. it gradually lost phosphorus, and after about 50 hours was completely converted into MnP (sp. gr. 5·39 at 20°/4° C.). Both phosphides were dark grey powders, not readily attacked by acids, and possessed ferromagnetic properties, the transformation point (Curie point) being about 38 C. for MnP_2 and 28° C. for MnP. When heated in air they burned like phosphorus, leaving black, strongly magnetic residues. For the purposes of analysis the phosphides were mixed with about 20 times their weight of sodium peroxide, heated very slowly to incipient fusion, the melt treated with water, the solution evaporated to dryness twice with hydrochloric acid, and the residue dissolved in hydrochloric acid. The manganese was then determined by titration with permanganate (this J., 1913, 510) and the phosphorus by precipitation as ammonium phosphomolybdate and reprecipitation as magnesium-ammonium phosphate.—A. S.

Nitrogen hexoxide and isonitrogen tetroxide: The —— of F. Raschig. E. Müller. Z. anorg. Chem., 1914, **86**, 230—238.

THE green substance obtained by Raschig (this J., 1911, 1208) and by the author (this J., 1912, 685) is considered to be not nitrogen hexoxide, but a mixture of the oxides NO_2, N_2O_4, N_2O_3 and NO. The green colour can be exactly reproduced by dipping a test-tube containing liquid air into liquid N_2O_3 and then into liquid N_2O_4, or even by depositing these oxides separately on tubes which will fit one inside the other. On washing with liquid nitrogen the green substance does not lose oxygen or pass into NO_2 or isonitrogen tetroxide.—W. H. P.

Hydrogen sulphide; Colourimetric determination of small quantities of ——. W. Mecklenburg and F. Rosenkränzer. Z. anorg. Chem., 1914, **86**, 143—153.

THE process depends on the formation of methylene blue when dimethyl-*p*-phenylenediamine sulphate and ferric chloride are added in small quantities to a hydrochloric acid solution of hydrogen sulphide. The reagents are added in the order: hydrochloric acid, diaminesulphate and ferric chloride, in definite quantities as rapidly as possible, the temperature being kept constant. The colours are compared with standards prepared in a similar manner from solutions of known concentration of hydrogen sulphide (determined iodometrically) containing 10×10^{-6} to 3000×10^{-6} grm. per litre. The quantities recommended for 500 c.c. of solution are: 10 c.c. of concentrated hydrochloric acid, 25 mgrms. of diaminesulphate, and 2·5 c.c. of a 0·1 molar solution of ferric chloride dissolved in equal volumes of concentrated hydrochloric acid and water. The limits of the method are from 10×10^{-6} to 3000×10^{-6} grm. per litre.—W. H. P.

Hydrogen peroxide; The photochemical decomposition of ——. J. H. Mathews and H. A. Curtis. J. Phys. Chem., 1914, **18**, 166—178.

A MERCURY vapour lamp was used as the source of light and in order to maintain a constant illumination the lamp was surrounded by an air current of constant temperature, circulated through a Uviol-glass tube. The peroxide solution was contained in a Uviol-glass tube which was rotated by means of a pulley fixed at its upper end, its lower end being plugged with paraffin wax and resting on a spindle inside a larger tube of Uviol-glass through which was circulated a stream of water at constant temperature The decomposition was measured by titrating with permanganate and sulphuric acid. It followed the course of a unimolecular reaction and ceased abruptly on extinguishing the light. The temperature coefficient of the reaction was 1·5. Various substances acted as negative catalysts: sulphuric acid, sodium hydroxide, iodine, mercuric chloride, potassium cyanide, sodium thiosulphate, hydrogen sulphide, acetanilide, sodium chloride, calcium hydroxide and barium hydroxide. The case of sodium hydroxide was especially interesting as this substance acted as a powerful positive catalyst for the decomposition of hydrogen peroxide by heat.—J. B.

Bromine associated with chlorine in haloid salts; Use of telluric acid in the determination of ——. F. A. Gooch and H. I. Cole. Amer. J. Sci., 1914, **37**, 257—262.

TELLURIC acid may be used instead of selenic acid (see this J., 1913, 140) for the selective oxidation of hydrobromic acid in presence of hydrochloric acid, but it is necessary to add also sulphuric acid to liberate the hydrobromic acid from bromides. A weighed quantity of the haloid salts (chloride and bromide) is placed in a Voit distillation flask together with 1 grm. of telluric acid and water to make 40 c.c. The flask is connected by ground glass joints with a receiver containing 300 c.c. of a 1 per cent. solution of potassium iodide. 10 c.c. of sulphuric acid (1 : 1) are run into the distillation flask, a slow current of carbon dioxide is passed through the apparatus, and the reaction mixture is distilled until its volume is reduced to 17—18 c.c. The free iodine in the receiver is then titrated with thiosulphate. Under the conditions described up to 0·3 grm. of bromine (as bromide) can b accurately determined in presence of up to 0·25 grm. chlorine (as chloride).—A. S.

Carbon and graphite; Heat resistivity of —— J. W. Richards. Trans. Amer. Electrochem. Soc., 1913 **24**, 109—118.

A 20 cm. cube of the material, with a 2·5 cm. cubical cavity in its centre, was heated by an electric arc, the temperature within 1 mm. of the cavity being measured by a thermocouple inserted in a small hole 5 mm. in diameter. From measurements of the temperature of the outer faces the following results were obtained:—

National Carbon Co. carbon (202°—853° C.)=
36·8 thermal ohms per cm. cube.
Acheson graphite (240°—420° C.)=
3·69 thermal ohms per cm. cube.

In the discussion the necessity for recognising that the temperature of the inner surface is not necessarily that of the source of heat, but that it is determined by the outside temperature, the conductivity, and the thickness of the walls, was pointed out. Thus it is not necessary that the temperature of the gases in an open-hearth furnace be below the melting point of the roof bricks; it is in fact frequently some hundreds of degrees higher.—W. H. P.

Sodium chloride as a reagent for the detection of soluble silicates. Isnard. *See* XII.

PATENTS.

Nitrogen oxides or oxyacids; Process and apparatus for the manufacture of ——. A. H. Lymn, London. Eng. Pat. 3194, Feb. 7, 1913.

A TUBE containing a bed of porous, refractory material, such as fireclay, is heated by means of a combustible gas, and a mixture of nitrogen and oxygen is passed over it and combination induced inside and around the refractory mass; or the gases may be passed through the walls of a porous cylinder and caused to combine near its surface, which is thus raised to incandescence. Steam, superheated to the point of dissociation, may also be introduced into the gaseous mixture, in which case the reunion of hydrogen and oxygen causes an intensely high temperature, which promotes the combination of nitrogen and oxygen. To minimise dissociation, the nitrogen oxides, as soon as they are formed, are cooled, or absorbed by a suitable liquor. The gases may be admitted under pressure, at a reduced pressure, at a high velocity, or intermittently by means of a series of explosions.—O. R.

Sulphuric acid from the sulphur compounds of ammonia-freed coal-gas; Process for manufacturing ——, and apparatus therefor. J. Mackenzie, Middlesbrough-on-Tees. Eng. Pat. 4770, Feb. 25, 1913.

COAL-GAS, which has been cooled, condensed, scrubbed, and freed from ammonia, is passed through a series of purifiers containing ferric oxide. As soon as one of the purifiers is charged with sulphur, hot air is passed through it, and the sulphur dioxide which is formed, mixed with air, is passed successively through a contact chamber containing heated spent pyrites, a Glover tower, a sulphuric acid chamber, and a Gay-Lussac tower, for the manufacture of sulphuric acid.—O. R.

Metallic oxides or compounds [hydroxides]; Manufacture [by electrolysis] of ——. C. White, London. Eng. Pat. 4082, Feb. 17, 1913.

AN alkali chloride solution (20—25 per cent.) previously purified and containing ½—1 per cent. of alkali hydroxide, is heated to 98° C. and electrolysed, using as anode the metal (copper, zinc, lead, tin, bismuth) of which it is desired to form the oxide or hydroxide. A current density of about 100 amps. per sq. m. under a pressure of 1 volt may be employed.—O. R.

Salt; Manufacture of —— by multiple-effect evaporation. S. M. Lillie, Philadelphia, Pa. U.S. Pat. 1,086,457, Feb. 10, 1914.

In a multiple-effect evaporator for the manufacture of salt from brine, two or more evaporators communicate by way of a suitable conduit with a device for separating deposited salt crystals; suitable steam connections allow the evaporators at either end of the series to act alternately as the hottest and coldest end respectively, and provision is made for a flow of brine through the conduit, sufficiently rapid to carry salt, which is deposited in the conduit, into the separator.—O. R.

Thoria from monazite sand; Process of extracting ——. C. Baskerville, New York, Assignor to Welsbach Light Co., Gloucester City, N.J. U.S. Pat. 1,087,099, Feb. 17, 1914.

A mixture of monazite sand, carbon, lime, and calcium fluoride is heated to a temperature high enough to eliminate phosphorus and silicon from the sand, and to convert the metals into carbides, which are then disintegrated by slaking.—O. R.

Stannic chloride; Apparatus for the manufacture of ——. W. F. Doerflinger, Halesite, N.Y., Assignor to Niagara Alkali Co. U.S. Pat. 1,087,437, Feb. 17, 1914.

An apparatus for treating tin with hydrochloric acid comprises a reaction vessel fitted with a double locked inlet for the tin, an inlet for the acid, an internal appliance for regulating the temperature, and a number of independent temperature-regulating jackets.—O. R.

Potash salts from kelp; Process of obtaining ——. H. Wilson, Assignor to Pacific Kelp Co., San Francisco, Cal. U.S. Pat. 1,087,477, Feb. 17, 1914.

Kelp is allowed to decompose in a porous vessel until converted into a semi-solution; chlorides are deposited on the outside of the vessel as an efflorescence and are recovered. The kelp is then allowed to decompose further until the moisture has evaporated, water is added to the residue and nitrates are recovered in a similar manner as an efflorescence on the outside of the vessel.—O. R.

Dissolving salts, especially potassium salts, continuously in a counter-current apparatus. K. Kölichen and R. Meyer. Ger. Pat. 270,380, Dec. 2, 1910.

The cylindrical apparatus is divided into compartments by conical partitions disposed in pairs and communicating at their adjacent narrow ends by small openings. These partitions act as heating surfaces and the upper one of each pair, with its wide end uppermost, serves as a dissolving chamber. The material is introduced at the top of the apparatus and is carried downwards through the series of conical dissolving chambers by stirrers mounted on a central shaft, which also carries distributing plates. The solvent enters at the lower end of the apparatus and the solution leaves near the top. Steam for heating flows from above downwards through the heating chambers bounded by the conical partitions and the outer wall of the apparatus.—A. S.

Kieserite almost free from chlorine; Apparatus for obtaining ——. S. Haun. Ger. Pat. 270,193, June 20, 1913. Addition to Ger. Pat. 265,044.

In the apparatus described in the chief patent (this J., 1913, 1067), a screw is mounted in the tube through which the kieserite passes into the dish below. The kieserite is forced downwards by the screw and gradually fills the dish and is discharged slowly over the side. The dish may be replaced by a valve held in place by a spring or counterpoise until opened by the kieserite forced downwards by the screw.—A. S.

Nitrogen; Fixation of ——. J. E. Bucher, Providence, R.I., U.S.A. Eng. Pat. 27,713, Dec. 2, 1912.

See Fr. Pat. 455,799 of 1912; this J., 1913, 943. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 5617 of 1881 and 1695 of 1908.—T. F. B.

Silicates containing potash; Process for producing from —— products which are richer in potassium oxide. P. Schneider, Cologne, Germany. Eng. Pat. 4403, Feb. 20, 1913. Under Int. Conv., Feb. 21, 1912.

See Fr. Pat. 454,632 of 1913; this J., 1913, 867.—T. F. B.

Alkali-metal compounds from silicates containing the same; Process of obtaining ——. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,087,132, Feb. 17, 1914.

See Ger. Pat. 252,278 of 1911; this J., 1912, 1179.—T. F. B.

Alkalis from natural rocks; Method of extracting ——. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,089,716, March 10, 1914.

See Ger. Pat. 264,900 of 1912; this J., 1913, 1066.—T. F. B.

Ammonium salts; Apparatus for manufacturing —— from ammoniacal substances. La Suburbaine (Vidanges et Engrais) Soc. Anon., Rueil, France. Eng. Pat. 4687, Feb. 24, 1913. Under Int. Conv., Feb. 24, 1912.

See Fr. Pat. 454,498 of 1913; this J., 1913, 882.—T. F. B.

Ammonia; Producing ——. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,089,185, March 5, 1914.

See Addition of Aug. 13, 1912, to Fr. Pat. 431,295 of 1911; this J., 1913, 233.—T. F. B.

Ammonia; Process for the synthetic preparation of —— from its constituents. A. Matignon, Bourg-la-Reine, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pats. 1,089,240 and 1,089,241, March 3, 1914.

See Fr. Pat. 430,595 of 1910; this J., 1911, 1381.—T. F. B.

Radiothorium; Process for the preparation of ——. P. M. Justice, London. From O. Knöfler und Co., Berlin. Eng. Pat. 5960, March 10, 1913.

See U.S. Pat. 1,076,141 of 1913; this J., 1913, 1116.—T. F. B.

Hydrogen peroxide; Manufacture of ——. H. Wade, London. From Henkel und Co., Dusseldorf, Germany. Eng. Pat. 10,476, May 3, 1913.

See Fr. Pat. 457,696 of 1913; this J., 1913, 1010.—T. F. B.

Chlorate solutions; Process for activating ——. K. Hofmann, Charlottenburg, Germany. Eng. Pat. 20,593, Sept 11, 1913. Under Int. Conv., Nov. 19, 1912.

See Ger. Pat. 267,906 of 1912; this J., 1914, 200.—T. F. B.

Lime in block form; Process for the production of ——. F. Neumerkel, Budapest. Eng Pat. 22,924, Oct. 10, 1913. Under Int. Conv., April 14, 1913.

See Fr. Pat. 461,359 of 1913; this J., 1914, 260.—T. F. B.

Aluminosilicates or artificial zeolites; Process of making hydrated ——. R. Gans, Pankow, Assignor to J. D. Riedel A.-G., Berlin. Reissue No. 13,691, Feb. 24, 1914, of U.S. Pat. 914,405, March 9, 1909.

See Eng. Pat. 8232 of 1907; this J., 1907, 1091.—T. F. B.

Hydrated alumino-silicates, or artificial zeolites, and process of producing same. R. Gans, Pankow, Assignor to J. D. Riedel A.-G., Berlin. Reissue No. 13,688, Feb. 17, 1914, of U.S. Pat. 943,535, Dec. 14, 1909.

See Fr. Pat. 374,525 of 1907; this J., 1907, 872.—T. F. B.

Tin tetrachloride; Process of producing ——. Obtaining tetrachloride of tin from tin-scrap and other materials containing tin. P. Wolff, Wetzlar, Germany, Assignor to Vulcan Detinning Co. U.S. Pats. 1,087,522 and 1,087,523, Feb. 17, 1914.

See Fr. Pat. 405,851 of 1909; this J., 1910, 424.—T. F. B.

Bisulphites; Process of stabilising ——. L. Nonnet, Brussels. U.S. Pat. 1,087,547, Feb. 17, 1914.

See Fr. Pat. 450,804 of 1912; this J., 1913, 602.—T. F. B.

Titanium cyanonitride; Process of producing ——. S. Peacock, Chicago, Assignor to E. I. du Pont de Nemours Powder Co. U.S. Pat. 1,088,359, Feb. 24, 1914.

See Eng. Pat. 11,392 of 1912; this J., 1913, 600.—T. F. B.

Electrolysis of alkali or alkaline-earth chlorides; Process for the ——. A. Clemm. Fr. Pat. 463,395, Oct. 8, 1913. Under Int. Conv., Dec. 3, 1912.

See Eng. Pat. 21,462 of 1913; this J., 1914, 312.—T. F. B.

Phosphorus pentachloride; Process for producing ——. S. Peacock. Fr. Pat. 463,497, Oct. 10, 1913.

See Eng. Pat. 23,023 of 1913; this J., 1914, 256.—T. F. B.

Sodium bisulphate; Process for making —— in a form which can be calcined directly. Akt.-Ges. Dynamit Nobel. Fr. Pat. 464,097, Oct. 23, 1913. Under Int. Conv., Jan. 22, 1913.

See Ger. Pat. 263,120 of 1913; this J., 1913, 909.—T. F. B.

Hydrogen; Production of ——. A. Messerschmitt, Stolberg, Germany. Eng. Pat. 18,028, Aug. 7, 1913. Under Int. Conv., Jan. 10, 1913.

See Fr. Pat. 461,480 of 1913; this J., 1914, 200.—T. F. B.

Oxygen [from air]; Apparatus for the manufacture of ——. E. F. Aumont, Paris. U.S. Pat. 1 088,052, Feb. 24, 1914.

See Eng. Pat. 11,306 of 1911; this J., 1912, 230.—T. F. B.

Hydrogen and oxygen; Electrolytic production of ——. The Knowles Oxygen Co., Ltd., and R. W. Grant. Fr. Pat. 463,507, Oct. 10, 1913.

See Eng. Pat. 1812 of 1913; this J., 1914, 24.—T. F. B.

Recovery of sulphur from pyritic ores. Eng. Pat. 26,370. *See* X.

Collection and separation of finely divided sulphur. Eng. Pat. 26,594. *See* X.

Electrolytic generator [for hydrogen and oxygen]. U.S. Pat. 1,087,937. *See* XI.

VIII.—GLASS; CERAMICS.

Transparent quartz; French manufacture of —— and its applications. Mercury vapour lamps. J. Gallois. Bull. Soc. d'Encour., 1914, **121**, 205—212.

Dependent till 1911 on English and German imports, the French now manufacture their own silica ware, a factory at Laigneville producing fused quartz which allows the whole mercury spectrum down to 2302 Angström units to pass through a thickness of 3 mm. of the medium, a transparency to ultra-violet rays which permits of its application to the sterilisation of liquids in addition to industrial illumination and chemical ware. A new mercury vapour lamp with quartz illuminating tube is described. In the initial position the mercury fills the illuminating tube, but when the current is started, a coil attracts an armature connected by a rod with the tube, and turns the latter on its axis about 40° whereby in consequence of the shape of the tube the mercury is divided into two portions and an arc is formed across the intervening space. Quartz lamps are constructed to work under tensions of 220 to 500 volts, giving a candle-power of 500—6600. The most powerful will illuminate an area of 2 hectares (5 acres).—H. H. S.

Patents.

Oil fired furnaces for melting glass or other fusible substances. A. A. Mohn, London. From J. Rothkopf, Paris. Eng. Pat. 26,494, Nov. 18, 1912.

A continuous furnace is provided with an arched double roof, the hot combustion gases returning through the space thus enclosed, with the result that a more intense and regular heat is reflected on to the material to be melted in the furnace, whilst the waste gases are utilised for the production of superheated steam which is employed to break up and spray the heavy liquid hydrocarbons used in the burner.—H. H. S.

Refractory products of quartz and similar materials; Manufacture of ——. W. Boehm. Fr. Pat. 463,147, Oct. 2, 1913.

Silica or zirconia is rendered conducting by addition of soda or potash lye and then fused by electric current, the heating being continued until the alkali is volatilised. The ware is shaped in the fused condition.—H. H. S.

Bricks; Methods and apparatus for the burning and like treatment of ——. E. C. R. Marks, London. From A. A. Scott, Knoxville, Tenn., U.S.A. Eng. Pat. 4286, Feb. 19, 1913.

Dried bricks are placed in a series of closed self-contained communicating kiln chambers, each forming in itself a complete kiln and having its own combustion chamber. The chambers are mounted on suitable trucks moving on a track through a tunnel of sufficient height to leave a drying chamber for wet bricks above the train. Means are provided for the introduction of fuel into each kiln-chamber, and flues connect the rear end of one with the forward end of its successor throughout the train. When the bricks in the middle kiln are burned, the train is advanced one chamber, a new kiln filled with dried hot bricks being added at the rear.—H. H. S.

Earthenware; Methods of placing articles of —— and the like in firing ovens and in saggers. W. Hassall, Burton-on-Trent. Eng. Pat. 14,325, June 20, 1913.

Lavatory basins and similar articles are supported in firing or glazing ovens by floors or shelves extending only partly across the area of the saggers so that the articles overlap one another vertically, the saggers of each "bung" or stack being arranged so that floors and spaces alternate in position.—H. H. S.

Abrasive compounds; Method of producing ——. T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,087,705, Feb. 17, 1914.

A molten magma having substantially the theoretical composition of garnet is allowed to cool slowly to permit of the crystallisation of garnet, and then quickly—for example, by crushing in water—in order to prevent dissociation of the garnet.—H. H. S.

Polishing material; Manufacture of —— from bauxite. E. Strasser. Fr. Pat. 463,570, Oct. 13, 1913.

Bauxite rich in iron is calcined at 1200°—1400° C., with addition of a reducing agent such as common salt and carbon, which will form a volatile compound of iron, and the residual alumina is fused in an electric furnace.
—H. H. S.

Ceramic materials and products; Manufacture of ——. T. Moses. Fr. Pat. 463,899, Oct. 27, 1913.

Fragments of porcelain, faience and glass, free from iron, are mixed in the proportions 100 : 35 : 20, powdered, and treated as in the manufacture of glazed tiles.—H. H. S.

Metal articles; Cleaning of —— preparatory to the application of a coating of enamel or the like. T. R. Davidson, Westmount, Quebec, Canada. Eng. Pat. 16,554, July 18, 1913.

The metal articles, such as sheet iron or steel, are first immersed in concentrated sulphuric acid to carbonise grease, etc., then allowed to stand in water, when the carbonised matter settles, and the dilute acid formed further cleanses the metal. Finally they are washed in clean water heated preferably to near the boiling point, and dried.—T. St.

Enamelling sheet-iron and the like: Process for ——. L. Honigmann, Aachen, Prussia. Eng. Pat. 28,398, Dec. 9, 1913. Under Int. Conv., April 4, 1913.

Metallic silver is used in the undercoat as a substitute for cobalt or nickel oxide, or for a silver compound in solution, in order to make the enamel more flexible and adherent.—H. H. S.

Enamels; Manufacture of white ——. Verein. Chem. Fabr., Landau, Kreidl, Heller und Co. Fr. Pat. 463,623, Oct. 14, 1913. Under Int. Conv., Oct. 22, 1912.

Oxides and silicates, *e.g.*, of zirconium, titanium, aluminium and tin, suitable for use as agents for producing opacity, are finely ground and treated in the enamel mill with very dilute acid or alkali, by absorption of which they become capable of combining with water. Formation of sols is avoided by addition of crystalloids.—H. H. S.

IX.—BUILDING MATERIALS.

Portland cement; Determination of the finest flour in ——. A. Hauenschild. Tonind.-Zeit., 1914, 38, 477—478.

Portland cement was divided into fractions of different legrees of fineness by first passing it through a sieve with 900 meshes per sq. cm. and then grading the finer ortion in an air centrifuge, the material being fed through hopper on to a distributing plate, on leaving which it vas subjected to the action of a centrifugal air current, roduced by a fan rotating at 2180 revs. per min. In his way considerable quantities of the material were reated, the different fractions being collected in a series f concentric receptacles. The finest fraction contained he greater part of the sulphates present in the cement. he various fractions did not differ much in composition xcept in regard to the loss on ignition, which was greatest the finest fraction, and decreased progressively with e decrease of fineness. The time of setting was accelerated, the volume-weight decreased, and the volume-nstancy increased with increasing fineness. The greatest rength was possessed by Portland cement grains the mensions of which were between 0·0363 and 0·0197 mm. he finest flour, less than 0·007 mm. in size, rapidly sorbed carbon dioxide and water, and was therefore not lapted to yield cement of the greatest strength.—O. R.

rtland cement; The iron in ——. H. Kühl. Tonind.-Zeit., 1914, 38, 537—540.

x groups of cements were prepared, all having the same icate modulus, or ratio of silica to alumina plus ferric ide, viz., 1 : 1·90, but with the percentage ratio $_2O_3 : Fe_2O_3$ varying in the different groups from 84 : 0·63 to 0·19 : 10·85. In each group, the proportion of lime only was allowed to vary. The highest portion of lime which could be safely introduced was siderably higher with the cements rich in alumina n with those rich in ferric oxide, the limiting values the "hydraulic modulus" being 1 : 2·3 and 1 : 2·0 pectively. Within the limits for a true Portland ent (silicate modulus, 1 : 1·2 to 1 : 4·0), the highest sible proportion of lime is given by the formula, $CaO,SiO_2+y,3CaO,Al_2O_3+z,3CaO,2Fe_2O_3$. A micropic study of cement clinker containing varying protions of ferric oxide indicated that iron compounds act beneficially as a flux in bringing about sintering, which is necessary for the proper formation and crystallisation of the clinker minerals.—F. Sodn.

Blast furnace slag in Portland cement; Determination of ——. F. Hart. Z. Unters. Nahr. Genussm., 1914, 27, 286—290.

The material is dried at 105° C. and the fine meal of Portland cement removed through a sieve with 5000 meshes per sq. cm. The residue is washed with alcohol and ether, dried, and particles of iron removed by a magnet. Twenty grms. are then submitted to systematic fractionation by shaking with mixtures of benzene and methylene iodide of sp. gr. 3·05, 3·00, 2·96, and 2·70 respectively, so as to obtain five fractions: (1) sp. gr. above 3·05 (cement clinker), (2) sp. gr. 3·0—3·05 and (3) sp. gr. 2·96—3·0 (mixtures of cement and slag), (4) sp. gr. 2·70—2·96 (slag), and (5) sp. gr. below 2·7 (coke, ash, gypsum, and slag). Fractionation is continued until portions 1 and 4, examined microscopically (and, if desired, by chemical analysis), are found to be pure, and the sulphide sulphur is then determined in each, as well as in the original cement. The percentage of added slag is given by the formula, $H = 100\frac{a-b}{c-b}$, in which a is the sulphide content of the cement, b and c that of fractions 1 and 4 respectively. The method is inapplicable if more than one kind of slag be present.—F. Sodn.

Patents.

Ovens and kilns; Bricks or quarries for use in the bottoms of ——. C. T. H. Phillips, Burslem, Staffs. Eng. Pat. 3613, Feb. 12, 1913.

The brick or "quarry" is formed with one or more semicircular indentations at its longitudinal and transverse edges, so that when one row of bricks on edge is bridged over with similar bricks on the flat, passages are formed for the circulation of air. (Reference is directed to Eng. Pats. 8561 of 1890, 18,730 of 1892, 21,256 of 1895, 9948 of 1905, and 8362 of 1911.)—O. R.

Refractory brick. H. Wessling, Hays Station, Pa. U.S. Pats. 1,088,755 and 1,088,756, March 3, 1914.

Fine particles of silica are bonded together by finely pulverised soapstone in the proportion of 6000 lb. to 150 lb. A smooth surface is obtained by dipping the brick in a bath of powered silica and water before drying and burning.—H. H. S.

Portland cement; Application of the waste from sugar-refineries to the manufacture of an artificial ——. Soc. Anon. des Etablissements A. Maguin. First Addition, dated Dec. 12, 1912, to Fr. Pat. 460,438, Oct. 4, 1912 (this J., 1914, 27).

The coal for firing the kiln passes first through a drying tube, and is then raised by an elevator into a hopper whence it is fed to a double tube grinding mill. The powdered coal is delivered by an elevator to a screw conveyor leading to the kiln, any surplus being returned by another screw conveyor to the elevator.—A. T. L.

Artificial stone; Porous —— and its production. J. W. Aylsworth, East Orange, and F. L. Dyer, Montclair, N.J. U.S. Pat. 1,087,098, Feb. 17, 1914.

Powdered aluminium and a small quantity of slaked lime are added to mixtures containing Portland cement, whereby hydrogen is evolved on the addition of water, with the formation of porous artificial stone.—O. R.

Cement, concrete and the like in briquette form; Apparatus for applying tensile and compressive tests to ——. A. K. Bamber, London. Eng. Pat. 6645, March 18, 1913.

The use of two separate machines in carrying out tensile and crushing tests is avoided by an apparatus comprising a fixed frame carrying an abutment for compression tests, and having a cross member provided with a jaw for tensile tests. A movable frame mounted so as to slide within the fixed frame and carrying a complementary abutment and a complementary jaw, is forced upwards by compressed liquid and exerts a tensile strain on the test briquette held by the jaws and a crushing strain on that between the abutments.—H. H. S.

Alkaline cements. J. H. Amies. Philadelphia. U.S. Pats. 1,087,914 and 1,088,646. Feb. 24. 1914.

Dry cement powders capable of being shipped in bags, and of securing the set of natural soil when mixed with such soil and water, are composed of: (1) 60 parts of Portland cement, 30 of calcium hydroxide, and 10 of soda ash or other water-soluble alkali; (2) 50 parts of Portland cement, 30 of calcium hydroxide and 20 of plaster of Paris.—H. H. S.

Concrete; Process of waterproofing ——. A. E. Horn, New York. U.S. Pat. 1,088,022, Feb. 24, 1914.

Ammonium stearate, or other ammonium soap unstable in air and free from other alkali, is added to the water used for gauging the concrete.—H. H. S.

Refractory brick [for lining rotary kilns]; Manufacture of —— from cement. Soc. J. et. A. Pavin de Lafarge. Fr. Pat. 463,394. Oct. 8. 1913.

To render bricks made from Portland cement clinker more durable small quantities of calcium fluoride and calcium chloride are added. The bricks are made by agglomerating with calcium fluoride, and chloride, powdered Portland cement clinker containing SiO_2 20—30, $Al_2O_3+Fe_2O_3$ 2—5, and CaO 65—70 per cent. The quantity of fluorine should not exceed 1 per cent. of the whole mass.—A. T. L.

Cement or artificial stone; Process for colouring —— with substances having a basis of kaolin or other aluminium silicates and prepared by special methods. A. J. Caubel. Fr. Pat. 464,057. Sept. 27, 1913.

A chrome green is prepared by mixing finely powdered kaolin with sodium bichromate, making into a paste with a 5 per cent. solution of common salt and a 1 per cent. solution of sodium silicate, drying and calcining in a reducing atmosphere. Cobalt blue is prepared similarly from kaolin and the double chloride of sodium and cobalt, and a red material from kaolin and ferrous sulphate. A lead chromate colour is made by precipitating with bichromate a boiling mixture of kaolin and lead acetate. Similar products may also be prepared by treating a paste consisting of kaolin and sodium silicate with an aqueous solution of the colouring matter, boiling, and precipitating with sodium carbonate and alum. For colouring cement and artificial stone, the materials prepared as described are boiled with a solution containing caustic soda, 2, and sodium carbonate 5 per cent., decanted and filtered. The dry colour is then mixed with cement and sand and water.—A. T. L.

Plaster of Paris; Kiln for burning ——. M. F. Clément Fr. Pat. 463,242. Dec. 11, 1912.

The material is supported in the kiln on a perforated floor through which are admitted the heating gases from furnaces or producers. Air is delivered to the latter by a blower, and dampers are arranged so that part of the air can be delivered above the fuel in order to regulate the temperature of the heating gases for the kiln. The air is preheated in a jacket enclosing the furnace or producer. To ensure a uniform temperature in the kiln, a perforated partition is arranged above the charge so that the gases passing through the charge are under slight pressure. —A. T. L.

Artificial wood; Manufacture of ——. McTavish, Ramsay and Co., and A. L. Ramsay, Dundee. Eng. Pats. 7038, March 25, and 12,286, May 27. 1913.

Sawdust is mechanically reduced or ground, preferably with the aid of heat and with addition of 0·5 per cent. of caustic potash. It may then be subjected, in a closed vessel, to alternating vacuum and release, after which a pressure of 3 lb. per sq. in. is applied till the mass softens. It is next mixed with 5 per cent. of cellulose acetate and with chemicals, *e.g.*, caustic alkali, or rosin size, or soda and alum, with or without jute or hemp waste previously steeped in hot caustic. The mass is finally compacted by alternate drying and pressing. The proportions of the ingredients may be: sawdust 70, jute waste 20, cellulose acetate 5, chemicals 5, per cent.—H. H. S.

Wood and other porous bodies; Apparatus for the impregnation of ——. F. Moll. Fr. Pat. 463,630. Oct. 14, 1913. Under Int. Conv., Oct. 16. 1912.

The vessels in which wood, etc., is treated under pressure with a solution of mercuric chloride, copper sulphate, or acid zinc fluoride are made of materials not attacked by the solution, such as cement, concrete, masonry or wood. The wood, etc., is carried on a wooden trolley running on hardwood balls or rollers. The pipe connections between the impregnating vessel and the reservoir containing the impregnating solution are of earthenware cased in iron, or of iron lined with ebonite.—A. T. L.

Wood and other vegetable substances; Preservation of ——. J. Gerlache. Fr. Pat. 464,117, Oct. 25. 1913.

Wood, etc. is treated with an ammoniacal solution of chromite, arsenite, antimonite or antimoniate of copper, zinc, cadmium, cobalt or nickel. These salts are insoluble in water and do not wash out of the wood. Caustic soda or other alkali is added to the solution in order to prevent the liberation of chromic or other oxidising acid in the wood. The ammoniacal solution may be made with salts such as copper sulphate or zinc chloride, with the addition of chromic or other similar acid and a strong alkali.—A. T. L.

Slabs, blocks, bricks, plates, boards, and the like from blast furnace slag; Manufacture of light ——. Manufacture of porous slag. Production of porous slag for use as an aggregate. C. H. Schol. Allendorf, Germany. Eng. Pats. 28,642, Dec. 12, 1912. and 838 and 839 of 1914, dates of appl., Dec. 12. 1912.

See Addition of April 12, 1913. to Fr. Pat. 437,595 of 1911: this J., 1913, 1012.—T. F. B.

Concrete, cement, and the like; Manufacture of products of ——. H. S. Owen, Salt Lake City. U.S. Pat. 1,087,974, Feb. 24, 1914.

See Eng. Pat. 8085 of 1911; this J., 1911. 1255.—T. F. B.

Impregnating porous substances [wood, etc.]; Apparatu for ——. W. J. Frame and H. L. Galloway. Fr. Pat 463,650. Oct. 15, 1913. Under Int. Conv., Nov. 1, 1912

See Eng. Pat. 25,029 of 1912; this J., 1914, 315.—T. F. B

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Russian platinum production in 1913. Board of Trade March 19. 1914. [T.R.]

H.M. Commercial Attaché for Russia reports that t yield of platinum in the Urals continued to decrea in 1913 in spite of the very high prices prevailing. Accor ing to the "Torgovo-Promyshlennaya Gazeta" (Petersburg) of Feb. 24, the production in 1913 w 299 pouds 18 funts, as compared with 337 pouds 9 fu in the previous year (40 funts=1 poud=526·64 oz. Tro

Iron: On the structural changes of —— during anneali D. Ewen. Int. Zeits. Metallog., 1914, **6**. 1—17

Thin strips of polished Swedish wrought iron of gr purity were heated at various temperatures *in vacuo* the surface network ("heat-relief") produced, examined. In a strip in which the temperature rose from 620° C. at one end to 830° C. at the other, a simple and continuous heat relief over the whole surface was obtained, indicating that the transformation at the A2 point involves no change of crystalline form. A strip in which the temperature ranged from 800° C. to 970 C. showed a structural change point corresponding to the A3 inversion. The portion which had been heated above the A3 point showed the heat relief corresponding to the original α- and β-iron, the γ-iron structure, and the final β- and α iron structure produced on cooling. Strips which were heated by an electric current showed considerable pitting. The development of the α-iron structure at temperatures below 760° C. was probably due to selective volatilisation from the crystal boundaries, and γ-iron, and the final β- (and α-) iron heat reliefs produced on cooling, to differences in dilatation of the allotropic modifications.—T. St.

Carbon steel; Thermal expansion and rate of solution of ——. J. Driesen. Ferrum, 1914, 11, 129—138, 161—169.

Steel containing C 0·05—3·9 per cent. and very small amounts of impurities, was tested over a temperature interval of 20°—1000° C., the heating and cooling curves being determined for both annealed and chilled bars. At 180° C., annealed carbon steel showed irregularities of expansion which indicate a transformation of the cementite. Ferrite and β-cementite (stable above 189° C.) had practically the same coefficient of expansion; that of α-cementite (below 180° C.) was smaller. With more than 0·85 per cent. C. the coefficient of expansion showed a well-defined maximum at 1·7 per cent. A maximum of contraction in the transition interval was observed for a carbon content of 0·33 per cent. Chilled steel, even when very poor in carbon, contracted at 275°—340° C.; the irregular expansion occurring at 100°—150° C. was observed for a minimum content of 0·6 per cent. C. Chilled steel showed permanent contraction on tempering; 0·9 per cent. C. caused a maximum contraction. The rate of solution of chilled carbon steel in $N/10$ sulphuric acid was greatest after tempering at 350°—420° and lowest at 100°—200° C. These ranges of temperature were the same as those of irregular expansion, and the curve showing the influence of carbon on the rate of solution of tempered steel, disclosed an irregularity at 0·9 per cent. C.—W. R. S.

Cyanide solutions; Electrolysis of ——. E. F. Kern Trans. Amer. Electrochem. Soc., 1913, 24, 241—270.

Electrolysis of cyanides with direct current and insoluble anodes, was accompanied by consumption of cyanide due to oxidation. Anodes of iron, nickel, or lead were dissolved, and immediately precipitated—the lead as hydroxide, the other metals as mixtures of hydroxide and cyanogen compounds, the consumption of cyanide being greater the lower the current density, since at high current density oxygen was evolved and less metal dissolved. The consumption was least with the lead anodes. Peroxidised lead and passive iron anodes were more permanent than those of the pure metals, and were not corroded so long as they were not exposed to the air. The passive iron was superior to the peroxidised lead. Electrolysis of cyanide solutions used for leaching a refractory gold and silver ore containing sulphides, did not reduce cyanide consumption, nor give a greater extraction. Low current density at both the anode and the cathode seemed to produce some "active" solvent but not enough to compensate for loss in electrolysis. The lower the current density at the anode and the higher at the cathode, the greater was the relative cyanide consumption. When solutions containing thiocyanate or ferrocyanide were electrolysed, the loss of cyanide was greatly diminished, whilst increasing alkalinity reduced the loss of cyanide by increasing the conductivity. Peroxidised lead and passive iron anodes were corroded in the presence of thiocyanate at current densities above 32 amp. per sq. m. The regeneration of cyanides containing thiocyanate and ferrocyanide did not occur in electrolysis with direct current.—W. H. P.

Alkali cyanides; Electrolysis of aqueous solutions of simple ——. G. H. Clevenger and M. L. Hall. Trans. Amer. Electrochem. Soc., 1913, 24, 271—296. (See preceding abstract.)

Most of the decomposition during electrolysis of a cyanide was found to be due to oxygen liberated at the anode through decomposition of water. The principal final reaction in alkaline cyanide solutions (usually containing lime) was the formation of carbonate. In technical electrolytic regeneration, more cyanide might be decomposed than regenerated by precipitation of the metal in solution, and in the treatment of refractory ores the electrolysis might actually interfere with extraction, by forming a coating of calcium carbonate on the ore particles. The Liebig method of titration in estimation of cyanides, gave low results for electrolysed solutions, and fresh and electrolysed cyanide solution underwent different changes on standing. In fresh solution the changes were due to exposure to air. In the electrolysed solution the changes were due to further reactions between the dissolved substances, which varied with the extent and nature (KOH or $Ca(OH)_2$) of the original alkalinity.—W. H. P.

Gold; Resistivity of pure —— in the temperature range 20° C. to 1500° C. E. F. Northrup. J. Franklin Inst., 1914, 177, 287—292.

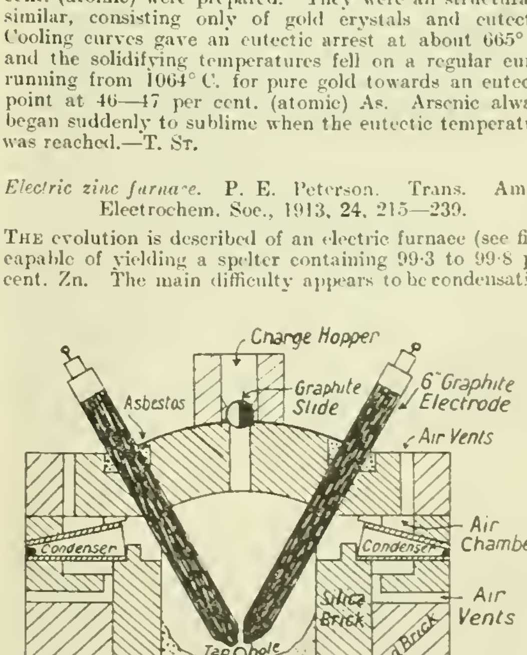
The same method was employed as for copper (see this J., 1914, 141 and 264). The values obtained were: 20° C., 2·317; 300°, 4·72; 500°, 6·62; 800°, 9·94; 1000°, 12·54; 1063°, (solid), 13·50; 1063° (molten), 30·82; 1100°, 31·34; 1200°, 32·76; 1300°, 34·17; 1400°, 35·58; and 1500° C., 37·00 microhms per cm.³. The curves show that the resistivity changes in a linear manner with temperature, both in the liquid and solid conditions.
—W. H. P.

Gold and arsenic; Alloys of ——. A. P. Schleicher. Int. Zeits. Metallog., 1914, 6, 18—22.

Alloys of gold and arsenic containing As up to 25·47 per cent. (atomic) were prepared. They were all structurally similar, consisting only of gold crystals and eutectic. Cooling curves gave an eutectic arrest at about 665° C., and the solidifying temperatures fell on a regular curve running from 1064° C. for pure gold towards an eutectic point at 46—47 per cent. (atomic) As. Arsenic always began suddenly to sublime when the eutectic temperature was reached.—T. St.

Electric zinc furnace. P. E. Peterson. Trans. Amer. Electrochem. Soc., 1913, 24, 215—239.

The evolution is described of an electric furnace (see fig.) capable of yielding a spelter containing 99·3 to 99·8 per cent. Zn. The main difficulty appears to be condensation and excessive formation of "blue powder." The solution of this involves the maintenance of a sufficient condensing



area at the right temperature (about 850° C.) near the source of volatilisation. In working the charge must be carefully mixed. A matte must be made of uniform composition and in sufficient quantity to effect a good saving of gold, silver, and copper. The nature and proportion of the reducing carbon are all important. Physically the charge must be fairly but not too finely divided, and perfectly dry, which involves the use of a preheating furnace for the whole charge. The matte is regulated by adjusting the percentage of sulphur in the calcined ore, about 5—7 per cent. being the best proportion. The paper contains suggestions for the treatment of blue powder, and for the improvement of condensation, together with details of the costs for the furnace worked out on a one ton unit. —W. H. P.

Brass ; Resistivity of solid and molten ——. E. F. Northrup. Met. and Chem. Eng., 1914, **12**, 161—162.

THE resistivity of brass containing Cu 63, Zn 34·6, and Pb 2·4 per cent. was measured from the temperature of melting down to the ordinary temperature and again up to 1104° C. Vaporisation of zinc was inappreciable under 1090° C. The resistivity of the rod-brass was found to be 7·101 microhms per cm³. at 20°, and 7·550 at 50° C. ; after cooling from the molten state it was 6·957 microhms at 20° C. The brass was molten at 972° C., and the ratio of resistivity just after fusion, to that just before fusion, was 2·37+. When molten the resistivity decreased with increase in temperature, being 41·20 microhms per cm.³ at 1000°, and 40·11 at 1084° C. At about 1090° C. the decrease became less rapid, indicating loss of zinc by vaporisation. Determinations of resistivity might be employed with advantage to detect alterations in composition, and generally, in studying the properties, of alloys. —W. R. S.

Corrosion ; Microchemistry of ——. [*Copper-zinc alloys.*] S. Whyte and C. H. Desch. Inst. of Metals, Jnl., 1913, **10**, 302 ; and March, 1914 [advance proof].

THE alloys were subjected to electrolytic corrosion over a definite area in a 5 per cent. solution of sodium chloride. Three β- (Zn 47 per cent.) and four α-brasses (Zn 30 per cent.) were examined, two of the former containing Sn 1 and Fe 1 per cent., and three of the latter Sn 1, Pb 1, and Pb 2 per cent. respectively. β-Brass was corroded more after quenching from above the transformation point (470° C.) than when slowly cooled : iron accelerated corrosion, and tin retarded it, chiefly owing to the formation of a tough adherent coating of basic salts. α-Brasses were corroded less than the β-alloys : tin accelerated corrosion at first, but retarded it subsequently. Corrosion was not retarded by 1 per cent. Pb, but the alloy with 2 per cent. Pb was less corroded than any of the others, a very firmly adherent layer being formed. The microstructure of a brass condenser tube corroded during service was reproduced by electrolytic corrosion in the laboratory. Corrosion of Cu-Zn alloys is preceded by dezincification, the residual spongy copper being converted into oxide as fast as it is formed when corrosion is slow and an abundant supply of oxygen is present, whilst otherwise a metallic layer free from zinc is left. —A. S.

Copper ore in Scotland. Times, March 30, 1914. [T.R.]

A PROMISING copper mine has been opened up on the estate of Otter, in Argyllshire, as the result of the chance discovery some years ago of a piece of ore ; no copper is shown on the geological map of Scotland for that district. Three rich lodes have been opened at Inveryne, Tighanraed, and Kilfinan. The operations have so far been mainly devoted to the last named, which is by far the richest. Work has now been going on for about 14 months, and 266 tons of selected ore, giving an average yield of 15 per cent., have already been sent to the smelters, in addition to which 70 tons of "dump" have averaged 3½ per cent. The average yield of the ore taken from the lode is expected to be 8 to 10 per cent.

When operations were commenced at Kilfinan the prospectors found a vertical vein of copper carbonate about 2 in. thick, which when followed for about 40 ft. expanded into a solid mass of grey sulphide 1 ft. or 2 ft. thick. There is an ample water supply and good timber in the neighbourhood, while the property is close to tidal waters.

Alloys of copper, nickel and aluminium. L. Guillet. Comptes rend., 1914, **158**, 704—706.

THE result of adding aluminium to Cu-Ni-alloys is illustrated in tables summarising the mechanical properties of three series of such alloys containing, respectively, Cu 60, 83 and 90 per cent. with gradually increasing percentages of aluminium up to 10. Traces of iron were also present. With progressive addition of aluminium, hardness and tenacity rapidly attained a maximum and then declined, although not concurrently. 15 per cent. Al rendered the alloys very brittle.—J. R.

Lead ; Solid, thick deposits of —— *from lead acetate solutions.* F. C. Mathers. Trans. Amer. Electrochem. Soc., 1913, **24**, 315—329. (See also this J., 1913, 429.)

THE best addition agent for producing good deposits from lead acetate solution, appears to be peptone in the presence of ammonium or sodium perchlorate and acetic acid. The amount of peptone must not be too small or a fringe of crystals will be obtained, whilst if too large, the deposits will be rough and brittle. The best current density is about 0·4—0·8 amp. per sq. cm. and the best concentration of lead acetate 6—10 per cent. The only salt capable of replacing the perchlorate is sodium naphthalenesulphonate (2 per cent.) ; this gives a heavy precipitate insoluble in acetic acid, and the bath, after filtration, yields excellent deposits of lead. Potassium perchlorate is too insoluble to be convenient, and sodium chloride always deleterious. Although glue, and the extract from feathers with glacial acetic acid, give fairly satisfactory deposits, no other addition agent has been found to replace peptone.—W. H. P.

Chromium, tungsten, molybdenum and vanadium ores ; Electric smelting of ——. R. M. Keeney. Trans. Amer. Electrochem. Soc., 1913, **24**, 167—189.

REFERRING to the more rarely mined minerals of the western States of America the author points out that ferrochrome can be manufactured directly from chromite in the electric furnace. The carbon content cannot be kept low by regulating the amount charged without excessive loss of chromium in the slag, but can be reduced by decarburising with an oxide slag after tapping off the slag from the reduction. Silicon and phosphorus cannot be kept low under the strong reducing conditions, but sulphur is easily slagged. Lime should not be used as it does not assist in removing the phosphorus. The power consumption should not be more than 3·7 kilowatt-hours per lb. of ferrochrome tapped, and the electrode consumption not more than 50—100 lb. per 2000 lb. of metal produced. Ferrotungsten can readily be obtained from ferberite ($FeWO_4$) ; with the use of a decarburising slag the carbon can be kept below 2 per cent. Manganese, silicon, phosphorus, and sulphur do not enter the alloy in large quantities and the loss of tungsten in the slag need not be excessive. The power consumption need not be more than about 3·5 kilowatt-hours per lb. of metal tapped. Molybdenite will yield ferromolybdenum low in carbon, and sulphur can be readily slagged in the presence of excess of lime. Vanadium alloys can also be obtained in similar ways from the oxide or from patronite a Peruvian sulphide ore.—W. H. P.

Strontium ; Preparation of metallic ——. B. Neumann and E. Bergve. Z. Elektrochem., 1914, **20**, 187—188.

METALLIC strontium in the form of rods can be prepare by the electrolytic method at a sufficiently low temperature. A mixture of 84·1 per cent. of strontium chlorid and 15·9 of potassium chloride is a suitable electrolyt and the metal can readily be obtained with current yield up to 80 per cent., if the temperature is not allowed t rise much above the m. pt. of the bath (628° C.)—W. H

Metals; The hardness of ——. J. H. Andrew. Int. Zeits. Metallog., 1914, **6**, 30—31.

The hardness of iron-carbon alloys is discussed. Hardness of a quenched steel is considered dependent upon the transformation of the true austenitic solution into martensite, which constituent may be regarded as being composed of finely divided cementite embedded in a matrix of partially undecomposed solid solution along with a small amount of α-iron, the extreme hardness of martensite being due to the exceedingly hard carbide molecules embedded in a relatively hard matrix.—T. St.

Lime and magnesia; Determination of —— in ores and slags. L. Blum. Stahl u. Eisen, 1914, **34**, 487—491.

In the determination of lime and magnesia in ores and slags a single precipitation with ammonia for the removal of iron, alumina, manganese, and phosphoric acid gives low results through co-precipitation of lime and magnesia. Double precipitation gives a precipitate free from alkaline earths, but the results are low because of the solubility of calcium oxalate and magnesium ammonium phosphate in strong ammonium chloride solutions. The basic acetate separation is recommended as being both rapid and exact; manganese is removed together with iron, etc., by addition of bromine water previous to boiling. Magnesia may be precipitated either hot or cold; sodium phosphate is preferable to sodium ammonium phosphate, as the precipitate produced by the latter consists of minute crystals difficult to filter.—W. R. S.

Determination of titanium as phosphate. Jamieson and Wrenshall. *See* XXIII.

Patents.

Sulphur from pyritic ores; Process for the recovery of —— W. A. Hall, New York. Eng. Pat. 26,370, Nov. 16, 1912.

A reducing gas, such as water- or producer-gas, is introduced into the upper level of a water-jacketed, pyrites-smelting furnace, whereby oxidation of sulphur vapour is prevented, and sulphur dioxide is reduced to sulphur. The products of the reaction, carrying sulphur in suspension, are passed through separating devices, such as gas-washers of the Thiesen type (see also following abstract).—O. R.

Sulphur; Process for the collection and separation of finely divided ——. W. A. Hall, New York. Eng. Pat. 26,594, Nov. 19, 1912.

Sulphur vapours and gases, containing hydrogen sulphide and sulphur dioxide (see preceding abstract), are agitated with a considerable volume of water. This may be effected by drawing water and the gases in question into the body of a centrifugal pump, or by means of an arrangement of vacuum pans containing water, through which the fumes from the furnace are caused to penetrate.—O. R.

Alkali or alkaline earth metals; Method of producing ——. J. E. Bucher, Providence, R.I., U.S.A. Eng. Pat. 139, Jan. 2, 1913.

See Fr. Pat. 453,086 of 1913; this J., 1913, 736. In place of the cyanides, other cyanogen compounds of alkali or alkaline-earth metals may be used, such as ferrocyanides or ferricyanides.—T. F. B.

Sodium and other alkali metals; Electrolytic process and apparatus for the manufacture of ——. E. Marguet. Eng. Pat. 11,278, May 14, 1913. Under Int. Conv., April 9, 1913.

Commercial caustic soda is employed, and the external walls of the electrolytic vessel are surrounded by a cold air chamber or coils for circulating water, with or without a bad heat conducting material between the cooling device and the walls of the vessel. The cathodes, of any suitable metal, are placed near the walls in the coolest part of the fused electrolyte, and are constantly covered by a crust consisting of impurities of the electrolyte together with the alkali metal. The thickness of the protective coating on the cathodes may be regulated by allowing the temperature of the electrolyte to rise, so as to break up the surface of the coating to a suitable extent. The anode, of iron or steel, is of large surface conforming to the shape of the electrolytic vessel, and the electrolyte is charged into the central part of the anode where the liquid is hottest. The sodium is removed from a collector near the walls of the vessel, without removing either cover, cathodes or anode.—B. N.

Magnetic separators. F. Krupp A.-G. Grusonwerk Magdeburg-Buckau, Germany. Eng. Pat. 14,426, June 21, 1913. Under Int. Conv., July 19, 1912.

The material travels across the magnetic field in the same direction, relatively to the co-operating magnet pole, as the surface to which the magnetisable particles are attracted. The magnetic field is divided into partial fields, of different strengths, and the gap and width in any one of these is adjustable independently of the others, by dividing the magnet pole or poles of the separator into lamellæ, which are individually adjustable and situated parallel to the direction of travel of the material, or by forming one or each magnet pole of the separator of interchangeable pole pieces, arranged side by side parallel to the feed of the material. Or, the subdivision of the fields may be effected by stepping the rotatable cylindrical armature to which the magnetic material is attracted, this formation being adopted in conjunction or not with a stepped formation of one or each of the magnet poles with which the armature co-operates.—B. N.

Copper from ores; Electrolytic process for extracting ——. N. V. Hybinette. Eng. Pat. 22,745, Oct. 8, 1913.

The ore, containing the copper partly as oxide and partly as sulphide, is leached with an acid sulphate solution containing a large quantity of iron, of which only a small portion is in the ferric state. The resulting solution is electrolysed in cells without diaphragms, the operation being interrupted before sufficient iron is oxidised to interfere with the plating, and the solution returned to the leaching tank, where the ferric salts are again reduced. After continuous leaching and electrolysis, the copper left in the ore is removed by the use of a portion of the same solution containing a larger quantity of ferric sulphate, the oxidation of the latter being effected by the use of an electrolytic cell with diaphragm.—B. N.

Copper; Hydrometallurgy of ——. E. R. Weidlein, Pittsburgh, Pa., Assignor to Metals Research Co., New York. U.S. Pat. 1,089,096, March 3, 1914.

Ores, roasted matte, or other copper-bearing materials are leached so as to obtain a solution containing not more than 1 per cent. of free sulphuric acid and not more than 3 per cent. (preferably about 1·5 per cent.) Cu. The solution is neutralised, and the copper precipitated almost quantitatively by heating with sulphur dioxide under pressure. After separating the precipitated copper, the residual liquor is used to extract a further quantity of copper from the ore, etc., and the sequence of operations repeated until the ore is exhausted, the last extracting liquor being washed out by a further quantity of residual leach liquor.—A. S.

Metallurgical and other furnaces. A. Williams, Brymbo, Wales. Eng. Pat. 26,218, Nov. 15, 1913.

To render the port end of a fixed or tilting furnace more easily accessible for cleaning or repairs, it is mounted upon a frame which in turn is mounted on a sub-frame. The main frame can be rotated about a vertical axis or an axis inclined to the vertical, and the sub-frame can be moved longitudinally away from the furnace.—A. S.

Furnaces; Ore roasting ——. E. Bracq, Lens, France. Eng. Pat. 26,736, Nov. 20, 1913. Under Int. Conv., Nov. 21, 1912.

In a roasting furnace with a helical hearth, the bricks composing the hearth are tapered in horizontal and vertical cross-section, and are provided at the edges with means for keying to each other. They are disposed in the hearth with "concentrically staggered joints."—T. St.

Converter. J. V. Bretaud, Highland Park, Mich. U.S. Pat. 1,088,401, Feb. 24, 1914.

The converter consists of an upper and a lower section, with a thin layer of refractory material between the adjacent ends, which are held in engagement with the refractory material in an annular pivoted supporting ring. An air-box constructed in two parts meeting in a vertical plane, has one part fixed to the pivoted supporting ring, and the other fixed to the lower section of the converter, and means are provided for forcing the two parts into contact so as to form an air-tight joint.—A. S.

Metallurgical furnaces; Electrical heating device for ——. U. Wedge, Ardmore, Pa. U.S. Pat. 1,088,496, Feb. 24, 1914.

The furnace comprises a series of superposed working chambers and a central rotating shaft, with an electrical resistance body mounted thereon. Electrical resistance bodies are also suspended by loops embedded in the roofs of the chambers, so as to radiate heat downwards upon the material on the hearths of the chambers, whilst the material itself is agitated by rabbles carried by the shaft. —B. N.

Mineral and metallic substances which are to be united by pressure; Process of preliminarily treating —— A. R nay, Berlin, Assignor to General Briquetting Co., New York. U.S. Pat. 1,087,183, Feb. 17, 1914.

Immediately before the loose particles are compressed, and before they are introduced into the briquetting press, they are treated with steam containing a hydrocarbon, so that the particles still contain steam, when the press is closed.—T. St.

Tin; Method of recovering ——. W. Hoskins, Chicago, Ill. U.S. Pat. 1,088,422, Feb. 24, 1914.

A bed of carbon is kept incandescent by introducing air at different levels and in progressively decreasing quantities in the downward direction, and the mixture of tin, or tin alloys, and their oxides is fed on to the top of the bed, whereby the oxides are reduced and the metal melted. The molten metal percolates downwards through zones of progressively lower temperature, and is discharged at the base of the bed of carbon.—A. S.

Centrifugal filtering or dewatering machine for ore-pulp. J. C. King, Assignor to A. Wilkins, La Junta, Colo. U.S. Pat. 1,088,823, March 3, 1914

Filtering screens are mounted on the outer edge of a rotary table and are normally stationary with respect thereto. The ore pulp is fed on to the screens and at intervals these are lifted bodily in a plane parallel to the axis of the table and at the same time turned to a position at right angles thereto, whereby slime deposited on the screens is discharged by centrifugal force.—A. S.

Sintering ores; Apparatus for ——. A. F. Plock, Pittsburgh, Pa., Assignor to Pittsburgh Metallurgical Co., Inc., Wilmington, Del. U.S. Pat. 1,089,153, March 3, 1914.

The apparatus comprises a series of cars for holding the ore, each with a false bottom in the form of a grating; the chamber below the grating has a restricted opening communicating with an exhaust pipe leading to a suction fan. The cars are supported on a track beneath an igniting hood, and lateral transfer tracks are provided whereby each car may be independently removed from the series. —A. S.

Ores; Process and apparatus for reducing ——. A. Niewerth. Fr. Pat. 463,230, Sept. 27, 1913. Under Int. Conv., Aug. 21, 1913.

See U.S. Pat. 1,081,287 of 1913; this J., 1914, 87. A current of air is pumped through one of the auxiliary shafts into the central shaft, where a reducing gas is formed to reduce the ore. The gas then passes into the second auxiliary shaft, where it is regenerated by the carbon. By reversing the pump, the gas is again brought to the ore charge in the central shaft, and the process is continued to the desired extent.—T. F. B.

Tungsten and molybdenum powder; Manufacture of heavy crystalline ——. H. Leiser. Ger. Pat. 270,194, Dec. 22, 1911.

A tungsten or molybdenum compound, *e.g.*, tungstic acid (hydrate), is treated with ammonia solution, whereby a relatively dense product, *e.g.*, $(NH_4)_2W_3O_{12}$, is obtained. This is heated first to a temperature at which liberation of the ammonia and slight reduction take place, and then at 1100°—1200° C. in presence of hydrogen, whereby transformation of the reduced amorphous metal into a coarse crystalline powder is effected.—A. S.

Zinc blende and other sulphide ores; Mechanical furnace for roasting —— and for treating chemical compounds with compressed air or other gases. R. Kessler. Ger. Pat. 270,273, Feb. 14, 1913.

A crucible furnace in which, during the blowing, the ore is agitated by a rotating screw, which is alternately raised and lowered.—A. S.

Steel; Process for the manufacture of —— and apparatus therefor. Rombacher Hüttenwerke, and J. I. Bronn, Rombach, Germany. Eng. Pat. 29,051, Dec. 17, 1912.

See Fr. Pat. 455,399 of 1912; this J., 1913, 947.—T. F. B.

Steel; Making or refining ——. E. Humbert, Barleduc, France. Eng. Pat. 18,116, Aug. 8, 1913.

See Fr. Pat. 461,459 of 1913; this J., 1914, 204.—T. F. B.

Metallurgical and chemical process [decarburising iron, etc.]. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co. U.S. Pat. 1,087,900, Feb. 17, 1914.

See Fr. Pat. 459,853 of 1913; this J., 1913, 1159.—T. F. B.

Iron and steel; Process and high-pressure furnace for the direct production of ——. C. Otto, Dresden, Germany. U.S. Pat. 1,089,951, March 10, 1914.

See Fr. Pat. 435,854 of 1911; this J., 1912, 393.—T. F. B.

Zinc ores; Plant for the recovery of zinc from ——. A. Roitzheim, Duisberg-Ruhrort, Germany. Eng. Pat. 6771, March 19, 1913. Under Int. Conv., April 10, 1912.

See Fr. Pat. 455,726 of 1913; this J., 1913, 949.—T. F. B.

Zinc-lead ores; Treatment of refractory ——. P. C. C. Isherwood, Bushey Heath. U.S. Pat. 1,089,412, March 10, 1914.

See Eng. Pat. 22,855 of 1912; this J., 1913, 1073.—T. F. B.

Zinc; Process for separating —— from crude materials containing zinc by blowing. F. C. W. Timm. Fr. Pat. 463,330, Oct. 7, 1913. Under Int. Conv., Oct. 8, 1912.

See Ger. Pat. 268,427 of 1912; this J., 1914, 143.—T. F. B.

Ores; Process of dressing —— by means of gas. K. Takeda, Tokyo. Eng. Pat. 7272, March 27, 1913.

See Fr. Pat. 455,430 of 1913; this J., 1913, 949.—T. F. B.

Ore-dressing apparatus. H. Velten, Milan, Italy. U.S. Pat. 1,089,606, March 10, 1914.

See Eng. Pat. 502 of 1913; this J., 1913, 540.—T. F. B.

Cupola furnaces; Method of and means for preventing the formation of carbon monoxide in ——. E. Schürmann, Dresden, Germany. Eng. Pat. 11,073, May 10, 1913.

See Fr. Pat. 458,242 of 1913; this J., 1913, 1071.—T. F. B.

Metal furnace. I. Hall, Birmingham. Eng. Pat. 11,843, May 21, 1913.

See Fr. Pat. 462,568 of 1913; this J., 1914, 320.—T. F. B.

Melting-pot furnaces. V. Coppée, Paris. Eng. Pat. 14,726, June 25, 1913. Under Int. Conv., June 26, 1912.

See Fr. Pat. 456,803 of 1912; this J., 1913, 1074.—T. F. B.

Metals [copper]; Process for the electrolytic deposition of —— from solutions containing same. N. V. Hybinette, Christiania. Eng. Pat. 22,744, Oct. 8, 1913.

See U.S. Pat. 1,084,150 of 1914; this J., 1914, 205.—T. F. B.

Metals [copper]; Process for the electrodeposition of —— from solutions. N. V. Hybinette. Fr. Pat. 463,599, Oct. 14, 1913. Under Int. Conv., Nov. 4, 1912.

See U.S. Pat. 1,084,150 of 1914; this J., 1914, 205.—T. F. B.

Copper; Electrolytic process for extracting —— from ores. N. V. Hybinette. Fr. Pat. 463,598, Oct. 14, 1913. Under Int. Conv., Nov. 1, 1912.

See Eng. Pat. 22,745 of 1913; preceding.—T. F. B.

Metal; Extraction of ——. H. Pape, Oker in Harz, Germany. Eng. Pat. 24,847, Oct. 31, 1913.

See Addition of Sept. 23, 1913, to Fr. Pat. 449,480 of 1912; this J., 1914, 321.—T. F. B.

Ores; Apparatus for roasting and sintering ——. J. E. Greenawalt, Denver, Colo. U.S. Pat. 1,088,818, March 3, 1914.

See Eng. Pat. 10,249 of 1913; this J., 1903, 1116.—T. F. B.

Ore-bricks; Channel-furnace for burning ——. A. Ramén, Helsingborg, Sweden. U.S. Pat. 1,089,868, March 10, 1914.

See Eng. Pat. 20,240 of 1910; this J., 1911, 1147.—T. F. B.

Metallurgical method [production of refractory metals]. H. Kuzel, Baden, and E. Wedekind, Strassburg. Assignors to General Electric Co., New York. U.S. Pat. 1,088,909, March 3, 1914.

See Eng. Pat. 23,215 of 1909; this J., 1910, 1255.—T. F. B.

Tungsten manufacture. T. W. Frech, jun., Cleveland. Assignor to General Electric Co., New York. U.S. Pat. 1,089,757, March 10, 1914.

See Eng. Pat. 1915 of 1913; this J., 1914, 319.—T. F. B.

Magnetic separator. G. Ullrich, Assignor to F. Krupp A.-G. Grusonwerk, Magdeburg-Buckau, Germany. U.S. Pat. 1,089,993, March 10, 1914.

See Eng. Pat. 4595 of 1913; this J., 1913, 870.—T. F. B.

Furnace; Electric —— for melting ferromanganese, ferrosilicon, and other alloys. Ges. f. Elektrostahlanlagen m. b. H. Fr. Pat. 463,334, Oct. 7, 1913.

See Ger. Pat. 269,298 of 1912; this J., 1914, 319.—T. F. B.

Nickel; Recovery of —— from its ores. The Madagascar Minerals Synd., Ltd. Fr. Pat. 463,615, Dec. 21, 1912.

See Eng. Pat. 27,626 of 1912; this J., 1914, 30.—T. F. B.

Ores; Furnaces for roasting or drying ——. H. M. Ridge. Fr. Pat. 463,453, Oct. 6, 1913. Under Int. Conv., Oct. 17, 1912.

See Eng. Pat. 23,763 of 1912; this J., 1913, 1115.—T. F. B

Apparatus for testing [grading] coal or ores. Eng. Pat. 4992. See IIa.

XI.—ELECTRO-CHEMISTRY.

Electrolytic oxidation of ammonia. Oesterheld. *See* VII.

Heat resistivity of carbon and graphite. Richards. *See* VII.

Electrolysis of cyanide solutions. Kern. *See* X.

Electrolysis of aqueous solutions of simple alkali cyanides. Clevenger and Hall. *See* X.

Patents.

Electrodes for electric furnaces for the fixation of nitrogen. E. K. Scott, Bromley, Kent. Eng. Pats. 4723 and 4724, Feb. 24, 1913.

(1) Each electrode, of the horn type, comprises a tube divided lengthwise by a central plate into two compartments, through which air or a cooling medium may be passed. The inner end of the tube is closed by a sleeve, preferably made so that it may be rotated. The electrode may be perforated, so that a portion of the air or other cooling medium may be used for cooling the fixed gases. For forming the compartments, two D-shaped tubes may be arranged with their flat surfaces in contact, or two separate tubes may be used with metal cast round them. (2) An auxiliary electrode, composed of or containing magnetite, is employed, which projects into the gap between the horn-shaped electrodes for the purpose of striking the arc. The magnetite may be contained in a tube, or in the annular space formed by two concentric tubes, the air passing through the inner tube only, or through a tube surrounding the magnetite tube, or through both the inner and outer tubes.—B. N.

Furnaces; Regulating arc ——. E. K. Scott, Bromley, Kent. Eng. Pat. 4725, Feb. 24, 1913.

The furnace is supplied with three-phase alternating current; a transformer is employed with each phase, the primary winding being connected with the source of supply, and the secondary winding with the electrodes. The magnetic cores of the transformer are connected by yokes, so designed that, under abnormal conditions of load, considerable magnetic leakage takes place, or the secondary coil may be made movable for the same purpose. One of the limbs carrying the primary or secondary winding may be movable, to suit the requirements of any particular furnace. Various modes of joining up the primary and secondary coils are described.—B. N.

Furnace; Electric ——. C. C. Whitmore, Assignor to W. B. Carroll, Butte, Mont. U.S. Pat. 1,089,300, March 3, 1914.

The furnace body is provided at its ends with slots, and electrodes of tubular form, to which a cooling fluid is supplied, extend through the body approximately parallel to each other. One of the electrodes passes through the slots, and is adjustable by suitable mechanism with respect to the first electrode, so that it may be tilted at different angles.—B. N.

Electrode; Storage-battery —— and process of making same. H. C. Hubbell, Newark, N.J. U.S. Pats. 1,087,236 and 1,087,237, Feb. 17, 1914.

(1) The electrode comprises a plate consisting of thin parallel strips of a metal electronegative to cadmium in an alkaline electrolyte, the strips being disposed face to face edgewise to the plate, and separated by layers of cadmium oxide. Cadmium strips may alternate with the electronegative metal, the cadmium layers being oxidised by heating the plate in the presence of oxygen to a temperature below the melting point of cadmium. (2)

Alternate layers of cobalt, nickel, and a metal having a solubility similar to copper are arranged in the order, copper-like metal, cobalt, nickel, cobalt, and copper-like metal. The copper layers are dissolved by using the plate as anode in a solution containing sodium and ammonium acetates and free ammonia, at a current density which leaves the cobalt unattacked, then oxidising the latter by employing the plate as anode in a dilute solution of phenol and fixed alkali, using a "forming" current of low density.—B. N.

Electrolytic generator [*for hydrogen and oxygen*]. C. Ellis, Montclair, N.J. U.S. Pat. 1,087,937, Feb. 24, 1914.

The apparatus, for generating hydrogen and oxygen, comprises a rectangular receptacle having T-shaped projections on its inner walls, with a cover from which hangs an anode, consisting of a plate having T-shaped projections disposed symmetrically along its surface and parallel to the T-shaped projections of the cathode wall. A gutter is disposed along the sides of the generator for the removal of spray. The cathode surface is 50 per cent. greater in area than the anode surface, and the cathode compartment is maintained under a pressure higher than that of the anode compartment, whereby hydrogen practically free from oxygen is obtained.—B. N.

Carbon electrode having protective covering, and process for producing same. C. H. Schroers, Assignor to Ges. f. Teerverwertung m. b. H., Duisburg-Meiderich. Germany. U.S. Pat. 1,088,734, March 3, 1914.

See Fr. Pat. 454,475 of 1913; this J., 1913, 874.—T.F.B.

Manufacture of metallic oxides or compounds [*hydroxides, by electrolysis*]. Eng. Pat. 4082. *See* VII.

Manufacture of a material suitable for electrical insulation and other purposes. Eng Pat. 8117. *See* XIII.

XII.—FATS; OILS; WAXES.

Japanese sardine oil; Highly unsaturated fatty acids of ——. R. Majima and T. Okada. Science Reports, Tôhoku Imp. Univ., Japan, 1914, 3, 1—18.

The unpleasant odour of Japanese sardine oil can be removed by dissolving the oil in petroleum spirit and shaking the solution with potassium hydroxide solution below 10° C. Saponification of the oil is readily effected cold. On bromination of the fatty acids, preferably in ethereal solution, a mixture of bromides, composition almost agreeing with the formula, $C_{18}H_{28}O_2Br_8$, was obtained, but this when freed from bromine by heating with zinc dust and acetic acid, left fatty acids with too high mol. weight (338) and iodine value (380) for the formula. $C_{18}H_{28}O_2$. Acetone effected only partial fractionation of the bromo-fatty acids. The saturated fatty acids obtained by the catalytic hydrogenation of the unsaturated acids had mol. weight 349 and m. pt. 75° C., and consisted in the main of higher homologues of stearic acid such as $C_{20}H_{40}O_2$ or $C_{22}H_{44}O_2$. Similar results were obtained on hydrogenating the more fluid fatty acids of the oil after separation of the less fluid acids by chilling with salt and ice and then with solid carbon dioxide and ether. Polymerisation prevented fractionation of the unsaturated acids by distillation as methyl esters. They yielded, on oxidation, a decahydroxybehenic acid, $C_{22}H_{34}O_2(OH)_{10}$ (m. pt. 215° to 218° C.), and two isomeric dihydroxypalmitic acids (m. pts. 125° and 112°—114° C.), but no tetrahydroxy- or hexahydroxystearic acid.—C. A. M.

Vegetable oils; Action of diazo-derivatives upon ——. P. Sisley and Frehso. Bull. Soc. Chim., 1914, **15**, 295—298.

Certain fatty oils appear to contain constituents which react with diazonium compounds to give red or reddish brown colourations. A solution of diazoparanitrobenzene chloride was found to give the most satisfactory results, the oil being shaken with a few drops of this reagent and half its volume of 20 per cent. sodium acetate solution. Pure olive oil gave a negative result, but arachis and sesamé oils gave red colourations, and could be detected when present to the extent of 10 per cent. in olive oil. Cottonseed, castor, walnut and linseed oils also gave reddish colourations, but not sufficiently characteristic individually to differentiate between them.—G. F. M.

Nickel in fats; Detection of ——. R. H. Kerr. J. Ind. Eng. Chem., 1914, **6**, 207.

In testing products containing hydrogenated cottonseed oil for nickel by Bömer's method (this J., 1912, 996), after the addition of dimethylglyoxime and ammonia a red colour sometimes appears which closely resembles that produced when a trace of nickel is present, except that it is fugitive, fading away almost entirely in a few minutes. It appears to be due to an organic base extracted from the oil by hot hydrochloric acid, for it is never produced, in absence of nickel, if the acid extract prepared in the usual way be evaporated and the residue heated with 2—3 c.c. of nitric acid to destroy organic matter, before applying the dimethylglyoxime test.—A. S.

Carnauba wax. C. Lüdecke. Seifensieder-Zeit., 1913, **40**, 1237—1238, 1274—1275, 1302—1303, 1327—1328. Chem. Zentr., 1914, **1**, 1031—1032.

The melting point of crude carnauba wax is above 83° C. (solidif. pt. 80° C.) and increases with the age of the sample up to over 86° C., but not up to or over 90° C. as is frequently stated in the literature: lighter specimens have a somewhat lower melting point than those of darker colour. For the determination of the acid and saponification values the author uses a method somewhat similar to that of Berg (this J., 1909, 991) and of Bohrisch and Kürschner (compare this J., 1906, 701). The chief characters of carnauba wax and of the most frequently used adulterants are shown in the following table:—

	Carnauba wax.	Montan wax.	Candelilla wax.	Rosin.	Japan wax.	Stearic acid.
Specific gravity	0·992	0·920—0·970	0·970	—	0·960—0·975	—
Acid value	6—10	22—36	13—18	146—180	19—24	195—200
Saponif. value	70—86	60—84	50—60	168—195	214—224	195—200
Ratio number	7·6—10·7	1·3—1·7	2·3—2·8	0·08—0·15	8·3—10	—

For the determination of unsaponifiable matter, 5 grms. of the wax are mixed with 2 grms. of olein (the unsaponifiable matter of which has been determined or removed) and saponified by heating with 5 grms. of caustic soda, 10 grms. of water, and 30 grms. of alcohol for 2—3 hours under a reflux condenser. The mixture is then evaporated and, after addition of 2 grms. of sodium bicarbonate and 20 grms. of ignited sand, dried till of constant weight. The powdered residue is extracted in a Soxhlet apparatus with petroleum ether, the extract evaporated, and the residue weighed. If it amount to more than 55 per cent., the excess over this quantity may be regarded as paraffin or ceresin, according to the melting point.—A. S.

Soluble silicates in soaps; Sodium chloride as a reagent for the detection of ——. E. Isnard. Ann. Chim. Analyt., 1914, 19, 98—100.

The precipitation of silicic acid by ammonium chloride is rendered more complete if sodium chloride is presen in the solution. Sodium chloride alone may be used as a precipitant of silicic acid if the solution be brought to saturation by adding the dry salt. The precipitate thus obtained contains no alumina which may be present in the solution, as is the case if precipitation is effected by means of ammonium chloride. In the case of soaps, after separating the fatty acids, the acid solution is neutralised with sodium carbonate, and saturated with sodium chloride.—J. A.

Washing powders containing perborate and their analysis. R. Jungkunz. Seifensiederzeit., 1914, 41, 4—6, 26—27. Chem. Zentr., 1914, 1, 1033.

The content of active oxygen in perborate washing powders is usually calculated to $NaBO_3$, but this may lead to erroneous results, as commercial sodium perborate does not always correspond to the formula $NaBO_3,4H_2O$; a determination of the boron should therefore also be carried out. 15—20 grms. of the powder are treated with hydrochloric acid (3 : 1) in presence of methyl orange until a red colour is produced, and after separating the fatty acids, 100 c.c. of alcohol are added, and the solution agitated for 1 hour, weighed and filtered. 50 c.c. of the filtrate are diluted to 100 c.c. with water in a tared flask, shaken with 0·5—1 grm of kieselguhr, filtered, and the boric acid determined in 20 c.c. of the filtrate, after neutralisation with $N/4$ caustic soda, by titration in presence of 1·5—2 grms. of mannitol. The solution should be free from carbon dioxide and phosphates.—A. S.

Determination of rosin in varnishes, oils and soaps. Wolff and Scholze. *See* XIII.

Erratum.

This J., March 31, 1914, p. 323, col. 1, line 27 from bottom, *for* "lard stearodipalmitin" *read* "butter stearodipalmitin."

Patents.

Glycerin; Process of distilling ——. F. J. Wood, Assignor to Marx and Rawolle, New York. U.S. Pat. 1,089,383, March 3, 1914.

The apparatus comprises a number of stills with their respective condensers arranged in series. After distilling off water, the substantially anhydrous glycerin is introduced into the first still and a portion is distilled off and condensed, the remainder being transferred to the second still and another portion distilled and condensed, and so on. Distillation and condensation are effected by a single current of steam led through the stills and condensers in succession, the glycerin at each still being combined with the steam from which the glycerin vapours of a preceding distillation have been condensed.—A. S.

Glycerin: Decolourising ——. F. Lindner, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,089,775, March 10, 1914.

See Eng. Pat. 16,260 of 1909; this J., 1910, 768.—T. F. B.

Fats and oils; Bleaching ——. F. Müller, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,089,253, March 3, 1914.

See Fr. Pat. 431,294 of 1911; this J., 1911, 1396.—T. F. B.

Sulphonated oils or fats: Process for making ——. Stolle und Kopke, and R. Russ. Fr. Pat. 463,312, Oct. 6, 1913.

See U.S. Pat. 1,081,775 of 1913; this J., 1914, 91.—T. F. B.

Hydrogenated [fat] product. U.S. Pat. 1,087,161. *See* XIXa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead; Constitution of ——. E. Euston. J. Ind. Eng. Chem., 1914, 6, 202—203.

Experience in the production of white lead on the manufacturing scale by precipitation of a solution of basic lead acetate by carbon dioxide has shown that when precipitation is effected slowly under standard conditions, the precipitate first produced has the composition, $PbCO_3,Pb(OH)_2$, and is colloidal in character. On continuing the treatment the CO_2-content of the precipitate increases gradually and uniformly up to 16·6 per cent. ($PbCO_3$), and there are no indications of the formation of compounds of the composition, $2PbCO_3,Pb(OH)_2$ or $3PbCO_3,Pb(OH)_2$. The properties of the precipitate also change gradually and uniformly, except that the "apparent density" increases suddenly at a certain stage, probably owing to coagulation when the solution becomes acid. At no stage is the precipitate appreciably soluble in cane sugar solution; *i.e.*, it does not contain uncombined lead hydroxide. Mixtures of $PbCO_3$ and $PbCO_3,Pb(OH)_2$ of the same composition as samples of white lead had the same characters in regard to the amount of linseed oil required to form a paste, ease of miscibility with linseed oil, and opacity and spreading power when mixed as a paint. It is concluded that white lead made by the precipitation process is a mixture of amorphous $PbCO_3$ and $PbCO_3,Pb(OH)_2$, whilst white lead made by the stack (Dutch) process may also contain crystalline $PbCO_3$ and occasionally $Pb(OH)_2$.—A. S.

Rinman's green. A. Hedvall. Z. anorg Chem., 1914, **86**, 201—224. (See this J., 1913, 982.)

Rinman's green is a solid solution of zinc oxide in cobalt oxide, which usually crystallises (like zinc oxide) in the hexagonal system. It is not possible to separate zinc oxide from cobalt oxide by digestion with ammonium carbonate solution, as cobalt always goes into solution to an appreciable extent.—W. H. P.

Paints; Toxic and antiseptic properties of ——. H. A. Gardner. Oil and Colour Trades J., 1914, 45, 1000—1006.

Water which had been exposed for 1 week in the "scrim" room of a linoleum factory contained appreciable quantities of formic, acetic, and butyric acids and also aldehydes. The author has shown previously (this J., 1914, 266) that the vapours evolved from drying oil paints contain small quantities of carbon monoxide, and the change in the blood corpuscles of a person who has breathed such vapours in an unventilated room is probably due to carbon monoxide rather than to turpentine (compare Armstrong and Klein, this J., 1913, 320); the turpentine appears to stimulate the production of carbon monoxide. The vapours from drying oil paints act as an efficient antiseptic. Of the volatile products used as paint thinners, *e.g.*, oil of turpentine, benzol, benzine (b. pt. 68° C.), benzol containing 5 per cent. of nitrobenzene, high-boiling petroluem spirit (flash point in open cup 39° C., b. pt. 160° C.), benzol is stated to be most, and high-boiling petroluem spirit least dangerous.—A. S.

Rosin; Determination of —— in varnishes, oils and soaps. H. Wolff and E. Scholze. Chem.-Zeit., 1914, **38**, 369—372, 382—383.

Fahrion's modification of the Twitchell method for the determination of rosin (this J., 1911, 1266) is subject to an error due to the solubility in water of oxyabietic acid, a constituent of all rosins, and the process of esterification is both long and incomplete. In the following method these difficulties are avoided. 2—5 grms. of the mixed rosin and fatty acids are dissolved in 10—20 c.c. of absolute methyl alcohol and esterified by boiling for 2 mins. under a reflux condenser with 5—10 c.c. of a solution of 1 part of sulphuric acid in 4 parts of methyl alcohol. The esterified mixture is treated with five to ten times its volume of a 7—10 per cent. solution of salt, in which oxyabietic acid is insoluble, and the fatty acid esters and free rosin acids are extracted with ether or a mixture of ether and petroleum spirit. The salt solution is drawn off and re-extracted once or twice with fresh solvent. The extracts are then washed with salt solution until the washings have a neutral reaction. After addition of alcohol, the ethereal extract is titrated with $N/2$ alcoholic potash and the percentage of rosin acids calculated on the assumption that they have an acid value of 160. The percentage thus found is reduced by 1·5, to allow for the fatty acids which escape esterification; or, after neutralisation of the rosin acids 1—2 c.c. excess of alcoholic potash may be added, the ethereal solution washed several times with water, the mixed washings and soap solution evaporated to small bulk, acidified, and after the addition of an equal volume of salt solution, extracted with ether. The ethereal extract is dried with anhydrous sodium sulphate and the ether evaporated. The residue is dissolved in 10 c.c. of absolute alcohol, re-esterified and extracted in the manner already described. The rosin acids thus obtained are free from fatty acids which have escaped esterification in the first treatment. The amount of rosin originally present in the mixture is obtained by multiplying the percentage of rosin acids by 1·07, there being, as an average, 7 per cent. of non-saponifiable matter in rosin.—J. A.

PATENTS.

Electrical insulation and other purposes; Manufacture of a material suitable for ——. The British Thomson-Houston Co., Ltd. From General Electric Co., Schenectady, N.Y. Eng. Pat. 8417, April 9, 1913.

THE resinous condensation product of a polyhydric alcohol and phthalic anhydride is prevented from hardening, whilst in the fused state, by dissolving in it 13 to 18 per cent. of naphthalene, anthracene, phenanthrene, etc. Cellular, fibrous or porous bodies may thus be impregnated with the fused mixture, the temperature being afterwards raised to vaporise the naphthalene and harden the resin. —B. N.

Oil varnish substitutes from animal oils; Process for the manufacture of ——. W. Kaempfe, Grossenhain, Saxony. Eng. Pat. 21,834, March 15, 1913. Addition to Eng. Pat. 15,012, June 27, 1912.

SEE Addition of April 1, 1913, to Fr. Pat. 445,565 of 1912; this J., 1913, 983. An alkaline-earth oxide, hydroxide, or carbonate may be used in place of the manganese sulphate.—T. F. B.

Pigments from titaniferous iron ores; Process of producing yellow ——. P. Farup, Trondhjem, Norway. U.S. Pat. 1,087,575, Feb. 17, 1914.

SEE Eng. Pat. 10,368 of 1911; this J., 1911, 1125.—T. F. B.

White lead; Process for the manufacture of ——. F. H. Sharpe, Lancaster. U.S. Pat. 1,088,460, Feb. 24, 1914.

SEE Eng. Pat. 21,292 of 1911; this J., 1912, 939.—T. F. B.

Preserving preparation. Preservative coating composition. W. Schoeller and W. Schrauth, Berlin, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,087,144 and 1,087,145, Feb. 17, 1914.

SEE Ger. Pats. 219,967 and 250,746; this J., 1910, 577; 1912, 1054.—T. F. B.

Plastic composition. J. W. Aylsworth, East Orange, Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,087,422, Feb. 17, 1914.

SEE Eng. Pat. 3498 of 1911; this J. 1912, 347.—T. F. B.

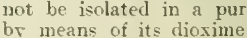
XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber [synthetic]; Recent work on ——. A. Holt. Z. angew. Chem., 1914, 27, 153—158.

FOR the manufacture of isoprene, the lowest-boiling fraction of petroleum, of the composition, C_5H_{12}, may be used: by systematic chlorination, isomerisation, and liberation and addition of hydrochloric acid, the three hydrocarbons present (iso- and normal pentane and tetramethylmethane) can all be converted into isoprene (see Fr. Pats. 435,312 and 452,246; this J., 1912, 409; 1913, 672). Butadiene is best prepared from benzene or phenol. These are converted by hydrogenation into cyclohexane and cyclohexanol respectively. The latter is converted into tetrahydrobenzene by means of alumina at 230° C. and the former into the same product by chlorinating and then removing hydrochloric acid from the chlorocyclohexane by means of lime at 450° C. The tetrahydrobenzene is converted into butadiene and ethylene by heating to 500° C. in a quartz tube (see Fr. Pats. 441,203 and 441,619; this J., 1912, 843, 951). Polymerisation of isoprene or its homologues may be effected rapidly and quantitatively by means of sodium, but the product is not a true caoutchouc, either chemically according to the definition of Harries (this J., 1911, 1073), or in its physical properties. When isoprene is treated with sodium in an atmosphere of carbon dioxide (see Fr. Pat. 459,005; this J., 1913, 1164), the reaction is quite different from that which occurs with sodium in presence of air. There is no perceptible action at first, but finally the isoprene is converted completely into a black voluminous mass, which on treatment with water or alcohol yields a pure white caoutchouc, characterised by its indifference to solvents, in which it neither dissolves nor swells. Polymerisation of isoprene by heating in presence of small quantities of ozonides or peroxides (see Fr. Pat. 440,173; this J., 1912, 735) gives a larger yield of caoutchouc than heating without such addition, and the physical properties of the products are improved. Caoutchoucs obtained from isoprene by all of the methods mentioned can be vulcanised; that obtained by means of sodium in presence of air, however, only incompletely and with difficulty. The products obtained by means of sodium and carbon dioxide are somewhat easily oxidisable, this tendency increasing in the products from butadiene, isoprene, and methylisoprene (2.3-dimethylbutadiene-1.3), in the order given. Recent work (see Steimmig, this J., 1914, 267) indicates that all of the synthetic caoutchoucs yet obtained differ chemically from natural caoutchouc; whilst physically the vulcanised products from synthetic (isoprene) caoutchouc are equal in quality only to the products from medium-grade natural rubbers.—A. S.

Caoutchouc; Diacetylpropane (1.5-heptanedione) from ——. C. Harries. Ber., 1914, 47, 784—791.

IN a previous paper (this J., 1913, 983) it was stated that among the decomposition products of the ozonide of caoutchouc regenerated by means of pyridine from the halogen addition compound of Para caoutchouc, was 1.5-cyclo-octanedione. It has now been found that the ketone in question is really the hitherto unknown diacetylpropane, $CH_3.CO.(CH_2)_3.CO.CH_3$, mixed with a certain proportion of 1-methylcyclohexene-1-one-3,



$$CH_3.C \begin{matrix} \diagup\!\!\diagup CH.CO \diagdown \\ \diagdown CH_2.CH_2 \diagup \end{matrix} CH_2,$$

readily formed from it, by elimination of water, in presence of small quantities of alkali. The diacetylpropane could not be isolated in a pure condition but was identified by means of its dioxime (m. pt. 87° C.) obtained by treatment with hydroxylamine hydrochloride in neutral solution.—A. S.

Patents.

Caoutchouc substances; Process for modifying the properties of and improving synthetic —— and vulcanising the products obtained. Badische Anilin und Soda Fabrik. Fr. Pat. 463,137, Sept. 3, 1913. Under Int. Conv., Nov. 1 and Dec. 3, 1912, Jan. 27, March 19, and April 15, 1913.

See Eng. Pat. 975 of 1913; this J., 1914, 93. The substances may be treated with hot alkali hydroxides, alkali alkyloxides, or analogous substances, or with organic acids or their derivatives. The products may be vulcanised if necessary.—T. F. B.

Rubber: Process for preparing a product analogous to hard ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 268,947, Feb. 21, 1913. Addition to Ger. Pat. 266,618 (see Eng. Pat. 11,530 of 1913; this J., 1913, 1078).

The product of polymerisation of $\beta\gamma$-dimethylerythrene described by Kondakow, is vulcanised in presence of a relatively non-volatile aliphatic base or a derivative thereof, or of a non-volatile derivative of a volatile base (see also Ger. Pats. 267,945 and 268,387; this J., 1914, 93, 269). —T. F. B.

Vulcanisation of natural or artificial caoutchouc substances; Process for accelerating the ——. Farbenfabr vorm. F. Bayer und Co. Ger. Pat. 269,512, Feb. 26, 1913. Addition to Ger. Pat. 265,221 (see Eng. Pat. 11,530 of 1913; this J., 1913, 1078).

Any relatively non-volatile aliphatic base, or a derivative thereof, may be used in place of piperidine or its homologues or derivatives to accelerate vulcanisation (see also Ger. Pat. 266,619; this J., 1914, 94).—T. F. B.

Rubber waste; Process for regenerating vulcanised ——. H. Hutz. Ger. Pat. 268,843, Dec. 24, 1912.

Vulcanised rubber waste is treated with a chlorhydrin or with the intermediate product of the action of hydrochloric acid on glycerin. Hydrogen sulphide is evolved. —T. F. B.

Indiarubber: Manufacture of products from ——. H. Dogny, V. Henri, and E. Veil-Picard, Paris. U.S. Pat. 1,088,551, Feb. 24, 1914.

See Fr. Pat. 422,118 of 1910; this J., 1911, 561.—T. F. B.

Rubber: Process for making artificial ——. O. Röhm. Fr. Pat. 463,801. Dec. 26, 1912.

See Eng. Pat. 613 of 1913; this J., 1913, 545.—T. F. B.

Elastic foam from volatile solutions: Process of manufacturing an ——. F. Laarmann, Dresden, Germany. U.S. Pat. 1,089,482, March 10, 1914.

See Fr. Pat. 402,996 of 1909; this J., 1910, 35.—T. F. B.

Manufacture of unsaturated hydrocarbons. Eng. Pat. 29,988. *See* XX.

Process of making isoprene. U.S. Pat. 1,087,261. *See* XX.

Preparing isoprene and its homologues. Ger. Pat. 268,722. *See* XX.

Treating solid by-products of the animal kingdom of fibrous structure. U.S. Pat. 1,087,904. *See* XV.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning extracts: Clarifying and decolourising ——. L. Pollak. Collegium. 1914, 129—130.

Edamin, a preparation from soya beans (compare Eng. Pat. 4597 of 1913; this J., 1913, 548), can be used in place of blood albumin for clarifying and decolourising tanning extracts. The substance is made into an emulsion with water, allowed to stand until slightly fermented and run into the tanning infusion at 45° C., the temperature being then increased to 60°—75° C. With Italian and Corsican chestnut and oak infusions, edamin has a decolourising power equal to blood albumin and a better decolourising power in the case of French chestnut infusions. Extracts decolourised with edamin contain as much lactic acid as blood-decolourised extracts.—T. C.

Sulphite-cellulose extract; Tanning with and detection of ——. W. Moeller. Collegium. 1914, 152—163.

Sulphite-cellulose extracts contain ligninsulphonic acids which are readily absorbed by hide substance and are very difficult to wash out. The sulphonic acids are the constituents which give the Proctor-Hirst reaction (this J., 1909, 293) and as they are so tenaciously retained sulphite-cellulose extract cannot be detected in aqueous extracts of leather tanned with it (see this J., 1913, 373). Cold 2 per cent. caustic soda solution extracts these sulphonic acids from such leather and on acidifying the solution gives the Proctor-Hirst reaction. Sulphite-cellulose extract which has been used to weight fully tanned leather is extracted by water alone. Hide tanned with a mixture of vegetable tanning material and sulphite-cellulose extract first absorbs the former and if sufficient is present to tan the hide fully, there is no absorption of the latter. (See also this J., 1913, 245, 616.)—T. C.

Leather; [Detection of] Free sulphuric acid in ——. J. Paessler. Collegium. 1914, 126—128.

When leather containing free sulphuric acid is immersed in pure water a proportion of the free acid, depending on the concentration of the acid in the leather, diffuses out. When the leather is placed in a dialyser the acid diffuses through the parchment membrane more rapidly than the other substances such as tannin and colouring matters which are also extracted by water, and can be detected by the usual methods in the diffusate. (See also this J., 1914, 95.)—T. C.

Patents.

Leather, hides, or skins; Treatment of —— with liquids. M. Loschkareff, Twer, Russia. Eng. Pat. 10,711. May 6, 1913.

The apparatus for treating hides or skins in tanning, dyeing, salt or other solutions, is provided with a spindle connected with a frame by three cross-stays arranged radially or tangentially to the spindle and forming an angle of 100° to 160° with each other; bars connecting the rim and the cross stays are arranged parallel or at a small angle to the cross-stays. The space is thus better utilised than with other devices and several bars of practically equal length may be used in each of the three groups. On the arm-cross or spider being turned, the supplementary angle between the main plane of the skins and the direction of rotation is greater and the action of the liquid during motion is thus better than in case of division into two or four.—D. J. L.

By-products of the animal kingdom: Method of treating solid —— of fibrous structure. A. H. Henderson. Assignor to The Henderson Rubber Co., Baltimore, Md. U.S. Pat. 1,087,904, Feb. 17, 1914.

The product in its natural condition is placed in a solution of salt in water combined with a mixture of water and glycerin, then immersed in a bath of heated oil which causes the natural moisture, surplus water and excess of glycerin absorbed to be expelled. The product is then separated into small particles, subjected to pressure in the presence of heat and vulcanising ingredients, immersed in a rubber solution and finally vulcanised.—D. J. L.

Leather: Cleaning goods made of washable ——. Karplus und Herzberger. Ger. Pat. 267,659, July 12, 1912.

In cleaning gloves, shoes, belts, etc., made of leather, substances capable of fixing the colour, *e.g.*, vegetable tannins, catechu, and gambier, are used along with the detergent. Dyestuffs capable of re-dyeing the leather, and substances, such as oil, glycerin, flour, or salt, which preserve the softness of the leather on drying, may also be added.—A. S.

Tanning. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng Pat. 7138, March 25, 1913.

See Fr. Pat. 462,635 of 1913; this J., 1914, 326.—T. F. B.

Tanning material. O. Schmidt and J. Müller, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,089,797, March 10, 1914.

See Fr. Pats. 451,875 and 451,876 of 1912; this J., 1913, 668.—T. F. B.

Glue; Process of manufacturing vegetable ——. F. Lehmann and J. Stocker, Berlin. U.S. Pat. 1,089,064, March 3, 1914.

See Fr. Pat. 408,240 of 1909; this J., 1910, 580.—T. F. B.

XVI.—SOILS; FERTILISERS.

Peat; Bacterial treatment of ——. W. B. Bottomley. J. Roy. Soc. Arts., 1914, 62, 373—380.

Analyses show the increase in the nitrogen content of soil to which "bacterised peat" (this J., 1913, 878, 919, 920) had been added. Experiments carried out at Kew, Chelsea Physic Garden, and Eton School Gardens, have shown its good effects on crops of various kinds. It has proved valuable as a top dressing for grass. Recent experiments indicate the remarkable effects of small quantities, and suggest that there is probably a factor analogous to that of the vitamines in animal growth and nutrition.—W. H. P.

Effects of the ensilage process on the solubility of "floats." Forbes and Fritz. *See* XIXA.

Patents.

Fertiliser [from fish-scrap]; Method of and apparatus for recovering the by-products in the manufacture of ——. S. C., Assignor to A. L. McGrath, Baltimore, Md. U.S. Pat. 1,087,031, Feb. 10, 1914.

The lighter constituents of the gases issuing from fish-drying furnaces are subjected to a preliminary acid treatment for the recovery of ammonia, the remaining gases are passed into a scrubber for the collection of solid matter, the scrubbed gases together with the gases issuing from the preliminary acid treatment are subjected to a second acid treatment, and the heat of the gases previous to scrubbing is utilised for drying the recovered solid matter. —O. R.

Phosphates; Process for obtaining —— *soluble in citric acid.* A. Hauck. Ger Pat. 270,329, Nov. 12, 1910.

Crude phosphates are fused at a temperature not below 2000° C. and treated with oxygen, air or other oxidising agent.—A. S.

Artificial manure [from leather waste]; Process for the production of an ——. A. Moise, Barr, Germany. Eng. Pat. 12,800, June 2, 1913.

See Fr. Pat. 458,674 of 1913; this J., 1913, 1079.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Localisation of potash in the ——, *and its physiological significance.* A. Matousek. Z. Zuckerind. Böhm., 1914, 38, 235—251.

Investigation of the distribution of potash in the sugar beet throughout its period of growth, showed that in the seed potash was present in the cotyledons, the radicle, and the endosperm, but not in the perisperm; whilst in the plant it was present in every part, mostly in the leaf, less in the leaf stalk, and least in the root. In the root the amount increased towards the crown, and accumulated largely in injured parts. In water cultures with no potash in the nutrient liquid, the reserve already present in the seed migrated for the greater part to the portions of the plant exposed to light, most being found in the leaf. Etiolated leaves contained a remarkably small proportion of potash.—J. P. O.

Sugar in the beetroot; Formation and disappearance of ——. L. Cassel. Bull. Assoc. Chim. Sucr., 1914, 31, 563—576.

The theory of the formation of sugar by the leaves of the beetroot by the agency of chlorophyll being accepted, the quantity of green substance at the disposition of the plant, for the same variety at least, must have a real importance for the saccharine richness of the beetroot. Delay in sprouting is injurious in this respect, and a regular and uniform vegetation is eminently favourable.—L. J. de W.

Sucrose; Constants for use in the double polarisation (Clerget Herzfeld) method of determining ——. R. Gillet. Sucr. Belge, 1914, 42, 271—275.

In applying the Herzfeld formula:

$$\frac{D+I}{142{\cdot}66-0{\cdot}5t}$$

for calculating the percentage of sucrose by the double polarisation method, the factor 0·5 used for correcting the concentration constant when readings are made at different temperatures is correct only for very low temperatures, viz., 3°—7° C., and when readings are taken at 13°—26° C. the factor 0·49 should be applied.—J. P. O.

Water; Determination of —— *[by distillation] in massecuites and molasses.* W. Clacher. Intern. Sugar J., 1914, 16, 126—127.

Reliable results are obtainable in the case of cane sugar factory products by the distillation method of determining water (this J., 1913, 62). 50 grms. of the product, and 300 c.c. of paraffin oil boiling a little over 100° C., are distilled together until about 100 c.c. of oil and water, which are collected in a graduated cylinder, have passed over. Frequently, in the cane sugar factory the Brix hydrometer reading is taken as an indication of the total solids, but when sulphitation has been excessive this value is quite untrustworthy.—J. P. O.

Sugar group; Dissociation in the ——. *Part III.* J. U. Nef. Annalen, 1914, 403, 204—383.

Hexoses in alkaline solution are capable of breaking down in three different ways, involving the intermediate formation of 1.2-, 2.3- and 3.4-hexosedienols and the final production, respectively, of: formaldehyde and aldopentoses (8); diose and aldotetroses (4); and two mols. of *dl*-glyceric aldehyde. The last two processes have already been described (this J., 1910, 1264). As an example of the first process dextrose and *d*-galactose on oxidation in alkaline solution with air or hydrogen peroxide yield, respectively, *d*-arabonic and *d*-lyxonic acid. The same result is also achieved by the use of Fehling's solution. When the amount of alkali is reduced from 1 to 1/20 equivalent, the number of products is considerably lessened; dextrose yields a mixture of only six isomeric optically active hexoses, while *l*-arabinose yields only three pentoses. After the attainment of this equilibrium the relative amounts of the various sugars present is very different. As an example, a 30 per cent. aqueous solution of either dextrose, *d*-mannose or lævulose mixed with 1/20 equivalent of calcium hydroxide attained complete equilibrium in about three months. The solution then contained a certain amount of resin, considerable quantities of polysaccharides, and the following six hexoses, viz.—dextrose, *d*-mannose, lævulose, *d*-pseudofructose and α- and β-*d*-glutose. This result precludes the formation of any dienol beyond α-1.2-*d*-glucosedienol.

$CH_2OH.(CHOH)_3.C(OH):CHOH$ and 2.3-*d*-glucosedienol, $CH_2OH).CHOH)_2.C(OH):C(OH):C(OH).CH_2OH$. Aldoses may be separated from ketoses by treatment with bromine in 12 per cent. aqueous solution, whereby oxidation of the aldoses to aldonic acids is effected: ketoses are unaffected by this treatment. The method is thus applicable to the isolation of ketopentoses and -hexoses; an important group of natural products which are as yet only very imperfectly known. The mixture of sugars obtained as above from dextrose, etc., contained ketoses and aldoses in approximately equal amounts. The quantity of dextrose was about five times that of *d*-mannose: a result which the author attributes to the unsymmetrical addition of water to α-1.2-*d*-glucosedienol. The absence of *d*-allose and *d*-latose in the mixture denotes that these sugars cannot occur either naturally or in formose; in presence of a trace of alkali or of suitable enzymes a non-reversible change to a mixture of the six sugars mentioned above would take place. Similar considerations hold for other groups of sugars, *e.g.*, the six members of the *d*-galactose series are *d*-galactose, *d*-talose, *d*-tagatose, *l*-sorbose and α- and β-*d*-galtose with two corresponding *d*-galactosedienols. From these results the author concludes that synthetic formose can only contain 24 hexoses out of the 32 which are theoretically possible; further, the aldose forming about half of the mixture must be composed chiefly of *dl*-glucose and *dl*-galactose. In brief, in presence of small quantities of caustic alkali only certain sugars are capable of formation in natural or in ordinary synthetical processes: these may be arranged in 4 groups of 6 hexoses, 4 groups of 3 pentoses, and 2 groups of 3 tetroses. Very dilute alkaline solutions of dextrose, containing about 6 equivalents of alkali, when oxidised at 20° to 40° C. by means of air or hydrogen peroxide yielded a complex mixture of carbon dioxide, formic acid, glycollic acid, oxalic acid and *dl*-glyceric acid; also *d*-arabonic and *d*-ribonic acids; and *d*-erythronic and *l*-threonic acids. Cupric or mercuric oxide yielded these products and also *d*-gluconic and *d*-mannonic acids. From this it is evident that only the 6 hexoses mentioned above were present and that they are not oxidised by air or by hydrogen peroxide. In presence of amounts of alkali down to 1/30 equivalent, especially on warming, sugar solutions give rise to appreciable quantities of resin. Other reactions give rise, respectively, to polysaccharides and saccharinic acids; and these three changes being non-reversible tend to disturb the equilibrium. In all three cases, however, the change is exceedingly slow. The saccharinic acids are stated to be produced, by means of a reaction resembling the transformation of benzil to benzilic acid, from ortho-osones, —CH_2.CO.CO—, which are in turn produced from the salts of the original sugars. This osone formation is favoured by lead acetate or lead chloride; but all three processes take place to some extent in presence of small amounts of caustic alkali. The disturbances due to these reactions may be avoided by employing ½ equivalent of pure sodium carbonate solution in place of caustic alkali. Polysaccharides are always produced in presence of caustic alkali or amounts of sodium carbonate above ½ equivalent. It is remarkable, however, that pure potassium carbonate solution up to 3 equivalents effected no change in concentrated sugar solutions after keeping in closed vessels for 2 months. The two classes of polysaccharides are distinguished by the relative ease with which they react with dilute acids or Fehling's solution. Polymerisation to tris-oses, $(C_nH_{2n}O_n)_3$ or to α-bis-oses $(C_nH_{2n}O_n)_2$, is favoured by calcium acetate (from 1 to 3 equivalents), which is unable to effect enolisation or salt-formation. Excess of sodium carbonate solution, besides effecting these changes, brings about a condensation to polysaccharides of the nature of lactose and maltose. The tris-oses and α-bis-oses, *e.g.*, α-bis-*d*-glucose-*d*-fructose, $C_{12}H_{24}O_{12}$, hydrolyse with extreme ease; they only change into anhydro-α-bis-hexoses (disaccharides) and still further dehydrated products under the influence of caustic alkali. Thus, sucrose is among the products formed from the dextrose group of equilibrium isomerides in dilute alkaline solution. Novel structural formulæ are advanced by the author in order to illustrate the formation of such polymerisation and condensation products.—J. R.

Maple products; Analysis of ——. III. Range of variation of analytical values in genuine maple syrups. J. F. Snell and J. M. Scott. J. Ind. Eng. Chem., 1914, **6**, 216—222.

Experiments with 126 samples of genuine Canadian maple syrup showed that the values in which the differences between the maximum and minimum numbers were least were the conductivity value, the alkalinity of the soluble ash, the weight of the total ash, and the Winton lead number. Determinations of the values mentioned and of the refractometer reading and lead number determined by the Canadian method, are recommended for rapidly detecting adulteration. The limiting values for genuine maple syrups are shown in the following table:—

	Limiting values.	
	Extreme.	Ordinary.
Refractometer reading	—	—
Conductivity value at 25° C.	110—230	113—205
Total ash, dry basis	0·61—1·68	0·69—1·47
Alkalinity of soluble ash, dry basis	41—122	48—109
Canadian lead number, 5 grms. of syrup, dry basis	1·37—6·56	1·51—4·55
Winton lead number, 25 grms. of syrup, wet basis	0·70—2·70	0·76—2·47

(See also this J., 1913, 954; 1914, 154.)—A. S.

Patents.

Defecatant and process of making same. W. J. Wayte, Philadelphia, Pa., Assignor to The American Agricultural Chemical Co. U.S. Pat. 1,088,751, March 3, 1914.

Kieselguhr is treated with phosphoric acid (sp. gr. not exceeding 1·2), dried, and the treatment repeated until the kieselguhr is charged with a quantity of phosphoric acid not exceeding 40 per cent. of its weight.—W. P. S.

Concentration and crystallisation apparatus especially for sugar manufacture. F. Tiemann, Berlin. U.S. Pat. 1,087,409, Feb. 17, 1914.

See Fr. Pat. 436,672 of 1911; this J., 1912, 453.—T. F. B.

Sugar juices; Apparatus for extraction of ——. W. Raabe, Cöthen, Germany, Assignor to E. C. Post, Ann Arbor, Mich. U.S. Pat. 1,089,495, March 10, 1914.

See Ger. Pats. 254,932 and 254,933 of 1911; this J., 1913, 441.—T. F. B.

Producing cellose and converting it into fermentable sugar. U.S. Pats. 1,087,743 and 1,087,744. *See* V.

Application of the waste from sugar refineries to the manufacture of an artificial Portland cement. Addition to Fr. Pat. 460,438. *See* IX.

XVIII.—FERMENTATION INDUSTRIES.

Barley, malt and beer; Determination of the amino-acid- and polypeptide-nitrogen in —— by titration with acid after treatment with formaldehyde (formalin-titration). L. Adler. Z. ges. Brauw., 1914, **37**, 105—108, 117—121, and 129—133.

The method described is based on similar principles to that of Sörensen (this J., 1908, 135). Eighty c.c. of the wort, beer, or extract, in a 100 c.c. flask are heated in boiling water for 10 mins. to precipitate coagulable proteins, then cooled and treated with 1—2 grms. of barium chloride and 1 c.c. of a 0·5 per cent. solution of phenolphthalein in 50 per cent. alcohol. After the barium chloride has dissolved, the liquid is neutralised with a saturated solution of barium hydroxide, made up to 100 c.c. and filtered. Of the filtrate two portions, each

40 c.c. are rendered neutral ($p\text{H}=6\cdot8$; see Sörensen, this J., 1909, 950) by addition of acid until a drop of the liquid placed on sensitive azolitmin paper (Kahlbaum's) produces a neutral colour similar to that produced by a solution containing 1/30 grm.-mol. each of monopotassium phosphate and disodium phosphate per litre ($p\text{H}=6\cdot81$). The two solutions are next treated each with 10 c.c. of 35 per cent. formaldehyde solution neutralised shortly before use by adding, for every 10 c.c., 0·2 c.c. of the 0·5 per cent. phenolphthalein solution, and then $N/2$ sodium hydroxide until the liquid is faintly but distinctly red. As a blank test 10 c.c. of this formaldehyde solution are diluted with 45 c.c. of distilled water, treated if necessary with a 0·5 per cent. solution of Bismarck brown to adjust the tint to that of the actual solutions to be analysed, and titrated with $N/5$ barium hydroxide solution until a strong red colour is produced ($p\text{H}=9\cdot1$) not, however, so strong that further addition of alkali does not increase its intensity. The solutions to be analysed are titrated to the same tint. The concentration of the original wort or other liquid, should if possible be such that the volume of $N/5$ barium hydroxide required by each 40 c.c. portion, less the volume required by the blank test, amounts to about 20 c.c. This number multiplied by 2·8 gives the weight in mgrms. of amino-acid- or polypeptide-nitrogen in the 40 c.c. portion of the sample. The nitrogen of ammonium salts reacts with formaldehyde and is determined by this method. The method can be made to yield other useful values by carrying out the titration "in stages" as recommended by Henriques and Gjaldbaek (Z. physiol. Chem., 1910, **67**, 8—27 ; 1911, **75**, 363). For example, if the volume of $N/5$ barium hydroxide from which the nitrogen is calculated, as above, is designated "Stage II" and the volume required to bring the solution from the point of neutrality to litmus ($p\text{H}=6\cdot81$) to the first appearance of red colour with phenolphthalein ($p\text{H}=8\cdot3$) before addition of formaldehyde, is designated "Stage I," then the ratio Stage II/Stage I varies according to the nature of the nitrogenous compounds with which the formaldehyde reacts. For amino-acids the ratio usually lies between 6·8 and 11·5, whereas for polypeptides it is much lower, *e.g.*, for glycylglycine 2·1. The ratio cannot be determined very accurately in the case of coloured liquids such as malt extracts, and in all cases it should be interpreted with considerable reserve.

In a sample of barley 0·017 per cent and in a sample of malt 0·085 per cent. of amino-acid- and polypeptide nitrogen were found. To determine these values it was found necessary to prevent enzymic action during extraction, by first boiling the finely ground grain for two hours with alcohol. If the grain is extracted without this preliminary treatment, proteolysis occurs during extraction, even at 1° or 2° C., and the quantity of amino-acid and polypeptide-nitrogen may under favourable conditions be doubled or trebled. A pale beer was found to contain 174·9 mgrms. per litre, of nitrogen determinable by "formalin-titration."—J. H. L.

Maltase ; Influence of acids on the activity of dialysed ——. W. Kopaczewski. Comptes rend., 1914, **158**, 640—642.

In general, the optimum acidity for dialysed maltase (see this J., 1913, 441) is considerably lower than that for maltase which has not been dialysed, *e.g.*, $N/725$ instead of $N/170$ in the case of sulphuric acid. The optima found for different acids do not correspond to the same concentration of hydrogen ions, the values of $p\text{H}$ ranging from 2·80 to 6·97. The influence of acids on the activity of maltase cannot therefore be due entirely to the hydrogen ions, but the anions must play some part (cp. Bertrand and Rosenblatt, this J., 1913, 376).—J. H. L.

Maltase from beer yeast : Conditions of action of ——. *III.* L. Michaelis and P. Rona. Biochem. Zeits., 1914, **60**, 598.

A correction of a misprint in the article of which an abstract has already appeared (this J., 1914, 272), but which does not affect the abstract.

Enzymes ; Chemical composition and formation of ——. *XI.* H. Euler and K. G. Dernby. Z. physiol. Chem., 1914, **89**, 408—424.

Treatment of yeast for 48 hours in Lindner's nutrient sugar solution, which has previously been shown to augment the invertase activity of living yeast (see this J., 1912, 245, 654 ; 1913, 669 ; 1914, 97, 272), produced also a marked increase (about 36 per cent.) in the proteolytic activity, and a decrease in the fermentative power of the yeast. The effect on the proteolytic power was not dependent on the temperature at which the treatment was carried out (cp. this J., 1914, 272) nor was it influenced by the addition of sodium fluoride to, or the omission of phosphates from the nutrient solution (cp. Iwanoff, this J., 1905, 100). The presence of sodium fluoride (0·005 per cent.) appeared to retard the assimilation of ammonium salts by fermenting yeast. The proteolytic power of yeast was measured by first plasmolysing (liquefying) the yeast by digestion with glycerol for 3 hours, and then diluting with water containing chloroform and measuring the rate of dissolution of the yeast nitrogen at 37° C. It was found possible to determine nearly the whole of the dissolved non-coagulable nitrogen by "formalin-titration" (Jessen-Hansen's modification of Sörensen's method, see Abderhalden's *Handbuch der biochem. Arbeitsmethoden*, vol. 6, p. 270) so the latter method was employed in preference to Kjeldahl's. The duration of the preliminary plasmolysis did not affect the results, but it was necessary to dilute considerably with water afterwards, as high concentrations of glycerol inhibited proteolysis (cp. Gromow and Grigorieff, this J., 1904, 995). The rate of proteolysis was slightly accelerated by addition of potassium nitrate, potassium chlorate or hydrogen peroxide (cp. Gromow, *loc. cit.*) and slightly but distinctly retarded by addition of an extract of living yeast made with hot water, in consequence of the action of antiproteases (cp. Buchner and Haehn, this J., 1909, 899).—J. H. L.

Alcoholic fermentation ; Mechanism of ——. *III. Cell-free fermentation of polyhydroxycarboxylic acids.* A. v. Lebedeff. Ber., 1914, **47**, 660—672. (See also this J., 1911, 973 ; 1912, 1195.)

Glyceric acid is readily fermented by yeast maceration juice or by yeast dried by v. Lebedeff's method (this J., 1911, 147), carbon dioxide and acetaldehyde being produced. The quantity of carbon dioxide formed corresponds approximately with the equation, $CH_2OH.CHOH.COOH=CHC_3HO+CO_2+H_2O$, but the amount of acetaldehyde, even when allowance is made for its partial conversion into alcohol by the yeast enzymes, appears to be considerably below the calculated yield. Glyceric acid is fermented about three times as strongly as glyceraldehyde, and both optical forms are attacked. The decomposition of glyceraldehyde, which forms part of the scheme suggested by the author and Griaznoff (this J., 1912, 1195) to represent the mechanism of fermentation, was formerly assumed to be through the intermediate formation of methylglyoxal and pyruvic acid, but experiments on the fermentation of methylglyoxal have given only doubtful results, and the author now suggests that the glyceraldehyde is first converted into glyceric acid,

$$CH_2OH.CHOH.CHO+H_2O=CH_2OH.CHOH.CH(OH)_2$$
$$CH_2OH.CHOH.CH(OH)_2-H_2=CH_2OH.CHOH.COOH$$

which is then fermented. It has long been known that glyceric acid, when heated with potassium bisulphate produces pyruvic acid, and it appears likely in view o the fermentability of the latter (see Neuberg and others this J., 1911, 1179, 1465) that the enzymes of yeast juic decompose glyceric acid in the same way. The production of acetaldehyde from glyceric acid by enzyme throws light upon the real problem of fermentation, whicl is the conversion of the group $-CH_2OH$ into the methy group. Gluconic acid is also fermented by dried yeast but it is at present uncertain whether this is due to carboxylase or to "dehydratase." The carbon dioxid produced may possibly contain a small quantity c hydrogen, and no acetaldehyde appears to be forme Both glyceric and gluconic acids are fermented abo half as rapidly as pyruvic acid, but only in dilute solutions; at concentrations of 1 and 2 per cent. respectively they are not fermented at all, and they retard the autofermentation of the juice.—J. H. L.

[Brewing] water; New method for the determination of the salts of ——. W. Windisch, C. ten Doornkaat Koolman and H. Krumhaar. Woch. Brau., 1914, **31**, 65—67, 73—75, 85—87, 93—96.

The authors criticise the practice of coupling all the magnesia with carbonic acid, the remainder of the latter with lime, the remainder of this with sulphuric acid, and the remainder of the sulphuric acid and the chlorine with sodium. The following figures (parts per 100,000) relating to the samo brewing water before and after softening by treatment with lime, show the curious results obtained by applying this method to waters containing much magnesia:—

	$MgCO_3$	$CaCO_3$	$CaSO_4$	$MgSO_4$	Na_2SO_4	NaCl
Before softening ..	20·1	17·5	28·7	0·0	5·1	2·6
After softening ..	3·0	0·0	10·0	18·0	2·3	2·6

Experiments in which quantities of 100 c.c. of various "artificial" waters were treated with varying quantities of a standard solution of calcium hydroxide, boiled for 1 min., filtered and the filtrates and precipitates analysed, indicated that in the action of lime upon the salts of water a definite sequence is followed, viz.: (1) fixation of dissolved free carbon dioxide, (2) conversion of bicarbonates into normal carbonates and precipitation of calcium carbonate, (3) interaction with magnesium carbonate to form calcium carbonate and magnesium hydroxide, both of which are precipitated, and (4) interaction with magnesium sulphate or chloride to form soluble calcium sulphate or chloride and magnesium hydroxide which is precipitated. As the proportion of lime added to the water is increased, the calcium-content of the filtrates diminishes until phase (2) is complete, after which it remains constant throughout phase (3) and subsequently increases. The difference between the lime-content of the filtrates corresponding to phase (3) and the lime-content of the original water, plus the quantity of lime corresponding to the solubility of normal calcium carbonate (0·8 part CaO per 100,000), represents the amount of lime present as carbonate in the original water. For the determination of this value in practice, 100 c.c. of the water are boiled for 1 min. with such a volume of standard calcium hydroxide solution as will bring the reaction to phase (3); the liquid is afterwards filtered and the calcium-content of the filtrate determined. The quantity of calcium hydroxide solution required can be readily calculated from the amount of free carbon dioxide in the water (found by titration with $N/10$ sodium hydroxide in presence of phenolphthalein) and the amount of carbonic acid present as bicarbonates, found by titration with acid in presence of methyl orange (the authors found that magnesium carbonate as well as calcium carbonate is present in natural waters as bicarbonate). When the quantity of calcium carbonate present in the water has been determined as above, the remaining carbonic acid is allotted to magnesia, the lime and magnesia not accounted for as carbonates are coupled with sulphuric acid, and the remainder of the latter, together with the chlorine, is combined with sodium. The following figures (parts per 100,000) represent the results obtained by the old and new methods as applied to a water containing CaO, 17·4; MgO, 9·8; CO_2 as carbonate (determined by acid titration in presence of methyl orange), 16·3; SO_3, 15·2; free CO_2, 1·6 parts per 100,000:—

	$CaCO_3$	$MgCO_3$	$CaSO_4$	$MgSO_4$	NaCl
Old method....	12·5	20·6	25·6	0·0	2·6
New method ..	26·4	5·9	0·9	21·0	2·6

With waters containing very small quantities of magnesia the two methods give very similar results.—J. H. L.

Glycerol; Dehydration of ——, by a ferment occurring in water. E. Voisenet. Comptes rend., 1914, **158**, 734—736.

Water from diverse sources is capable of fermenting glycerol in the presence of appropriate nutrient material, which may be wholly mineral in character. Dehydration products of glycerol are thereby formed, the first of which, presumably 1.3-propanolal, changes rapidly to acrolein, which may be separated by fractional distillation. The optimum temperature is 25° to 30° C.—J. R.

Wines; The sulphuric acid content of German and other ——. C. A. Neufeld. Z. Unters. Nahr. Genussm., 1914, **27**, 299—311.

German wines are not plastered and do not contain more than 1·3 grm. of potassium sulphate per litre. A number of German red and white wines examined recently by the author contained, however, considerable quantities of sulphate, the amount present in the red wines (12 samples) varying from 2·12 to 3·98, and in the white wines (19 samples) from 2·01 to 4·54 grms. of potassium sulphate per litre; 11 French wines contained from 2·14 to 3·93 grms. per litre. The sulphuric acid was probably derived from the casks in which the wine had been stored, these having been treated with sulphurous acid and insufficiently washed before the wine was introduced. Such quantities of sulphuric acid influence the taste of the wine to a marked degree; in many countries a limit of 2 grms. of potassium sulphate per litre is fixed as the maximum quantity allowable in wines.—W. P. S.

Caramel [in wine, vinegar, brandy, etc.]; Detection of ——. D. Schenk. Apoth.-Zeit., 1914, **29**, 202—203. (See also this J., 1913, 376.)

When sugar is caramelised, hydroxymethylfurfural is produced which can give characteristic colour reactions with certain phenols dissolved in strong acids. Resorcinol in hydrochloric acid gives a cherry-red, β-naphthol in sulphuric acid a violet, and phenol in sulphuric acid an orange-yellow colouration. Colouring matters derived from coal tar do not react in the same way. The liquid to be tested, wine, vinegar, brandy, etc., is neutralised if acid, concentrated to a small bulk, extracted with ether, the ethereal extract treated with a few drops of a 5 per cent. solution of phenol in ether and allowed to evaporate. The residue is mixed with about 5 c.c. of sulphuric acid when the characteristic colour rapidly appears.—F. Shdn.

Distillation-residue of wine; Treatment of the ——. C. Matignon. Chem.-Zeit., 1914, **38**, 386—387.

The residues from the distillation of wine or of fermented molasses are rendered alkaline, and inoculated with a culture of the butyric acid ferment, after addition of aluminium sulphate, with a smaller proportion of aluminium phosphate and manganese and magnesium chlorides. Air is blown through the liquid for the first 6—10 hours, and the process is complete in about 3 days. Ammonia and trimethylamine, acetic, propionic, butyric, tartaric, malic, and citric acids and their potassium salts, glycerol, carbon dioxide, methane, and hydrogen are produced. The volatile bases and acids are recovered by distillation respectively before and after acidulation with sulphuric acid; the glycerol is distilled from the dried residue, which contains the dibasic acids and potassium salts. Ammonia and trimethylamine are separated by passing them as gases over a mixture of their sulphates; ammonium sulphate remains behind, and the trimethylamine is converted into cyanide by passing it through a tube heated to 1000° C. and absorbing the hydrocyanic acid formed in alkali. The volatile acids are dehydrated with aluminium sulphate and fractionated. These processes, which are due to Effront, have been in use for 3 years at Nesle, France. The conversion of the acetic and butyric acids, by catalysis with coke, into the corresponding ketones, for use in internal combustion engines, is contemplated.—O. E. M.

PATENTS.

Beer; Process of manufacturing ——. G. L. H. Seize. Fr. Pat. 464,080, Oct. 10, 1913.

MALT is steeped in about its own weight of water at 50° to 75° C. for from 5 to 15 hours, then crushed or ground, diluted with warm water (at about 75° C.) so that from 3 to 3·5 litres of water shall be present for each kilo. of malt, and when saccharification is complete, the wort is separated. Or, the mass, after being crushed, may be heated to boiling for about 10 minutes, and then treated with a suitable proportion of ground malt.—W. P. S.

Vinegar from milk; Manufacture of ——. F. Huberty et Cie. Fr. Pat. 463,266, Oct. 3, 1913.

PROTEINS are removed from milk serum by precipitation with tannin either before or after the addition of alcohol, or by concentrating the serum and adding alcohol. Or, the serum is distilled to dryness under reduced pressure, and the dry residue extracted with the distillate, leaving the proteins undissolved, and the solution treated with alcohol. The alcoholic solution is submitted to acetic fermentation. The resulting vinegar contains much of the lactose present originally in the serum.—W. P. S.

Acetifiers; Utilisation of the alcohol and acid vapours from —— *in the "rapid" vinegar process.* A. Mohr. Ger. Pat. 270,320, Feb. 15, 1913.

THE wort flows from the reservoir through a closed tube, wherein by an action similar to that of a water-pump, it creates a partial vacuum and draws in the alcohol and acid vapours from the acetifiers; the vapours are condensed by contact with the cold liquid. The wort flows into a receptacle, the air space of which is connected with a tube through which the vinegar from the acetifiers flows on its way to the storage vessel, so that any uncondensed vapours still present in the air are condensed in the latter.—A. S.

Saccharometer [; *Fermentation* ——]. A. Eppens, Berlin. U.S. Pat. 1,089,464, March 10, 1914.

SEE Eng. Pat. 26,696 of 1912; this J., 1913, 310.—T. F. B.

Dealcoholising liquids. O. G. C. L. Overbeck, Great Grimsby. U.S. Pat. 1,089,862, March 10, 1914.

SEE Eng. Pat. 5170 of 1911; this J., 1912, 354.—T. F. B.

Dehydration of colloidal substances. Ger. Pat. 270,061. *See* I.

Treatment of wood refuse for the recovery of valuable by-products therefrom. Eng. Pats. 3963, 8359, and 13,746. *See* V.

Removing organic constituents from residues obtained in producing alcohol from waste sulphite cellulose lyes. U.S. Pat. 1,087,356. *See* V.

Producing cellulose and converting it into fermentable sugar. U.S. Pats. 1,087,743 and 1,087,744. *See* V.

XIXA.—FOODS.

Salt-soluble proteins in wheat flour; Determination of the ——. G. A. Olson. J. Ind. Eng. Chem., 1914, 6, 211—214. (See also this J., 1913, 1124.)

GLIADIN was extracted from flour by both 1 per cent. and 10 per cent. solutions of sodium chloride; of the total protein extracted about 29 per cent. was gliadin with the 1 per cent. salt solution and 5 per cent. with the 10 per cent. solution. The following method is suggested for the determination of the salt-soluble proteins. 10 grms. of flour are digested with 500 c.c. of a 1 per cent. solution of sodium chloride, the mixture being shaken at intervals of 5 mins. for the first 2 hours and then allowed to stand overnight. After filtering, the total soluble nitrogen is determined in one 200 c.c. portion, and another similar portion is evaporated to dryness, the residue digested with 100 c.c. portions of 55 per cent. (by vol.) alcohol, the extracts filtered, and the filter washed with 55 per cent. alcohol: the nitrogen content of the precipitate is reckoned as albumin-nitrogen. The alcoholic solution is concentrated to 10 c.c., treated with 50 c.c. of distilled water, concentrated to 35 c.c., treated with 15 c.c. of water, allowed to cool, filtered, and the filter washed with cold water. The solution is precipitated with phosphotungstic acid, and the nitrogen content of the precipitate reckoned as globulin-nitrogen. The nitrogen-content of the filtrate is reckoned as amide-nitrogen, and the gliadin-nitrogen is obtained by subtracting the sum of the albumin-, globulin-, and amide-nitrogen from the total salt-soluble nitrogen. In all the nitrogen determinations, blank determinations are also made and the necessary corrections applied.—A. S.

Crude fibre; Determination of —— *in finely powdered substances.* J. Grossfeld. Z. Unters. Nahr. Genussm., 1914, 27, 333.

IN the determination of crude fibre in such substances as cocoa, flour, etc., by König's method, it is recommended that the filtration be carried out without the aid of the filter-pump. The glycerol-sulphuric acid mixture containing the crude fibre should be filtered through a Gooch crucible containing a layer of asbestos. If suction is applied, the fine particles of the substance tend to penetrate the layer of asbestos for some distance and the filter rapidly becomes clogged.—W. P. S.

Ensilage process; Effects of the —— *on the solubility of "floats."* E. B. Forbes and C. M. Fritz. J. Ind. Eng. Chem., 1914, 6, 222—223.

EXPERIMENTS were made to ascertain whether it would be practicable to add "floats" to corn before introducing the latter into the silo, instead of applying the "floats" to the soil directly admixed with manure. Ensilage was effected for six months in closed earthenware jars and the product from corn to which "floats" had been added in the proportion 1 : 250, appeared identical in taste, odour, and appearance with that from untreated corn: the content of phosphorus soluble in 0·2 per cent. hydrochloric acid increased considerably during ensilage. The average composition of the samples before and after ensilage are shown in the following table:—

Product.	Total P.	Water-sol. P.	Citrate-sol. P.	Inorgan. P sol. in 0·2 per cent. HCl.
	per cent.	per cent.	per cent.	per cent.
Untreated green silage corn	0·207	0·149	0·021	0·083
Silage from untreated corn	0·224	0·160	0·008	0·111
Green silage corn, plus "floats" (250 : 1) ..	0·371	0·136	0·061	0·172
Silage from treated corn	0·384	0·157	0·060	0·237

See also this J., 1912, 895.)—A. S.

Butter fat [*in butter*]; *Rapid method for the gravimetric determination of* ——. F. König. Apoth.-Zeit., 1914, 29, 223—224.

ONE grm. of the butter is treated in a 200 c.c. cylinder with 9 c.c. of hot water, and when melted, 2 c.c. of ammonia, 10 c.c. of alcohol, 20 c.c. of ether, and 20 c.c. of petroleum spirit (b. pt. about 40° C.) are added, shaking after each addition. The whole is shaken thoroughly for 1 min., set aside for 15 mins., the cylinder inverted and, by carefully loosening the cork, the aqueous layer allowed to flow away. About 0·4 grm. of powdered tragacanth is then added, and, after shaking, the ethereal solution is decanted into a weighed flask; the gelatinous mass in the cylinder is then washed with petroleum spirit, the washings being added to the flask, the solvent is evaporated from the latter, and the residue of butter fat dried and weighed. —W. P. S.

Cottonseed meal; The organic phosphoric acid of ——. R. J. Anderson. J. Biol. Chem., 1914, **17,** 141—150. (See also this J., 1912, 701, and 1913, 42.)

The acid was extracted from cottonseed meal by digestion with 0·2 per cent. hydrochloric acid and was freed from inorganic phosphate and bases other than baryta by repeated slow precipitation of the crystalline barium salt from its solutions in dilute hydrochloric acid; a process which was effected alternately by the addition of barium hydroxide and of alcohol to the solutions. Although the reactions of the free acid were identical with those of phytic acid, which is usually assigned the formula $C_6H_{24}O_{27}P_6$, analyses of the barium salts agreed more closely with the formula, $C_6H_{18}O_{24}P_6$, of inositol hexaphosphate; by suitably adjusting the conditions of crystallisation two salts were obtained, corresponding to tri-barium inositol hexaphosphate, $C_6H_{12}O_{24}P_6Ba_3$ and hydrated hepta-barium inositol hexaphosphate, $(C_6H_{11}O_{24}P_6)_2Ba_7$. The free acid was obtained as a colourless syrup which gave no reaction with ammonium molybdate. (See also succeeding abstracts.)—J. R.

Oats; Phytin in ——. R. J. Anderson. J. Biol. Chem. 1914, **17,** 151—163.

The substance was isolated in the form of barium salt from 0·2 per cent. hydrochloric acid extracts of oats by precipitation with barium chloride; purification was effected by repeatedly precipitating the salt from dilute hydrochloric acid alternately with alcohol and barium hydroxide. The snow-white amorphous powder thus obtained was resolved into two substances by treatment with small quantities of cold water. The undissolved portion crystallised readily, and two salts were isolated from it identical with those obtained from cottonseed meal (see preceding abstract). These salts readily yielded inositol when heated in a sealed tube with dilute sulphuric acid. The soluble barium salt, which remained amorphous and differed markedly from the crystalline product, resembles a substance isolated in a similar manner from wheat bran.—J. R.

Corn [maize]; Phytin in ——. R. J. Anderson. J. Biol. Chem., 1914, **17,** 165—170.

By treatment similar to that recorded in the foregoing abstracts the meal yielded a white amorphous barium salt which gave analytical results corresponding with the usually accepted formula, $C_6H_{18}O_{27}P_6Ba_3$, of tri-barium phytate. Further treatment resulted in the isolation of two crystalline barium salts identical in every respect with those described above.—J. R.

Phytin; A contribution to the chemistry of ——. R. J. Anderson. J. Biol. Chem., 1914, **17,** 171—190.

Neuberg's formula (Biochem. Zeits., 1908, **9,** 551—557) for phytic acid, $C_6H_{24}O_{27}P_6$, differs by 3 mols. of water from the formula, $C_6H_{18}O_{24}P_6$, of inositol hexaphosphate, which was suggested for phytic acid by Suzuki and Yoshimura (this J., 1907, 1061). Salts prepared from commercial phytin without especial purification are usually amorphous and give analytical results corresponding closely with Neuberg's formula. The author has succeeded, however, in isolating from the crude amorphous barium salt two crystalline barium salts identical with those obtained from cottonseed meal, etc. (see preceding abstracts). From the analytical data these substances are salts of the acid $C_2H_6O_8P_2$ or $C_6H_{18}O_{24}P_6$. The composition of the free phytic acid obtained from crystalline barium phytate also agrees well with these formulæ, indicating that phytic acid is either inositol hexaphosphate or an isomeric substance. The free acid, and to a lesser degree the salts, decompose slowly under ordinary conditions with liberation of inorganic phosphate, but without formation of inositol. The latter substance is produced when the acid is dried at 105° C. under reduced pressure. The other products in both cases are stated to be barium salts of penta- to mono-phosphoric acid esters of inositol. The acid is always hydrolysed appreciably on drying.—J. R.

Detection of adulteration of saffron by means of phosphomolybdic acid. Verda. *See* IV.

Patents.

Fish, crayfish, crabs, lobsters, molluscs, and the like; Process for preserving ——. A. Danilevsky, St. Petersburg. Eng. Pat. 8775, April 14, 1913.

Fish, crabs, etc., are placed alive in a solution consisting of water, 100 parts, sodium chloride, 1 to 2, and hydrogen peroxide, 0·01 to 0·5 part. After a period of from 1 to 5 hours, the dead fish, etc., are removed from the solution, wrapped in linen impregnated with a preserving solution, and stored in a refrigerating chamber. Fish preserved in this manner may, it is stated, be dried directly in the air, or smoked, without risk of decomposition. (See also this J., 1914, 215.)—W. P. S.

Hydrogenated [fat] product. C. Ellis, Montclair, N.J. U.S. Pat. 1,087,161, Feb. 17, 1914.

An edible product of butter-like consistence consists of a mixture of hydrogenated cottonseed oil and hydrogenated palm oil. (See also U.S. Pat. 1,037,881; this J., 1912, 1004.)—W. P. S.

Cream; Process of producing ——. W. E. McCaddon, Assignor to H. M. De Witt, Denver, Colo. U.S. Pat. 1,087,599, Feb. 17, 1914.

A column of liquid, consisting of a milk product and a fat, is impelled upwards to a point of discharge against a resistance produced by its own weight, the force employed exceeding the said pressure to a predetermined degree.—W. P. S.

Grain-purifying process. E. H. Reynolds, Chicago. U.S. Pat. 1,087,684, Feb. 17, 1914.

Grain is treated with a quantity of sodium chloride solution sufficient to raise the moisture-content to about 15 per cent., and is then subjected to the action of sulphurous acid fumes.—W. P. S.

Cocoa and chocolate; Process of preparing ——. F. E. F. Neumann. Fr. Pat. 463,325, Oct. 6, 1913.

To obtain products having a uniform taste, the cocoa-mass is formed into a layer about 1 mm. thick and heated to 100°—150° C., for a few seconds. The thin layer is then exposed to the atmosphere for a time, and again heated, these operations being repeated until the desired effect is attained.—W. P. S.

Manufacture of vinegar from milk. Fr. Pat. 463,266. *See* XVIII.

XIXb.—WATER PURIFICATION; SANITATION.

Chlorides in drinking water; Importance of the amount of —— *for control and evaluation.* M. F. Malméjac. Comptes rend., 1914, **158,** 650—652.

The sources of the chlorine in drinking water are the soil through which the rainfall passes and the excreta of living beings. From the first source the amount of chlorine is markedly constant for any one water and is generally small, viz., 13 to 20 mgrms. per litre, though in deep wells the quantity may rise to 1 grm. per litre. From the second source, the amount of chlorine is variable and accidental, though often considerable. Analyses of

various waters are given showing the concurrence between the results for the variable chlorine and those for organic matter of animal origin as estimated by the oxygen absorption in an alkaline medium, and the relation between the chlorine and the number and kind of bacteria present; any sudden increase in chlorine was accompanied by an increase in the bacteria and the appearance of *B. coli.*
—J. H. J.

Sewage disposal. G. J. Fowler. Times Eng. Suppl., Mar. 11, 1914.

Sewage sludge is now very generally being sold as a manure. At Manchester the "slurry" from the washing of the contact beds is being dried, powdered and sold to Canada at a price which covers cost. At Bradford the crude sewage is "cracked" with sulphuric acid, the resulting sludge hot pressed, the grease recovered and sold at a profit, and the residual sludge cake sent to Northern France for intensive gardening. At Oldham the sludge is distilled and the residue sold. At Dublin the sludge is fermented by yeast, which causes a separation of water; the solid sludge is dried and the resulting powder sold for 50s. a ton (see also this J., 1914, 157). An organism has been isolated from the water of an old colliery which has the property of precipitating iron in presence of organic matter. When this organism was added to an effluent together with a salt of iron and then air blown in, complete clarification was obtained; the deposit produced had a high nitrogen content.—J. H. J.

Disinfectants; New method for determining the value of ——. C. A. Duyser and W. K. Lewis. J. Ind. Eng. Chem., 1914, **6**, 198—200.

Portions of the disinfectant are diluted with known quantities of water and a measured volume of a standard bacteria culture is introduced into each of the solutions and into solutions of pure phenol of equal concentration. After allowing to stand for an exact number of minutes, an aliquot part of each mixture is plated out in Petri dishes on nutrient agar and incubated until the colonies representing the surviving bacteria can be counted; plates of equal dilutions of the culture but without disinfectant are also incubated. The ratio of surviving organisms to the number present on the undisinfected plates is then plotted against the dilution, whereby two curves, one for the phenol and one for the disinfectant, are obtained, from which the relative strength of the disinfectant compared with that of phenol can be read off at any desired point. The curves for the so-called emulsion disinfectants are practically straight lines which can be plotted from the results of a small number of tests. It is stated that the results can be duplicated with sufficient accuracy even by two analysts working separately. The degree of accuracy attainable is shown by the following results of duplicate determinations: 4·82, 4·58; 5·17, 5·05; 6·95, 6·64; 9·64, 9·30; 4·28, 4·08; 2·04, 2·24.
—A. S.

Formaldehyde and its polymerides; The vapours of ——. F. Auerbach and W. Plüddemann. Arbb. Kais. Gesundh.-Amt, 1914, **47**, 116—132. Chem. Zentr., 1914, **1**, 956.

α-Polyoxymethylene when vaporised in a current of dry air at 40°—100° C., and β-polyoxymethylene under similar conditions at 40°—60° C., yield almost exclusively polyoxymethylene vapour, the β-compound changing, in part, into the stable α-compound. Anhydrous formaldehyde vapour diluted with nitrogen can be prepared by vaporising α-polyoxymethylene in a current of warm nitrogen, dissociating the vapour by heating to 220°—230° C., and then separating the residual polymerides by cooling to —25° to —30° C. In the vaporisation of solid polyoxymethylenes for disinfecting purposes, the active formaldehyde is produced only by the dissociating action of water or steam, and then only slowly and incompletely: hence a relatively larger quantity is necessary than when aqueous solutions of formaldehyde are used. In the iodometric analysis of formaldehyde solutions, the iodine and alkali solutions should not be mixed before addition of the formaldehyde. Alkaline solutions of formaldehyde should be neutralised and again made alkaline after addition of the iodine (an excess of at least 50 per cent. over the quantity consumed).—A. S.

New method for the determination of the salts of water. Windisch and others. *See* XVIII.

Dehydration of glycerol by a ferment occurring in water. Voisenet. *See* XVIII.

Patents.

Liquids; Sterilisation of ——. R. F. Edwards, London. Eng. Pat. 8500, April 10, 1913.

The liquid, such as water, milk, or the like, is sprayed or atomised into a chamber containing lamps capable of emitting ultra-violet rays; the treatment may take place *in vacuo*, in air, or in the presence of an inert gas.
—W. P. S.

Water; Process for adding coagulants to ——. A. P. Strohmenger, London. Eng. Pat. 22,050, Sept. 30, 1913.

The water is conducted under pressure through a tube containing an aluminium rod of slightly smaller diameter than the tube; this rod is connected with the positive pole of a source of electricity and the tube with the negative pole. For example, the tube may have an internal diameter of 1$\frac{3}{8}$ inch and contain an aluminium rod 3 ft. in length and $\frac{7}{8}$-inch in diameter, and water, under a pressure of 8 lb. per sq. inch, may be passed through it at the rate of 100 galls. per hour. With water containing 20 parts of total solids per 100,000, a difference of potential of 3 volts will produce 0·072 grm. of aluminium hydroxide per 100 galls. of water.—W. P. S.

Water; Purification of ——. F. M. Leavitt, Smithtown, N.Y., Assignor to Leavitt-Jackson Engineering Co., Brooklyn, N.Y. U.S. Pat. 1,088,232, Feb. 24, 1914.

A gas under pressure is introduced into the water, the supply of gas, irrespective of its pressure, being controlled by its loss of weight; the rate of the loss of weight is regulated by the rate of flow of the water.—W. P. S.

Alumino-silicate compounds for the purification of water; Process of manufacturing ——. P. de Brünn. First Addition, dated Sept. 27, 1913, to Fr. Pat. 455,391, Mar. 10, 1913 (this J., 1913, 958).

A dilute solution of an alkali aluminate is mixed with a solution of an alkali silicate, suitable soluble salts are added, and the precipitate formed on heating is collected, washed, and dried. For instance, 845 c.c. of a solution of sodium aluminate, containing 45·6 grms. Al_2O_3, and 315 grms. of a solution of sodium silicate, containing 75 grms. SiO_2, are added to a solution of 2·75 kilos. of sodium sulphate in 54·5 litres of water. Or, 25 kilos. of crystallised aluminium sulphate are dissolved in 135 litres of water, 31 kilos. of a 40·7 per cent. solution of sodium hydroxide are added, the mixture is added to 4500 litres of a 5 per cent. solution of sodium sulphate, and 26·25 kilos. of solution of sodium silicate, containing 25 per cent. SiO_2, are introduced.—W. P. S.

Water; Process for sterilising —— *by means of vessels lined with radio-active cement.* H. Farjas. Fr. Pat. 463,352, Dec. 13, 1912.

The water is stored in closed receptacles lined with cement containing radio-active minerals or concentrates.
—W. P. S.

Sewage, waste water, etc.; Purifying apparatus for ——. A. Girard. First Addition, dated Sept. 17, 1913, to Fr. Pat. 416,814, June 6, 1910. Under Int. Conv., Sept. 25, 1912.

A series of shallow basins or trays is arranged in steps, with weirs in between, each basin containing a layer of material such as coke. The liquid to be treated is allowed to flow over a weir into the first basin and thence through the series.—W. P. S.

Water; Process for purifying ——. W. Drechsler, Dresden, Germany. U.S. Pat. 1,088,063, Feb. 24, 1914.

See Eng. Pat. 1416 of 1913; this J., 1913, 922.—T. F. B.

Water; Process for purifying ——. Leavitt-Jackson Engineering Co. Fr. Pat. 463,317, Oct. 6, 1913. Under Int. Conv., Oct. 8, 1912.

See U.S. Pat. 1,088,232 of 1914; preceding.—T. F. B.

Steriliser. P. G. Triquet, Paris. U.S. Pat. 1,089,990, March 10, 1914.

See Addition of May 26, 1912, to Fr. Pat. 434,069 of 1910; this J., 1912, 948.—T. F. B.

Liquids; System for treating —— with ozone. M. Fuss, Frankfort, Germany, Assignor to General Electric Co., New York. U.S. Pat. 1,090,044, March 10, 1914.

See Fr. Pat. 401,599 of 1909; this J., 1909, 1162.—T. F. B.

Human and animal bodies and their organs; Process of the hardening or mummification of ——. G. and P. Fratarcangeli, Frosinone, Italy. U.S. Pat. 1,088,977, March 3, 1914.

See Eng. Pat. 6095 of 1912; this J., 1913, 449.—T. F. B.

Process for obtaining gas from sewage sludge. Ger. Pat. 270,338. *See* IIa.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine; Occurrence of —— in the seeds of Cinchona Ledgeriana, Moens. P. van Leersum. Pharm. Weekblad, 1913, **50**, 1464—1467. Chem. Zentr., 1914, **1**, 994.

According to Moens ("*Chinakultur in Asien*") the seeds of *C. Ledgeriana* contain 6·13 per cent., those of *C. officinalis* 13·3, and those of *C. succirubra* 9·5 per cent. of fat, but no alkaloid. The author has detected quinine in *C. Ledgeriana* seeds. The powdered seeds were extracted with petroleum ether, dried, ground, and treated with slaked lime. The resulting powder was treated with caustic soda solution, extracted with benzene, and the alkaloids (yield 0·38 per cent. on the dried seeds) recovered from the benzene solution by means of hydrochloric acid. Quinine was identified by means of its tartrate. The seeds yielded also 18·6 per cent. of a greenish yellow oil of sp. gr. 0·930 at 18° C., $\alpha_D^{20} = -26°$ in a 200 mm. tube. —A. S.

Quinine salts; Some coefficients of precipitability of —— in saline solutions of various concentrations. N. Tarugi. Gaz. chim. ital., 1914, **44**, I., 131—151.

Solutions of different salts (chlorides of sodium, potassium and calcium and sodium nitrate) of various concentrations were added gradually to a definite volume of a solution of quinine hydrochloride ($C_{20}H_{24}N_2O_2.HCl.2H_2O$) of known concentration until a turbidity was produced, and determinations were also made by performing the operation in the reverse direction. From the results, the proportions of the salt and of the quinine hydrochloride (both expressed in grms. per 100 c.c.) in the solution when a turbidity was just produced were calculated and also the relative solubility product (concentration of salt × concentration of quinine hydrochloride). The detailed results are given in tables. In the case of calcium chloride, the relative solubility product mentioned was approximately constant, the mean value being 6·43, but in the other cases it varied with the concentration of the salt, as shown in the following table:—

Sodium chloride.		Sodium nitrate.		Potassium chloride.	
Conc. of NaCl.	Relative sol. prod.	Conc. of $NaNO_3$.	Relative sol. prod.	Conc. of KCl.	Relative sol. prod.
grms. per 100 c.c.		grms. per 100 c.c.		grms. per 100 c.c.	
2·02	5·2	0·677	1·9	2·63	6·69
2·18	4·9	0·778	1·9	2·85	6·2
2·49	4·85	0·869	1·8	3	5·64
2·66	4·85	0·970	1·8	4·16	4·86
3·40	4·1	1·14	1·59	5·57	4·17
4·08	3·55	1·23	1·34	8·26	4·38
8·34	2·82	2·008	1·34	10·12	4·24
9·12	2·88	3·455	1·53	12·71	3·71
11·40	2·33	3·65	1·54	17·87	3·66
13·39	2·22	9·21	2·67	19	3·15
15·56	2·17	11·05	2·97	23·16	2·61
17·64	1·94	13·13	2·73	25·74	2·56
19·83	1·48	19·12	2·23	—	—
—	—	25·18	2·45	—	—
—	—	31·78	2·09	—	—

The data given may be utilised for the rapid determination of the concentration of a solution of quinine hydrochloride, a known volume of the latter being titrated with one of the saline solutions (of known concentration) until a turbidity is produced, and the concentration (C) of the salt in the total solution then calculated. Then if calcium chloride has been used, $\frac{6\cdot43}{C}$ gives the concentration of the quinine hydrochloride in the total solution, whilst in the case of the other salts, this concentration is obtained by dividing C into the corresponding relative solubility product as ascertained from the table. The varying solubility of the hydrochlorides of the cinchona alkaloids in saline solutions may also be used for the detection of down to 3 per cent. of the hydrochlorides of cinchonine or cinchonidine in quinine hydrochloride. 25 c.c. of the solution of the hydrochloride are saturated in the cold with sodium nitrate, filtered after 3 hours, and 5 c.c. treated with 1·5 c.c. of ammonia solution of sp. gr. 0·88: a turbidity is produced if cinchonine or cinchonidine be present.—A. S.

Belladonna plant; Alkaloids in ——. A. F. Sievers. Amer. J. Pharm., 1914, **86**, 97—112. (See also this J., 1914, 40.)

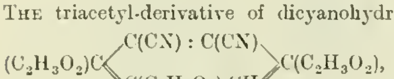
Belladonna plants were dried at 60° C. and the alkaloid determined in the various portions, with the following average results:—Four third-year plants: flowers 0·385; flowering tops, 0·865; leaves, 0·475; stems, 0·292; roots, 0·448; entire plant, 0·444 per cent.; six first-year plants: leaves, 0·686; young sprouts, 0·9315; fruit, 0·3192; stems, 0·1145; roots, 0·1605; entire plant, 0·343 per cent. In the early summer, the herb, including the leaves, tops and small stems could be advantageously picked if the herb instead of the leaves were officinal. Small leaves of both belladonna and *Datura* contained more alkaloid than large leaves, and young and small stems and roots were richer than large and old stems and roots. The woody part of the roots was richer than the bark.—F. Shdn.

Yohimbine and quebrachine; Identity of ——. E. Fourneau and H. J. Page. Bull. Sci. Pharmacol., 1914, **21**, 7—16. Chem. Zentr., 1914, **1**, 986—987.

A comprehensive investigation of yohimbine (from *Corynanthe Yohimba, N.O. Rubiaceæ*) and quebrachine (from *Quebracho blanco, N.O. Apocynaceæ*) and of their salts has shown that the two alkaloids are identical. The free base when freshly precipitated dissolves easily in absolute alcohol, but almost immediately separates from the solution in the anhydrous form, which is soluble in 25 parts of cold and 10 parts of boiling absolute alcohol. It crystallises in prismatic needles of the composition, $C_{21}H_{26}N_2O_3$, m.pt. 247°—248° C. (Maquenne block), $[\alpha]_D^{20} = +56°$ to 56·1° in alcoholic solution. A solution of the alkaloid in concentrated sulphuric acid gives a violet colouration with potassium bichromate. The alcoholic solution is coloured yellow by ferric chloride and by nitric acid, and gives a white precipitate with bromine water. The hydrochloride, $C_{21}H_{26}N_2O_3,HCl$, melts at 302°—303° C., the sulphate, $(C_{21}H_{26}N_2O_3)_2H_2SO_4,8H_2O$, after dehydration, at 281°—282° C., and the tartrate, $(C_{21}H_{26}N_2O_3)_2C_4H_7O_6$, $6H_2O$, at 213° C. (278° C. when anhydrous.)—A. S.

Trimethoxyphthalic acids ; Constitution of some ——. *II.* G. Bargellini. Gaz. chim. ital., 1914, **44**, I., 182—192.

The triacetyl-derivative of dicyanohydroxyquinol,



$$(C_2H_3O_2)C\left\langle\begin{array}{l} C(CN):C(CN) \\ C(C_2H_3O_2)\cdot CH \end{array}\right\rangle C(C_2H_3O_2)$$

, prepared as described by Thiele and Günther (Annalen, 1906, **349**, 45), was converted by the action of dimethyl sulphate and potassium hydroxide into the trimethyl ether of dicyanohydroxyquinol, and from the latter 3.4.6-trimethoxyphthalic acid was obtained by boiling with a concentrated solution of potassium hydroxide. After purification the acid melted at 212°—213° C. when heated slowly, but this was really the melting point of the anhydride ; when heated rapidly the acid melted at about 185° C., losing water and then solidifying again. This acid appears to be identical with the trimethoxyphthalic acid of m.pt. 202° C. prepared by Feist (this J., 1907, 1159) by oxidation of the methyl ether of columbamine ; the low melting point observed by Feist was probably due to the presence of impurities. These results and those obtained previously (this J., 1912, 1146) show that in the alkaloids of Columba root (columbamine and jateorhizine) the three methoxy (or hydroxy) groups are disposed asymmetrically, whilst in colchicine they are in adjacent positions.—A. S.

Limonene ; Conversion of —— *into carvomenthene and menthane.* G. Vavon. Bull. Soc. Chim., 1914, **15**, 282—287.

The catalytic hydrogenation of limonene in presence of platinum black was carried out at ordinary temperatures by agitation in an atmosphere of hydrogen. The absorption proceeded in two distinct stages, two atoms being first added on to the side chain with the production of active carvomenthene, and this being later converted into inactive menthane. The rotatory power of carvomenthene is given as $[\alpha]_{578}=+118°$, $[\alpha]_{436}=+234$; and of its nitrosochloride (m.pt. 95° C.) $[\alpha]_{578}=+344°$, $[\alpha]_{436}=+724°$. The hydrochloride, $C_{10}H_{19}Cl_{578}$, is inactive and hence symmetrical.—G. F. M.

Oxalacetic ester. H. Gault. Comptes rend., 1914, **158**, 711—714.

Oxalacetic ester on keeping changes slowly to oxalocitric lactone, by the elimination of one mol. of alcohol from two of the ester. The rapidity of the change depends upon the initial degree of purity of the specimen. At 150° C. from 70 to 80 per cent. of the ester was lactonised in 4 hours. Dilute potassium carbonate solution hastens the reaction, but strong solutions yield a separation of the potassium derivative, which, unlike the corresponding derivative of the lactone, is practically insoluble in the carbonate solution. The potassium derivative is very stable under ordinary conditions, so that it is advisable to purify and preserve the ester in this form. Upon acidifying in the cold it yields the perfectly pure ester. This distils unchanged under reduced pressure, whereas the lactone cannot be distilled. The lactone is readily converted into propanetetracarboxylic ester and tricarballylic acid.—J. R.

Patents

Monosalicylide ; Process for the production of ——. E. Kopetschni, Berlin, L. Karczag, Szolnok, Hungary, and O. Fodor, Berlin. Eng. Pat. 7875, April 3, 1913. Under Int. Conv., April 3, 1912.

See U.S. Pat. 1,075,581 of 1913 ; this J., 1913, 1085. The same product is obtained by heating salicylic chloride *in vacuo*.—T. F. B.

Unsaturated hydrocarbons ; Manufacture of ——. W. H. Perkin, Manchester, F. E. Matthews, E. H. Strange, and H. J. W. Bliss, London. Eng. Pat. 29,988, Feb. 15, 1913.

Amino-alcohols may be converted into doubly unsaturated hydrocarbons by heating with catalysts, such as phosphoric acid ; diluting vapours or gases may be used and the pressure in the reaction vessel may be reduced (compare Eng. Pats. 3873 and 12,771 of 1912 ; this J., 1913, 449, 711).—T. F. B.

Isoprene ; Process of making ——. C. Ruder, Wandsbek, Germany. U.S. Pat 1,087,261, Feb. 17, 1914.

The vapour of terpineol or "a terpineol substance" is subjected to a temperature sufficiently high to decompose the cyclic compound and to produce isoprene, at a pressure not exceeding that of the atmosphere. The vapour may be passed over a heated metal spiral.—T. F. B.

Isoprene and its homologues ; Process for preparing ——. A. Gerlach and R. Koetschau. Ger. Pat. 268,722, Sept. 10, 1912.

The mono- or di-hydrochloride of a singly or doubly unsaturated terpene is treated with a heated substance which has the power to remove hydrogen chloride, at a temperature above 500° C., a relatively small amount of the hydrochloride being brought in contact with a large surface of the soda-lime or other agent used for the purpose. The process may be carried out under reduced pressure, or in presence of a diluent gas, such as carbon dioxide. The crystalline hydrochloride may be melted and dissolved in a small quantity of terpene or an indifferent solvent, and the solution allowed to fall in drops on the soda-lime in an iron vessel or an iron or porcelain tube. The hydrochlorides of pinene, dipentene, sylvestrene, and limonene are converted into isoprene, whilst those of the terpenes, C_6H_{10} and C_8H_{12} are transformed into erythrene and dimethylerythrene.—T. F. B.

Pinene ozonide. Cinnamic aldehyde ozonide. W. J. Knox, New York, Assignor to Knox Terpezone Co. of America. U.S. Pats. 1,086,372 and 1,086,373, Feb. 10, 1914.

The ozonides of pinene and cinnamic aldehyde, the preparation of which is described in Eng. Pat. 27,371 of 1912 (see this J., 1913, 924) are claimed as being white, opaque substances. Pinene ozonide is also claimed to be an inhalable germicidal compound.—T. F. B.

Alcohols from chlorhydrocarbons ; Preparation of ——. W. E. Masland, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,086,381, Feb. 10, 1914.

A monohalogen derivative of a saturated aliphatic hydrocarbon is converted into the corresponding alcohol by heating with zinc oxide. The process may be applied to other halogen compounds in which the halogen is attached to an alkyl group.—T. F. B.

Casein calcium and process for producing the same. P. Sprenger and A. Tschudi, Basle, Switzerland, Assignors to Hoffmann-La Roche Chemical Works, New York. U.S. Pat. 1,087,515, Feb. 17, 1914.

A solution of casein calcium of about 10 per cent. strength is converted into a dry, white, stable powder, easily soluble in water and in milk, by drying it in the form of drops and preventing the drops from touching the surface of the drying vessel until the water has evaporated. For example, the drops may be exposed to a column of warm air produced by a number of fine jets of high velocity, so as to suspend the drops until they are dry.—T. F. B.

Bismethylaminotetra-aminoarsenobenzene ; Preparation of derivatives of —— *easily soluble in water to neutral solutions.* C. F. Boehringer und Söhne. Ger. Pat. 269,660, Jan. 24, 1913.

bis-Methylaminotetra-aminoarsenobenzene (see U.S. Pat. 1,081,079 ; this J., 1914, 41) is dissolved in water in presence of an alkali bicarbonate or ammonium bicarbonate, and the product is separated from the solution by addition of an organic solvent. The resulting salts, which are probably carbamates, are suitable for therapeutic purposes, *e.g.*, for intramuscular injection.—T. F. B.

Arsenic-phosphorus, arsenic-arsenic, arsenic-antimony, arsenic-selenium, and arsenic-tellurium compounds ; Process for preparing mixed organic ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 269,699 and 269,700, Oct. 8 and 19, 1912.

(1) The hydrogen compounds of phosphorus, arsenic, antimony, selenium, and tellurium react with aromatic arseno-dichlorides, forming the compounds mentioned in the title. (2) The corresponding arsenoxides may be used in place of the dichlorides. In this case, however, the arsenic-tellurium compounds cannot be obtained in a pure state, owing to the hydrogen telluride being oxidised by the arsenoxide.—T. F. B.

Arsenic-bismuth compounds ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,745, Sept. 27, 1912. Addition to Ger. Pat. 269,743 (see Eng. Pat. 17,533 of 1913 ; this J., 1913, 1030).

An aromatic arsine is made to react with a bismuth compound containing the grouping, -Bi(halogen)$_2$. —T. F. B.

3.3′-Dinitro-4.4′-dihydroxyarsenobenzene ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 269,886 and 269,887, Oct. 11, 1912, and Jan. 9, 1913. Additions to Ger. Pat. 206,456.

(1) 3-Nitro-4-hydroxybenzene-1-arsinic acid, or the corresponding arsenoxide, is reduced by means of stannous chloride, preferably in presence of hydriodic acid, whereupon 3.3′-dinitro-4.4′-dihydroxyarsenobenzene is produced, the nitro groups not being reduced by this process. (2) Hypophosphorous acid is used as a reducing agent in place of stannous chloride.—T. F. B.

Cantharidyl-ethylenediamine ; Process for preparing salt-like double compounds of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,661, Aug. 2, 1912.

The condensation product of cantharidine and ethylenediamine of the empirical formula, $C_{12}H_{18}O_3N_2$, is treated with a gold salt. The products are extremely active bactericides, and may be used in the treatment of tuberculosis by injection into human beings or animals.—T. F. B.

Hexamethylenetetramine-methyl thiocyanate ; Process for preparing ——. K. H. Schmitz. Ger. Pat. 269,746, April 8, 1913. Addition to Ger. Pat. 266,788.

Instead of using isolated hexamethylenetetramine itself, as described in the principal patent (this J., 1913, 1032), a mixture of concentrated solutions of ammonia and of formaldehyde, or of concentrated ammonia solution and a polymeride of formaldehyde, is used.—T. F. B.

Carbamic esters ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 269,938, April 13, 1913.

Glycol ethers of the formula, $HO.CH_2.CH_2.OR$ (where R represents a simple or substituted aryl group) are converted by the usual methods into the corresponding urethanes $X_2N.CO.O.CH_2.CH_2.OR$, which possess powerful antipyretic and analgesic properties.—T. F. B.

Alcohols from chlorhydrocarbons ; Preparation of ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 29,964, Dec. 30, 1912.

See U.S. Pat. 1,086,381 of 1914 ; preceding.—T. F. B.

Aldehydes and ketones from monohalogen derivatives ; Manufacture of ——. Fabriques de Prod. de Chimie Organique de Laire, Issy, France. Eng. Pat. 5533, March 5, 1913. Under Int. Conv., March 7, 1912.

See Fr. Pat. 452,537 of 1912 ; this J., 1913, 673.—T. F. B.

Esters of [hydr]oxy fatty acids ; Process for the manufacture of ——. Chem. Werke vorm. Dr. H. Byk, Lehnitz-Nordbahn, Germany. Eng. Pat. 11,741, May 20, 1913. Under Int. Conv., June 3, 1912.

See Fr. Pat. 458,645 of 1913 ; this J., 1913, 1086.—T. F. B.

Cantharidine compounds suitable as a remedy for tuberculosis ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 17,693, Aug. 1, 1913. Under Int. Conv., Aug. 1, 1912.

See Ger. Pat. 269,661 of 1912 ; preceding.—T. F. B.

Benzyl acetate ; Manufacture of ——. F. W. Klever, Cologne, Germany. Eng. Pat. 20,501, Sept. 10, 1913. Under Int. Conv., Sept. 11, 1912.

See Fr. Pat. 462,439 of 1913 ; this J., 1914, 277.—T. F. B.

Organic compounds ; Separation of —— *at low temperatures.* W. E. Masland, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,087,961, Feb. 24, 1914.

See Fr. Pat. 453,165 of 1913 ; this J., 1913, 767.—T. F. B.

Ozonides ; Apparatus for the production of gaseous ——. W. J. Knox, New York, Assignor to Knox Terpezone Co. of America. U.S. Pat. 1,088,346, Feb. 24, 1914.

See Eng. Pat. 27,371 of 1912 ; this J., 1913, 924.—T. F. B.

Alkylalkoxymethyl esters of cresotinic acids. J. Callsen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,088,966, March 3, 1914.

See Eng. Pat. 16,387 of 1913 ; this J., 1913, 1030.—T. F. B.

p-Nitrosophenylglycine ; Process for making ——. J. D. Riedel A.-G. Fr. Pat. 463,333, Oct. 7, 1913. Under Int. Conv., Oct. 8, 1912.

See Eng. Pat. 22,694 of 1913 ; this J., 1914, 70.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Dyestuffs employed in photography ; Process for sensitising ——. J. H. Smith, Bois-Colombes, France. U.S. Pat. 1,089,594, March 10, 1914.

See Fr. Pat. 413,222 of 1910 ; this J., 1910, 1135.—T. F. B.

Colour photography ; Process for producing polychromatic screens, plates, films, and paper for ——. J. Szczepanik, Luisenhof, Germany. U.S. Pat. 1,089,602, March 10, 1914.

See Eng. Pat. 17,065 of 1908 ; this J., 1908, 1178.—T. F. B.

Kinematograph films ; Plastic material used in the manufacture of ——. H. Danzer, Assignor to Comp. Générale de Phonographes, Cinématographes, et Appareils de Précision, Paris. U.S. Pat. 1,089,910, March 10, 1914.

See Fr. Pat. 443,031 of 1911 ; this J., 1912, 1008.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Nitrocellulose; Solubility of —— in ether-alcohol. A. Matteoschat. Z. ges. Schiess- und Sprengstoffw., 1914, **9,** 105—106.

Five grms. of nitrocellulose, containing N 12·95 per cent., which had been dried at 60° C., was shaken with alcohol, and ether (sp. gr. 0·720) then added. 505 c.c. of the mixed solvents were added, there being a contraction of 5 c.c. on mixing. The mixture was shaken for 1 hour, allowed to stand overnight, then agitated frequently during the course of the day and allowed to stand for 40 hours. 100 c.c. of the clear liquid were then drawn off, evaporated, the residue dried for 24 hours at 70° C., and weighed. Four different samples of alcohol were employed containing respectively 99·5, 95·0, 90·0 and 80·0 per cent. of alcohol. With equal quantities of ether and alcohol, solubilities of 52·3, 42·3, 28·7, and 14·2 per cent. were obtained, with the varying concentrations of alcohol respectively mentioned above. When the ratio of ether to alcohol was 2 to 1 and 3 : 1, solubilities of 40·5, 52·4, 53·9 and 45·0 per cent., and 25·0, 42·4, 53·0 and 57·5 per cent. respectively were obtained.—G. W. McD.

Nitro-compounds of benzene and toluene. W. Will. Ber., 1914, **47,** 704—717.

As a factor in the prevention of accidents in manufacture, the chemical properties of the trinitrotoluenes were studied. Attempts to prepare isomerides other than the three known, by increase of pressure, temperature, or time of nitration, gave rise to trinitrobenzoic acid, the salts of which would be a source of danger in manufacture, or to tetranitromethane. The constitution of γ-trinitrotoluene was confirmed; the β-modification was proved to be the 2.3.4-trinitrotoluene. As explosives, the three isomerides differed but little; γ-trinitrotoluene was somewhat more sensitive to impact than α-trinitrotoluene, and less so than β-trinitrotoluene. The α-isomeride was less readily attacked by alkalis than the other two, which formed sensitive salts of dinitrocresol. With alkali and an oxidising agent, α-trinitrotoluene formed hexanitrodibenzyl. With acetone and ammonia, α-, β-, and γ-trinitrotoluene gave respectively a red, a yellowish-green, and a blue colouration. The existence of tetranitrobenzene, and of the dinitrodinitrosobenzene melting at 133° C. (Nietzki, Ber., 1901, **34,** 55) was not confirmed. —O. E. M.

Explosion at the works of the Aktien-Gesellschaft für Anilinfabrikation, Rummelsberg, Germany. Chem. Ind., 1914, **37,** 149—150.

Without starting the stirrer or the cooling water, a workman in the nitrobenzene factory ran the nitrating acids into the benzene, the charge forming two layers. When the stirring-gear was thrown in, heat was suddenly evolved, the cover of the apparatus was blown off, and the escaping nitrobenzene and benzene vapour formed with the air a mixture which exploded spontaneously, or was fired by sparks from fragments of the iron vessel or by hemp packing or straw set on fire by projected acid. The use of interlocking cocks was adopted after a somewhat similar accident at another works.—O. E. M.

Nitro-compounds; Explosion of ——. P. W. Uhlmann. Chem.-Zeit., 1914, **38,** 389—390.

Dinitrophenol forms explosive salts with alkalis, ammonia, etc., and should not be heated with them in closed vessels; highly nitrated substances should not be heated in autoclaves at all. At moderate temperatures nitro-compounds do not explode in contact with sulphuric acid: even dinitrodiazobenzene can be heated to 50° C. in very concentrated acid. Dinitronaphthalene and dinitroanthraquinone have fired, without exploding, during manufacture. The possible causes of the Rummelsberg explosion are discussed; interlocking, to prevent the opening of the acid cock before the cooling water and stirring gear are started, is recommended. (See preceding abstract.)—O. E. M.

Heat Test Committee. *See under* Official Notice, page 337.

Patents.

Explosive; Manufacture of an ——. C. Claessen. Fr. Pat. 463,714, Oct. 17, 1913.

Hexanitroethane is used as an explosive, alone or in combination with other substances, *e.g.*, propellant powder: nitrocellulose (68 parts), hexanitroethane (16), trinitrotoluene (9), and diethyldiphenylurea (7 parts); blasting explosive: trinitrotoluene (36 parts) and hexanitroethane (64 parts).—G. W. McD.

Explosive cartridges containing liquid oxygen. Soc. L'Air Liquide (Soc. anon. pour l'Etude et l'Exploit. des Proc. G. Claude). Fr. Pat., 463,876, Dec. 28, 1912.

Lampblack of apparent density 0·2—0·25, obtained, for example, by the incomplete combustion of naphthalene, is used as an absorbent for about four times its weight of liquid air. Naphthalene may also be added. A special long detonator which brings the priming charge near the middle of the cartridge has to be used in order to prevent missfires. (See also this J., 1913, 627, 768, 769, 843, 1131).—G. W. McD.

Guncotton and smokeless powder. L. Guiguet. Fr. Pat. 464,028, Jan. 3, 1913.

To produce cellulose free from foreign matter cotton waste is dissolved, the solution filtered, and formed into threads of a thickness of from 1 to 3 deniers, which are then nitrated.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Fluorine in reagents. P. Carles. Ann. Chim. Analyt. 1914, **19,** 101—104.

Sulphuric and hydrochloric acids are generally quite free from fluorine but the authors were unable to find any nitric acid which did not contain it. Nitric acid free from the impurity can be obtained by distilling, and rejecting the first two-fifths which come over. Potassium nitrate and probably also sodium nitrate contain fluorine from which they cannot be freed by repeated recrystallisation. To obtain these salts pure it is necessary to precipitate the fluorine as barium fluoride by boiling a solution of the alkali nitrate with a little barium nitrate and then adding sufficient barium hydroxide solution to make the liquid just alkaline, the excess of barium being subsequently removed by precipitation with carbon dioxide. The nitrate obtained by double recrystallisation is then free from fluorine. Commercial caustic baryta contains large quantities of fluorides but these are entirely insoluble in water and a perfectly clear solution of barium hydroxide is free from fluorine. Barium acetate is not free from fluorine unless its solutions are neutral and perfectly clear. Barium chloride is usually free from the impurity but sodium and potassium bicarbonates and ammonium carbonate always contain fluorine. Glacial acetic acid, separated by pouring off the mother liquor from the crystals, does not contain fluorine.—J. A.

Arsenic, copper, and iron; Iodometry of ——. G. D. Lander and J. J. Geake. Analyst, 1914, **39,** 116—121.

The method described by Avery and Beans (this J., 1901, 936) for the iodometric determination of arsenious acid in the presence of copper yields correct results, and may also be applied to mixtures of arsenite with ferric, but not with ferrous, chromium, nickel, cobalt, bismuth, and zinc salts, and to the determination of arsenic acid, for instance, in copper arsenate, after the arsenic acid has been reduced with sulphur dioxide in the presence of sulphuric acid. Antimony may be titrated in a similar manner in the presence of cupric, ferric, and bismuth salts. The following process may be used for the determination of cuprous and cupric salts in mixtures of the same, for example, in commercial cuprous chloride. A quantity of 0·1 grm. of the salt is dissolved in dilute hydrochloric acid, boiled water is added, the solution cooled, an excess of potassium iodide introduced, and the liberated iodine titrated with thiosulphate: this gives the amount of cupric salt present. Sodium potassium tartrate, a slight excess of solid sodium bicarbonate, and an excess of standard iodine solution are then added to the solution, and the excess of iodine titrated with thiosulphate. The quantity of iodine used is equivalent to the total cuprous salt now present, and the amounts of cuprous and cupric salt contained originally in the sample may be calculated. Attempts to determine ferrous salts by oxidation with iodine in the presence of alkali tartrate and sodium bicarbonate did not yield quite satisfactory results and attention is drawn to the fact that iodine reacts to a certain extent with sodium bicarbonate in solution.—W. P. S.

Titanium; Determination of —— as phosphate. G. S. Jamieson and R. Wrenshall. J. Ind. Eng. Chem., 1914, **6**, 203—205.

For the determination of titanium in ferrotitanium or in ores, the authors recommend the method of Ericson (Iron Age, Aug. 27, 1903) in which iron is reduced to the ferrous state by means of ammonium bisulphite or sulphur dioxide and then the titanium precipitated as phosphate in acid solution by adding ammonium phosphate and boiling. In the case of ores containing only small quantities of titanium, after dissolving by treatment with hydrochloric and sulphuric acids and evaporating with sulphuric acid, the solution should be neutralised with ammonia, and then again made acid with hydrochloric acid before proceeding with the determination. For quantities of titanium up to 3 mgrms., precipitation is effected in 50 c.c. of solution containing 3 c.c. of hydrochloric acid (1 : 1); for larger quantities, in 100 c.c. of solution containing 15 c.c. of acid. The iron may also be reduced by hydrogen sulphide in presence of tartaric acid, the ferrous sulphide being dissolved in hydrochloric acid and the determination continued as usual. When tartaric acid is added, titanium can be determined in presence of aluminium by this method.
—A. S.

Kjeldahl method [for estimating nitrogen]; Some limitations of the ——. H. D. Dakin and H. W. Dudley. J. Biol. Chem., 1914, **17**, 275—280.

It is usually stated that Kjeldahl's method is not directly applicable to substances containing nitrogen linked directly to oxygen or to nitrogen: the authors find that the method is also unsuitable for pyridine and derived substances, and that with piperidine, quinoline, isoquinoline, acridine and their derivatives, accurate results can only be secured after very prolonged heating (about 4 hours). The use of potassium bichromate in the method appears to obviate the difficulty in the case of pyridine. Other cyclic nitrogen compounds presented no difficulty, but it is recommended that in all cases of this kind control analyses should be made with pure substances.—J. R.

Separation of hydrocarbons by means of liquid sulphur dioxide. Edeleanu. *See* IIA.

Detection of adulterants in saffron by means of phosphomolybdic acid. Verda. *See* IV.

Valuation of fluorspar. Bidtel. *See* VII.

Colourimetric determination of small quantities of hydrogen sulphide. Mecklenburg and Rosenkränzer. *See* VII.

Use of telluric acid in the determination of bromine associated with chlorine in haloid salts. Gooch and Cole. *See* VII.

Determination of blast-furnace slag in Portland cement. Hart. *See* IX.

Determination of lime and magnesia in ores and slags. Blum. *See* X.

Action of diazo-derivatives upon vegetable oils. Sisley and Frehse. *See* XII

Detection of nickel in fats. Kerr. *See* XII

Determination of rosin in varnishes, oils and soaps. Wolff and Scholze. *See* XIII.

Sodium chloride as a reagent for the detection of soluble silicates in soaps. Isnard. *See* XII.

Washing powders containing perborate and their analysis. Jungkunz. *See* XII.

Tanning with and detection of sulphite-cellulose extract. Moeller. *See* XV.

[*Detection of*] *free sulphuric acid in leather.* Paessler *See* XV.

Constants for use in the double polarisation (Clerget-Herzfeld) method of determining sucrose. Gillet. *See* XVII.

Determination of water [by distillation] in massecuites and molasses. Clacher. *See* XVII.

Analysis of maple products. III. Range of variation of analytical values in genuine maple syrups. Snell and Scott. *See* XVII.

Determination of the amino-acid- and polypeptide-nitrogen in barley, malt, and beer by formatin-titration Adler. *See* XVIII.

New method for the determination of the salts of water. Windisch and others. *See* XVIII.

Detection of caramel [in wine, vinegar, brandy, etc.]. Schenk. *See* XVIII.

Determination of the salt-soluble proteins in wheat flour. Olson. *See* XIXA.

Determination of crude fibre by König's method. Grossfeld. *See* XIXA.

Rapid gravimetric determination of butter-fat. König. *See* XIXA.

New method for determining the value of disinfectants. Duyser and Lewis. *See* XIXB.

The vapours of formaldehyde and its polymerides. Auerbach and Plüddemann. *See* XIXB.

Some coefficients of precipitability of quinine salts in saline solutions. Taragi. *See* XX.

PATENTS.

Thermocouples for pyrometry. R. W. Paul. London. Eng. Pat. 12,708, May 31, 1913.

One member of the thermo-couple consists of a tube and cap, so as totally to enclose the other member.—B. N.

Detectors of combustible gases. A. Philip and L. J. Steele, Portsmouth. Eng. Pat. 5467, March 4, 1913.

A catalytically-active wire and an inactive wire are joined alternately in a Wheatstone bridge with resistance elements, and the relative changes in resistance are observed by the readings of a galvanometer in a battery circuit. The galvanometer is joined to the resistance elements, through sliding contacts, adjustable, *e.g.*, by means of a screw, as a means of securing an initial zero reading. The active and inactive wires are surrounded by tubes, the one round the inactive wire being provided with adjustable openings for equalising the heat losses by radiation from the wires, so as to secure a practically constant reading. A window is provided in the case surrounding the active wire for observing the glowing of the wire in a combustible atmosphere.—B. N.

Gaseous mixture ; Apparatus for determining a definite constituent of a —— by the absorption method. Drägerwerk H. und B. Dräger. Ger. Pat. 270,088, Feb. 21, 1913.

A vessel containing the sample of gas is combined with a manometer for measuring the reduction of pressure due to absorption of one of the constituents. The absorbent is contained in a receptacle inside the gas vessel, normally fastened gas-tight to the cover of the latter, but forced away therefrom by a rod, or by a screw which also serves to close the opening provided for equalising the pressure before making a determination.—A. S.

Inflammable-gas indicator. A. Guasco, Paris. U.S. Pat. 1,089,050, March 3, 1914.

See Fr. Pat. 437,585 of 1911 ; this J., 1912, 560.—T. F. B.

Chemical analysis ; Means for use in ——. J. G. Hume, Duns, Scotland. U.S. Pat. 1,087,239, Feb. 17, 1914.

See Eng. Pat. 21,076 of 1910 ; this J., 1911, 1233.—T. F. B.

Apparatus for testing [grading] coal or ores. Eng. Pat. 4992. *See* IIA.

Apparatus for applying tensile and compressive tests to cement, concrete, and the like. Eng. Pat. 6645. *See* IX.

Books Received.

Die Medikamentösen Seifen. Ihre Herstellung und Bedeutung unter Berücksichtigung der zwischen Medikament und Seifengrundlage möglichen chemischen Wechselbeziehungen. Ein Handbuch für Chemiker, Seifenfabrikanten, Apotheker und Aertzte. Von Dr. Walter Schrauth. Julius Springer's Verlag. Berlin, W 9, Linkstr. 23—24. 1914. Price M. 6. Bound M. 6.60.

This volume (9½ by 6½ ins.) contains 159 pages of subject matter, with alphabetical indexes of names, subjects, and one of technical proprietary terms, with names and addresses of proprietors, etc. This is preceded by a list of German patents and patentees with claims, and trade names of medicated soaps defined. The subject-matter itself is classified as follows :—I. Soap as a washing, disinfecting, and curative agent. II. General technology of medicated soaps. III. Special composition of medicated soaps. IV. Methods for the examination and testing of medicated soaps. V. Legal regulations relating to the dealing in and dispensing of medicated soaps.

A Text-Book of Organic Chemistry. By A. F. Holleman, Ph.D., etc., Professor Ord. in Amsterdam University. Edited by A. Jamieson Walker, Ph.D., assisted by O. E. Mott, Ph.D. Fourth Edition. John Wiley and Sons, Inc. New York. 1914. Price 10s. 6d. Chapman and Hall, Ltd., London.

This volume (9¼ by 6 ins.) containing 590 pages of subject-matter with 79 illustrations, and an alphabetical index of subjects. The text is classified as follows :—I. Introduction. Qualitative and quantitative analysis. Molecular weight determinations. Laboratory methods, etc. II. Aliphatic compounds. III. Cyclic compounds. (*a*) Alicyclic compounds, and (*b*), Aromatic compounds. IV. Alkaloids.

A Laboratory Manual of Organic Chemistry for Beginners. By A. F. Holleman, Ph.D. Professor Ord. University of Amsterdam. An Appendix to the Author's Text Book of Organic Chemistry. Edited by A. Jamieson Walker, Ph.D., B.A. John Wiley and Sons, Inc., New York. Chapman and Hall, Ltd., London. 1913. Price 4s. 6d.

Volume (7¾ by 5 ins.), contains 74 pages of subject matter, and an alphabetical index.

Summary Report of the Mines Branch of the Department of Mines for the Calendar Year ending December 31st, 1912. Canada Dept. of Mines, Ottawa. No. 224 (No. 26a, 1913). Price 15 cents.

Magnetite Occurrences along the Central Ontario Railway. By E. Lindeman. Canada Dept. of Mines, Ottawa. Mines Branch Rept. No. 184.

Austin Brook Iron-bearing District, New Brunswick. By E. Lindeman. Canada Dept. of Mines, Ottawa. Mines Branch Rept. No. 105.

Explosives ; Tests of Permissible ——. By Clarence Hall and Spencer P. Howell. Bulletin 66. U.S. Bureau of Mines, Washington.

The results are given of all explosives permissible in coal mining in the United States, tested between May 15, 1909 and March 1, 1913. A copy of the test requirements and the names of explosives on the permissible list are appended.

Symboles Internationaux. Commission Electrotechnique International. Secrétaire Général, 28, Victoria Street, Westminster, S.W. Price 2s.

Contains preface, remarks on the standardisation of symbols, rules for quantities, tables of symbols adopted, units and signs for names of units, mathematical symbols and rules, abbreviations for weights and measures, and name for electrical unit.

Poisons and Habit-Forming Drugs. By Martin I. Wilbert and Murray G. Motter. Reprint No. 146 from the Public Health Reports. U.S. Public Health Service, Washington.

A digest of laws and regulations relating to the manufacture, sale, use, and possession of poisons and habit-forming drugs enacted during 1912 and 1913, now in force in the United States.

Dust and Gas Explosions in Coal Mines ; Notes on the Prevention of ——. By George S. Rice. Technical Paper 56. U.S. Bureau of Mines, Washington.

Suggestions and recommendations with a view to decrease the number and extent of mine explosions.

Explosives in Coal Mining. Use and Misuse of——. Miners' Circular 7. By J. J. Rutledge, with a preface by Jos. A. Holmes, U.S. Bureau of Mines, Washington.

METALLURGICAL COKE. By A. W. BELDEN. U.S. Bureau of Mines, Washington. Technical Paper 50.

A SUMMARY of the history of coke making in the United States, indicating the development of modern methods and types of oven, and giving the composition and physical properties of metallurgical cokes produced in the United States.

BULLETIN OF THE DEPT. OF AGRICULTURE, TRINIDAD AND TOBAGO. Vol. XIII. No. 77, Trinidad. Price 3d.

CONTAINS "manurial experiments on cocoanuts." By JOS. DE VERTEUIL.

OIL-SEEDS, OILS, FATS AND WAXES. Selected Reports from the Scientific and Technical Department, Imperial Institute. [Colonial Reports No. 88, Miscellaneous.] V. (In continuation of No. 82 [Cd. 6022], January, 1912.) Wyman and Sons, Ltd., 49, Breams Buildings, Fetter Lane, London, E.C., and 28, Abingdon Street, S.W., and 54, St. Mary Street, Cardiff; or, H.M. Stationery Office (Scottish Branch), 23, Forth Street, Edinburgh; or, E. Ponsonby, Ltd., 116, Grafton Street, Dublin. [Cd. 7260]. Price, 8½d.

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INTERMETALLIC COMPOUNDS. By CECIL H. DESCH, D.Sc., Ph.D. Graham Young Lecturer in Metallurgical Chemistry in the University of Glasgow. Longmans, Green and Co., 39, Paternoster Row, London, New York, Bombay and Calcutta. 1914. Price 3s. net.

VOLUME, containing 108 pages of subject matter with 17 illustrations, 4½ pages of references, and an alphabetical index. The text is subdivided and classified as follows:—I. Thermal analysis. II. Microscopic structure. III. Isolation of intermetallic compounds. IV. Native intermetallic compounds. V. Physical properties. VI. Existence of intermetallic compounds in the liquid state. VII. Relations of intermetallic compounds to carbides, silicides, etc. VIII. Ternary compounds.

INDIA-RUBBER LABORATORY PRACTICE. By W. A. CASPARI, B.Sc., Ph.D., etc. Macmillan and Co., Ltd. St. Martin's Street, London. 1914. Price 5s. net.

VOLUME (7¾ by 5 ins.), containing 177 pages of subject matter, with 25 illustrations, appendix with statistics, tables, etc., filling 11 pages, and an alphabetical index of subjects. The text is classified as follows:—I. Crude and washed rubber. II. Machinery and apparatus. III. Rubber diluents. IV. Solid compounding materials. V. Miscellaneous accessories. VI. Specific gravities. VII. Analysis of manufactured rubber (organic). VIII. Analysis of manufactured rubber (inorganic). IX. Gutta-percha and Balata.

LABORATORY MANUAL OF GLASS BLOWING. By FRANCIS C. FRARY, Ph.D. McGraw-Hill Book Company, Inc., 239, West 39th Street, New York, and 6, Bouverie Street, London, E.C. 1914. Price 3s. 2d. net.

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VOLUME (9¾ by 6¾ ins.) containing 258 pages of subject matter with alphabetical indexes of names of authors and subjects. There are 22 illustrations. The carbides and silicides of the metals are fully treated, methods of preparation and properties being given. There is an appendix, in which thermal analysis is first explained, and then applied to the cases of the silicides and carbides. Polymorphic changes in these groups are described, with methods, and in reference to various silicides (iron, nickel, cobalt, manganese and copper), and also carbides.

KURZES HANDBUCH DER KOHLENHYDRATE. Von Dr. B. TOLLENS, O.H. Professor auder Universität Göttingen, &c., Dritte Auflage. Johann Ambrosius Barth's Verlag. Leipzig. 1914. Price M. 22. Bound M. 23.50.

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A THIRD YEAR COURSE OF ORGANIC CHEMISTRY. The Heterocyclic Compounds, Carbohydrates, and Terpenes. By T. P. HILDITCH, D.Sc. Methuen and Co., Ltd., 36, Essex Street, London, W.C. 1914. Price 6s.

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W. B. Hart.
T. Jackson.
S. E. Melling.
C. Rawson.
F. H. Terleski.
T. R. Wollaston.
M. Wyler.

Hon. Local Secretary :
L. E. Vlies, Belmont, Gowan Road, Alexandra Park, Manchester

The following take office after the Annual General Meeting: *Committee :* P. Gaunt, B. Hart, T. Jackson, H. Levinstein, W. Thomson, and S. Wolff.

Newcastle Section.

Chairman : T. W. Lovibond.
Vice-Chairman : E. F. Hooper..

Committee :

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S. H. Collins.
J. T. Dunn.
E. M. Fletcher.
W. Gemmell.
T. Hardie.
G. P. Lishman.
H. Louis.
N. H. Martin.
C. J. Potter.
A. Short.
J. Watts.

Hon. Local Secretary and Treasurer :
F. C. Garrett, Armstrong College, Newcastle-on-Tyne.

The following take office after the Annual General Meeting: *Chairman :* F. C. Garrett; *Vice-Chairman :* T. W. Lovibond; *Committee :* W. Diamond, C. H. Ridsdale, H. D. Smith. *Secretary :* E. F. Hooper.

New England Section.

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Vice-Chairman : (vacant.)

Committee :

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C. G. Bird.
D. J. Danker.
W. C. Durfee.
C. H. Fish.
C. L. Gagnebin.
R. Hütz.
H. P. Knapp.
W. D. Livermore.
L. A. Olney.
W. K. Robbins.
B. E. Schlesinger.
H. J. Skinner.
W. S. Williams.

Hon. Treasurer :
Frank W. Atwood, 216, Milk Street, Boston, Mass., U.S.A.

Hon. Local Secretary :
A. A. Claflin, 88, Broad Street, Boston, Mass., U.S.A.

New York Section.

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Vice-Chairman : J. E. Teeple.

Committee :

J. Alexander.
C. A. Doremus.
T. R. Duggan.
W. M. Grosvenor.
Martin H. Ittner.
J. M. Matthews.
Eugene Merz.
H. S. Miner.
H. R. Moody.
T. J. Parker.
Albert Plaut.
G. W. Sargent.
M. C. Whitaker.

Hon. Treasurer : Frank C. R. Hemingway, 17, Battery Place, New York City, U.S.A.

Hon. Local Secretary :
P. C. McIlhiney, 7, East 42nd Street, New York City, U.S.A.

The following take office after the Annual General Meeting: *Committee :* Carleton Ellis, E. F. Hicks, A. Lichtenstein, Gilbert Rigg, Allen Rogers.

Nottingham Section.

Chairman : Sir John Turney.
Vice-Chairman : S. R. Trotman.

Committee :

L. Archbutt.
J. Dunford.
F. Stanley Kipping.
D. J. Law.
H. B. Mayfield.
C. E. B. Merriman.
W. G. Timmans.
H. J. Wheaton.
J. White.
J. M. Wilkie.
J. T. Wood.

Hon. Treasurer :
S. J. Pentecost, Lenton Works, Nottingham.

Hon. Local Secretary :
H. J. S. Sand, University College, Nottingham.

The following take office after the Annual General Meeting: *Chairman:* John White; *Vice-Chairmen :* Sir John Turney and S. R. Trotman; *Committee :* T. H. Adams, T. F. Harvey.

Scottish Section.

Chairman : Thos. Ewan.
Vice-Chairman :

Committee :

Thomas Callan.
Wm. B. Clark.
A. Davidson.
Thos. Gray.
Robert Hamilton.
Jas. Hendrick.
W. Scott Herriot.
J. K. Hill.
J. P. Longstaff.
D. A. MacCallum.
Quintin Moore.
John P. Osbourne.
D. J. Playfair.
A. Oswald Ransome.
James Reid.
J. H. Young.

Hon. Secretary and Treasurer :
G. S. Cruikshanks, Royal Technical College, Glasgow.

The following take office after the Annual General Meeting: *Chairman :* Robt. Hamilton; *Vice-Chairman*, Jas. Macleod; *Committee :* A. R. Berry, W. H. Coleman, Cecil H. Desch, G. T. Purvis.

Sydney, N.S.W., Section.

Chairman : Loxley Meggitt.
Vice-Chairman : Thos. Steel.

Committee :

F. A. Coombs.
C. E. Fawsitt.
W. Clunies Ross.
J. A Schofield.
S. E. Sibley.
B. J. Smart.
H. G. Smith.
F. W. Steel.
E. S. Stokes.

Hon. Local Secretary and Treasurer :
T. U. Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S.W.

Yorkshire Section.

Chairman : George Ward.
Vice-Chairman : L. T. O'Shea.

Committee :

F. W. Branson.
E. A. Brotherton.
W. B. Hill.
L. L. Lloyd.
W. Lowson.
H. R. Procter.
F. W. Richardson.
G. E. Scott-Smith.
A. R. Tankard.
Thorpe Whitaker.
J. B. Wilkinson.
W. Gathorne Young.

Hon. Local Secretary and Treasurer :
T. Fairley, 17, East Parade, Leeds.

The following take office after the Annual General Meeting *Chairman :* F. W. Richardson; *Vice-Chairman :* J. W. Cobb *Committee :* A. M. Auty, J. Evans, W. McD. Mackey, Geo. Ward.

Official Notice.

ANNUAL GENERAL MEETING, 1914.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held at University College, Nottingham, at 10.30 a.m., on Wednesday, July 15th, 1914. A programme of the proceedings will be issued later.

In accordance with the provisions of By-law 24, those members whose names are printed in *italics* in the List of Council will retire from their respective offices at the forthcoming Annual Meeting.

Prof. G. G. Henderson, D.Sc., has been nominated to the office of President under By-law 20; Mr. N. H. Martin, Dr. W. H. Nichols, and Mr. Harry Silvester have been nominated Vice-Presidents under By-law 21, and Sir Wm. Crookes, O.M., President R.S., has been nominated a Vice-President under By-law 20; Mr. Thos. Tyrer and Dr. R. Messel, F.R.S., have been reappointed Hon. Treasurer and Hon. Foreign Secretary respectively.

In accordance with the provisions of By-law 72, notice is hereby given that the Council has awarded the Society's Medal to the Rt. Hon. Sir Henry Roscoe, LL.D., F.R.S., for his conspicuous services to science, to education, and to this Society.

Members are requested to nominate, on or before May 22nd next, fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the Secretary of the Society.

By-law 23:—An ordinary member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid, shall receive notice thereof from the Secretary, and shall not be submitted for election.

Canadian Section.

Meeting held at Toronto on Thursday, 18th December, 1913.

PROF. J. W. BAIN IN THE CHAIR.

THE EVOLUTION OF THE REFUSE DESTRUCTOR.

BY DR. E. KOHLMANN.

The removal and disposal of municipal refuse in a sanitary and economical manner, has always been one of the most acute problems of civic administration. Formerly the city waste was either dumped upon plots of land, usually located on the outskirts of the city, or used as a fertilizer. However, with the rapidly increasing growth of the cities, these dumps, which were mostly breeding places for all kinds of germs and were also sources of annoyance in many ways, had to be done away with, and the area formerly occupied by them was converted into building land. Relatively to the growth of the cities the value of the refuse decreased; the refuse lost its fertilizing properties so that the demand from the agriculturists lessened.

The necessity for disposal of the waste in an economical and sanitary manner thus became more and more urgent, and many efforts were made to discover the best method.

The only perfectly sanitary way in use up to the present time had been considered that of incineration. Incineration was first started in England. In 1874, a dust contractor, Fryer, built an experimental furnace, which was improved upon by the erection at Manchester, in 1876, of the first efficient type of furnace, called a "destructor," consuming all forms of town's refuse in an unseparated condition. His invention originated from the knowledge of the large amount of carbonaceous matter in English refuse; even now if the composition of refuse, brown-coal, and peat is compared, it is apparent that the calorific value of refuse in some cities, especially where anthracite or pit-coal is burnt, is as high as that of raw brown-coal and peat But more recently the value of the inferior constituent parts has been realised, and this knowledge has been the basis for the further evolution of destructors.

The incinerator of Fryer deserves attention, in so far that a number of destructors of this type were installed all over England, and according to whether rear or top charging was adopted, a number of different systems were introduced. The furnaces themselves had all as a rule a single oblique grating on which the refuse was burnt. The escaping gases passed either through openings at the rear of the furnaces or through holes in the covering vaults.

On the same principle the first plant on the European continent was built in 1896, at Hamburg, but with certain alterations. In place of Fryer's grating the Hamburg Board of Management introduced a grate with numerous conical-shaped holes; the reason for this alteration was that a perforated sheet-iron plate distributes the draught more uniformly over the whole mass of refuse which is being consumed. Fig. 1 shows a diagram of the first Hamburg destructor of the Horsfall type. The gas outlet is seen in the covering vaults. The second alteration of importance was the adoption of fans instead of steam jet-blowers. To promote combustion English furnaces used steam jet-blowers, but, as condensed steam absorbs the heat, it would have been practically impossible to consume the Hamburg refuse, which is of inferior combustible composition.

Independent of Hamburg the firm of Herbertz at Cologne (Germany) came to the same conclusion that a perforated grate with the fan in lieu of the steam jet-blower, was an advantage over the English styles, and in 1900 they first brought out a destructor improved on these lines. The cell of Herbertz retained a rectangular plan similar to that of the English furnaces, but the flue was arranged too close to the grate so that only a very limited quantity of refuse could be treated. But as the perforated plate works with much higher draught and a much greater efficiency per square foot of grate results, a limit was soon attained as to the size of the grate and the cell above which the operator could not manage the cake of clinker.

Then Herbertz introduced the small cell of 1·2 sq. yds. of grate area against 3·3 sq. yds. of the English furnaces To obtain a balance of the fluctuating temperature in the single cell, several cells were combined to one furnace block, and a system of mutual support established; English engineers in the meantime had also adopted similar ideas. But Herbertz took a further step. To avoid possible fluctuation of temperature in the separate cell, he made 2 or 3 small charges on the grate before he removed the clinker cake. Thus the criteria of Herbertz's furnace are small cell and small individual charges. (Fig. 2.)

Previous to the introduction of this system in Fiume and Brünn (Austria) and Kiel (Germany) in 1905 and 1906 respectively, the plants of Brussels and Zürich had been constructed in 1903 and 1904 respectively.

Up to this time the English furnaces show no marked improvement. In 1903, however, Messrs. Hughes and Stirling, two English engineers, had erected the destructor plant of Frederiksberg (Denmark), in which the system of mutual support of a group of cells is adopted similarly to the Herbertz system. By the arrangement of 4 cells in one group, the partition wall is partly done away with, so that the gases of one cell escape through the other. This double cell was the beginning of the

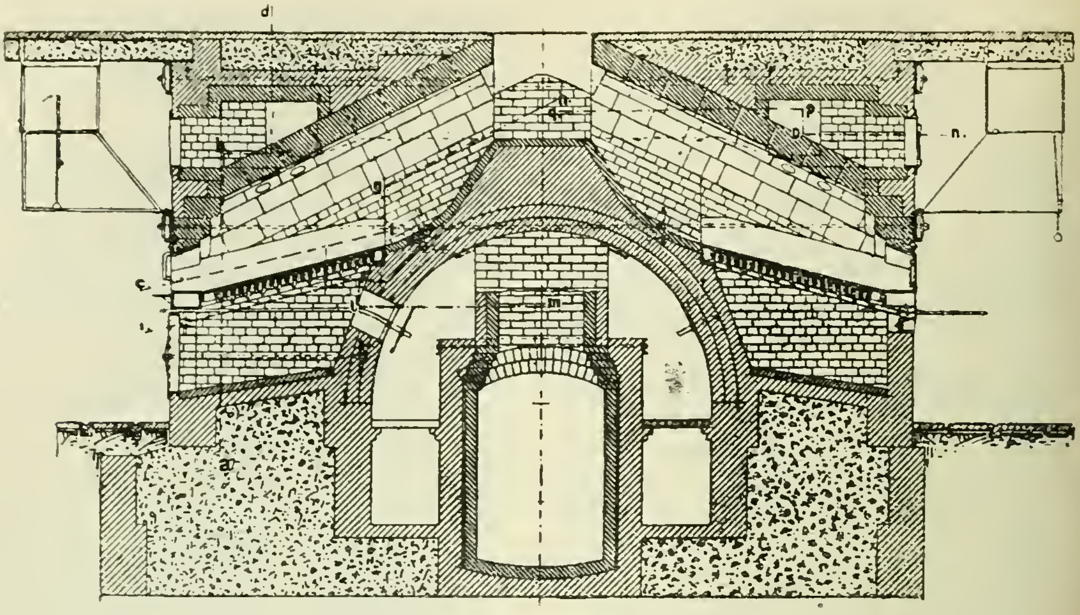

FIG. 1.—First Hamburg Destructor, Horsfall Type.

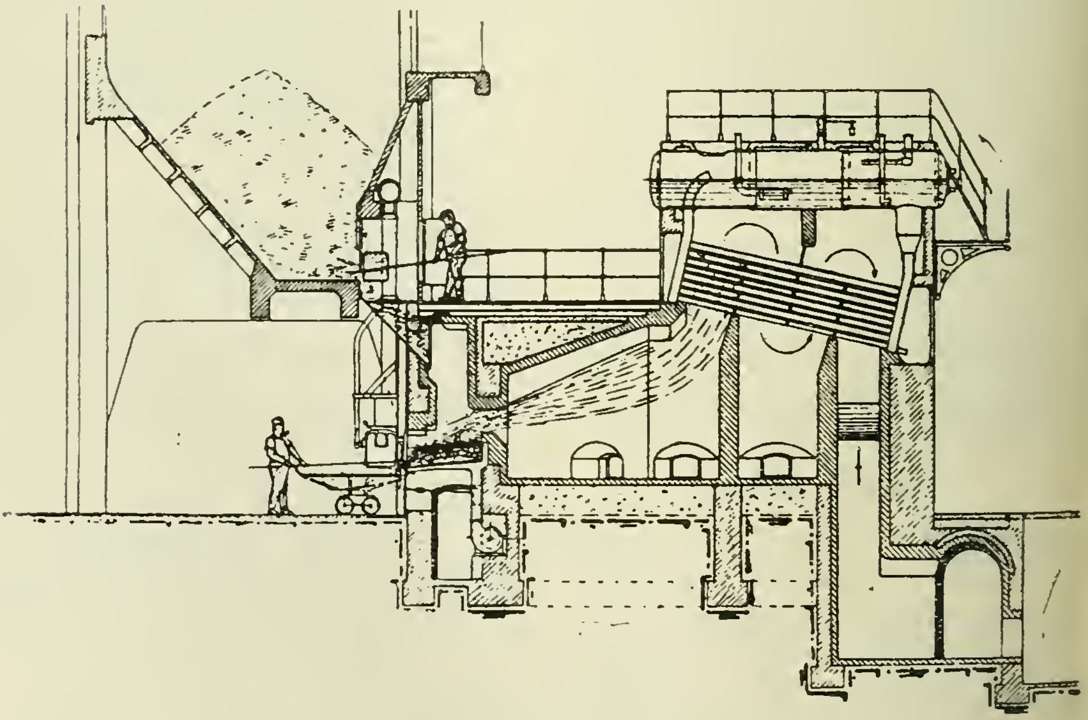

FIG. 2.—The Herbertz Furnace.

continuous grates, widely used in England, in which the division wall disappears wholly and a broad grate results, the parts of which are charged and discharged alternately. An example of this plant may be seen at Seattle (Wash., U.S.A.). The destructor has a capacity of 60 tons, and is constructed on the Meldrum system.

The objection to this type is that the removal of clinker could not practically be effected without derangement of separate parts, so that it has given place to that of Frederiksberg, where the division of cells is at least indicated by a small wall above the grate. This partition has been constructed in order to separate each cake into smaller portions and to facilitate the handling of clinker. However, these division walls suffered greatly from the adherence of clinker and from heat so that it was necessary to cool them by the incoming draught. The grate thus resulting consisted now of a bottom part and two sid walls, and an exceedingly favourable shape of grate wa obtained, namely, the mould grate (Fig. 3). This shap has the advantage that the air affects the cake on al sides and develops therefore a very intense heat. The mould grate was at first installed in English furnaces, but is in use also in other systems, as *e.g.* in Humboldt's.

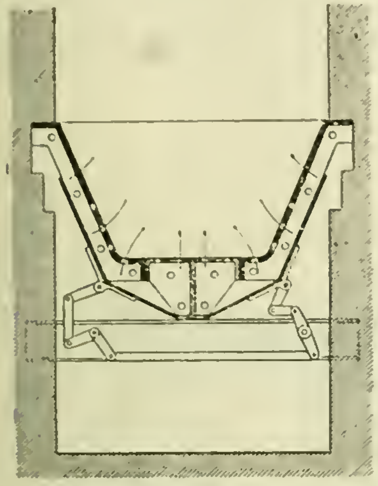

Fig. 3.—Mould Grate.

The English furnaces have not adopted from Herbertz the small cells and the manifold individual feeding devices, but remain of the same large capacity of 20 to 24 tons in order to save wages. Since the cake became consequently too heavy, mechanical discharge was introduced, for which the mould-shaped grate is admirably suited, because the clinker on account of the intense heat vitrifies well and takes the form of a mould and can be removed as a whole. The handling of the clinker is facilitated to the operator by the use of a bar generally bent to a spiral shape, which is put into the refuse and around which the clinker melts. By means of a ring-shaped handle attached to the spiral iron bar the whole cake can be removed by a winch without any trouble. This device is patented by Heenan and Froude (Fig. 4).

With the aid of this device the difficulty of enlarging the cells was removed and mechanical removal was adopted. Thus four cells in Frankfort a/M. have been replaced by two of double the size, and the daily capacity of 25·30 tons of a group of cells could be increased to 40—50 tons dealt with in two large cells. The temperature is likewise essentially higher than in the old Herbertz type.

The above traces briefly the evolution of the so-called hearth furnaces up to the present time. English and German firms have come to the same conclusions by different paths. Although Herbertz has not given up the independence of the unit cell as in the English furnaces, the result in both systems is the same, namely, a cell of 2·4—3·0 sq. yds. area and a capacity of 20—25 tons per 24 hours.

The evolution of the hearth furnace has reached its limit. Further increase of capacity per square yard of grate area, not possible on account of the small charging height, would necessitate a still greater draught and further, with charging in thin layers, the draught would penetrate only in some places, so that unconsumed coal and superfluous air would result, especially if the refuse is not carefully distributed. This distribution work becomes again more difficult in large grates, recently recommended as more advantageous.

The large amount of vegetable ingredients suggested the idea of gasifying the refuse. With the great charging height of such gasifiers of about 1·1 yd., the distribution of draught is easier because the air has a better opportunity to mix with the coal and to promote more perfect combustion. The upper layer of refuse can dry without withdrawing too much heat from the combustion centre

The best generator of gas is the blast furnace, and on this principle Dr. Dörr designed his incinerator, which was erected at Wiesbaden. It consists simply of a shaft of fireproof masonry which is constantly filled with refuse. The air is forced into a front channel at the bottom of the shaft and passes at a high velocity through the clinker, which is withdrawn at the front (Fig. 5).

The refuse gasifier of Dörr was a badly constructed gas generator. In every shaft furnace, the air tends to rise along the walls while the mass in the centre remains unburnt. By forcing draught through the front channel the air escapes by the shortest route. This means the draught ascends on the front wall and does not affect the refuse

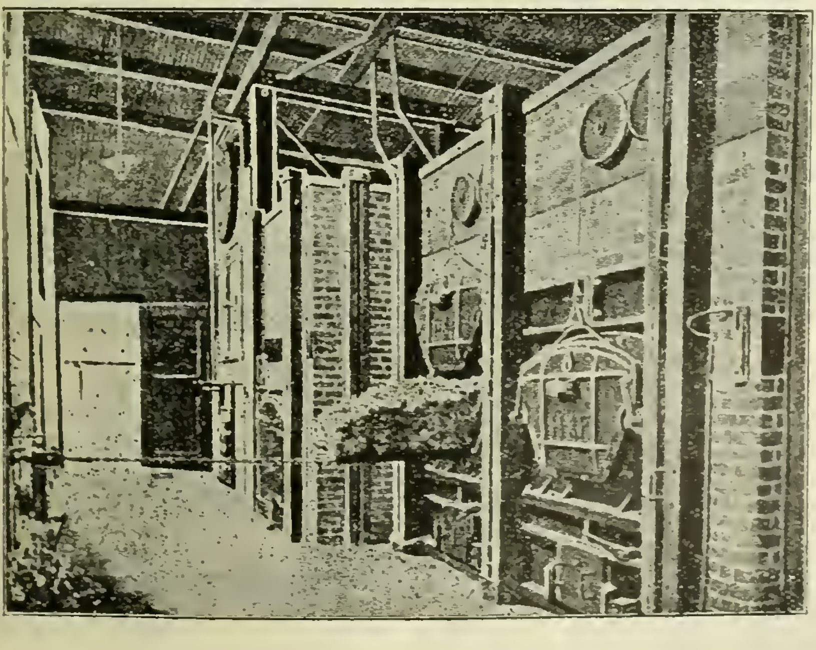

Fig. 4.—Heenan-Froude Discharger.

at the rear of the furnace, thus leaving it in an imperfect state of combustion.

The failure of this was proved by Dr. Ing. Meyer in a series of experiments conducted at Wiesbaden and Kiel, on destructors of the Dörr and Herbertz type, the results of which are shown in Table I. (p. 388). It will be noticed that the composition of smoke gases of Dörr was fairly good; the small excess of air proves that the combustion in the Dörr furnace left nothing to be desired. The temperatures attained were likewise favourable. If in face of this the resultant effect of the Dörr furnace amounted only to 41 per cent. against 66·5 per cent. in the Herbertz furnace, the reason for this may easily be found in the loss of unburnt coal in the clinker which amounts to 40 per cent. with Dörr's against 10·8 per cent. with Herbertz's furnace. This fact proves that with Dörr's system the combustion only occurred in the front part of the shaft, while the refuse at the rear was removed in an unburnt state.

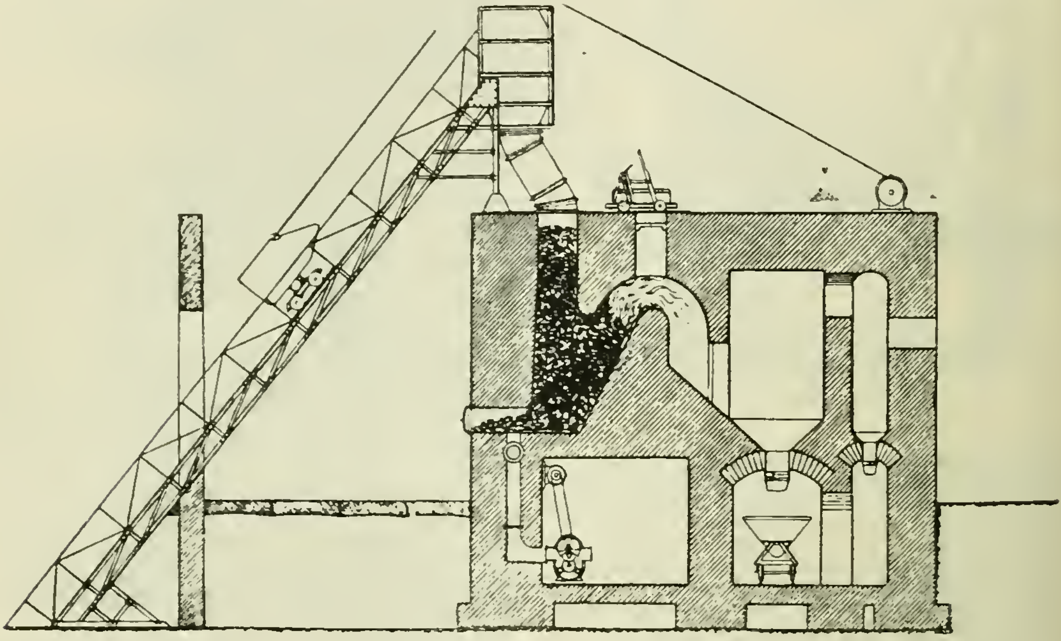

Fig. 5.—The Dorr Incinerator.

The table shows other interesting features. Besides the loss of unburnt coal, there are also losses by radiation and of heat carried away with the clinker. However, it is obvious from these experiments that the amount of heat remaining in the clinker when drawn from the grate is a negligible quantity, thus proving that Humboldt is incorrect in his statement of the value of clinker heat for heating air which he claims to be the advantage of his system. The clinker heat in both systems is nearly equal and amounts only to 3·4 and 3·5 per cent. respectively.

The loss by radiation amounts in the Dörr furnace to 15·6 per cent., and in the Herbertz furnace to 19·2 per cent. In both systems this loss could be reduced, although it is always an advantage in the shaft furnace to keep the heat more concentrated, and its radiating surfaces are much smaller than those in hearth furnaces.

Recently the tendency has been to do away with the constructive failures of the Dörr furnace and to borrow ideas from the blast furnace and the modern gas generator; particularly is this the case as regards the circular shafts which can be charged much more easily than rectangular ones. The air is forced in either centrally or, as in the blast furnace, radially through jets.

Further, it had been necessary with the introduction of gasification of refuse to cool the walls of the furnace because the clinker easily adheres to a hot wall. Dr. Dörr considered that a firebrick wall with a cavity would obviate this difficulty. But this did not prove to be the case, as the temperature in the cavity could not be reduced sufficiently. Thus the water-cooled jacket was introduced.

Improved means for discharge were also attempted. The discharge in gas generators for coal is done mechanically by a kind of eccentric which ejects the cinders continuously over the sides directly into wagons. It seems doubtful whether this device can be adopted in the same way for the discharge of refuse clinker. However, meanwhile a destructor had been constructed by Didier at Wiesbaden which had all these features of a cooled shaft and which performed the discharge by a knife-edge which cut off the clinker, removing it thus downwards without disturbing the service of the real gasifier in the upper part.

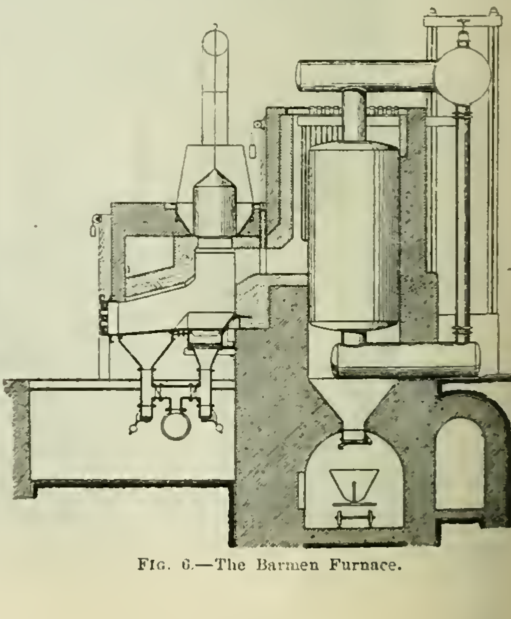

Fig. 6.—The Barmen Furnace.

Whether it is right to encourage a continuous gasification as is done in Didier's furnace or to burn down periodically several charges remains to be proved. Each combustion of refuse shows three phases: the first is the evaporation of water and the heating of the refuse up to 100° C., the second is the escape of products of distillation up to 500° C., and the third is the gasification of the remaining carbon. Only the last process generates heat and produces all heat including that for the formation of clinker. With the continuous gasification the danger is that the simultaneous evaporation of water withdraws too much heat from the hearth and a mean temperature results which suffices to gasify the refuse but which is probably insufficient to vitrify the clinker. For each charge it is simpler in practice first to evaporate the water and finally to burn the dried refuse, so that in the last phase of the process the full development of heat is not influenced by any other process consuming heat.

Meanwhile, the Hamburg management had noticed that in the charge of the Horsfall furnaces, lasting 1½ hours, the second half of this period represented only a current of air passing principally through ashes. Therefore the furnace was charged hourly for experiment. The result of this operation reduced the cooling losses and the excess of air considerably. Five minutes after charging the maximum temperature, 1150° C. was reached, while it was formerly difficult to reach 1000° C. The method of operation in the Horsfall furnace, however, required too many operators owing to the height (referring to Fig. 1) from the grate to the crown being so low that the difficulty of uneven distribution of draught increased with the increasing air pressure.

A further increase of efficiency was accordingly only possible by means of a greater height of the crown, *e.g.*, by shaft furnaces similar to a blast furnace. The result of this difficulty was the invention of a special type of furnace at Hamburg in 1904. For a grating a perforated iron sheet was chosen. The furnace itself was constructed in a rectangular form, the upper part of which was of a fustrum of a pyramid, and a double bell trap was used for charging. In order to attain an equal distribution of refuse the corners of the shaft were oblique so that the plan was octagonal. The hearth itself remained rectangular and was water-jacketed for cooling purposes. Against this the objection is often raised that water-cooling deprives the furnace of heat to a certain extent; although recent styles of incinerators with a water-cooling jacket have been more generally adopted because it is safer for the operation as the clinker does not adhere to the walls and is more radical. The loss of heat in shaft furnaces serving for the gasification of coal is approximately 3 to 4 per cent.; on the other hand the effluent from the jackets may be used for feeding a boiler or other purposes.

This furnace burnt successfully in permanent operation 31 tons of refuse. The mean temperature was 1050° C.; the amount of CO_2 reached 18—20 per cent. after each charge.

The principle of the Hamburg furnace was adopted by the City of Barmen, where a similar furnace was designed, distinguished by a divided grate; this has been tried in other places as well as in Hamburg. In 1903 a furnace was built in Stockholm (Sweden) which deserves notice for its peculiarity. The refuse falls into a high shaft which is closed below by an oblique grate, from which the clinker cake is drawn on to a similar inclined preliminary grate in order to burn here completely and to give off its gases through a preliminary chamber and openings in the partition wall into the combustion shaft proper. The practice of using the heat of the hot clinker was likewise applied to the Barmen furnace (Fig. 6). Here also the proper combustion chamber is a high shaft which shows exactly the Hamburg feature; the feeding is done by a double bell as in Hamburg, and the grate is also similar. In the front of this a preliminary grate is provided similar to the one previously used in Stockholm, on to which the clinker cake is drawn after 20 minutes, so as to provide heat to the incoming air which is to serve as highly heated secondary draught for combustion of CO formed in the furnace proper. As already stated, the amount of clinker-heat is very slight, and this furnace may work with it or without. It is immaterial whether the clinker is drawn on to the pre-grate after 20 minutes or whether it remains on it for 40 minutes. The system was recently introduced by the City of Fürth (Germany) and is designated as the Humboldt system (Fig. 7).

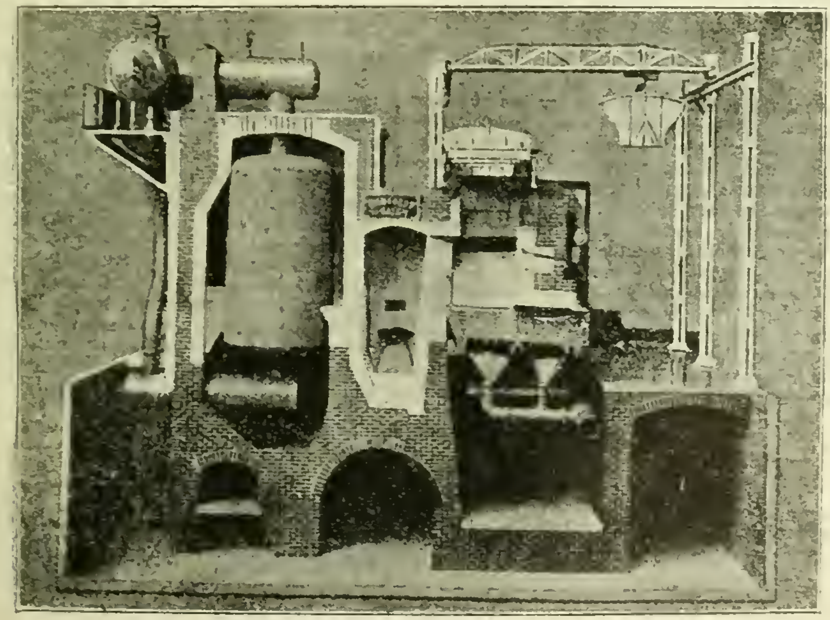

Fig. 7—Humboldt System.

The engineers of the Horsfall Co. have also followed the evolution of the Hamburg furnaces and have adopted its system of direct feeding and the perforated grate, so that practically from 1905 the old pre-drying hearth has disappeared even in the English types.

In the whole of these systems working with thin layers, manual labour is necessary to distribute the refuse uniformly over the grates, thus proving the advantage of the shaft furnace which can be worked mechanically.

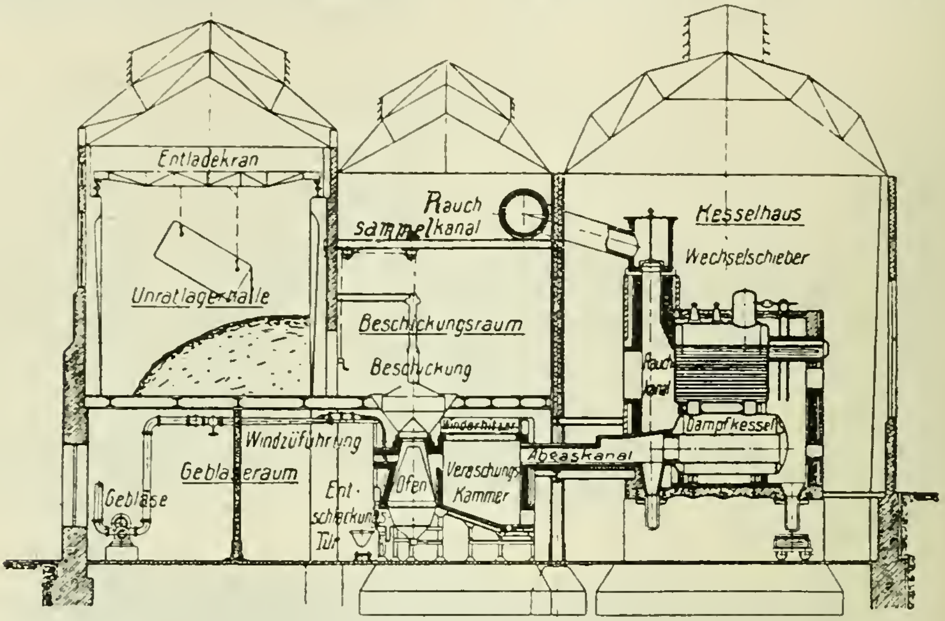

Fig. 8.—Hamburg Furnace.

In the meantime the Hamburg furnace has been further improved. Here especially it has been recognised that the evaporation of water retards the ignition and thus the combustion accordingly reduces the efficiency of the furnace. To counteract the period of cooling the principle of the blast furnace has been adopted, by which the combustion air is previously heated. This has been done in some types by installing a superheater system by means of boilers connected with the furnace. But as these boiler gases ought normally to have a maximum temperature of 250° C. the heat gradient is much too small to attain an effective preheating. On the other hand the whole benefit of heat is not obtained by the boiler if wet or inferior refuse is consumed. In this particular case preliminary heating of the air is essential. Here also the blast furnace has shown the way. The air heaters were placed at the hottest point in the system, that is in the combustion chamber, and so it is possible to attain temperatures of 350° C. in the combustion air.

The adherents of other systems have acknowledged the importance of high air-heating. Dörr has calculated for medium garbage of 15 per cent. water and 66·4 per cent. residue, that with double the amount of air necessary for good combustion, a temperature of only 1150° C. can be obtained, whereas with air heated to 300° C. a temperature of 1530° C. is produced. Without this preheating such refuse would probably no longer produce useful clinker and pre-heating is of much more importance on wet refuse.

The most important results of air heating are quicker ignition, the accelerated combustion of the refuse and an increase of the furnace efficiency. The Hamburg furnace of 1·4 sq. yds. grate area consumes in 24 hours in a normal average 37 tons and 44 tons of refuse at a maximum rate.

The charging takes place at Hamburg by the double bell trap (Fig. 8). Two cranes lift the body of the wagons

Table I.

Carbon in dry refuse. per cent.	Percentage of cellulose.	Carbon in cinder. per cent.	CO_2 in gas. per cent.	Excess of air. per cent.	Temp. ° C.	Heat given off cal. per m. per hour	Heat supplied in cal. per m. per hour	Effect per cent.	Losses.		Radiation per cent.
									Unburnt material in clinker. per cent.	Heat of clinker. per cent.	
Wiesbaden (Dörr System.)											
25·31	0·93	13·9	11·0	1·59	940	508	1090	53	30·5	3·3	13·2
25·39	1·03	16·4	14·4	1·27	395	502	1330	38	36·0	3·2	22·8
26·37	1·38	19·3	12·2	1·46	870	485	1200	40·5	43·0	3·4	13·1
22·42	1·12	16·5	12·6	1·43	895	410	960	43	41·0	3·65	12·3
25·9	1·11	21·0	13·6	1·34	830	345	1113	31	49·5	3·4	16·1
26·57	1·22	19·6	11·0	1·59	855	423	1090	39	42·0	3·3	15·7
						Average		41	40·0	3·4	15·6
Kiel (Herbertz System.)											
15·76	11·35	5·88	10·8	1·62	745	2520	3980	63·4	13·8	3·5	19·3
14·31	12·78	3·7	12·1	1·47	830	2860	4040	71·0	8·2	3·3	17·5
16·1	4·26	4·07	14·1	1·30	870	2425	3720	65·2	10·3	3·8	20·7
						Average		66·5	10·8	3·5	19·2

TABLE II.

System.	Horsfall.		Dörr.	Herbertz.	Humboldt.		Heenan	Hamburg.
City.	Hamburg (old).	Zürich.	Wiesbaden.	Frankfurt.	Fürth.		Milwaukee.	Hamburg (new).
Size of plant	36 cells	12 cells	6 furnaces	6 × 4 cells	2 furnaces		3 × 4 cells	12 furnaces
Total daily capacity in tons	180	120	108	180	53		225	500
Initial cost — Total £	24,000	28,250	17,750	69,000	5000 + 2500 (for additions)		45,000	57,000
Initial cost — Total per ton of daily capacity £	133·5	235	164	382·5	142·5		200	115
					1911	eventually		
Actual daily capacity in tons ..	170	68	55	150	16	39	174	325
Actual annual capacity in tons	53,000	20,000	17,000	46,500	5000	12,000	54,000	100,000
Cost of operation .... £	5950	3875	2400	7700	7830	1650	13,250	980
Do. per ton of actual capacity shillings	2·25	3·85	2·80	3·30	3·15	2·75	4·90	1·96
Cost of operation, including 10 per cent. interest and sinking fund...................... £	8350	6700	4175	14,600	1533	2400	17,750	15·5
Per ton of refuse......shillings	3·15	6·70	4·90	6·30	6·15	4·00	6·55	3·10

TABLE III.

System.	City.	Grate area sq. metres.	Max. capacity per cell per day. Kilos.		Capacity per hour per sq. m. of grate.
Horsfall	Hamburg	2·75		5000	76 133 220
	Zürich	1·89		8750	133
	Brüssels	2·5		10,000	133
Heenan	Milwaukee	2·5	4 cells	80,000	335
	Dublin	2·7	2 × 3	100,000	260
	Cheltenham	2·7	4	60,000	235
	Vancouver	3·0	3	55,000	255
	Coventry	2·7	3	75,000	385
Herbertz	Fiume	1·25			345·75
	Brünn	1·25	7	66,780	325
	Kiel	0·94	6	60,000	445
	Frankfurt	1·1	4	30,000	285
		2·2	2	50,000	480
Humboldt	Fürth	1·5		27,500	720
Dörr	Wiesbaden	1·0		19,500	815
Hamburg	Hamburg	1·2		44,000	1530

in which the refuse is collected and dump the contents on a large platform whence the refuse is conveyed in wheelbarrows to a feeding stage adjoining the platform. At first the circular trough between the exterior bell and the hopper-shaped opening of the furnace is filled. By lifting the bell the refuse drops into the funnel and the outer bell is closed. The inner bell is then raised and the refuse falls on to the grate so that the furnace is never actually open. The charging by hand was retained here on account of the existing haulage method, and a further reason was that Hamburg would not abandon this system as shells and other explosive matter have frequently been found in the waste and accidents have occurred. A third reason was the extremely varying composition of the Hamburg garbage, in which big pieces exist up to 1 yard long, which would require large buckets. Experiments with such a construction had but unfavourable results.

However, there is no reason to continue the charging by the double bell method, which is used exclusively in the blast-furnace with bucket feeding, or to empty the wagon-bodies directly into the mouth of the bell as it is done with the Ochsner system (see Fig. 7).

The Hamburg plant is at present not in a position to sell steam or electric power like other incinerator plants. Still a considerable revenue appears in the annual reports from the sale of the slag, which has proved to be valuable as a substitute for gravel in mixing concrete or as a filling material for road construction and covering old dumping grounds.

A concise idea of the costs and efficiency of the various types can be obtained from Tables II. and III.

From the above it will be seen clearly that an incinerator should be of the simplest and most efficient type, and of the lowest cost, which is without doubt that of the shaft furnace.

Liverpool Section.

Meeting held at the University on Wednesday, January 28th, 1914.

PROF. E. C. C. BALY IN THE CHAIR.

COAL AND THE CHEMISTRY OF ITS CARBONISATION.

BY JOHN HARGER, M.SC., PH.D. M.INST.M.E.

VERY little is known of the chemical composition of the various constituents of coals though some progress has been made by various workers in separating them by the solvent action of pyridine, as discovered by Professor P. Bedson. Some coals, such as anthracite, semi-anthracite, and steam coals, yield very little pyridine-soluble matter, neither do brown coals nor cannels yield very much, but some bituminous coals give as much as 40 per cent. extract. The utility of the pyridine extraction method is however impaired by the facts that the ultimate chemical analyses of the soluble and insoluble portions from the same bituminous coal differ very little, and that, up to now, all the fractions contain more nitrogen than the original coal, indicating that some pyridine, in spite of all the precautions employed to remove it, has been retained by the coal substances. By the usual Soxhlet method the quantity slowly dissolved by pyridine is large at first, then more is dissolved very slowly indeed. An extraction usually extends over two weeks at least.

The author has lately found that a better method is to take a small quantity of the finely powdered coal (passing through 120 mesh sieve), say about one gram, add 150 grams of pyridine, seal in a strong glass tube and heat to about 160-180° C. for twenty-four hours. By this method more extract is obtained in twenty-four hours than by the usual method in months.

The chemists at the Government Experimental Station at Eskmeals have found that the inflammability of coal-dust is in proportion to the quantity soluble in pyridine. The French Government chemists, however, have found that, for French coals at least, this relation does not apply. The author has found that cannel coal contains very much less soluble in pyridine than ordinary bituminous coals, *e.g.*, by the Soxhlet method. Old Roundwood cannel yields 15½ per cent. and Lancashire Arley coal 22½ per cent., yet there is no doubt whatever that the cannel dust is far more inflammable than the dust of the Arley coal, each of the same degree of fineness. It was found, however, that Arley coal dust, which gave only 22½ per cent. soluble in pyridine by two weeks' extraction in the Soxhlet, gave 40½ per cent. soluble in pyridine by the sealed tube method. 150 grams of a different sample of Arley coal, but taken from the same mine, was extracted first by chloroform and then by several portions of pyridine, boiling up in each case for a long time until only a trace of soluble matter was obtained. A portion of the residue was then taken and heated in a sealed tube for thirty-four hours at 161—180° C, and the residue from this heated with a fresh portion of pyridine for twenty-four hours at 160—180° C with the following results, stated on the dry and ash-free substance :—

Some of these fractions were saturated with chlorine, after removal of pyridine, etc., in a current of inert gas at 150° C., and the increase in weight is stated below. Chlorine and hydrochloric acid were removed *in vacuo* over sodium hydroxide.

Increase in weight, per cent., Fraction B, 74·4 ; C 64·4 ; E 55·7 ; F 31 ; H 64·2.

A considerable number of experiments have been made on the action of chlorine at high temperatures. CH_3Cl, CH_2Cl_2, $CHCl_3$, CCl_4 and C_2Cl_6 in considerable quantities were obtained, but further experiments are being made which will be reported later.

The fact that pyridine dissolves the so-called resin bodies so very slowly and dissolves much more with the slight increase in temperature by the sealed tube method, shows that this is not a case of ordinary solution. The extract once obtained is quite readily soluble in pyridine and gives a thick, viscid, tar-like mass, and that it is not "absorbed" by the insoluble portion of coal is shown by examination of thin sections which show the resinous bands and nodules to be separate from the general matrix.

There appears to be some kind of simplification in the constitution of the constituents which yield the pyridine soluble matter, a process similar to depolymerisation and due to the action of pyridine and heat. This is similar to the behaviour of many ordinary resins which are only soluble in certain solvents after they have been heated at moderately high temperatures for some time. Clark and Wheeler* have shown that the pyridine extract from silkstone coal can be separated into two fractions by the solvent action of chloroform, and the author has found that this is the case with the pyridine extract from Arley coal also. The solution by chloroform is an extremely slow process and requires about two weeks to make the extraction complete. This points to either absorption or depolymerisation.

An interesting point is that this chloroform soluble portion does not appear to be in the original coal as such. There is some portion of Arley coal soluble in chloroform and the quantity seems to vary very much with coal

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* Trans. Chem. Soc. 1913, 1705.

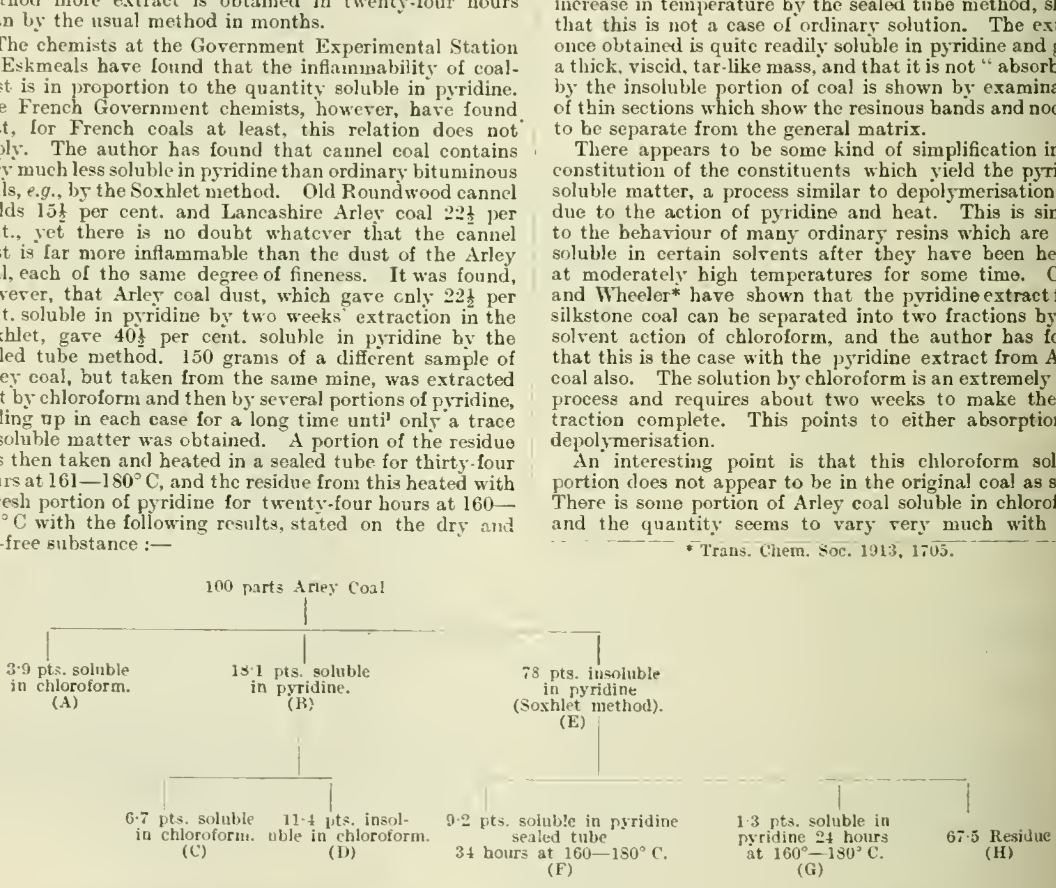
100 parts Arley Coal
3·9 pts. soluble in chloroform. (A)
18·1 pts. soluble in pyridine. (B)
78 pts. insoluble in pyridine (Soxhlet method). (E)
6·7 pts. soluble in chloroform. (C)
11·4 pts. insoluble in chloroform. (D)
9·2 pts. soluble in pyridine sealed tube 34 hours at 160—180° C. (F)
1·3 pts. soluble in pyridine 24 hours at 160°—180° C. (G)
67·5 Residue (H)

Table showing changes during the separation of silkstone coal fractions by Clark and Wheeler.

All calculated on ash and moisture-free coals.		A 100 pts. original coal.	B 80 pts. insoluble in pyridine.	C 20 pts. soluble in pyridine.	D Average of 80 pts. B, 20 pts. C (should equal A).	Diff. + or —	E 12 pts. C insoluble in $CHCl_3$	F 8 pts. C insoluble in $CHCl_3$.	Average of 12 pts. of E, 8 pts. of F (should equal C).	Diff. + or —
Proximate Analysis	Volatile matter	36·73	34·96	55·24	39·02	+ 2·29	31·88	77·33	50·66	— 5·18
	Fixed carbon ..	63·27	65·04	44·76	60·98	— 2·29	68·12	22·67	49·94	+ 5·18
Ultimate Analysis	Carbon	82·92	80·81	82·80	81·26	— 1·66	77·32	85·33	80·52	— 2·37
	Hydrogen	5·58	5·23	7·14	5·61	+ ·03	5·14	7·08	5·91	— 1·23
	Oxygen	8·45	10·40	6·62	9·64	+ 1·19	14·26	4·56	10·38	+ 3·76
	Nitrogen	1·31	2·14	1·91	2·09	+ ·74	2·07	1·71	1·92	+ ·01
	Sulphur	1·70	1·42	1·44	1·42	— ·28	1·21	1·32	1·25	— ·19

even from the same seam. In one experiment it was as much as 3·9 per cent. but generally it did not exceed 1½ per cent. This substance contained no sulphur and no nitrogen and gave on analysis, hydrogen, 8·81 per cent., carbon, 83·92 per cent., oxygen, 7·27 per cent.

The portion dissolved out of the pyridine extract by chloroform was rather more than one-third of the total pyridine extract, and this material contained nitrogen and sulphur as well as carbon, hydrogen, and oxygen.

In the paper by Clark and Wheeler results of extraction of silkstone coal (Altoft's Colliery) by pyridine, and subsequent action of chloroform on the extract obtained, are given with analyses of the various fractions. From their figures it is evident that all fractions contain more nitrogen than the original coal, and it appears on calculation that pyridine amounting to 4 per cent. on the coal taken has been retained by the fractions. Examination of their figures also shows (assuming the analyses to be correct) that in the extraction by pyridine and subsequently by chloroform a considerable quantity of oxygen has been absorbed and some sulphur lost.

These figures show that :—

(1) 100 parts of coal have retained slightly more than 4 per cent. of pyridine.

(2) Oxidation has occurred in both extractions, but especially with chloroform, where the oxygen has increased by nearly 60 per cent.

(3) There is loss of sulphur in both extractions.

It might be gathered from these figures that the absorption of oxygen is an essential feature in the solution of these constituents by pyridine and chloroform, but the fact that more is dissolved by treatment in a sealed tube in absence of air proves that this is not so.

The fact that pyridine is retained by the fractions even after heating in vacuo at 100° for several days has been proved by heating a portion of pyridine extract in a current of nitrogen at 150° C. The gas which came off contained pyridine, and was passed through H_2SO_4, which was distilled later with potash and the distillate titrated. This experiment showed the presence of 3·7 per cent. of pyridine in the material. Later experiments have shown that the portion insoluble in pyridine contained pyridine after heating in vacuo for several days at 100° C, and it has been found much more difficult to remove all the pyridine from the insoluble than from the soluble fractions.

The coking property.

Not every coal gives a satisfactory coke on carbonisation. A coal which will coke must contain a certain minimum quantity of bituminous matter. Coals like anthracite and semi-anthracite do not coke nor do the tertiary coals—lignites and brown coals. The coals selected for making metallurgical coke contain sufficient bituminous matter to fuse on heating to a few degrees above 310° C. The mass of washed coal is converted on heating to a pasty mass, from which, on further heating, the volatile matters distil, leaving a fixed carbonaceous residue which becomes harder and stronger the higher the temperature employed because volatile hydrocarbons are decomposed, with deposition of carbon, in proportion to the temperature of the solid material through which these volatile hydrocarbons have to pass. With very high temperatures the product is hard and will withstand considerable pressure.

It appears that the coking properties of coals must be due to some compounds of C, H, O, N, and S, about which little further is known than that they melt at about 320° C. Anderson and Roberts[*] showed that coals of the Clyde Basin began to soften at 310° C and melted fairly completely at 320° C. The best coking coals melted at 317° C. The older coals coked, the newer ones did not.

	Carbon.	Hydrogen.	Oxygen, etc.	Coking power.
on-coking	82·65	5·55	10·1	3·9
emi coking	83·16	5·48	8·98	4·1
oking	85·41	5·36	7·22	13·5

It is not possible to tell from the ultimate analysis of a coal whether it will coke, but it is often found possible to say that it will *not* coke. Cases are known of coals of exactly the same ultimate chemical composition some of which coked quite well and the others not at all. An essential part of the process of coking takes place between 250° C. and 400° C. If coking coal is carbonised below 400° C., then powdered and heated to very high temperatures such as are employed in metallurgical coke ovens, there is no sign of sticking together of the particles. It is generally believed that it is the quantity of the so-called resinous constituents in coal which determines its coking or non-coking property. According to Anderson this has been proved to be wrong, but on what evidence is not clear. A study of his papers reveals no facts supporting this conclusion.

Some of the fundamental facts about the coking property are :—

1. The coking property in some coals is destroyed by exposure to air, and even in more strongly coking coals it is sensibly diminished.

2. The coking property in some coals is destroyed, in others weakened and in some not affected by boiling with dilute caustic potash.[*]

3. Heating in a current of inert gas at 300° C. for several hours destroys the coking power of some coals and weakens it in all coking coals. The strongly coking coals, however, retain sufficient to coke when strongly heated.

Anderson and Roberts conclude, and Professor V. B. Lewes agrees, that on these facts strongly coking coals, in addition to the so-called resin bodies, contain a class of substances which are not soluble in alkali, do not oxidise in warm air and do not decompose or volatilise at 300° C., and that substances of this class melt on strongly heating and yield enough luting material to form coke. They call the substances of this class the "hydrocarbon bodies." The assumption or deduction of the existence of a class of compounds in coal called hydrocarbons, on such evidence, is not, in the author's view, justifiable and they must be omitted from the constituents of coals. (Hydrocarbons have been found only in mere traces in coals.)

The phenomena described above would be observed if the so-called resin and other bodies on slow heating, etc., decomposed and yielded, amongst other products, a *smaller* quantity of a substance which was fusible at higher temperature, and this is what the author has found does actually take place. The true coking coals contain sufficient resin-like bodies to yield, after heating at about 300° C., sufficient fusible material to form coke when heated to 320° C. or above. While the feebly coking coals on heating, etc., gave the same kind and proportion of fusible bodies, the quantity was not sufficient to melt or render liquid the whole of the material and so coke could not be formed.

A sample of Arley coal extracted with chloroform gave 1·2 per cent. soluble ; on heating another portion of the coal to 230° C. in inert gas for five hours it gave on extraction 1·4 per cent. soluble in chloroform. A third portion, heated for five hours at 270° C., gave on extraction 7·6 per cent. soluble in chloroform. A fourth portion was alternately heated to 330°—340° C. in inert gas, and extracted with chloroform five times ; the total time of heating was twenty-two hours, and the total of the chloroform extracts amounted to 8½ per cent. on the original coal. It is evident that a subtle change starts in Arley coal at about 250° C. and at 270° C. it is very marked, although the coal is changed very slightly in appearance and no permanent gas appears to be evolved. Experiments were made to ascertain which part of the coal gave rise to these products soluble in chloroform. Pyridine extract after heating to 340° C. gave 8·2 per cent., and pyridine residue after similar treatment gave 1·6 per cent. It is therefore evident that both constituents give rise to the products.

Nitrogen in coal.

There is evidence to show that nitrogen occurs in coal combined in two or more essentially different ways. A small quantity of the total is given off as ammonia on carbonisation, whilst half of it remains in the coke, indicating that it occurs in coal combined in at least two different ways and probably more.

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[*] See this Journal, 1898, 1013—1020.

[*] Anderson and Roberts, *loc. cit.*

It has been observed that in some coals the amount of nitrogen estimated by the Kjeldahl method is a mere trace, when a Dumas estimation reveals the fact that there is about 2 per cent. In other coals the two methods show exactly the same amount, showing that the nitrogen is not held in a similar way in all coals. It has been further observed that when some coals are mixed with caustic soda and ignited much less nitrogen remains fixed in the residue after carbonisation than in the residue of the untreated coal, and, on the contrary, it has been observed that other coals, when treated in a similar way with caustic soda, etc., had more of their nitrogen fixed than when heated alone.

Some of the fixed nitrogen can be converted into ammonia by passing hydrogen over the red-hot coke, but the only practical method hitherto devised of increasing the yield of ammonia is to burn the coke while keeping the temperature as low as possible, as in the Mond producers.

The nitrogen which comes off as ammonia on the carbonisation of coal probably exists in side-chain groups whilst that which remains fixed in the coke probably occurs in ring compounds, the ring part being stable at a red heat.

Over twenty years ago R. J. Friswell discovered that by acting on powdered coal with nitric acid of about 50 per cent. strength, a complex organic acid or acids were obtained, which decomposed sodium carbonate with evolution of carbon dioxide. These bodies, which were later called the coal acids by Anderson, are insoluble in water containing much mineral acid but in pure water or dilute alkali or dilute acid they are soluble, giving an ink-like solution. The solid coal acids on heating with zinc dust gave hydrogen, cyanogen, and a small quantity of aqueous distillate, smelling of ammonia and pyridine and containing hydrocyanic acid (Friswell).

Anderson worked on compounds, made from very different kinds of coals by treating with nitric acid, and found that the resulting coal acids had about the same ultimate chemical composition. It seemed probable that the nitric acid oxidised all the side-chains, giving COOH groups attached to a nitrogen ring complex. To test this the author oxidised some Arley coal with fuming sulphuric acid (so as to keep nitrogen containing reagents out of the experiments) and obtained similar compounds to those got by Friswell and by Anderson. The solid purified coal acid was mixed with caustic soda and heated. A gas smelling like charred albumen or bone was obtained, and the same was obtained several times on repeating the experiment with fresh quantities of coal. This would appear to indicate that coal contains nitrogen in the form of a ring complex, which on oxidation with fuming sulphuric acid is converted into a carboxylic acridine.

The old and modern Coalite processes were described by the author. In the modern process the coal is carbonised at about 650° C. with the result that the fuel is not so friable. The yield of sulphate is raised from 12 lb. to 28 lb., the tar is reduced to 18 gallons and the gas increased to 8,500 cubic feet per ton of an average bituminous coal. He also referred to low temperature carbonisation *in vacuo*, and pointed out that as much as 80 to 100 gallons of coal oils were obtainable from certain cannel coals by this process, a considerabe portion of which could be converted into petrol (8 to 10 gallons) and a large proportion of the remainder into oils suitable for use in Diesel engines. Another low temperature carbonisation process, viz., the "Del Monte," was briefly mentioned.

None of these processes was intended to replace either gas-works practice or the metallurgical coke ovens, and the author questions whether, in view of the demand for a smokeless fuel and the great advance in the value of petrol and oil suitable for Diesel engines, the modern gas-works practice of obtaining as much gas as possible per ton of coal had not been overdone, and the old lower temperature carbonisation was not more suitable to present needs.

As regards metallurgical coke it was also a question whether this could not be produced in two stages, viz. :—

(1) Carbonisation at a sufficiently low temperature to preserve the valuable light oils and give rich gas, and (2) High temperature carbonisation to give the finished hard coke and poor gas.

Both the gas-works manager and the coke-oven manager could learn from the study of big gob-fires that, under certain conditions, it was not a question of how difficult it was to heat up coal, but how difficult it was to prevent it heating up spontaneously. Also that a gob-fire could give a beautiful hard coke with coal which no existing coke-oven process could coke at all.

Practically any bituminous coal could be coked in favourable circumstances, but ordinary coke-oven processes did not give these favourable conditions.

Meeting held at the University on Wednesday, February 25th,
1914.

PROF. E. C. C. BALY, F.R.S., IN THE CHAIR.

PREDICTION AND INVENTION IN CHEMISTRY.

BY H. E. POTTS, M.SC., CHARTERED PATENT AGENT.

This paper deals with the antithesis between prediction and invention in chemistry ; first, the nature of invention, and second, the possibility of prediction. For this purpose we must consider the manner in which modern chemical technology evolves and differentiate this evolution in order to display two distinct types of factors which contribute to it. One of these types includes continuous improvements such as may result from the exercise of skilled workmanship or good judgment, from the satisfaction of local requirements, or from the dictates of convenience or necessity. The other of these types includes what are denoted "inventions." An invention represents a discontinuous advance, a sudden change, even though it may be a small one. Such a discontinuous technological variation may result from a fortunate accident, from careful experiment, from keen observation, from a happy thought, or from the concentration of an intellect far more powerful than the average. Any of these causes may give birth to an improvement which somehow differs from the other type of improvement arising from skilled workmanship, and we may express this difference by saying that discontinuous improvement is an invention.

Technology may advance by improvements in degree, which are not inventions, and by improvements in kind, which are inventions, but this sentence would give an erroneous impression if read apart from what follows.

An American authority, Professor Robinson, has expressed the difference by saying that an invention involves the exercise of the creative, as opposed to the imitative, faculties of the mind. This is well put, but it does not take us much further, since it calls for a definition of the word "creative."

From the legal point of view an invention is a advance in technology which is capable of forming th subject-matter for a patent. For over a century it ha been recognised that the principle upon which the Crow grants patents resembles that of an ordinary contract The inventor comes forward with an invention and put the public in full possession of it. In return, the Crow grants him a monopoly of its exercise for the term o fourteen years.

There are certain conditions attached to the contract If the inventor is to receive a reward he must give the publi a real something which was not before in their possessio and that something must be useful to the public. It is n every improvement in technology which can form th subject-matter of a patent, since if this were so industri advance would be unduly hampered, because peop would be prevented from making the slightest modificati in what they had been doing previously. For instanc it would have been ridiculous if, by means of the Pate Law, manufacturers could have been prevented fro using plantation rubber for the various purposes f which they had previously used Para rubber, even thou its substitution might effect an improvement in the direction of reducing expense. Clearly, therefore, in granting and in upholding patents the law must draw a distinction somewhere between the various kinds of improvements. In this way, we may assume that there is a possibility of discriminating by considering industrial advance as made up of improvements belonging to either the continuous or discontinuous type.

It is often difficult to draw any such sharp distinction between these antithetic types. This may be illustrated by one or two parallel cases in chemistry. For example, how are we to draw a definite line between acids and bases in presence of the class of amphoteric substances, which form a perfect and uninterrupted transition from acids to bases? Similarly, in spite of the wide difference between them, the aliphatic and aromatic bodies are linked by the hydro-aromatic compounds and the various polymethylene rings. Again, there is the transition from a typical crystalloid such as salt to a typical colloid such as gold hydrosol through solutions of substances possessing a very high molecular weight and lying upon the border line.

The same tendency may be found in nearly all scientific investigation. As Pater well remarked :—" The sciences of observation . . . reveal types of life evanescing into each other by inexpressible refinements of change. Things pass into their opposites by accumulation of undefinable qualities."

From a chemical point of view these cases on the border line are of great theoretical interest and do not present serious difficulties. We content ourselves by saying that an amino acid, for instance, is an amphoteric substance, and we thus create a third class intermediate between acids and bases.

In legal matters this easy solution is impracticable. When invoked to decide the validity of a patent, the law must hold that it is either valid or invalid, and no intermediate decision is normally possible. Hence, for legal purposes, it is necessary to throw considerable emphasis upon distinctions such as those I have mentioned above, in order to give us some criterion which will enable the dividing line to be drawn. While, therefore, in the abstract it may be true enough that *all* differences are differences of degree, that is, continuous, and not of kind, that is discontinuous, it is as well to bear in mind a fragment on " Differences " in Butler's Note Books, in which he says :—" This in theory ; but in practice it would get us into such a mess that we had better go on talking of differences of kind as well as degree." In what follows, therefore, I will assume that it is essential for legal purposes to mark out two different classes of improvements which must be kept mentally distinct from one another as far as possible.

We will assume that the improvement in question is new, in the sense of being different from what has gone before. Extremely subtle points may arise in this connection which are outside the scope of the present paper ; it will be sufficient to give two examples.

The American case Libbey *v.* The Mount Washington Glass Co. dealt with an invention arising out of an old process of making articles of glass-ware of a ruby colour from a well-known glass mixture containing gold, from which mixture a ruby colour used to be obtained by reheating the glass.

The patentee discovered that if portions only of the glass were reheated it was possible to obtain an article exhibiting both amber and gold colours to any desired extent. It was shown that accidents had taken place previously in preparing the ruby glass so that occasionally portions remained of an amber colour ; in these cases however the articles were spoilt and no one thought of utilising them. Under these circumstances such spoilt articles accidentally produced and rejected were not anticipations of commercial products of great beauty, prepared according to the reasoned application of the process of reheating in parts.

For another example we may turn to the litigation involving the Flour Oxidising Processes. It had long been known that flour was bleached naturally on prolonged storage with exposure to air, but Andrews showed that rapid and satisfactory results could be attained artificially by subjecting the flour to the action of air containing small quantities of nitrogen peroxide.

It was argued that this process was anticipated by a previous patent which had unsuccessfully proposed to bleach flour artificially by subjecting it to the action of an electric discharge. Now it is well known that nitrogen peroxide can be produced from air by sparking.

This contention however was unsuccessful because nitrogen peroxide is only produced to any appreciable extent by a spark discharge in contra-distinction to a brush or a silent discharge, both of which produce ozone. The previous patentee did not state that a spark discharge rather than a brush discharge was to be employed and therefore he did not give information leading to the essential condition for practical success, namely, that bleaching must be effected by nitrogen peroxide instead of ozone.

Unless therefore the previous patentee could prove that he actually had used his apparatus so as to give a spark discharge rather than a brush discharge, he had not anticipated Andrews. He was unable to bring such evidence and therefore Andrews' patent for bleaching by the use of nitrogen peroxide was held to be not anticipated by a previous apparatus which *might* have been used so as to achieve this object.

How are we to determine whether an improvement which differs qualitatively from what has gone before, differs sufficiently to justify us in terming it an invention? Seeing that invention involves a certain discontinuity, in many chemical cases we can arrive at some estimate as to whether such discontinuity exists, by examining whether it would have been possible to predict the improvement or its result beforehand, without making experiments.

In many chemical cases prediction and want of invention are synonymous terms but there are other cases to which this does not seem to apply at all. In mechanical cases it seems usually quite inapplicable. Moreover everything depends upon the exact use we make of the term prediction.

A chemical industrial process obeys certain laws and it will not usually be an invention to modify or improve a process by the *mere* application of well-known chemical laws. For this purpose, we will take a number of these laws, giving a parallel series of examples of unpatentable, and of patentable inventions.

(1) One of the simplest examples is the *additive law* according to which the properties of a mixture of $A+B$ can be predicted from a knowledge of the properties of the separate constituents A and B. Some time ago it occurred to me that in view of the difference in price, it might be worth while to make crucibles of a mixture of platinum and gold, thus obtaining a metal which would be cheaper than platinum but yet stronger than gold. Now assuming that it is known to manufacture alloys of platinum and gold, it may be said that there is no invention in making crucibles of such an alloy since the properties of such crucibles would at once be predicted from the additive law.

We might generalise this statement by saying that in cases where the *law of continuity* applies, there is generally no invention in interpolating between known limits or extrapolating beyond known limits, even though no one had previously done precisely the same thing before, provided that no unexpected result is produced.

(2) Again in many cases there is no invention in simply applying the *law of mass action* to a chemical reaction. Suppose that a manufacturer is preparing the ester of an expensive organic acid with a certain alcohol. If the price of the alcohol suddenly rises there will be no invention in applying the law of mass action by using an excess of acid so as to reduce the loss of alcohol at the expense of the acid which has now become cheaper. This result could have been predicted beforehand and the process is clearly not patentable.

Similar considerations apply in lixiviation where the amount of substance extracted, *e.g.*, sugar from cane, will depend on the price of fuel, and the maximum theoretical efficiency of extraction will not be the most profitable. This, however, is usually a matter of business judgment not of invention.

(3) There are certain laws in connection with *reaction velocity.* It is generally known that the reaction velocity rises rapidly with increase of temperature and therefore no invention is involved in simply performing a reaction at a higher temperature; in normal cases the temperature chosen may be a matter of convenience depending upon the balance between the cost of fuel and the advantages gained by a high reaction velocity. In the absence of complicating factors therefore the application of this law is not invention even though it means that a manufacturer is doing something which may never have been done before.

(4) *Le Chatelier's principle* tells us that if the substances produced by a reaction occupy a smaller volume than the reacting substances themselves, the equilibrium will be shifted by pressure so as to produce more of the reaction-products. In connection with the condensation of isoprene to rubber, it occurred to me some time ago that the reaction would certainly be facilitated by pressure, but it may be taken as quite clear that the *mere* suggestion to raise the pressure is not patentable since the result is capable of prediction offhand. If a definite range of pressure were found by experiment within which a valuable result was obtained, the case would be different.

(5) Finally we have the *periodic law*, though predictions based upon this must be applied with caution. Speaking broadly, however, we may say that in the absence of special results there is no invention in substituting potash for soda or strontium for barium, etc.

I will now give examples in which the above laws are found to exhibit anomalies which would justify the grant of patents thereon.

(1) It is clear that the *additive law* does not hold for certain properties. For example the first person who discovered a useful eutectic might have made a valuable invention, although, at present this phenomenon of depression of the melting point is comprehended under another well known law. In cases where the additive law is not obeyed and an unexpected result is produced, the improvement will probably be an invention. For example, in the leading case of Muntz v. Foster, a patent was upheld for a sheathing for ships' bottoms composed of 60 parts of copper to 40 parts of zinc both in a very pure condition. As a result of this particular selection of proportions, it was found by exhaustive experiments that the metal could be rolled hot and especially that it oxidised just sufficiently to prevent the growth of barnacles and yet not sufficiently to cause rapid deterioration. Of course this result was very valuable, since if pure copper is used corrosion is very rapid whereas if plates of zinc were hung on to protect the copper by reason of selective attack, it was found that the copper became coated over with barnacles. Muntz' alloy just solved the difficulty and seeing that it was necessary not only to select certain proportions but also to employ very pure metals, it was held that his improvement was sufficiently novel and ingenious to support a patent.

(2) If it can be shown that a valuable result is attained which could not be predicted by the *law of mass action* the improvement will be an invention if novel. A good example of this will be found in the case mentioned by Prof. Haber in the Hurter Memorial Lecture. In producing formates from carbon-monoxide and caustic soda, it was discovered that a 10 per cent. solution of caustic soda gave much better results than other solutions, either stronger or more dilute. The reasons for this phenomenon do not appear to be understood even yet and we can therefore say without hesitation that this behaviour could not have been predicted, and that invention is involved.

(3) In connection with *reaction-velocity*, it will usually be an invention to accelerate the velocity by a suitable catalyte, if useful results are obtained thereby, since catalysis is at present outside the bounds of prediction. Hence the whole field of catalysis is a fruitful one for invention. Thus in the recent case of Crosfield v. Techno-Chemical Laboratories it was held that there was invention in applying to a liquid fatty acid, a process of catalytic reduction by hydrogen which had been applied to certain gases by Sabatier and Senderens. Although the action failed on other grounds it is quite clear that it was impossible in 1903, the date of the patent, to predict that catalytic reduction would be operative upon a liquid fat of fatty acid.

(4) Prof. Haber's researches give another interesting example of investigation originally based upon the *principle of Le Chatelier.* It would not involve invention merely to suggest that the equilibrium between nitrogen and hydrogen would be displaced towards the ammonia side by the employment of high pressures, but when we find that it was necessary to devise special apparatus, to correlate the temperatures and pressures, and to seek out appropriate catalytes for the various temperatures of reaction, we may certainly conclude that invention of the highest order is present. The fundamental conditions of success could not have been predicted from the mere application of the principle of Le Chatelier and the laws of reaction-velocity.

(5) The *periodic law* naturally presents many cases of deviations from strict regularity. More especially is this the case with the first members of the various groups such as lithium, whose chloride exhibits anomalous properties, or fluorine, whose silver salt is readily soluble in contra-distinction to the other halogen salts of silver. This behaviour therefore narrows the field in which prediction is possible; we may compare it with the behaviour of the first member of a homologous series. We know that of the fatty acids, formic acid exhibits properties which in many respects are different from those of the remaining members of the series and that therefore in many cases formic acid would not be a legal equivalent for acetic acid. On the other hand if a process is successful with propionic acid, we might reasonably expect it to be equally successful with butyric acid.

In the case of the Badische Anilin und Soda Fabrik v. Levinstein, although it had previously been proposed to couple diazonaphthalene hydrochloride with *phenol*, it was decided that invention was required to produce a dye-stuff by coupling diazonaphthalene hydrochloride with *naphthol* and sulphonating.

The diazo reaction had been discovered by Griess, "But," as Lord Justice Fry stated, "the value of any particular combination of these derivatives from the hydrocarbons was not within the range of the prophetic power of science." In the House of Lords, Lord Herschell stated "It is suggested that even though the particular substance was unknown, similar bodies arrived at by similar processes were well known, and that chemical analogy would at once indicate the supposed invention. A complete answer is given to this argument by Dr. Griess, one of the highest authorities on this branch of chemistry. He says, 'In 1864, I distinctly state that, by the combination of diazobenzol and phenol, dye was obtained, and if I had been a little cleverer, analogy would have induced me to prepare this very dye which is now under consideration. But analogy did not lead me to do that; analogy does not go a long way in chemistry.'"

This principle has recently been applied in the case of Osram Lamp Works Ltd., v. Z. Electric Lamp Manufacturing Co. It had previously been proposed to make filaments for electric lamps of the metal osmium. The patentees claimed the manufacture of filaments of the metal tungsten, which was cheaper and more effective. Except for the fact that the patentees selected one suitable process of decarbonising out of three known processes, their invention as stated in their specification, simply consisted in transferring to the metal tungsten, a process which had previously been proposed for the apparently analogous metal osmium.

Further examples might be given from the problems of stereoisomerism and the phenomena governed by the phase rule in which cases there are brilliant possibilities of prediction; however, I will simply give two final examples drawn from the Flour Oxidising Cases, the reports of which are a storehouse of felicitous illustrations in this field.

In one case it was held that invention was undoubtedly required to bleach flour by nitrogen peroxide when a previous unsuccessful process had employed ozone. It was justly said that if the innocuous ozone produced a taint in the flour, no one could have predicted that the strong smelling gas nitrogen peroxide would have successfully solved the problem. Lord Justice Farwell remarked that the inventor of the ozone process had left his wrecked barque as a warning to subsequent navigators of that channel. His process had failed and it could not have been foretold that the nitrogen peroxide process would succeed.

Against that it is instructive to consider a subsequent process which bleached flour by the action of the gases produced by subjecting air to the passage of a flaming arc. This patent was declared void as requiring no invention. It was known that the passage of a flaming arc in air produced nitrogen peroxide; Andrews had shown that nitrogen peroxide would successfully bleach flour; therefore although there was no evidence that anyone had actually used or proposed to use the gases from a flaming arc for the purpose of bleaching flour, yet nevertheless this application was obvious and practically speaking it could have been predicted. A few lines of the judgment in this case are worth quoting, since they show the prediction of which I have spoken above does not refer to absolute or mathematical certainty, but to reasonable certainty—the kind of certainty upon which we act in everyday life. Lord Parker said:—

"Under these circumstances, I think that any ordinary man with a working knowledge of chemistry would have inferred that the medium disclosed in Andrews' specification could be produced electrically. If he were a cautious man he might probably have thought it well to test by experiment the truth of his inference, not because he would doubt its truth but because the gaseous medium produced by the electric discharge might possibly contain some unexpected constituent which might spoil so sensitive a substance as flour. There would be no reason to think that there could be any such unexpected constituent, but a chemist, aware as he would be of the extent of the unknown compared with the known in chemistry, would naturally desire to make himself secure."

I am not suggesting that the possibility of prediction or otherwise is a unique factor in determining the presence of invention. Indeed invention is a function of a number of variables of which only one has here been considered. Prediction is certainly an important one; its bearing upon invention may be compared to that of Berthelot's principle of maximum heat development upon the occurrence of chemical reactions. We know now that in most cases, as an approximation, reactions take place in the direction indicated by thermo-chemical data, but we also know that these are only particular cases of a more fundamental law, that of the free energy gradient.

It would be easy to give examples demonstrating this statement. One important case is that of combination processes and especially cyclic processes; for instance a German patent was granted for a process of splitting up ammonium chloride by treating it with syrupy phosphoric acid, heating to expel the hydrochloric acid, and heating still further to expel the ammonia which was collected separately, thus leaving behind the syrupy phosphoric acid ready for a fresh cycle. Although this process does not work well on a large scale, no one can deny its ingenuity, yet it seems probable that it could have been predicted from scientific data a priori. Its merit appears essentially synthetic.

It is also necessary to add that in speaking of prediction the term is meaningless unless we consider the subjective lement, namely the person by whom the prediction could or could not be made. For the purposes of Patent Law his person is always the average operator who is skilled n the particular industry in question; in chemical industries this pre-supposes some knowledge of chemistry but not the very highest chemical attainments.

In order to allow for this subjective element the decision s to invention must always in the end rest to a certain xtent upon the experience, instinct and judgment of the erson who is making the decision. It is impossible to ormulate the decision in terms of hard and fast principles ust as it is impossible for us to give a set of differential quations to express a symphony or to decompose a unset into permutations of radiation frequencies. In all these cases there is a personal element involved and this must never be forgotten in considering the questions of Patent Law.

In practice the system does not work out so badly. I have prepared a table of the cases in which the validity of a patent was brought into question in English Courts during the five years 1908-1912. The results show that out of 74 cases, the patent was declared to be valid in 53 per cent. of the actions. Taking the chemical patents alone they were considered to be valid in 65 per cent. of the actions.

In about three-quarters of these cases the patentees were able to prove that infringement of their patent had actually occurred in spite of ingenious attempts to argue that the defendants were really doing something quite different. The actual figures are that the patent was proved valid and it was also proved to have been infringed by the defendants in 39 per cent. of all the cases and in 47 per cent. of the chemical cases.

This shows, therefore, that in about half the chemical cases the patentees were entirely successful in proving invasion of their rights.

Discussion.

Mr. W. P. Thompson agreed with Mr. Potts that for a patent generally to be valid, the result achieved must be something more than would naturally be predicted from the elements of the invention by a man in the trade without inventive faculty, but the amount of advantage over that which would naturally be predicted may be very small. They had had two cases in this district, first, that of Cannington v. Nuttall over a glass furnace. Every one of the parts of that furnace had been used before for the same purpose in the same way in glass furnaces, but the result of the combination produced so much better effect than was anticipated that the House of Lords decided the patent to be valid. Again in the case of Patent Exploitation Ltd. v. Siemens (the Burnley battery) it was decided in the lower court that every part of the invention was old, and the combination therefore no subject for a patent. In the Court of Appeal and the House of Lords it was unanimously accepted as a good patent, though it was admitted that every single part of the battery had been patented before for the same purpose. Lord Davy, who gave the decision in the House of Lords, stated that as the combination drove every other dry battery out of the market as soon as it came out, they were obliged to consider that there was some patentable novelty in the combination. Again, especially in mechanical patents, the very prediction is often the novelty. Take for instance the patent for making wood screws with a point. Hitherto screws had been made with blunt ends. By pointing the screw the screw-driver itself could work the screw into soft wood at any rate. Anyone could have invented this, but did not, but making the prediction and carrying it out was itself the invention, and the patent was sustained. If an invention were proved to be a distinct advance it made little matter whether it was a sudden departure or a gradual development.

London Section.

Meeting held at Burlington House on Monday, April 6th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

BY-PRODUCTS FROM PEAT.

BY DR. F. MOLLWO PERKIN.

With the attention of everyone turned to-day to the production of new fuels and the recovery of by-products from coal and other sources for the use of internal combustion engines or oil-fed boilers, peat as a raw product is naturally being considered.

In Great Britain there are upwards of 6,000,000 acres of peat bog with an average depth of 12 feet. In Ireland there are about 3,000,000 acres of peat bog, some of the bogs being very deep. Peat as dug contains very large quantities of water, generally speaking from 80 to 90 per cent. In this condition, of course, it is of very little use, therefore it has to be, at any rate, partially dried. For the recovery of by-products it is usual to dry it down as far as 20 per cent. of moisture—that is if peat coke is to be one of the by-products. Probably each acre would yield from 3,000 to 3,500 tons of such dried peat. Taking the lower figure we arrive at the huge total of 1,800,000,000 tons of peat available in the United Kingdom, and in Ireland, where the average depth is greater, probably nearly as much again.

The great problem in dealing with peat, and the rock on which most of the older enterprises have split, is the removal of the moisture. If wet peat is subjected to hydraulic pressure it is only possible to remove a comparatively small proportion of the water, owing to it being bound up in the cellular structure of the peat. A similar difficulty applies to drying by heat.

Various methods have been used for breaking down the cellular structure of peat and thus obtaining it in a condition in which the moisture can be expelled, either by pressure or by air drying. Obviously, seeing what an enormous percentage of water is contained in peat, drying by artificial heat alone is out of the question. Generally speaking air drying has been found the most satisfactory, but it is a slow process, and is dependent, to a large extent, on atmospheric conditions. The methods most commonly employed on a large scale are :—

1. The peat is cut out of the bog by hand or machinery and then air-dried by stacking without undergoing any mechanical treatment.
2. The peat, after being cut out from the bog, is subjected to a macerating process in specially constructed machines.

The methods may be classed under two headings :—

(a) Macerating and adding extra water so as to form a peat slime which can be run into moulds.
(b) Macerating without the addition of water, then moulding.

By any or all of these processes, however, the difficulty of drying still remains. After maceration the water evaporates very much more freely, but it takes a considerable time for the briquetted peat to lose its moisture down to 20 per cent. Another difficulty is that when the briquettes are dried too rapidly they warp and crack.

In Ireland, Scotland, and other places peat is employed as a fuel. In such cases, however, it is simply cut into brick-shaped pieces and stacked in such a manner that a large surface is exposed to the air, and it is generally left several months before it is employed as a fuel. Peat prepared in this manner is not suitable for the production of hard coke and by-products, since it is of a more or less porous and spongy nature and occupies too much space.

Peat for the recovery of by-products, therefore, must be treated in such a manner that the cellular structure is broken so that when pressed or moulded it will form a hard briquette.

As already mentioned this may be done by means of macerating machinery. A very large number of these have been patented and several of them give very satisfactory results.

Thoroughly pulped peat, when moulded, forms a compact mass with practically no hollow spaces. Such peat, on exposure to the air, dries comparatively rapidly, the drying taking place throughout the mass. After the outside layer has dried it may be exposed to damp weather without further moisture being taken up, because the outside dried part swells up, the pores close, and moisture is prevented from entering the interior. In dry weather the pores open out again and the drying continues.

The machines for pulping or macerating the peat consist generally of a vertical cylinder or horizontal half cylinder in which knives placed in the form of a screw thread rotate. The raw peat is fed in at one end, and by means of the rotating knives is thoroughly mixed and pulped and carried forward to the other end of the cylinder, where it is extruded in the form of a porridge-like mass. Sometimes it passes directly forward by means of a band into a briquetting machine. The briquettes are then placed on wooden frames which are piled one above the other in open sheds where they are air-dried.

It is not intended here to go into the merits of the different machines which have been patented and employed for macerating the peat. The cellular structure can, however, be broken down and the water then pressed out hydraulically by other means than maceration.

Even if peat is only intended for fuel, machine-made briquettes, that is briquettes made from macerated peat, are far more efficient than when the peat is simply cut and dried. The calorific value is higher and the briquettes burn away more slowly. In Holland and in Norway and Sweden machine made briquettes are largely used for domestic heating purposes.

Other methods have been tried for breaking the cellular structure and thus obtaining the peat in a condition in which it will dry more readily. Electricity has been used to break down the cells. A plant of considerable size was put down at Kilberry, in Ireland, but unfortunately was not successful. The peat was scooped out of the bog and placed in a rotary hydro-eliminator which removed the surface water. It was then passed through a press and subjected to an alternating electric current. This, it was claimed, broke up the cells and allowed the water to run out. A number of other electrical processes have been suggested.

A recent patent in which it is claimed to render the natural water expressible, is to pass an electric current through peat heated to a temperature of at least 100° C., under a pressure sufficient to prevent the formation of steam. The current may be either direct or alternating, although the direct current is preferred. A pressure of 200 volts is stated to be the most economical. Personally I do not think that the difficult problem of eliminating water will be solved by the use of electrical processes.

Other methods are the addition of bleaching powder or lime to the peat, thoroughly mixing and heating to a temperature of 30° to 40° C. The objection of these processes is the large amount of handling they entail, and, it must be remembered, for a peat proposition to be a paying concern very large quantities must be worked up. The addition of lime or bleaching powder will also increase the ash content.

Ekenberg found, by heating peat to 150° or thereabout, under pressure, that the cells were broken and that the water could be readily removed.[*]

In a recent French patent it is claimed that if raw peat is simply heated to 60°—100° and allowed to cool the moisture can be removed by pressure. In other processes the peat is heated by live steam under a pressure of several atmospheres. The pressure is then suddenly released and the peat dropped into the receptacle of a specially constructed hydraulic press. On the application of pressure the water contents are reduced to about 28 to 30 per cent. in the course of a few minutes. This particular process only occupies about 30 minutes, that is to say, peat, direct from the bog containing 80 to 90 per cent. of moisture, can be reduced down to 30 per cent. in this time. In all these methods, however, the great bulk of the wet peat to be dealt with has to be taken into consideration.

Bacterial processes have also been suggested. In one it is claimed that the bacteria produce hydrogen peroxide which oxidises the peat and converts it into a condition in which the water is readily eliminated.

Carbonisation of peat.

The oldest method of coking peat, and which is still to certain extent employed, is to coke it in heaps in th same manner as the old charcoal burning process, all th by-products being thus lost. The only satisfactor method, and the only one likely to be a commercial success is to coke in some form of oven and recover the by-pro ducts. If, however, a firm dense coke which will be value in the metallurgical industry is to be obtained, it necessary to produce briquettes formed from well macerate and dried peat before coking. If there is much moisture then the coke formed will be too porous and friable. An alternative method is to coke moderately dried peat, which need not be briquetted, and to briquette the resulting coke in a manner somewhat similar to that employed in the patent fuel industry.

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[*] See this Journal, 1903, 1122, 1238.

When peat is coked various by-products are obtained, the quantities and proportions of which depend upon the quality of the peat and the method of coking employed. A peat containing much mineral matter will give a coke which will not be of much value for metallurgical purposes, but this will not to any extent affect the by-products. Peat which contains a high percentage of nitrogen will give a high yield of ammonia, but it will be necessary to carbonise at a moderately high temperature in order to obtain the maximum yield of ammonia. On the other hand the character of the oils will be altered. Generally speaking low temperature carbonisation seems to yield the most valuable oils, but there is no reason why the oils should not be driven off at a low temperature, and then, either by moving the partly carbonised peat to a hotter zone in the retort or by increasing the temperature of the whole retort, the maximum yield of ammonia should not also be obtained. The first would be a continuous process and the second an intermittent one.

On carbonisation of peat the following products are obtained :—Gas, oils containing paraffin wax, phenols, ammonia and small quantities of other bases, methyl alcohol and acetone, acetic acid, pitch, and coke.

From the distillation of 576 tons of air-dried briquetted peat containing 31 per cent. of moisture at Oldenberg in Germany the following products were obtained per one ton of peat. In order to make a comparision I give the results obtained in my laboratory from a Scotch briquetted peat containing about 16 per cent. of moisture.

	Oldenberg.	Perkin.
Oils	54·0 lb.	50·0 lb.
Paraffin wax	6·0 ,,	not determined.
Phenols	26·0 ,,	28·0 lb.
Methyl alcohol	6·8 ,,	5·1 ,,
Ammonium sulphate	6·2 ,,	30·2 ,,
Calcium acetate	10·0 ,,	8·0 ,,
Pitch	4·0 ,,	3·5 ,,

The Oldenberg peat contained 0·7 per cent. of nitrogen, and the Scotch peat 2·1 per cent. which accounts for the difference in the yield of sulphate of ammonia. Other differences are readily accounted for when it is borne in mind that my results were obtained from the distillation of 5 kilograms of peat at a time, whereas the German results were from 576 tons in quantities of several tons at a time.

The gas, having a good calorific value, can be burned under the retorts, and should be sufficient to supply all the heat required when once the process has started. This is shown by the analyses of gases produced :—

	Oldenberg.	Perkin.
Carbon monoxide	8·6	11·4
Methane	14·8	11·5
Unsaturated hydrocarbons	1·0	3·4
Hydrogen	23·6	19·0
Carbon dioxide	27·4	31·4
Nitrogen	22·5	19·9
Oxygen	2·2	0·4

The yield of gas is between 5000 and 6000 cubic feet per ton of peat carbonised.

The calorific value of the Scotch peat briquettes containing 16 per cent. of moisture was 8558 B.T.U., that of the coke produced 13,680 B.T.U.

The tar from which the oils are obtained by distillation, is generally considerably contaminated with finely divided carbon which, on distillation, causes further carbonisation. A rather brittle pitch is thus obtained if the whole of the oils are distilled off. If, however, live steam is injected towards the end of the distillation a much better pitch is obtained, which can be used for insulating purposes.

The oils obtained in my laboratory consist mainly of saturated hydrocarbons. They have a peculiar burnt peaty odour. This smell, however, can be removed by treatment with about 1 per cent. of strong sulphuric acid. The lighter oils could be used for internal combustion engines. The heavier oils lack viscosity, so are not of much use for lubricating purposes, but they could be used as oil fuel or might be cracked into light spirit and then employed for automobiles. The phenols, which are obtained in rather large quantities, contain, amongst other products, guaiacol. They have already been employed for making disinfectant bodies and appear to form very good antiseptics.

The Peat, Coke and Oil Syndicate, of Doncaster, carbonise peat containing from 50 to 60 per cent. of moisture. The peat is not briquetted previous to being carbonised, the briquetting operation being carried out with the peat coke obtained in the process. This is mixed with certain binding materials, some of which are obtained from the peat by-products. The briquettes are then pressed and coked again in the usual manner. From four lots of one ton each carbonised, the following by-products were obtained :—

Water-free crude oils	8·8	gallons
Ammonium sulphate	21·2	lb.
Spirit (petrol)	3·9	gallons
Spirit 160°—200°	3·5	,,

Apparently the methyl alcohol and phenols had not been worked up. The paraffin was left in the pitch, which makes a good insulating material. The briquettes produced by this process are very hard and have been well reported upon for steel smelting, the average crushing pressure being 812 lb. per square inch. It is now proposed to erect a plant capable of dealing with 100 tons of coke per week. Preliminary tests have shown that the by-products alone more than cover the whole costs of the process and that the sale of the coke is all profit.

Peat for power purposes.

Another method of working up peat and producing by-products is to employ it for the manufacture of power gas. In this respect some very interesting experiments have been made in Canada by the Department of Mines.

In a modified Körting peat gas producer the best results seem to have been obtained when the peat contained from 25 to 30 per cent. of moisture. With larger quantities of moisture there is great difficulty in eliminating the tar from the gas. It is stated, however, that peat gas power plant has a distinct advantage over one using bituminous coal. With coal the accumulation of tar in the valves and cylinder is difficult to remove, and necessitates the shutting down of the engine. Whereas tar from peat is readily removed by injecting into the open end of the cylinder a mixture of oil, soap and water. This completely dissolves the tar which is thrown out by the forward movement of the cylinder.

The Power Gas Corporation have also a special producer in which peat is employed. In this producer peat containing 50 per cent. of moisture can be satisfactorily employed. The Company have a special mechanical process for drying peat from 80 per cent. to 50 per cent. of moisture which renders them independent of weather conditions. It is claimed that by this process the total cost of the peat is only 3s. per ton including excavating, manufacturing, and drying. In all producer processes the peat is completely burnt up, and there is thus no carbon as a by-product. Larger quantities of ammonium sulphate are, however, obtained than by distillation in retorts. On the other hand the tar obtained is less valuable. Given a peat containing a fair proportion of nitrogen, it is claimed that the yield of ammonium sulphate is more than sufficient to pay all working and depreciation costs, so that the power gas is obtained free of cost.

New York Section.

Meeting held at Chemists' Building on Friday, March 27th, 1914.

MR. G. W. THOMPSON IN THE CHAIR.

RECENT IMPROVEMENTS IN GAS MANUFACTURE.

BY ALFRED E. FORSTALL.

In the following paper I have limited myself to the manufacture of illuminating gas in central station plants. The process divides itself into two stages, the generation of crude gas from the raw materials, and the purification of this crude gas in order to make it fit for general use.

Taking first the generation of coal gas, an important recent improvement has been the development and quite general installation of retorts set vertically, which were tried unsuccessfully in the early years of the nineteenth century. Retorts set horizontally were, however, finally adopted and used solely, until, in 1885, M. André Coze developed a setting in which the retorts were inclined at an angle of from 29° to 33° to the horizontal. At such angles the coal would spread fairly evenly over the whole length of the retort by gravitation and the coke would run out fairly easily when the charges were thoroughly carbonized. Though adopted quite generally on the Continent of Europe and in Great Britain, only three important installations of inclined retorts, and not more than five or six minor ones, were made in the United States.

In the year 1902 two different types of vertical retort settings, the intermittent and the continuous, were brought to the notice of gas men. The intermittent type, in wheh an amount of coal which nearly or entirely fills the retort is dropped in at one time and allowed to remain until completely carbonized, when the resulting coke is dropped out, also at one operation, was developed by Dr. J. Bueb, of the Deutsche Continental Gas-Ges., in the gas works at Dessau, Germany. The first patent taken out for these retorts, in the early part of 1902, described them as provided with outlets, spaced from top to bottom along the whole length of the retort and opening into a verticle flue so placed in the setting as not to be exposed to a high heat, the object being to permit the gas as it was drievn out of the coal to escape to the hydraulic main without being subjected to contact with either the highly heated coke or the walls of the retort. Settings built under this patent were put into operation in 1903, but the side outlets were abandoned soon after actual work began, and by 1905 the design had been developed to that which is now being employed, in which the gas evolved from each portion of the charge travels through all the superincumbent portions before it escapes to the hydraulic main.

As the Dessau verticals have been developed in Europe, the retorts are made either four metres or five metres (13 ft. 2 in. or 16 ft. 5 in.) long with cross-sectional dimensions of approximately 9 in. by 22in. at the top and 14 in. by 27 in. at the bottom, and are set in groups of either twelve or eighteen, each group being heated by its own gas producer, or generator furnace, and provided with its own recuperators. In the only installation of this type in the United States, which is at Providence, R.I., the retorts are 13 ft. 2 in. long with the same cross-section as given above, and are set ten in a bench. The coal is charged into the retorts from over-head bunkers and the coke is dropped into buggies or into a conveyor.

The combustion of the producer gas takes place in a combustion chamber surrounding the lower ends of the retorts, and the hot products of combustion pass horizontally to the back of the setting and then up to a second set of horizontal flues running to the front, up again to a third set of horizontal flues running to the back, and then into a fourth set of flues running to the front, and pass out from the top of the bench to the recuperators and thence to the chimney.

In the United States the United Gas Improvement Company began experimenting with intermittently filled vertical retorts about 1908. As a result of these experiments the benches of this type last built contain nine retorts each 18 ft. 6 in. long with an oval section 12 in. by 22 in. at the top and 18 in. by 30 in. at the bottom. The reasons given for the use of the larger cross section are that when the coal was smaller it coked too rapidly at the top of the retort causing excessive pressure at the bottom, that with the small retort the discharge of the coke did not take place satisfactorily except when the whole charge of coal was thoroughly carbonised, while a large retort will discharge readily even when the coal has not been thoroughly carbonized, and that the larger retorts produce larger coke, an advantage in many localities.

In this type of setting the combustion of the producer gas also takes place around the lower ends of the retorts and the products of combustion pass upwards to the top of the setting.

The German practice is to fill the retorts completely with coal, while the United Gas Improvement Company leave 4 ft. of the retort at the top empty, to provide a space in which the heavy hydrocarbon vapours may be converted into gas by the action of radiant heat.

It is interesting to note that Mr. C. F. Dietrich obtained in 1880 a United States patent making claims for a setting of retorts which were very similar to those of the original Bueb patent, including even the lateral openings into a channel protected from heat through which the gas could pass out from the retort. At that time, however, conditions in this country were favourable to the manufacture of carburetted water gas and the field for coal gas did not seem to warrant the trouble of developing a new method of manufacture, so apart from building one experimental bench nothing was done by Mr. Dietrich to develop these retorts.

The reason for the provision of side outlets in the retorts under the original Bueb patent was the belief that, if compelled to pass up through the incandescent charge, the hydrocarbons first evolved from the coal would be over-decomposed into hydrocarbons of lesser value from the illuminating and calorific value standpoint, and that carbon and naphthalene would be formed and cause trouble during the handling of the gas as it passed from the generating apparatus to the consumer. The disadvantage of the side outlets was that the retort could not be heated around its entire perimeter and that therefore more fuel was required for the carbonization of a given weight of coal than where the heat could be applied around the entire perimeter. When the lateral outlets were bricked up and the gas taken off from the top of the retort, the decomposition of the hydrocarbons was not as great as had been anticipated provided the retorts were heated to a very high temperature and care taken to fill them completely with coal. It was claimed that under these conditions the generation of gas from the portions of the coal in contact with the internal surfaces of the retorts was rapid, owing to the high heat, and this coal was at once converted into a compact coke, impermeable to the gas generated. The gas was therefore forced to pass, from all points of the layer in which carbonization was taking place, inwards and upwards through the uncoked and more permeable portions of the charge. Its temperature was thus prevented from rising beyond the point at which over-decomposition of the heavy hydrocarbons, with the formation of carbon and naphthalene, would take place.

This theory as to the course followed by the gas in passing through the charge in an intermittently charged vertical retort was for a long time accepted as correct, but recently Dr. H. G. Colman in England and Mr. O. B. Evans in the United States have reached the conclusion, as the result of experiments, that in reality only part of the gas travels through the core of uncarbonized coal and the rest passes through the incandescent coke.

Dr. Colman argues that if even the largest portion of it travelled through the uncarbonized coal the gas would show some of the characteristics of a gas produced at a low temperature, modified to a certain extent by the gas produced in the latter stages as the temperature of the coke is raised, and that the tar produced would be a low temperature tar containing but a small amount of aromatic substances. As a matter of fact his analyses had shown that the gas possessed all the characteristics arising from exposure to high temperatures, the proportion of hydrogen to methane being even higher than that obtained from the same coal when distilled in highly heated, horizontal retorts, and that the tar produced, although containing more paraffin derivatives than did tar from horizontal retorts, consisted chiefly of aromatic substances, showing that, during its formation, the vapours produced at low temperatures must have been subjected to a considerably higher temperature before passing out from the retort. This could not happen if even the larger part of these vapours passed through the uncarbonized coal, since then the travel would be in a direction which would expose them to a constantly decreasing, instead of to a higher, temperature. Moreover the existence of a high pressure in the retort at the commencement of carbonization when the area of the core was the greatest, and the diminishing of this pressure as carbonization proceeded, although the rate at which gas was produced did not decrease greatly during the first seven hours of the charge, while the area of the core did decrease quite rapidly, was strong evidence that the gas did not find its principal direction of travel through the core. He concludes that the great bulk of the gas is produced on the outer side of the pasty layer formed by the coal as it carbonizes and that this gas mainly travels through the hot coke, mixing with the poorer gas produced by the continued action of heat on the low temperature coke first produced. The gas produced on the inner side of the pasty layer will pass through the coal, and he considers it probable that the vapours which pass in this direction form the undesirable paraffin constituents of the tar, so that as far as travel through the core does take place it is disadvantageous.

Mr. Evans, reasoning from the pressure conditions existing in the interior of an intermittently charged vertical retort, came to the conclusion that during the early part of the charge, when the layer of coke formed around the perimeter of the retort was compact and offered no ready means of passage to the gas, most of the gas produced was obliged to force its way through the pasty layer of coal, in the initial stage of carbonization, and pass up through the uncarbonized coal, but that as the outer layer of coke contracted and cracked under further heating most of the gas formed in the latter portions of the charge passed up through this coke. He reached the conclusions that of the gas made during the first six hours of the charge, which amounted to 70 per cent. of the total amount of gas made, 45 per cent. passed up inside of the pasty layer through the core and 55 per cent. through the hot coke next to the retort walls, and that the gas evolved at low temperatures escapes through the core while that evolved at high temperatures escapes along the wall. Mr. Evans considers that this is advantageous since the low temperature gas is more subject to injury by over exposure to heat, and this is correct provided that after leaving the coal this gas is exposed to heat in a free space at the top of the retort.

This discussion as to the path followed by the gas in passing out from intermittently charged vertical retorts has been given somewhat at length, because of the claims originally made that the freedom from naphthalene experienced with gas made in such retorts was largely due to the fact that the travel was through the cool core of uncarbonized coal.

While the work of the Germans in connection with vertical retorts was confined entirely to those charged intermittently, in England the design of such settings was approached with the idea of adapting them to continuous carbonization. This had been experimented with in connection with the horizontal retorts and had given good results as far as the quantity and quality of the gas were concerned, but had always proved a failure from the manufacturing standpoint because of mechanical troubles.

In 1902 there was built in Exeter a setting of vertical retorts into which the coal was charged at regular intervals, the length of which could be varied, in amounts varying from 2 lb. to 7 lb. The retorts, about 9 ft. long, were made straight for part of the distance and then were curved so that the coke was withdrawn through an opening in the side of the setting at right angles to that in the top through which the coal was charged. The coke was drawn intermittently in comparatively large amounts at one time so that the extent to which the retort was filled with coke and coal undergoing carbonization varied quite considerably. After being tried in several places in England further use of the settings was abandoned because of trouble experienced with the working of the coal feeding device and in keeping the curved portion of the retort from cracking, and also with the formation of lampblack owing to the large variation in the volume of the charge, because of the intermittent drawing of the coke, and the consequent variation in the extent to which the gas passing off from the charge was exposed to heat in the vacant space left at the top of the retort.

While this retort was being experimented with, Messrs. Woodall and Duckham were developing at Bournemouth, England, another type of continuously charged and operated vertical retorts. Starting with a mechanical coal feed as well as mechanical and continuous extraction of the coke, the former was soon abandoned because of operating difficulties, and the introduction of coal into the retort is now brought about entirely as a result of the extraction of coke at the bottom. The construction of the coke extractors has also been very materially changed from the form shown in the original patent and the first plant erected.

As now built each retort is surmounted by a charging magazine filled through a rotary valve from an overhead coal bunker and holding enough coal for two hours' supply. There is free communication between the magazine and the top of the retort, the coal in the former being supported by that in the retort. As the coke extractor withdraws the coke from the bottom the whole column of material in the retort settles and coal runs in at the top from the magazine, the supply of coal in which is replenished at intervals of from twenty minutes to an hour.

The coke extracting device consists of a rotating horizontal shaft provided with arms placed spirally around it and of loose arms hung on hinges at their upper end and having sufficient weight to hold back the coke except as their lower ends are pushed out by the action of the revolving shaft. The coke is discharged into a closed hopper which will hold the amount produced during two hours and is intermittently emptied either into dumping wagons running on an industrial railway track, or into a conveyor. The extractor can be run at varying rates of speed to suit the differing amounts of coal that can be carbonized under varying conditions.

As originally built the settings consisted of four oval retorts 25 ft. long and having cross-sectional dimensions of practically 9 in. by 23 in. at the top and 20 in. by 29 in. at the bottom. In recent installations the retorts have been replaced by rectangular ovens, or slots, of the same length and having cross-sectional dimensions of 8 in. by 3 ft. 10 in. at the top and 20 in. by 5 ft. 3 in. at the bottom. At the top of these slots there is a division plate, extending down an adjustable distance, which forms two separate spaces, into one of which the coal magazine opens while the other is kept free from coal so that the gas can pass out through it and in passing out be exposed to radiant heat for the purpose of decomposing the hydrocarbon vapours with low boiling points. As the settings are operated it would seem that the desired effect was obtained to only a very limited extent, if at all.

The combustion of the producer gas begins at the top of the setting and the products of combustion pass down, surrounding the retorts and are taken off into the recuperators a short distance above the bottom. From the recuperators they either pass directly to the chimney or in some cases are taken through the tubes of a waste heat boiler which furnishes practically all the steam required for the operation of the plant.

The primary air is heated before entering the furnace by passing across the setting in contact with the side walls of the retorts at their lower end, and the coke is sufficiently cooled in this way to require no quenching.

While Messrs. Woodall and Duckham were developing their design Messrs. Young and Glover were also doing, at St. Helens, England, work which has resulted in what is now known as the Glover-West system of continuous vertical retorts. The chief differences between the Woodall-Duckham and the Glover-West systems are in the form of the coke extractor and in the methods of heating the retorts. In the Glover-West, as in the Woodall-Duckham, coal runs into the retorts from a charging magazine in free communication with the top, as the coke is extracted at the bottom. The coke extractor is in the form of a worm set with its axis vertical and slowly revolved, and delivers coke into a receiving chamber, large enough to hold that produced during a period of two hours and regularly discharged at intervals of any length less than two hours. The retorts are oval in section and have a total length of 20 ft. with cross-sectional dimensions of 10 in. by 30 in. at the top and 22 in. by 36 in. at the bottom. To the bottom of each one is added a cast iron chamber 3 ft. deep, at the bottom of which is placed the coke extractor. The retorts are set in groups of eight and the setting is divided into either two or four chambers so that the retorts can be worked in units of four or two. The combustion of the producer gas takes place at six points evenly spaced along the portion of each chamber extending from the bottom to within about 5 ft. of the top, and the products of combustion, after passing horizontally around each set of retorts, ascend through vertical flues to chambers surrounding the upper 5 ft. of the retorts, from which they pass to the chimney. The secondary air is heated by passing the cast iron chambers at the lower end of the retorts and this cools the hot coke on its way to the coke extractors, and does away with the necessity of quenching it when taken from the coke chambers.

Shortly after, and partly as a consequence of, the successful introduction of intermittently charged vertical retorts the method of operating horizontal retorts was substantially modified. This had been to charge such retorts with a layer of coal about 4 in. to 5 in. thick leaving a large free space above the coal, through which the gas passed to the mouthpiece and standpipe. The maximum charge for each of the 9 ft. retorts with one end permanently closed, in general use in the United States, was from 340 lb. to 350 lb. of coal. The front end of the retort being enclosed in the front wall of the bench for a depth of 13 in., almost a foot of the length was not effective for carbonizing purposes and the weight of charge was not more than 45 lb. and in many cases not over 40 lb. per lineal foot of the effective portion. There had been some theoretical discussion of the advisability of more completely filling the retorts, but this had not produced any result in practice until the completely filled vertical retorts afforded an object lesson of the freedom from carbon and naphthalene troubles secured by reducing the extent to which gas was exposed to contact with the highly heated walls of a retort. In England, where the use of through retorts, or those open at both ends, was common, it was easy to change from the lighter charges to the heavier ones, but in the United States it was necessary to change to the use of through retorts instead of single end ones before the increase in weight of charge could be made, since where the coke must be drawn from the retort by means of a rake it is necessary to leave sufficient space above the charge to permit the free passage of the rake, while with the through retorts, from which the coke can be pushed, provision for the passage of the rake does not have to be made. The present practice, where through retorts are in use, is to charge about 70 lb. of coal per lineal foot of the effective portion of the retort. When so charged from 66 per cent. to 70 per cent. of the area of the retort is occupied by coal, leaving only from 30 per cent. to 34 per cent. of the area for the passage of the gas, while when weighing 40 lb. to 45 lb. per lineal foot of retort the charge only occupies from 30 per cent. to 36 per cent. of the area. The expansion of the charge during the coking process makes the actual free space left in the retort still smaller in proportion for the heavy charges.

The use of heavier charges resulted in a large increase in the amount of gas made per pound of coal with a decrease in the operating difficulties caused by the presence of free carbon in the gas and in the tar. In England the yield of gas, which formerly averaged only about 10,500 cu. ft. per ton of 2,240 lb. of coal now averages nearly 12,000 cu. ft., while in one plant in the United States, that at Worcester, Mass., the former average yield of 5 cu. ft. per pound has been increased to 5·9 cu. ft. In other works in the United States which have adopted the heavy charges the yields of gas have been increased about 10 per cent. as compared with those formerly obtained. This increase in yield has not been accompanied by a decrease either in the illuminating value or in the calorific value per cubic foot and has therefore resulted in obtaining a greater total illuminating value and calorific value in the gas from a given quantity of coal.

The yield from the continuous vertical retorts is also greater than that formerly obtained from horizontal retorts operated with light charges, but in this country has not been as large as that obtained from the horizontal retorts at Worcester, Mass.

Some analyses have been obtained of the gas made in each of two plants, one having horizontal retorts and the other vertical retorts of the Woodall-Duckham type. The horizontal retorts are operated with moderately heavy charges which, however, do not come up to 70 lb. per lineal foot of retort. These plants are under the same management and the coal used is purchased from the same company and is presumably practically the same, so the analyses show to some extent the difference in the gas due to the difference in method of carbonization.

	Horizontal retorts.	Vertical retorts.
	per cent.	per cent.
Carbon dioxide	1·44	1·49
Benzol	0·67	0·55
Illuminants	3·15	3·98
Oxygen	0·48	0·28
Carbon monoxide	4·75	6·90
Hydrogen	51·36	45·02
Methane	33·60	37·33
Nitrogen	4·55	4·44
	100·00	99·99
Candle-power (Sugg D burner)	13·60	15·57
Calorific value—		
(B.T.U. per cu. ft. by calculation)	610·00	—
(B.T.U. per cu. ft. observed)	—	615·00
Yield per pound of coal	4·85	5·39

The total illuminants run slightly higher, and there is much less hydrogen in proportion to the methane in the gas from the vertical retorts than in that from the horizontal retorts. The illuminating value of the gas from the vertical retorts is also higher while the yield per pound of coal was 10 per cent. higher. During the period over which the analyses of the gas from the horizontal retorts were taken very wet coal was being carbonized and this may have affected the illuminating value and the yield of gas, which were lower during this period than the average for the preceding month, but even the averages for that month were lower than the results obtained from the vertical retorts, which, however, were those made during a test lasting eight days, and in regular working results have not been quite as good.

Comparable analyses of the gas made in the working scale testing plant at the gas works in Birmingham, England, both in intermittent vertical retorts, of the Dessau type, but apparently charged so as to leave a free space above the coal at the top of the retort, and in horizontal retorts, have been given by Dr. W. B. Davidson (see table on p. 401).

Dr. Davidson observes that the gas made in the vertical retorts is deficient in unsaturated hydrocarbons and methane and high in hydrogen, and that a cursory examination of the analyses leads to the conclusion that the hydrocarbon gases are subject to more drastic degradation before leaving the retort in the vertical system than they are in the horizontal system, but that it is not unlikely that the gas suffers both in quality and volume by the escape uncracked of a larger proportion than usual of tar oil vapors.

	Dessau verticals.	Horizontals.
	per cent.	per cent.
CO_2	2·4	2·2
C_nH_m	2·8	3·4
O_2	0·5	0·5
CO	10·3	9·7
CH_4	28·0	31·5
H_2	51·0	47·3
N_2	5·0	5·4
	100·0	100·0
Illuminating value, candles	15·0	18·0
Net calorific B.t.u. per cu. ft.	500·0	525·0

NOTE.—The illuminating values given by Dr. Davidson cannot be compared directly with those given previously since they were obtained from the Metropolitan No. 2 Argand burner and are probably about three candles higher than would have been obtained had the Sugg D Argand been used, as was done in the other case.

Experience with the United Gas Improvement Company verticals operated with a large free space above the coal seems to show that the provision of this free space leads to an improvement in the illuminating and calorific value of the gas, which is obtained at the expense of the extra quantity of tar produced when the retorts are completely filled according to the strict use of the Dessau system.

As far as the quality and quantity of the gas are concerned, intermittent vertical retorts of the Dessau system give poorer results than are obtained in horizontal retorts, while the intermittent verticals of the United Gas Improvement Company type and the continuous verticals do not give any better results along these lines than can be obtained from properly operated horizontal retorts. The improvements effected by the use of vertical retorts consist in a saving of labour in medium size plants in which it is impossbile to work charging and discharging machinery for horizontal retorts to advantage, and in greater freedom from trouble caused by free carbon and naphthalene, while the sulphur compounds other than sulphuretted hydrogen are also produced in smaller amount. In addition there is a saving in the ground space required, although it is necessary to go higher into the air with verticals. To these advantages the continuous vertical retort system adds that of practically complete avoidance of the smoke and steam emitted during the charging and discharging of either horizontal retorts or intermittent vertical ones.

The work recently done in determining the character of the products given off by coal subjected to distillation at different temperatures indicates that the greatest efficiency, from the gas making standpoint, in the carbonization of coal could be obtained by so adjusting the heating of continuous vertical retorts that the temperature of the upper 2 ft. or 3 ft. of the charge should never exceed 1000° to 1100°F., while that of the lower portion of the charge would be carried as high as 1800°F. By this method of heating the rich hydrocarbons would be driven off from the coal without having to come into contact with very highly heated surfaces, while the gas remaining after these hydrocarbons were driven off, which is of such a character as not to suffer to any great extent from such contact, would be entirely expelled from the coal in the lower portion of the retort. In order to decompose the heavy hydrocarbon vapours, which would otherwise condense into tar, in such a manner as to convert them into the maximum amount of permanent gas mixed with hydrocarbon vapours that could be carried by the gas, with the setting free of the minimum amount of carbon, all the gas leaving the top of the charge should then be passed through a free space exposed to heat radiated from walls carried at a temperature adjusted to the rate of travel of the gas, but probably about 1400° to 1500°F. This free space could be maintained either in the upper part of the retort or, if this leads to difficulty in feeding the coal, it might be entirely separate from the retort and possibly common to several retorts.

This method of manufacture would increase the quantity and quality of the gas at the expense of the tar and would not be advantageous unless the value of the gas gained was greater than that of the tar lost. It has never been actually worked but in my opinion is entirely feasible.

The recent improvements in connection with the manufacture of carburetted water gas consist in the devising, and putting into general use, of appliances for measuring the amount of air blown through the fuel bed during the "blow," or heating up period, and the amount of steam passed through the fire during the "run," or gas making period, together with the use of electric pyrometers for indicating the temperatures existing at selected points in the checker brick of the carburetter and superheater of the type of apparatus most commonly employed in the manufacture of this gas. The use of these appliances makes it possible to determine, and operate the apparatus constantly under, the conditions of blast, amount of steam used and temperature to which the oil vapours are subjected which give the best results, and by so doing to decrease the amount of fuel used and increase the efficiency of the conversion of the oil into oil gas, as compared with the former more or less hit-or-miss operation.

Purification.

In the second division of the process of gas manufacture, that of the preparation of the crude gas for delivery to the consumer, the recent improvements have been chiefly in connection with the removal of hydrogen sulphide and the other sulphur compounds present in the crude gas. For many years attempts have been made to use for the removal of hydrogen sulphide from coal gas the ammonia obtained from the gas itself. About 1886 a process for doing this was devised by Claus in Belfast, Ireland. Although chemically correct it proved too complicated mechanically and was finally abandoned largely because it was impossible to keep in working order the numerous pumps required for its operation. It is possible that if modern centrifugal pumps had been available the process might have been successfully operated.

In the United States an extremely simple method of purification of gas from sulphuretted hydrogen by means of ammonia has been recently devised by Mr. Jas. G. O'Neill and used on gas produced in coke ovens and sold for for illuminating purposes.

The ammonia in ordinary ammoniacal liquor is already largely saturated with sulphur and carbon dioxide, and one of the chief problems in connection with the use of this liquor for more complete removal of sulphuretted hydrogen is to accomplish its conversion into a condition suitable for combination with sulphuretted hydrogen without introducing too much complication of apparatus. Mr. O'Neill has solved this problem in a very simple manner by using liquor withdrawn from the still of the Coffey type, which is in general use in gas works for the concentration of ammoniacal liquor. He finds that when the liquor fed to the still has reached the point at which it has a temperature of 214° to 215°F., it has lost 80 per cent. to 90 per cent. of the hydrogen sulphide and 70 per cent. to 80 per cent. of the carbon dioxide, but still retains practically all the ammonia, which it contained when it entered the still. When brought in contact with crude coal gas in scrubbers of the ordinary type this liquor can take up on an average 500 grains of hydrogen sulphide per gallon and if used in sufficient quantities will reduce the hydrogen sulphide from as much as 900 grains, down to from 20 to 30 grains, per 100 cu. ft. of gas. If the complete removal of the hydrogen sulphide with liquor is attempted the average efficiency of the liquor is much less than this, and it is more economical to use the liquor only to the extent named and then finish the removal of the sulphuretted hydrogen by the ordinary process of purification by means of hydrated sesquioxide of iron.

The process devised and used by Mr. O'Neill adds to the apparatus customarily found in gas works only a heat exchanger, in which heat is transferred from the hot liquor coming from the concentrating still to the cool liquor on its way to the still, and a cooler for further cooling the treated liquor, both of which are simple and inexpensive.

Apparently this process could be adopted in many coal gas works with a saving in the labour required to operate the oxide of iron purifiers and also in the investment in the purifiers required for a given quantity of gas.

In Europe, where the gas coals contain as a rule more sulphur than do those in common use in the United States, and on the Pacific Coast, where gas is largely made from crude petroleum containing a somewhat high percentage of sulphur, the problem of reducing the amount of sulphur compounds, other than hydrogen sulphide, contained in crude illuminating gas has had some importance. In those parts of the world, therefore, attention has recently been paid to new methods of removing the principal one of these sulphur compounds, carbon bisulphide.

Of the more recent processes having this object the one first brought to the attention of gas engineers was that devised by Messrs. Hall and Papst and used since 1908 for the treatment of all the gas made, about 3,000,000 cu. ft. per day, in the works at Portland, Oregon. In this process the gas is merely heated to a temperature of from 1300° to 1600° F. by being passed through tall cylindrical vessels, formed of steel plates lined with fireclay blocks and filled with a checker work of firebrick, which are heated by the combustion in them of fuel oil. The vessels are in pairs, one being in process of heating while gas is being passed through the other. The operations are reversed as soon as the vessel through which the gas is passing becomes cooled below the effective temperature. Under the effect of heat, the carbon bisulphide reacts with the water vapour present in the gas and is largely converted into hydrogen sulphide, which is removed by passing the gas through an additional set of purifiers containing oxide of iron.

Another process which has been employed on a large working scale is that devised by Mr. E. V. Evans and used since the beginning of 1913 to treat all the gas made, about 10,000,000 cu. ft. per day, at a works of the South Metropolitan Gas Company, of London. This process utilises the catalytic effect of nickel in accelerating the reaction between carbon bisulphide and steam, by which hydrogen sulphide is produced and carbon set free. The catalyst is in the form of balls, presumably of fireclay, 1 in. in diameter impregnated with nickel obtained by the reduction of the chloride in a current of hydrogen. These balls are contained in tubes having a length of 11·5 ft. and a diameter of 6 in., through which the gas to be treated is passed. Before reaching the catalysing tubes the gas passes through heat exchangers, or recuperators, in which it absorbs heat from the gas passing out from the apparatus, and then through preheating tubes in which its temperature is raised to 750° F. With this preheating of the gas it is possible to carry on the process while maintaining a temperature of 800°F. in the catalysing tubes, and the principal direction in which the process has been gradually improved has been this preheating of the gas before it enters the catalysers. A single combustion chamber, supplied with producer gas from an outside producer, furnishes the heat required by both the preheating and the catalysing tubes. After about thirty days' use it is necessary to stop the flow of gas through a set of catalysers and blow air through them in order to burn off the deposited carbon which is found to be, at times, 50 per cent. in excess of the quantity calculated from the amount of carbon bisulphide reduced to hydrogen sulphide. This carbon may be obtained from the decomposition of hydrocarbons in the gas, but analyses of the gas made before and after treatment, which are given below, show that the quantity so decomposed is negligible.

No information has been given as to the cost of operating this process, and although it does not require the maintenance of as high a temperature as is employed in the Hall and Papst process it would seem to be somewhat more complicated and expensive, even though no loss of nickel be suffered.

Another process which has only been tried at an experimental plant of the Heidelberg, Germany, Gas Works, consists in treating the gas, entirely freed from tar, ammonia, sulphuretted hydrogen, and carbon dioxide, with a compound of soda and cellulose obtained by treating cellulose sulphite with soda lye. The resulting material, after having been rolled and crumbled to a powder, is placed on trays in purifying vessels in the same way as oxide of iron. When brought into contact with carbon bisulphide the soda cellulose is changed into cellulose xanthogenate or viscose, the raw material from which are obtained cellulose hydrate and the formyl-cellulose used in the manufacture of non-inflammable celluloid. In the experimental plant ten tons of the soda cellulose material, known as "Athion," absorbed 1·25 tons of carbon bisulphide, so that with gas containing 45 grains per 100 cu. ft., ten tons would purify over 35,000,000 cu. ft. of gas, but the cost of operation is not given.

	Gas before treatment.	Gas after treatment.
	per cent.	per cent.
CO_2	1·82	1·80
C_nH_m	3·61	3·79
O_2	0·27	0·07
CO	8·85	8·62
CH_4	26·62	27·45
H_2	52·45	52·19
N_2 (by difference)	6·38	6·08
	100·00	100·00
Illuminating power in English candles	14·05	14·05
Calorific value. B.t.u. per cu. ft. ..	590·00	594·00

Since it is not the custom in the United States to remove carbon dioxide from illuminating gas, the employment of this process would involve the installation of additional apparatus for that purpose.

A very promising process, which, however, has not yet been tested on a working scale, is based upon the fact that at temperatures above 100° F. metallic iron acts as a catalyst that brings about and accelerates the reaction between bisulphide of carbon and moisture in illuminating gas. The fact that gas, free from sulphuretted hydrogen originally, contained this substance after having passed through a wrought iron service pipe which, because of running near a steam pipe, was heated to temperatures varying between 90° and 158° F., attracted the attention of Mr. J. G. Taplay, and a number of experiments made by him showed that at a temperature of 158° F. the reaction between the bisulphide of carbon and moisture with the formation of sulphuretted hydrogen took place quite rapidly in gas travelling through a wrought iron pipe, and also that as the interior of the pipe became rusted the sulphuretted hydrogen produced was absorbed by the oxide of iron and did not show at the outlet of the pipe.

A French gas engineer, M. Guillet, observed the same action taking place inside a gasholder, and by experiments determined that when gas containing bisulphide of carbon was passed through ordinary oxide of iron purifying material at temperatures above 25° C. (72° F.) 25 per cent. of the original content of carbon bisulphide was removed. He found 100° C. (212° F.) to be the temperature at which the change became interestingly rapid, while at a temperature of 130° C. (266° F.) more than 67 per cent. of the bisulphide of carbon originally present was converted into hydrogen sulphide and removed as the gas passed through the material. The percentage removed increased with the amount originally present, the treated gas containing only from 3·01 to 5·82 grains, while the original gas contained from 9·48 to 24·42 grains of bisulphide of carbon per 100 cu. ft.

Since the efficiency of oxide of iron for the removal of sulphuretted hydrogen is very much increased by heating and it should not be difficult to maintain the temperature of the purifying material at the comparatively low temperature of, say, 250° F., this process would seem to offer the simplest and most inexpensive means of removing from illuminating gas the larger portion of the bisulphide of carbon which it still contains after the treatment ordinarily given to it in gas works, whenever the amount of this impurity present is sufficiently large to make it important that it should be reduced.

Yorkshire Section.

Meeting held at the University, Leeds, on Monday, January 26th, 1914.

MR. GEO. WARD IN THE CHAIR.

CORROSION BY DISSOLVED OXYGEN.

BY PROF. J. W. COBB AND G. DOUGILL.

It has long been recognised that the presence of dissolved oxygen in water is practically certain to increase its corrosive action on iron, whether by its depolarising action (the electrochemical view) or in some other way. On the other hand, data are not available, so far as the authors are aware, to demonstrate how far this action goes in practice, whether a negligible, a small, or a large proportion of the dissolved oxygen is likely to combine with the iron in any ordinary water system, particularly when the water is being subjected to heat and so to increasing inability to hold the oxygen in solution. For this reason it is notorious to those concerned with actual practice in these matters, that the consideration given to the possible effect of dissolved oxygen, when water-heating plant is designed and erected, is usually of a cursory kind. Our results were obtained in connection with an industrial problem, and are published by consent. Their theoretical interest is small, but it is hoped that they may be useful practically. They illustrate to what a marked extent the phenomenon in question may be manifested in an ordinary water-heating apparatus.

The object of the series of experiments was to determine the extent to which dissolved gases might be responsible for extensive rusting in hot water pipe systems. Such an inquiry seemed very necessary because several cases of such rusting had come to the notice of one of us, when the water was satisfactory to the ordinary chemical tests, and there was no reason to suspect abnormality in the iron. For this purpose an apparatus was set up (Fig. 1) in which to some extent conditions of practice were reproduced.

The iron pipe shown was 6 ft. long and 1 in. internal diameter, heated by a small tube furnace. Water was fed from a constant-head apparatus, open to the atmosphere, into the lower end of the iron pipe, passing on its way through a bottle which acted as an air-trap. The rate of flow was controlled by the insertion of a glass tube drawn down to a jet, in the inlet connecting length before the iron tube. The average rate of flow was 10 litres per 24 hours, and the pipe held 0·93 litre, so that the water was about 2¼ hours in the pipe before coming out at the upper end. There it passed through a gas holder, where any liberated gas collected, through a guard bottle, D, and finally out by a long glass capillary tube into a measuring cistern.

The water entered at air temperature, was near boiling point on reaching the thermometer bulb 5 inches up the tube, and averaged 65° C. on leaving. Daily tests were made of the quantities of water passed and gas collected in the 24 hours, and oxygen contents of inlet and exit water and gas were determined. The methods of determining the oxygen dissolved in the water are appended. Gas analyses were made in the Hempel apparatus. A colorimetric method was used for determining the dissolved and finely suspended iron, which coloured the exit water decidedly red-brown when air-saturated water was used. A description of this method is also appended.

The apparatus was run for some time in this way, and then, as a sort of blank test, was run with air-free instead of air-saturated water. By-passed bottles were found necessary for obtaining water samples without possibility of air contact. The results of the run on air-free water are given in Table II., and those on air-saturated water in Table I.

The air-free water was prepared in the apparatus shown in Fig. II. J, a vessel of 5—6 litres capacity, was exhausted by a water pump to about 30 mm. mercury pressure. Water was boiled in the flask, A, and the steam and expelled gases passed out at B into the beaker, E, which was thereby raised to boiling point. After A had boiled for 10 minutes, the water was drawn through the cooling worm, W, into J. When the flask, A, was nearly empty, the tap, H, was closed and the bunsen removed. This caused the steam in A to condense, and drew in a fresh charge of hot water from E. By repeating the process air-free water was accumulated in J. In the blank run this

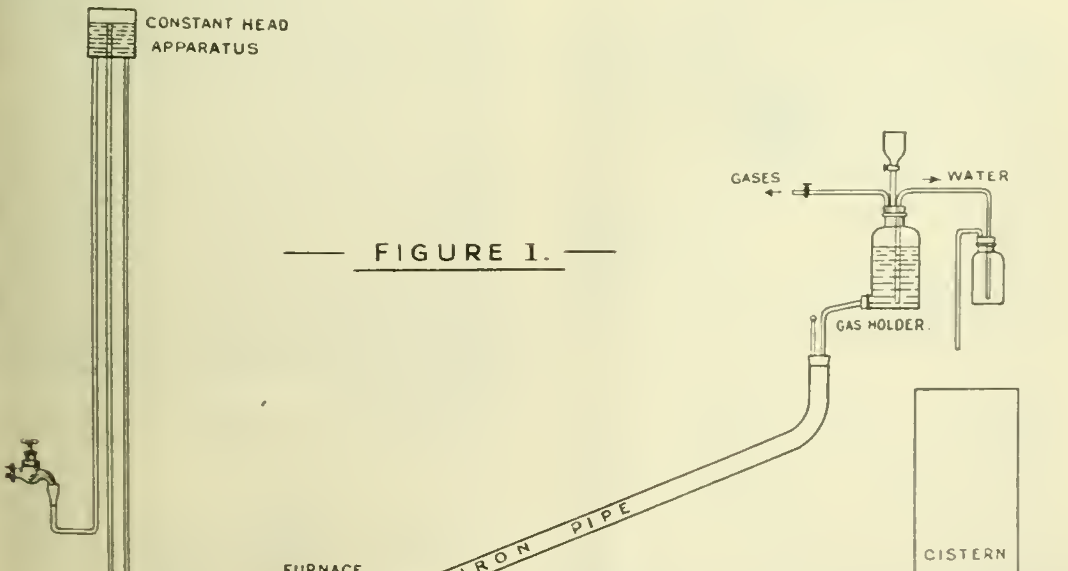


FIGURE 1.

TABLE I.

Experiments with tap water.

Date.	Temps.		Run hrs.	Water.	Oxygen in H_2O.			Gas evolved.			
	Inlet.	Exit.		litres/hr.	Inlet.	Top by-pass.	Exit.	c.c./hr	c.c./lH_2O.	% of O_2	c.c. O_2/lH.
A.											
	92	60	24	0·454	—	0·10	0·60	2·3	5·0	2·4	0·30
Oct. 5, 1913	99	65	24	0·510	—	0·13	0·60	—	—	—	—
to	100	68	24	0·440	—	0·70	0·90	5·6	12·7	9·5	1·20
Oct. 17, 1913	98	67	23	0·289	5·71	—	0·47	3·1	10·8	5·2	0·54
	98	68	48	0·258	4·80	—	0·47	2·1	8·2	4·2	0·35
	99	68	24	0·269	5·80	—	0·50	3·4	12·8	5·1	0·65
B.	100	68	48	0·548	7·15	—	—	8·5	15·6	9·9	1·54
Nov. 4, 1912	84	60	24	0·575	6·68	—	—	7·1	13·7	6·3	0·87
to	94	69	24	0·497	7·14	—	—	7·3	14·7	8·7	1·28
Nov. 8, 1912	88	65	24	0·314	7·00	—	—	4·7	15·0	5·8	0·87

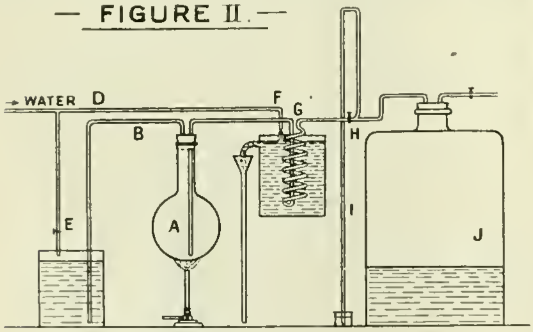
TABLE II.

Experiments using air-free water.

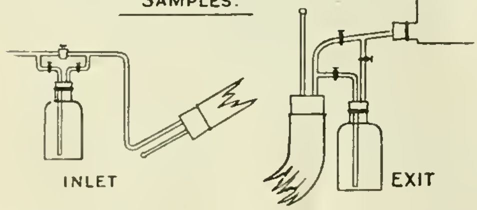
Date.	Temps.		Run hrs.	Water.	O_2 in water.		Gas evolved.				Remarks.
	Inlet.	Exit.		l/hr.	Inlet.	Exit.	c.c./hr.	c.c./l.	O_2 %.	O_2 c.c./l.	
Nov. 21, 1912	85	63	12	0·339	2·06*	1·38*	0·5	1·5	20 (?)	0·29	*Sample not by-passed.
to	90	69	22	0·219	0·29	trace	0·5	2·4	1·7	0·05	
Nov. 27, 1912	90	70	24	0·200	0·26	trace	nil	0	0	0	

water was driven through the heating apparatus by compressed nitrogen from a cylinder. The results showed that with air-free water very little oxygen entered the heating apparatus, and since no gas was collected at the upper end, was presumably absorbed by the metal. Incidentally, the iron in the exit water, determined by the colourimetric method, was smaller than with air-saturated water, but this result was of little significance, as the amount would depend partly on agitation detaching rust from the walls.

— FIGURE II. —



— ARRANGEMENT FOR BYPASSING — SAMPLES.



After the first run lasting about 3 weeks, and before using air-free water, the iron pipe was taken down and examined. The accumulation of chocolate-coloured rust in the lower end of the pipe was plain proof of extensive rusting.

A simple interpretation can be placed on results given in Table I. The gases dissolved in cold water if simply expelled would contain 30 per cent. oxygen. The gas collected after passing through the tube contained only from 5—10 per cent. of oxygen. Moreover, the oxygen in the exit water and gas together, easily calculable from the experimental results, was only a fraction of the total oxygen dissolved in the water entering. This was plainer from experiments made later for the express purpose of obtaining a balance. The results obtained were in agreement with those already given (see Table III.).

The loss of nitrogen is disregarded as being within the limits of probable experimental error. The loss of oxygen presumably represents oxygen which has been absorbed by the metal forming oxide rust. It represents 95 per cent. of the total oxygen dissolved in the inlet water. The loss of CO_2, also presumably absorbed by the iron to form rust, represents 30 per cent. of that originally present.

Since the dissolved gas was likely to be expelled on boiling in the first length of the iron pipe, it was interesting to know what would be the effect if the gases were as far as possible removed by some method just after heating. For that purpose the apparatus was altered as shown in Fig. III.

One foot from the lower end of the sloping tube was inserted a piece of thin sheet iron, and a length of iron tubing was tapped into the main tube so as to stand vertically immediately below the inserted strip. Gas evolved from the water on heating was trapped by the inserted strip and collected in the vertical tube. Water at this point was drawn off by a vertical glass tube connected with a sampling bottle.

Air-saturated water was run through the apparatus and results are given in Table IV. A typical result was as follows :—

O_2 entering.	O_2 collected at lute.	O_2 in water at lute.	O_2 in exit water and gas.
6 c.c./lH_2O	3 c.c./lH_2O	nil	all

This indicated that about half the originally dissolved oxygen had been absorbed by the pipe in the first foot length of the tube. The remainder was collected as gas at the lute, and air-free water passed up the rest of the apparatus, *i.e.*, no rusting from the action of dissolved oxygen in the water-supply could take place beyond the lute.

TABLE III.

	O_2 c.c.		CO_2 c.c.		N_2 c.c.	
Dissolved gases in 1 litre of inlet water	8·6		2·0		19·9	
Dissolved gas in 1 litre of exit water	0·4	0·6	1·3	1·3	11·3	19·5
Exit gas accompanying 1 litre of exit water	0·2		0·0		8·2	
Loss of gas in tube	8·0		0.7		0·5	

TABLE IV.

Gas withdrawn immediately after furnace.

Date.	Temps.		Water.	Run. hrs.	Gas at lute.					Gas at Exit.	O_2 in water.	
	Inlet.	Exit.	l/hr.		c.c./hr.	c.c./l.	% of O_2.	% of CO_2.	*O_2 c.c./l.		Lute.	Exit.
	100	68	0·48	18	11·6	24·4	16·5		4·1	nil	0·03	0·00
Nov. 13, 1912	87	63	0·47	24	9·4	20·1	14·1		2·8	nil	0·01	0·00
	100	64	0·46	20	10·5	22·6	12·1	5·5	2·8	nil	trace	trace
to	100	66	0·41	24	10·5	25·3	13·6	4·6	3·4	trace	nil	nil
	92	62	0·43	23	8·5	19·7	12·8	3·2	2·52	0	nil	nil
Dec. 20, 1912	100	64	0·35	25	8·2	23·2	11·5	4·8	2·66	nil	nil	nil
	100	60	0·47	22·5	10·7	22·9	14·3	5·9	3·28	nil	nil	nil

*Average of a large number of readings = 3·0 c.c. O_2/litre.

When the gases were not separated at the lute, most of the remaining oxygen was absorbed in the further length of the tube.

Up to 5 per cent. of CO_2 was found in gas collected at the lute, and practically none in the water, but when no lute was used 2/3 of the CO_2 originally present was found in the exit water, and none in the gas, indicating extensive re-solution of CO_2 in the cooler end of the tube beyond the heated portion and lute.

The following results were obtained from an experiment in which the gas was collected at the lute (see Table V.).

TABLE V.

	O_2 c.c.		CO_2 c.c.		N_2 c.c.
Dissolved in 1 litre of inlet water	5·9		1·7		15·3
Dissolved in 1 litre of water at lute	0·0	3·0	0·1	1·3	0·5
Gas accompanying 1 litre of water at lute	3·0		1·2		14·8 (diff.)
Absorbed by iron between inlet and lute (by diff.)	2·9		0·4		—

Summarising the results so far obtained, the actions indicated as taking place are as follows: Cold water enters and is raised to boiling point. The dissolved gases are liberated, and about half the oxygen present is absorbed by the tube. At a point one foot from the lower end of the tube the system consists of

(1) Gas-free water.

(2) Gas containing (*a*) all the nitrogen; (*b*) most of the CO_2; (*c*) half the oxygen originally dissolved.

If the gas is tapped off here a large amount of rusting during the rest of the tube due to oxygen and CO_2 is avoided. If it is left to pass up the tube most of the oxygen unites with the iron, while some nitrogen and all the residual CO_2 are redissolved in the exit water. In any case, about half the oxygen and a small proportion of CO_2 are absorbed by the metal of the tube in the heated length. (Much less stress is laid on the CO_2 than on the oxygen results; they are deduced from a very much smaller number of experiments.)

TABLE VI.

Time in mins.	Temp. °C.	Conditions.
0	15	—
10	45	Bubbles of gas rising and adhering to foil.
20	72	Rust visible—gas rising.
30	84	More rust visible.
40	88	" " "
56	90	" " "
60	91	" " " and very little gas rising.
105	91	Surface covered with rust and no gas rising.

It was therefore made plain that a considerable amount of rusting from dissolved oxygen could be avoided by mechanical removal of the gases evolved at the end of the heated length, before the water came into the rest of the system. It also appeared that considerable absorption of gas and rusting took place in the heater itself. We decided to see how far the action was manifested on a still smaller scale, and whether the destruction of dissolved oxygen by simple chemical means was useful. The following experiments were made.

A litre flask was fitted with a cork, holding a capillary tube to allow for expansion, a glass hook, and a thermometer. A small piece of Kahlbaum's pure iron foil was suspended from the glass hook. The flask was filled with tap water, and left for 1¾ hours on a steam bath. Table VI. shows the progress of the experiment. Rusting was extensive.

Another similar flask was filled with water, and boiled to expel the gas. The foil was suspended in it, and left on the steam bath alongside the first. No gas bubbles appeared, and no rusting. Preliminary removal of oxygen by boiling is then an effective means of minimising rusting.

Removal of oxygen by chemicals.

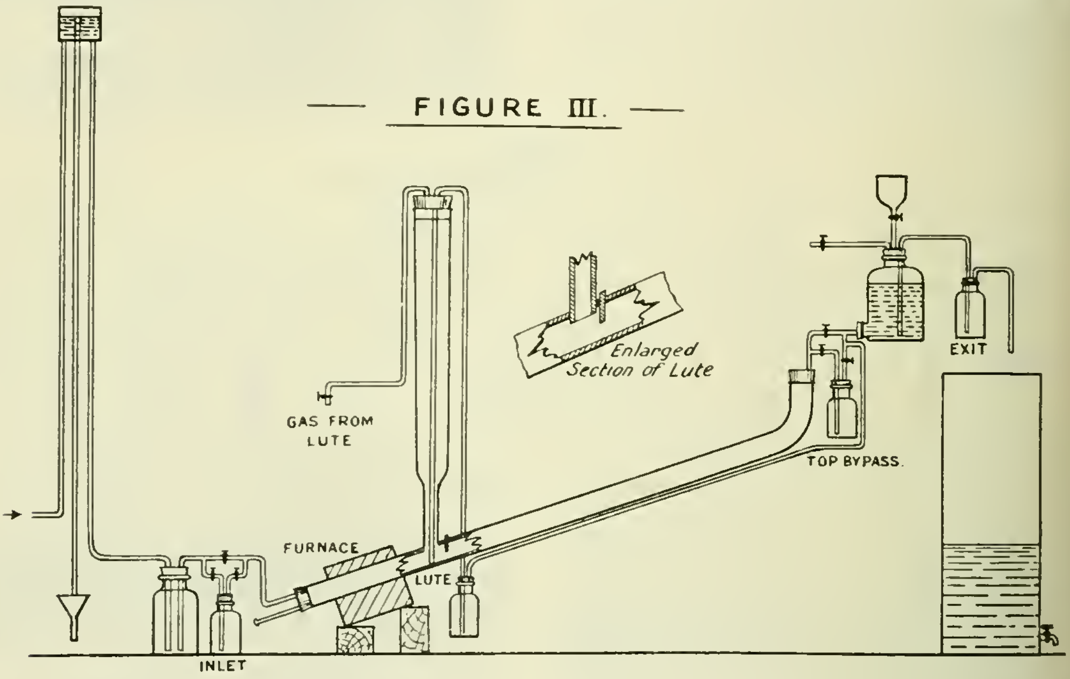
The next experiments were made with chemicals which would themselves take up the dissolved oxygen, and the first tried was sodium arsenite, of which 0·11 grm. per litre of water (the quantity theoretically required) was used.

The sodium arsenite was added to the cold air-saturated water, which was then heated in contact with pure iron foil as before. The rusting was decidedly lessened. The proportion of sodium arsenite was then varied by stages from 50 per cent. of the theoretical to three times the theoretical quantity. The rusting was reduced with increasing quantities of arsenite to a very small amount, but not entirely prevented. The results were interesting, but in order to test materials which were possible in practice on the large scale, a mixture of sodium hydroxide and ferrous sulphate was added in the proportions necessary to take up the dissolved oxygen according to the equation :—

$$4NaOH + 2FeSO_4 = 2Na_2SO_4 + 2Fe(OH)_2.$$
$$2Fe(OH)_2 + O_2 = Fe_2O_2(OH)_2.$$

Commercial caustic soda and green vitriol were used. On adding the substances separately in solution a bulky green precipitate formed, which rapidly turned reddish-brown and settled to the bottom of the flask. The prevention of rusting was found to be nearly but not completely effected by theoretical quantities. The cost of chemicals for such a treatment, which may often be practicable, especially as a finishing process in the elimination of oxygen, would be 2d.—2½d. per 1000 gallons for an ordinary water containing 6—7 c.c. of oxygen per litre: 1·3 lb. caustic soda and 4·5 lb. ferrous sulphate, quantities 20 per cent. in excess of the theoretical, are here assumed necessary, and the whole of the dissolved oxygen is supposed to be treated.

FIGURE III.



Summarising, we found :—

(1) That in our experiments a very large proportion of the dissolved oxygen in the water supply, used for a simple heating system consisting of one pipe, was not present in the water or gas leaving, but had been absorbed in the pipe. It was presumably used up in rusting the iron, and a large quantity of rust was actually formed.

(2) That about half the loss of oxygen occurred in the first foot length of the pipe—the heater.

(3) That the further loss of oxygen occurred in the 5 ft. of pipe beyond the heated length, and could be prevented if the expelled gases were mechanically taken off at the end of the heated length.

(4) That in small scale experiments with pure iron foil the expulsion of dissolved gas from the water by previous boiling was an effective means of preventing rusting.

(5) That in similar small scale experiments it appeared that the rusting of iron foil could be almost prevented by treating the cold air-saturated water with the sodium hydroxide and ferrous sulphate necessary to take up the oxygen dissolved in the water supply.

Appendix on methods of analysis.

The following were used :—

(1) The gasometric method described in Lunge and Keane's Technical Methods of Analysis, Vol. I., p. 776. This method depends on the expulsion of dissolved gases by CO_2; the gases are collected over caustic potash and, of course, any CO_2 dissolved in the water is not estimated.

(2) Winkler's titration method. In this well-known and widely-used method the power of manganous hydrate for taking up oxygen is utilised. Only oxygen is estimated. Methods (1) and (2) were compared on the waters used and gave identical results.

(3) The gases were boiled off the water, collected over mercury, measured and analysed. This gave all the dissolved gases.

The following method was used for the determination of dissolved and finely suspended iron compounds.

50 c.c. of the water, containing 1 c.c. of strong nitric acid, were brought to boiling point and kept hot for 1 hour. This was necessary to ensure complete solution of suspended iron oxide. 5 c.c. of the cooled solution were poured into a graduated comparison tube with 2 c.c. of potassium thiocyanate, and 5 c.c. ether added to extract the red compound. After shaking, the colour of the ether was compared with that obtained with a standard solution. This standard was made by running into 2 c.c. of potassium thiocyanate and 5 c.c. of ether an iron solution of known strength from a burette until the ether layer was about the same colour as the layer in the other tube. Distilled water was added until the volumes were equal, and then a little more iron solution to make the colours match exactly. The iron solution was made by dissolving 0·1 grm. of iron wire in sulphuric acid, oxidising by nitric acid and making up to 1 litre. 5 c.c. were diluted to 500 c.c. as required. 1 c.c. of solution = 0·000001 grm. iron. To match the colour usually produced about 2·5 c.c. of iron solution was required.

DISCUSSION.

Mr. G. **Ward** asked whether the nature of the iron of the pipe used for the experiment was at all comparable to th cast iron tubes employed in heating apparatus. He supposed it would be a piece of gas tubing, which was ver different to the tubing used by water engineers. Probabl the cast iron pipes used by engineers were very much les liable to corrosion.

Mr. J. **Miller** said that when engineers used condense water they expected to have little or no corrosion, as th water contains no dissolved solids. However, the con denser water got thoroughly mixed with air, and extensiv corrosion occurred. If means were taken to prevent ad mixture of air, no corrosion took place.

Dr. **Meyer** said that when water contained not more tha 5 c.c. of dissolved oxygen, his experience was that the was very little corrosion. When 5·5 c.c. of oxygen were present, there was some corrosion, whilst if there were between 20 and 30 mgrms. of free carbonic acid present with 5·5 c.c. of oxygen, there was very great corrosion. He would like to know the limit. He would also like to know whether Professor Cobb included all the organic acids in his free CO_2, as he had found that when 1 to 2 or 3 c.c. of organic acids were present, the water was very corrosive.

Mr. W. G. **Young** asked as to the condition of the iron pipe before the experiment. Was it cleaned or burnished, or was it simply a piece of rough gas piping. Was any attempt made to weigh roughly the iron oxide formed. Under the conditions of the experiment he supposed that some of the oxygen would be used up by the organic matter, as all water contained organic matter. Would it be possible to use some simple mechanical means to get rid of the dissolved gases before the water entered the boiler ?

Dr. **Meyer** said that if a water contained 6 c.c. of dissolved oxygen per litre, it was possible to bring it down to 2 c.c. by heating to 60° C. Would it be possible to do this first, and then to put soda and ferrous sulphate into the boiler. Also did Prof. Cobb agree to use manganese permutite to remove the last trace of iron, after removing the oxygen by means of soda and ferrous sulphate.

Mr. C. P. **Finn** asked if the oxide produced was removed mechanically by the flow of the water up the pipe, or did it remain more or less as a firm coat. In either case was corrosion continuous, or did it reach a point when it began to be less. Pointing out that the conditions which existed in the experiments were similar to those in the case of economisers, he asked whether the authors could say to what extent economiser pipes suffered.

Dr. H. T. **Calvert** asked whether the amount of corrosion increased with increasing amounts of oxygen in the feed water. One would imagine oxygen would readily escape with the steam. A large excess of ammonium thiocyanate was necessary to obtain the maximum colour in the method used for estimating iron. This, he presumed, had been taken into account in the estimation.

Mr. **Rushby** did not think that corrosion would take place to the same extent with cast iron tubes as with those made of wrought iron. What was the reaction when a slight excess of an alkali carbonate or hydroxide was added to a water to prevent corrosion. He thought corrosion was due not so much to the oxygen alone, as to the oxygen plus acids. For instance corrosion could be avoided by adding seaweed extract ; also by adding an alkali. He had noticed that corrosion took place most extensively along the seating of a boiler, which is the coolest part. Could Professor Cobb explain this. He also pointed out that boilers worked under high pressures, and this would probably modify the results.

Prof. **Cobb**, in reply, said that the nature of the metal would no doubt influence its corrosion as suggested. Their experiments were made with a wrought iron tube. Small cast iron pipes were almost unknown, but larger sizes were, of course, extensively used. It was inadvisable to assume that cast iron necessarily corroded less than wrought iron. The "skin" of cast iron had a protective influence, but when that was removed, as by machining, the exposure of graphite and iron and carbide opened the way to electro-chemical action. In confirmation of Mr. Miller's remarks, he said that in a particular case which had come to his notice one set of pipes carrying condensed water, freed from air, suffered no corrosion, while another set, fed with the same water, air-saturated for make up, was badly corroded. They had not studied possible corrosion due to peat acids. Reducing the dissolved oxygen by a preliminary heating to about 60° C. and treating chemically to remove the rust, seemed to be a promising way of working in practice. Treatment with manganese permutite would apply particularly to the removal of that small proportion of the oxidised iron which had gone into solution. The pipe used was ordinary wrought iron steam pipe, and was not prepared in any way. Attempts to weigh the rust formed had been made, but were useless. Most of the oxide remained attached to the iron pipe. The organic matter in the water might be responsible for the destruction of a small portion of the dissolved oxygen. But the heating or boiling of waters in the ordinary process of estimating organic matter with permanganate would seem to indicate that any error arising from this cause would be small. In the colourimetric process for estimating iron, a large excess of thiocyanate was present. The use of alkali to lessen corrosion due to acid in water, was no doubt of service. Corrosion along the seating lines of a boiler was, so far as he knew it, external, and was probably due to low temperature and "pocketing" of the flue gases along those lines.

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT ; MACHINERY.

Patents.

Refrigerating apparatus. E. C. R. Marks, London. From The Iceless Refrigerator Co., Chicago, Ill., U.S.A. Eng. Pat. 27,598, Nov. 30, 1912.

The apparatus consists of a pair of vessels each of which acts alternately as a generator or an absorber of, for example, ammonia vapour. Heating and cooling devices are mounted on a rocking frame so that they can be changed over and the functions of the vessels reversed as required. The reversing gear is controlled by devices in the vessels sensitive to heat and pressure.—W. H. C.

Separation of impurities from liquid by centrifugal force ; Method of and apparatus for ——. J. Hamill, Liverpool. Eng. Pat. 6333, Mar. 14, 1913.

The centrifugal is divided horizontally into compartments wherein the suspended impurities, respectively denser and lighter than the liquid itself, may be separately and successively removed.—J. L. F.

Incrustation in boilers and the like ; Prevention of ——. I. Radaeff, Moscow. Eng. Pat. 11,354, May 15, 1913.

A mixture of sodium hydroxide, sodium carbonate, tannin and tannin extracts and a mucous vegetable substance obtained by boiling linseed, Iceland moss or similar bodies with water is introduced into the boiler.—W. H. C.

Charging and discharging retorts, muffles and the like. R. von Zelewski, Engis, Belgium. Eng. Pat. 12,120, May 24, 1913. Under Int. Conv., May 31, 1912.

A scraper with a series of equally spaced blades has a working stroke equal in length to the space between successive blades, so that the muffle, etc., may be gradually charged or discharged by a succession of strokes of the scraper.—J. L. F.

Drying apparatus; Air or gas supply arrangement for ——. W. P. Thompson, Liverpool. From A/S. Myrens Verksted, Christiania. Eng. Pat. 21,276, Sept. 20, 1913.

In apparatus for drying boiled crang (whale flesh), and the like, a series of superposed, concentric, cylindrical chambers is used, over the bottoms of which a series of arms carrying scrapers or knives revolve on a vertical shaft, so as to loosen and disintegrate the material. Drying and heating gas or air is admitted through the central hub of the scrapers, through the rear of the latter, and thence through the hub of the set of scrapers in the chamber immediately above, and so on from chamber to chamber.—J. L. F.

Drying chambers. E. C. R. Marks, London. From The Cutler Dry Kiln Co., Inc., New York. Eng. Pat. 22,985, Oct. 11, 1913.

Air enters and leaves the drying chamber through one or more porous walls and is forced through the interstices of the heat-radiating device by a fan fixed within the chamber.—W. H. C.

Drying apparatus. W. J. Elsworth, W. H. Allen and O. Elsworth, Newcastle-on-Tyne. Eng. Pat. 25,956, Nov. 12, 1913.

The heating furnace is enclosed by a casing which conveys hot air to the drying chamber. The latter contains the furnace flues, which terminate in a chimney surrounded by the annular duct discharging the moist air. By reducing the area of the moist air outlet to less than that of the dry air inlet, a small increased pressure can be obtained in the drying chamber.—J. L. F.

Desiccating and collecting apparatus. I. S. Merrell, Assignor to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 1,088,436, Feb. 24, 1914.

The material is forced by a current of air into one end of a desiccating chamber having a number of collecting chambers at the opposite end, each fitted with a filter and a valve. Some of the dried dust falls to the bottom of the chamber where it is carried forward on a travelling conveyor to a discharge outlet at the side, while the dust which collects on the filters is caused to drop on to the conveyor from time to time by closing the outlet valve of any one collecting chamber to prevent air from passing, and shaking the filter.—H. H.

Conveying and mixing slurry, mud, sludge and the like; Method of and apparatus for ——. O. Polysius, Dessau, Germany. Eng. Pat. 21,481, Sept. 23, 1913.

The compressed air used for conveying the mixture also serves for stirring it, a number of similar holders being arranged so that as one fills, a second is emptied, and a third, which has been emptied, is connected with a compressed air collector, in which the pressure of the air is reduced to render it suitable for agitating the mixture in the storage tank. The holders, fitted with automatic inlet and outlet valves, are supplied from a constant level feed-tank, or tanks, and are successively placed into communication with the delivery, the air collector and the atmosphere by means of three-way cocks operated by floats. The surplus air, if any, is discharged when the holder is connected to the air prior to filling. The agitation is effected by means of an air-lift device, consisting of a vertical pipe connected with the exhaust air collector at its lower end, open at both ends, and perforated or slotted to permit of its working independently of the height of the mixture to be agitated.
—J. L. F.

Pumping or raising liquids; Method of and apparatus for ——. H. J. Mellis, London. Eng. Pat. 22,012, Sect. 30, 1913.

To overcome the difficulty of accurately timing the periodic application of pressure to a column of liquid caused to oscillate by means of an elastic body, (usually a gas or air pocket), to which it is connected at its lower extremity, floats, pistons or the like, operated by the movements of the column of liquid are provided, and mechanically connected with suitable valves in such a way that the periodic application of pressure is dependent upon the movement of the oscillating column.—J. L. F.

Grinding, crushing, pulverising and the like; Roller and ring mills for ——. J. Y. Johnson, London. From Gebr. Pfeiffer, Kaiserslautern, Germany. Eng. Pat. 24,822, May 8, 1913.

The grinding rolls and rings are supported by flexible bearing awhich move in relation to the grinding ringa, radially, and to the rolls, axially.—W. H. C.

Furnaces provided with regenerative chambers. H. Poetter and Poetter, Ges. m. b. h., Düsseldorf, Germany. Eng. Pat. 26,411, Nov. 18, 1913.

A slide which runs on rails and moves across the flues leading to the regenerative chambers, has three ports, of which the central one is always used for supplying air for combustion, whilst the two outer ports alternately conduct the waste gases to one of the two regenerative chambers and the air to be preheated to the other.—J. L. F.

Furnace for baking refractory earths. A. Valuy. Fr. Pat. 463,574, Oct. 13, 1913.

A calcining furnace for refractory earths heated by cheap fuels such as lignite, is formed with a central calcining chamber having a furnace at one side. The furnace gases enter the calcining chamber through a horizontal passage at the top and are deflected downwards by a curved roof or partition separating the calcining chamber from a chamber above it which acts both as a flue and as a drying chamber for the refractory earth. The air supply passages are in the heated walls of the furnace.—H. H.

Catalyser and process of making same. C. Ellis, Montclair, N.J. U.S. Pat. 1,088,673, Feb. 24, 1914.

Finely divided carbonaceous or other porous granular material is impregnated first with a precipitant of nickel and then with a solution of a nickel salt, in such proportions that not more than 15 per cent. of "nickel material" is precipitated.—H. H.

Coating objects with subdivided material; Process of ——. F. F. Bradley, Assignor to Bradley and Vrooman Co., Chicago, Ill. U.S. Pat. 1,088,874, Mar. 3, 1914.

Bodies having a multiplicity of surfaces to be coated wit subdivided material are first coated with adhesive materia and then placed in the centre of a chamber into whic opposing streams of gas carrying the finely divided coatin material in suspension are projected.—H. H.

Evaporator. J. T. Wann, Berkeley, Cal. U.S. Pa 1,089,027, Mar. 3, 1914.

A series of racks carrying trays for fruit, etc., is arrange in the upper part of a chamber with vertical inlet an outlet flues for hot air between the racks. The tray are inclined upwards from the inlet to the outlet flue and the inlet flues are fitted with deflectors to direct t hot air between the trays.—H. H.

Evaporating apparatus for all kinds of liquids. E. Barbet. First Addition, dated Dec. 26, 1912, to F Pat. 461,890, Nov. 8, 1912 (this J., 1914, 188).

The envelope enclosing the tubes is made cylindric instead of pyramidal. This arrangement is to strength the apparatus and make it possible to have two removal ends, so as to facilitate cleaning.—N. C. A.

Dried or concentrated products; Process for obtaini without loss ——. G. A. Krause. Fr. Pat. 463,3 Oct. 6, 1913. Under Int. Conv., Oct. 12, 1912.

The finely-divided particles carried away when substan in the form of spray are evaporated or dried by a curr of hot air or other gas are caused to deposit by the action of a high-tension electric current. The wall of the metallic containing vessel, or a metallic lining or plates suspended in the vessel, may form one electrode, the other being fine wires or wire gauze. Ozone or oxides of nitrogen may also be produced by the current whereby the product is bleached or otherwise modified.—N. C. A.

Separating fluids having different characteristics; Method and means for ——. C. S. Brown, Nashville, Tenn. U.S. Pat. 1,089,187, March 3, 1914.

The fluids are caused to flow through an orifice in a plate or other surface and then to spread out in a thin film between the surface and a thin plate movably supported upon the surface. The passage between the plate and surface rapidly increases in area as the fluid moves away from the orifice and the pressure in the passage varies correspondingly but is different for different fluids. The distance between the plate and surface adjusts itself automatically so that one fluid is able to escape whilst the escape of the other is substantially prevented.—H. H.

Grading powdered material; Apparatus for ——. Comp. de Fives-Lille and P. Habets and A. France. Fr. Pat. 463,864, Oct. 21, 1913.

The material (fine coal, ores, grain, etc.) is fed from a hopper by a rotating feeder, into a chamber in which it is submitted to an upward blast of air, which carries with it the finer particles. The heavier particles fall into an hydraulic seal at the bottom of the chamber from which they can be continuously removed without disturbing the air pressure. The intensity of the blast and the size of the outlet through which the air carrying the fine particles escapes are regulated by valves. The plant can be used as a unit or in batteries.—N. C. A

Crystallisation of hot saline solutions; Continuous ——. Häberlein. Ger. Pat. 271,102, June 18, 1912.

The quantity of cooling liquid supplied to the different compartments or groups of compartments of the crystallising vessel is progressively diminished so as to ensure that the requisite conditions in regard to fall of temperature and temperature difference between cooling surface and solution are maintained in the different parts of the apparatus.—A. S.

Drying apparatus; Shaft or tower ——. A. Huillard, Suresnes, France. Eng. Pat. 17,521, July 30, 1913.

See Fr. Pat. 461,612 of 1913; this J., 1914, 187.—T. F. B.

Desiccating fluid substances; Method for ——. W. B. McLaughlin, New York. U.S. Pat. 1,090,740, March 17, 1914.

See Fr. Pat. 441,742 of 1912; this J., 1912, 947.—T. F. B.

Separating mixtures of gases. A. Sinding-Larsen, Christiania. U.S. Pat. 1,091,023, March 24, 1914.

See Eng. Pat. 8211 of 1910; this J., 1910, 1092.—T. F. B.

Filter plate. P. Porges, Vienna, Assignor to L. Steinschneider, Brünn, Austria-Hungary. U.S. Pat. 1,091,080, March 24, 1914.

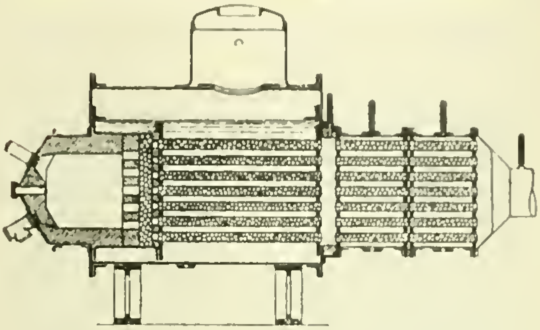
See Eng. Pat. 12,737 of 1912; this J., 1913, 740.—T. F. B.

Method and apparatus for expressing oil from seeds, nuts, and other oleaginous substances, and juice or fluid from fruits, herbs, flowers, peat, etc. Eng. Pat. 29,331. *See* XII.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Flameless surface combustion. O. Dobbelstein. Stahl u. Eisen, 1914, 34, 561—578. (See also this J., 1911, 527; 1912, 61, 524; 1914, 303.)

Details of tests of the "Bonecourt" boiler installed at Krupp's works are given. Considerable difficulty was experienced on account of the strong corrosion of the tubes and clogging of the material with which they were packed, mainly due to the sulphur contained in the coke-oven gas.



In every test several of the tubes did not work satisfactorily, and with the present arrangement it was difficult to ensure equal distribution of, and resistance to, the gas in all the tubes. The Berlin-Anhaltische Maschinenbau A.-G. have constructed a small experimental boiler, fired with tar-oil, embodying certain features (see Fig.), designed to eliminate this difficulty of unequal distribution, etc. This boiler on test evaporated no less than 26·3 lb. per sq. ft. of heating surface per hr.—about twice the rate of the Krupp boiler—with a heat-efficiency of 0·90, and a net efficiency of about 0·82. Existing designs of this type of boiler did not prove suitable to he demands of practical steam-raising.—J. L. F.

Flame; Initiation and propagation of ——. H. B. Dixon. J. Gas Lighting, 1914, 125, 819—822.

Experiments by Falk (this J., 1908, 324) in which a mixture of gases was heated by sudden compression by a falling piston in a steel cylinder, appeared to indicate that the mixture of oxygen and hydrogen most easily ignited was one of equal proportions of the two gases. In these experiments the greatest depth reached by the piston before it was shot upwards by the force of the explosion was observed, it being assumed that since the whole gas column was compressed and heated to the ignition point, the flame would spread through the gas as an explosion wave, and hence the time elapsing between the initiation of the flame and the reversing of the motion of the piston could be neglected. Using a method of photographic analysis the author found that when the gases were compressed to the ignition point and the movement of the piston then artificially arrested, a flame appeared at some spot in the heated gas after an interval and spread slowly throughout the mixture. The flame did not start as an explosion wave, though it quickly set up such a wave in a sensitive mixture such as electrolytic gas. In the case of the latter mixture the pre-flame period was short and would not appreciably affect the results obtained by Falk, but with a mixture containing 3 vols. of oxygen to 1 vol. of hydrogen. it was so prolonged that the piston moved in a considerable distance after the "ignition point" was reached, and an appreciable distance even after the flame appeared. The duration of the pre-flame period of combustion varied with different gases; it was remarkably prolonged in the case of methane. It was only in this initial stage of combustion that the influence of water vapour was exerted: pure mixtures of hydrogen or a hydrocarbon and oxygen were ignited by a spark however thoroughly they were dried, and the flame was propagated more rapidly than when water vapour was present. The ignition point of a gaseous mixture may be accurately determined by compression in a steel cylinder by a falling piston provided with a head-piece which is arrested at the desired moment by a collar through which the piston-rod passes. Successive trials are made, with increasing compression, till the mixture fires. The values so obtained are lower than those determined at atmospheric pressure, *e.g.*, 526° C. as compared with 585° C. in the case of electrolytic gas.

The possibility of determining the specific heats of gases at high temperatures by measuring the velocity of sound therein is discussed and some experiments in this direction are described.—A. S.

Producer gas; Chemical changes occurring during the passage of —— through pipes. E. Schmatolla. Chem.-Zeit., 1914, 38, 409—410.

When an installation of gas-fired furnaces or retorts is first set to work, the gas conduits become thickly coated with a mixture of tar and soot which can only be removed by laborious scraping, or by burning. After normal working conditions have been reached, the conduits require cleaning only at long intervals, and only soot is deposited, which can easily be removed by admitting a blast of compressed air into the conduit, which should for safety be above the ignition temperature. The deposit formed at first is produced by the adherence of soot to the tar which condenses on the cold walls of the new conduit, and at temperatures of about 450° C., the gas is partially decomposed with deposition of more carbon: $2CO+C=CO_2+2C$. The reverse reaction which occurs at 700°—800° C. can be used for partially cleaning out the conduits, the supply of fresh coal to the producer being interrupted so that a very hot gas is passed through the conduits.
—A. T. L.

Carbonising chamber for gas-works; New type of ——. The Koppers combination oven. G. S. Cooper. J. Gas Lighting, 1914, 125, 813—815.

The oven can be used as a gas-oven heated entirely by producer gas or as a coke-oven heated by part of the gas produced from the coal: the change can be made in a very short time and without interfering with the working of the oven. The oven is provided with divided regenerators and with a distribution pipe for supplying gas to the heating flues direct. When used as a coke-oven, all the regenerators serve for preheating the air, the coke-oven gas used for heating being supplied direct to the heating flues. When used as a gas-oven, one pair of regenerators serves to preheat the air and the other the heating gas (producer gas or blast-furnace gas). When using the oven as a coke-oven, benzol may be recovered from the portion of the gas used for heating purposes. Installations of 35 of these combination ovens have been in operation for some time at Koenigsberg, Germany, and at Joliet, Ill., U.S.A.—A. S.

Self-ignition temperature of motor oils; Determination of the ——. E. J. Constam and P. Schläpfer. Les Matières Grasses, 1914, 7, 4037—4042. (See also this J., 1913, 1096.)

A small crucible is imbedded in calcined silica in a larger platinum crucible, through the cover of which is passed a platino-rhodium thermo-element and a tube for admitting a current of oxygen or air. When the required temperature is attained, a drop of the oil is introduced, and this is repeated at gradually increasing temperatures until ignition takes place. A sharp explosion in a current of oxygen or a dull explosion in air occurs at the moment of ignition. The following results were thus obtained in the examination of 117 samples of oils:—Diesel motor naphthas, 300° to 350° C.; Borneo liquid fuel, 400° C.; creosote oil, 550° C.; and arachis and palm oils, 400° C.
—C. A. M.

Gasoline from natural gas in the United States. U.S. Geol. Survey. Oil, Paint, and Drug Rep., March 30, 1914. [T.R.]

The number of gasoline plants in operation in the United States increased from 176 in 1911 to 250 in 1912, and the daily capacity almost doubled. These figures included the regularly established compressor plants, also those which use the simple method called the "gas-pump" or vacuum process. The natural gas gasoline industry was confined to eight States in both 1911 and 1912; West Virginia takes first place in the quantity produced. The total production of gasoline from gas in 1912 was 12,081,179 gallons, valued at $1,157,476, as compared with 7,425,839 gallons, valued at $531,704, in 1911. The estimated quantity of gas used in the extraction of 12,081,179 gallons of gasoline in 1912 was 4,687,796,329 cubic feet, an average yield of 2·6 gallons of gasoline per thousand cubic feet of gas used. Various uses are made of the residue or "exhaust" gas, which is the gas left after the gasoline has been extracted. In some places it is sold to gas companies and run through their lines to consumers; in other places it is used to drive gas engines and the gasoline plant of the operator; but it is most commonly returned to the original producer for field purposes. In some few places it is wasted.

Alkali fusions. [Formation of acetic acid and ethane from acetylene.] Feuchter. *See* IV.

Direct recovery of ammonia as sulphate without distillation. Strommenger. *See* VII.

Determination of carbon monoxide by means of yellow mercuric oxide. Moser and Schmid. *See* XXIII.

Patents.

Coal and other slimes and materials of a like nature; Method of and apparatus for draining and concentrating ——. S. Hunter and Simon-Carves Bye-Product Coke Oven Construction and Working Co., Manchester. Eng. Pat. 22,189, Oct. 2, 1913.

The washed material is passed over an inclined sieve and the slimes which pass through the sieve are collected in a settling tank. The concentrated slimes from the tank are passed over a fine inclined sieve and from the upper surface of this sieve to a rocking sieve. The fine material which passes through the rocking sieve is delivered upon the washed material passing down the first sieve which acts as a filter.—A. T. L.

Graphite and combustibles in general; Process and apparatus for the enrichment of ——. J. Mauduit. Fr. Pat. 463,609, Dec. 20, 1912.

Graphite etc. is purified by the volatilisation of the impurities in an electric furnace. The furnace is preferably formed from a block of graphite, the openings for charging, introduction of electrodes, and escape of volatilised bodies being sealed against ingress of air. A number of electrodes may be used, and the top of the furnace through which the electrodes pass may be partly isolated from the rest by the interposition of cooling chambers to protect the packing material round the electrodes from the effect of very high temperatures.
—H. H.

Combustible; Agglomerated —— and process for manufacture thereof. Comp. d'Agglomérés d'Anthracite Pur. Fr. Pat. 463,138, Dec. 9, 1912.

Anthracite dust is mixed with 5 to 8 per cent. of finely powdered soft coal and with an agglutinant, and moulded into blocks, which are heated to 900° or 1000° C. The agglutinant is eliminated at the high temperature, the soft coal then acting as the binding agent.—H. H.

Coke-ovens; Gas-inlet nozzles for ——. H. Gossler, Herne, Westphalia. Eng. Pat. 14,241, June 19, 1913.

The nozzle is fitted coaxially with the gas supply conduit and is so tapered towards its discharge orifice as to produce eddies which serve to prevent the deposition of tar vesicles upon its sharp edge.—J. L. F.

Coke ovens; Regenerative ——. N. Schuster, London Eng. Pat. 29,517, Dec. 22, 1913.

Coke ovens having regenerative tunnels in the base o the structure are constructed so as to secure equal heatin of the whole foundation and consequent equality c expansion and contraction therein. Two pairs of tunnel run at right angles to the coke chambers, each bein divided by transverse partitions into separate regenerativ chambers equal in number to half the number of cok chambers and also to half the number of heating chambers in the oven side walls. One half of any one heating chamber is connected by a passage with one of the regenerative chambers in one tunnel of a pair, while the other half is connected with one of the regenerative chambers in a tunnel of the other pair. The two halves of the next heating chamber communicate respectively with regenerative chambers in the other tunnels of each pair, so that uniform conditions of heating always obtain. The regenerative chambers act alternately as inlet and outlet chambers for gases in the usual manner.—H. H.

Coke ovens. C. Semmler. Fr. Pat. 463,299, Oct. 6, 1913.

The hot coke from coke ovens is cooled in chambers having double walls through which water is circulated under pressure so as to become superheated, the waste heat being thus rendered available for power or heating purposes.—H. H.

Coke oven; Recuperative ——. T. von Bauer. Ger. Pat. 267,480, Feb. 13, 1913.

The heating walls of the oven are subdivided horizontally by rows of perforated boxes filled with fragments of firebrick. Air and heating gases are supplied to passages between the rows of boxes and have to pass through the masses of granular material in the boxes, whereby intimate mixing and more complete combustion are attained. —A. S.

Coke oven. Gebr. Hinselmann. Ger. Pat. 268,327, Jan. 14, 1913.

To obtain uniform heating of coke-ovens with vertical heating flues, the flues start from different heights, or some of them are made of small cross-section up to a certain height, so that the flame opens out only in the upper part of the flue.—A. S.

Coke low in sulphur; Manufacture of ——. A. Fingerland, A. Indra, and A. Lissner. Ger. Pat. 270,573, July 7, 1913.

Coal is carbonised, or coke is heated, after addition of metals, oxides, hydroxides, or salts capable of acting catalytically in the subsequent treatment, and the hot coke is then treated, preferably in a separate apparatus, with gases or vapours, which in conjunction with the substances added previously, serve to remove sulphur. For example with iron filings as catalyst and chlorine as the gas, ferric chloride and sulphur chloride are formed, both of which are volatilised.—A. S.

Gaseous fuel; Production of ——. A. W. Southey, Mill Hill. Eng. Pat. 4006, Feb. 17, 1913.

A spray of liquid fuel is injected by a jet of gas from an internal combustion engine cylinder into a chamber to which air is admitted so that partial combustion and consequent vaporisation of the fuel takes place, ignition being effected by a sparking plug. The spray is preferably directed upwards from the surface of liquid fuel maintained at a constant level in a well at the bottom of the vaporising chamber, so that it impinges against a horizontal baffle-plate from which the excess of fuel drips back into the well, while the mixture of vapour, air, and products of combustion passes on through an annular channel surrounding the baffle into the inlet pipe of the engine. See also Eng. Pat. 27,612 of 1911: this J., 1913, 77.) —H. H.

as-producers. J. B. Jolly, Chorley, Lancs. Eng. Pat. 13,737, June 13, 1913.

N a producer of the multi-chamber, shaft, regenerative ype, suitable for the treatment of sewage coke, a secondary nd temporary pronged grate is introduced above the ain grate, to hold up the fuel bed while the latter is ithdrawn and the clinker removed.—J. L. F.

as-generators. T. de Fontaine, Hanover, Germany. Eng. Pat. 18,413, Aug. 31, 1913. Under Int. Conv., Aug. 13, 1912. Addition to Eng. Pat. 24,611, Oct. 26, 1909.

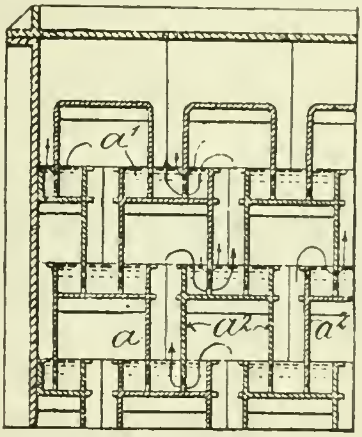
HE rotary grate generator with helical projections scribed in the chief patent (this J., 1910, 684) removes the clinker from caking coals too rapidly. To avoid this the pitch of the helical crushing surface of the breaking-jaws is gradually and continuously diminished towards their bases.—J. L. F.

Gas; Apparatus for manufacturing ——. E. C. and L. B. Jones, San Francisco, Cal. U.S. Pat. 1,089,926, March 10, 1914.

The generator comprises two lined shells, connected at the base, the shorter containing two and the longer three chambers divided by chequerwork. The lower chamber in the shorter and the middle one in the longer shell are provided with oil-inlets. The top chambers have inlets for steam and gas. The other usual inlets and outlets are provided.—J. L. F.

Washing or scrubbing gas; Apparatus for ——. P. E. Williams, Wanstead. Eng. Pat. 10,066, April 29, 1913.

The stationary washer is built up of similar units, each consisting of a chamber, *a*, open at the bottom and provided with a recessed top, a^1. The sides, a^2, stand in the corresponding recesses of the row below, and are both notched to allow free downward flow of scrubbing liquid, and perforated to permit the independent passage of ascending gas. Alternate rows are staggered to produce a cellular structure. The gas-distributing chamber units are closed and laterally flanged at each end.—J. L. F.



Purifying "producer" and like gas; Materials for ——. J. M. Wallwin, Salford, and F. S. Sinnatt, Manchester. Eng. Pat. 28,682, Dec. 12, 1913.

The purifying material is mixed with particles of cork. —J. L. F.

Blast-furnace gas; Purification of ——. W. Schwarz. Ger. Pat. 271,067, Nov. 17, 1912.

Purification is effected by a revolving washer, and the impurities, in the form of sludge, pass into an adjacent tank provided with a revolving drum, the interior of which is connected with a suction device. The impurities form a cake on the surface of the drum; this is removed by a scraper, whilst the water is returned for use again.—A. S.

Separating light oils from washing oil and regenerating the latter; Process of ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 15,965, July 10, 1913.

Light oils which have been separated from gas by heavier washing oils are distilled out by steam and the vapours passed through a fractionating column. The liquid condensing in the column passes into a steam-heated chamber from which a further quantity of light oil is distilled and conducted to the top of the fractionating column to mix with the other light oil vapours, while the unvaporised heavy oil passes out into cooling vessels where the naphthalene separates. The heavy oil can then be again used for washing gas.—H. H.

Carbon ; Conversion of —— into liquid hydrocarbons and halogen derivatives thereof. G. Tischenko and H. Plauson, St. Petersburg, Russia. Eng. Pat. 27,430, Nov. 28, 1912.

Coke, coal, charcoal or other carbonaceous material is impregnated with a saturated solution of the oxides, hydroxides or salts of alkali or alkaline-earth metals or of aluminium, iron, zinc, copper, lead, tin, or antimony, or the carbon is mixed with the dry salts or with the metal powder, and the mixture heated in a closed furnace by means of the electric arc in the presence of free hydrogen. water vapour, or combined water. Various hydrocarbons are formed according to the metal used, including acetylene and benzene. The gases are cooled and washed, and the hydrocarbons which have not been polymerised are passed through tubes packed with catalytic material (spongy nickel or iron) at 450°—500° C. Aluminium salts yield hydrocarbons of the methane series ; alkali carbonates yield aromatic hydrocarbons ; sodium aluminate yields a mixture of paraffins, aromatic hydrocarbons and terpenes. Halogen derivatives are obtained by using chlorides of the metals. (See also Eng. Pats. 27,428 and 27,429 of 1912 ; this J., 1914, 244.)—A. T. L.

Petroleum ; Process and apparatus for the transformation of —— and similar hydrocarbons into products having a lower boiling point. G. Renard, Brussels. Eng. Pat. 3413, Feb. 10, 1913.

A stream of liquid petroleum is forced through an uninterrupted passage, *e.g.*, a nickel steel tube 10 mm. inside and 21 mm. outside diameter, and 60 metres long, the first part of which is maintained at 400°—450° C. and at a pressure in excess of the vapour tension, such as 40 to 50 atmospheres, while the second part serves for cooling. A weighted valve at the end of the passage may be used to maintain the pressure.—H. H.

[*Mineral oil*] *Lubricant.* W. M. Simpson, Hastings. Eng. Pat. 24,461, Oct. 28, 1913.

Crude or heavy refuse mineral oil (80 to 95 per cent.) is heated to 300°—350° F. (149°—177° C.) and mixed with hot asphaltum (20 to 5 per cent.). 0·25 per cent. of graphite or mica may also be added. The lubricant is suitable for heavy machinery.—A. T. L.

Coal ; Process for converting fine —— into a marketable fuel. J. Evans, Melbourne. Eng. Pat. 18,270, Aug. 11, 1913. Under Int. Conv., Aug. 19, 1912.

See Fr. Pat. 461,400 of 1913 ; this J., 1914, 243.—T. F. B.

Gas producers. L. Carretero, Lugo, Spain. Eng. Pat. 6262, March 13, 1913. Under Int. Conv., March 14, 1912.

See Fr. Pat. 455,518 of 1913 ; this J., 1913, 936.—T. F B.

Sulphuretted hydrogen from gases ; Process for removing ——. K. Burkheiser, Hamburg, Germany. Eng. Pat. 13,724, June 13, 1913.

See Ger. Pat. 263,593 of 1912 ; this J., 1913, 971.—T. F. B.

Distilling or mixing petroleum, tar oils, etc. Ger. Pat. 270,832. *See* III.

Calorimeter for flowing liquids or gases. U.S. Pat. 1,088 280. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Direct recovery of ammonia as sulphate without distillation. Strommenger. *See* VII.

Patents.

Distillation of bituminous matters ; Process and apparatus for the continuous fractional ——. J. G. Aarts. Fr. Pat. 463,739, July 23, 1913. Under Int. Conv., Aug. 1, 1912, July 10, 17, and 19, 1913.

Coal, etc., is supplied to a continuously acting vertical retort in such a manner that it becomes closely packed and compressed near the walls of the retort but remains loosely packed at the centre, thus allowing the distillation gases to escape readily. The coal is fed through an annular passage and is forced downwards at the sides of the retort by a spiral screw working in this passage, or by reciprocating stamps, or merely by the weight of the coal itself. The temperature increases progressively as the coal descends in the retort. The coke produced enters a cooling zone where steam is injected into the mass, and is discharged through a water-seal by a reciprocating grate or other mechanical device.—H. H.

Heating kilns and retorts ; Method of ——. D. S. Jacobus, Jersey City, Assignor to The Babcock and Wilcox Co., Bayonne, N.J. U.S. Pat. 1,086,716, Feb. 10, 1914.

In operating a series of steam heated drying kilns, saturated steam and then superheated steam are admitted to the kilns in turn. The superheated steam passes without condensation through the kiln to which it is first supplied and is then conducted into one or more of the other kilns where it condenses.—H. H.

Electric filaments ; Manufacture of ——. C. Auer von Welsbach, Vienna. U.S. Pat. 1,090,111, March 10, 1914.

A solution of a mixture of salts of osmium and of a refractory oxide is treated with a reagent such as ammonium sulphydrate which precipitates both the osmium and the refractory oxide. The precipitate is washed, dried, and heated in a reducing atmosphere till the osmium is reduced to metal, whilst the other compound remains as a refractory oxide. The resulting mixture is then formed into filaments.—W. H. C.

III.—TAR AND TAR PRODUCTS.

Tar treatment of roads. Revision of Road Board specifications. J. Gas Lighting, 1914, **125**, 807.

The chief modifications of the earlier specifications (this J., 1911, 676) are as follows : *Tar No.* 1 (*for surface tarring of roads*). The requirement that the distillate between 170° and 270° C. shall remain clear and free from crystals of naphthalene, etc., when kept at 30° C. for ½ hour, may be waived in the case of tar supplied direct from gasworks, but it is preferable not to use tar containing much naphthalene. The tar should contain from 12—21 per cent. of " free carbon " (*i.e.*, residue left after extraction with benzene and carbon bisulphide). *Tar No.* 2 (*for making tar-macadam and for surface tarring in very hot weather when the road crust is exceptionally dry*). The tar should contain 12—22 per cent. of " free carbon " and may contain up to 25 per cent. by vol. of tar (or distillates or pitch therefrom) produced in the manufacture of carburetted water-gas. *Pitch and tar oils.* Prepared pitc from tar distilleries should contain 16—28 and com mercial soft pitch 18—31 per cent. of " free carbon." Th soft pitch and tar oils may contain up to 25 per cent. o products from carburetted water-gas tar.—A. S.

Patents.

Coal tar or its products ; Treatment of —— for the remov of the properties therein tending to induce pitch cance H. W. Robinson, Sedgley. Eng. Pats. 4159 and 10,15 Feb. 18 and April 30, 1913.

The addition of small quantities of formaldehyde or oth aldehyde, or their equivalents, to coal tar at a suita stage in the distillation process, results in the producti of a pitch entirely or almost free from "auxetics" and therefore harmless as regards liability to induce pitch cancer. Should it be inconvenient to add formaldehyde during the distillation, sugar or other substance which decomposes at a temperature below 250° C., with formation of formaldehyde, may be used. When formaldehyde is to be added to the tar during distillation, it is advisable to remove the lighter fractions in the usual manner, and when the temperature of the residue reaches 250°—270° C., to introduce the formaldehyde along with the steam. Successful results have been obtained by using about 1½ gallons of 40 per cent. formaldehyde to 2000 galls. of tar. A special apparatus is described for mixing formaldehyde with the steam to be introduced into the stills. —T. F. B.

Pitch ; Hard commercial —— and method of preparing the same. C. N. Stevens, Kenilworth, Assignor to Barrett Manufacturing Co., Chicago. U.S. Pat. 1,088,635, Feb. 24, 1914.

Hard pitch in a granular and globular form is obtained by allowing the molten material, in the form of small particles, to fall through an ascending current of air into a cooling bath, and subsequently removing the product from the bath and drying it.—T. F. B.

Tar oils and tars of vegetable, animal, or mineral origin, and similar products ; Process for treating ——. R. J. Zink. Ger. Pat. 269,261, Dec. 15, 1912.

Tars or tar oils are treated with neutral or alkaline solutions of sulphonated soaps, sulphonated oils or fats, etc., such as Turkey-red oil, and the solutions or emulsions thus formed are heated or mixed with large quantities of water to separate the soluble from the insoluble fractions of the tar.—T. F. B.

Distilling or mixing petroleum, tar oils, etc. ; Process for ——. L. Steinschneider. Ger. Pat. 270,832, Jan. 7, 1913.

Steam or air is introduced intermittently under pressure into the distilling or mixing apparatus : for this purpose a series of cylinders may be provided, through which the steam or air is forced by means of pistons worked by suitable gearing : pipes with perforated distributing nozzles serve to lead the steam or air from the cylinders to suitable points in the apparatus.—T. F. B.

n-Cresol from p-cresol ; Process for separating ——. H. Terrisse. Fr. Pat. 463,221, Sept. 26, 1913.

HE mixture of *m*- and *p*-cresol is treated with the amount f 70 per cent. sulphuric acid theoretically necessary to ulphonate the *m*-cresol : this process is carried out in partial vacuum, *e.g.*, under a pressure of about 30 mm., nd preferably at a temperature of 35° to 40° C. The -cresolsulphonic acid is converted into its sodium salt y adding sodium carbonate or normal sodium sulphate nd the *p*-cresol is separated from it by distillation with eam : the residue of sodium *m*-cresolsulphonate is conerted into the free acid by treatment with sulphuric id, and the *m*-cresol is separated by means of superheated eam.—T. F. B.

on-explosive preparations [nitro-compounds] ; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 463,288, Oct. 4, 1913. Under Int. Conv., Oct. 19 and Nov. 5, 1912, and Sept. 10, 1913.

PLOSIVE nitro-compounds, such as di- and polynitroenols and their salts, can be rendered entirely nonplosive by adding to them either waste sulphite-cellulose s, with or without addition of caustic soda or sodium rbonate, or certain inorganic salts, such as common salt, c chloride, phosphates, etc., or a phenol or salt of a enol. For example, the nitro-compound may be mixed th its own or a greater weight of sulphite lyes and the ste evaporated to dryness at a moderate temperature : product is dry and non-explosive. The addition of phenols or of the inorganic salts is especially suitable en the nitro-compounds are to be used for impregnating od.—T. F. B.

Nitrosulphazones ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,747, Nov. 12, 1912.

Nitrosulphazones are obtained by treating sulphazones in concentrated sulphuric acid solution with nitrating agents at low temperatures. The products can be reduced to amino-compounds, and can be combined with diazo-compounds in alkaline solution.—T. F. B.

Sulphazonesulphonic acids ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,748, Nov. 16, 1912.

Sulphazones can be sulphonated by treating them with sulphuric acid containing anhydride at moderate temperatures. The products are capable of combining with diazo compounds to form azo dyestuffs.—T. F. B.

Condensation products of the anthraquinone series ; Process for preparing nitrogenous ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,749, Jan. 26, 1913. Addition to Ger. Pat. 265,725 (see this J., 1913, 1060).

1-Amino-4-chloroanthraquinone is condensed with β-naphthol in presence of zinc chloride, at a temperature below 200° C., preferably at 180°—190° C. The product is insoluble in alcohol, acetone, and aromatic hydrocarbons, but is easily soluble in pyridine. The chlorine atom is highly reactive.—T. F. B.

Anthraquinone derivatives containing nitrogen ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 269,842, Jan. 21, 1913.

A diazonium salt of o-aminomethylanthraquinone or a derivative thereof is heated in feebly acid solution or is treated with a substance which will unite with mineral acid, or an o-aminomethylanthraquinone is treated with nitrous acid in absence of other mineral acid. The products are formed by the elimination of the elements of water or of a hydrohalogen acid from *o*-diazomethylanthraquinone or of a salt thereof, and are therefore indazole derivatives.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Iron salts of phenols. VI. Salts of alizarin ferri-acid. R. F. Weinland and K. Binder. Ber., 1914, **47**, 977—985. (See also this J., 1913, 1029.)

Alizarin forms a ferri-acid of formula :

$$[Fe(C_6H_4(CO)_2C_6H_2O_2)_3]H_3$$

which gives well crystallised sodium, potassium and ammonium salts in the form of dark reddish-black crystalline powders. These are soluble in alcohol and water ; no precipitation occurs on adding alkali to the aqueous solutions, but dilute acids destroy the colour and give a precipitate of alizarin. The calcium salt is not crystalline and is only sparingly soluble in water. A crystalline brownish-red acid potassium alizarate,

$$C_6H_4(CO)_2C_6H_2(OK)OH+C_6H_4(CO)_2C_6H_2(OH)_2,$$

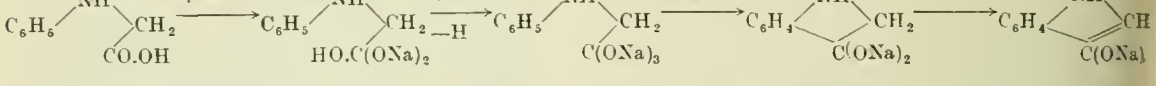
is described and also a similar tri-potassium-dializarate. —G. H. F.

Galloflavin and purpurogallin. J. Herzig. Ber., 1914, **47**, 953—955.

By the oxidation of galloflavin, or of isogalloflavin (this J., 1914, 131) with dilute nitric acid, the author obtained a crystalline substance of m. pt. 101°—103° C., proved to be oxalic acid. It was similar in properties, m. pt., and m. pt. of its dimethyl derivative, to the compound obtained by Dean and Nierenstein [Ber., 1913, **46**, 3868] by oxidising purpurogallin with dilute nitric acid and described by them as dihydroxyhemimellitic acid. Moreover, the product obtained from purpurogallin by working according to Dean and Nierenstein's method, also proved to be oxalic acid.—G. H. F.

Alkali fusions. [*Formation of indoxyl from phenylglycin and of acetic acid and ethane from acetylene.*] H. Feuchter. Chem.-Zeit., 1914, **38**, 273—274.

Theory of indoxyl ring formation in the fusion of phenylglycin with alkali. By the action of metallic sodium on anhydrous sodium acetate in presence of fused alkali at 200°—220° C., 1 mol. H_2 is evolved and 2 mols. Na consumed per 2 mols. CH_3CO_2Na, and the whole of the acetic acid of the sodium acetate can be recovered from the reaction product. This indicates that reaction takes place only at the CO-group, with formation of alkali ortho-acetate, $CH_3C(ONa)_3$, which is decomposed by water into alkali and alkali acetate. Alkali orthosulphate, $S(ONa)_6$, is formed in an analogous manner from anhydrous sodium sulphate at 260° C.: and the improved yield of alkali-indoxyl from the alkali compound of phenylglycin and fused alkali produced by addition of sodium, is attributed to an analogous formation of the ortho-salt of phenylglycin-alkali :—



Behaviour of acetylene in the alkali fusion. Acetylene is completely absorbed by fused alkali (caustic potash plus caustic soda) at 220° C., hydrogen being evolved, and the reaction product when treated with water yields alkali acetate. Alkali ortho-acetate is probably formed as intermediate product :

$$CH{\vdots}CH+2NaOH=$$

$$CH_3.CH(ONa)_2 \xrightarrow[-2H]{+NaOH} CH_3\,C(ONa)_3 \longrightarrow CH_3.CO.ONa.$$

Up to 60 per cent. of the theoretical quantity of acetic acid is produced. If metallic sodium be added to the fused alkali, acetylene is still absorbed but no hydrogen is evolved, and the residue, which is free from acetate, when treated with water evolves a volume of ethane equal to that of the acetylene absorbed.—A. S.

Bisazophenolphthalein and the coloured salts of phenolphthalein ; Constitution of ——. B. Oddo. Ber., 1914, **47**, 967—972.

EVIDENCE in support of the lactone formula,

$$(HO.C_6H_4)_2:\overline{C.C_6H_4.CO.O},$$

for phenolphthalein is given by the formation of bisazo derivatives of the type :

$$(R.N_2.C_6H_3.OH)_2:\overline{C.C_6H_4.CO.O}.$$

The latter give di-acetyl compounds, and on reduction diaminophenolphthalein, identical with the diamine formed by reducing dinitrophenolphthalein :

$$(\overset{3}{NO_2}.\overset{4}{C_6H_3}.OH)_2:\overline{C.C_6H_4.CO.O}.$$

—G. H. F.

1.2-*Naphthoquinone-4-sulphonic acid ; Condensations with* ——. F. Sachs and L. Öholm. Ber., 1914, **47**, 955—961.

OXYTHIONAPHTHENE and fluorene behave as "negative" methylene compounds (Sachs, this J., 1905, 1327), giving coloured condensation products with 1.2-naphthoquinone-4-sulphonic acid. The product from oxythionaphthene crystallises from alcohol, xylene or nitrobenzene, in fine brown-violet needles, having a metallic lustre and subliming at 170° C. It is a mordant dyestuff, and also dyes as a vat colour because of its indigoid structure, giving upon air oxidation a beautiful blue shade, very sensitive to acids.—G. H. F.

Dyestuffs ; A relation between constitution and depth of colour of ——. E. R. Watson. Chem. Soc. Trans., 1914, **105**, 759—767.

THE possession of a deep shade (*i.e.* blue, etc.) by a dyestuff is not merely a question of molecular complexity : dyestuffs which vary in shade from one end of the spectrum to the other may have similar general configurations and molecular weights, *e.g.*, hexahydroxybenzophenone and Anthracene Blue WR, diaminoazobenzene and indamine, quercetin and gallacetein, etc. The theory is put forward that if a dyestuff be quinonoid in all its possible tautomeric forms it will show a deep colour, however simple the molecule may be. If, on the other hand, there is a possibility of the molecule existing in a non-quinonoid form it will not attain a deep colour, although the molecule may be complex. Thus, the triphenylmethane dyestuffs, the pyronines, benzeins, fluorones, indophenols, indamines, oxazines, thiazines and azines all satisfy the test for a deep colour. On the other hand the benzophenone and xanthone derivatives, the flavones and flavonols, ellagic acid and the azo-dyestuffs can all be represented by non-quinonoid formulæ and many members of these groups, despite considerable molecular complexity, have no great depth of colour. To ensure a deep colour it is not sufficient that a substance should have a permanently quinonoid structure, but it must be capable of tautomerisation from one quinonoid arrangement to another, the change taking place in one and the same benzene ring. Dyes which have possible non-quinonoid forms are not included, many of these (*e.g.* indigo) having deep colours. Irregularities are introduced into the author's scheme by certain factors well known to have a deepening effect on the shape of dyestuffs, *e.g.*, increasing the number of auxochromes, the replacement of hydroxyl- by substituted amino-groups, and so on. The theory explains the contrast in shade between auramine, which can be represented in a non-quinonoid form, and the triphenylmethane dyestuffs, which are quinonoid in all their possible tautomeric forms.—J. B.

Secondary colours : Contribution to the question of ——. E. Havas. Ber., 1914, **47**, 994—995.

SPECTROSCOPICAL examination of 1-aminophenylphenazonium chloride, and of 1-aminophenylnaphthophenazonium chloride, support the view of Kehrmann and Cordon (this J., 1913, 973) that the greenish yellow colour of thes compounds is to be regarded as secondary yellow.—G. H. I

PATENTS.

Azo dyestuffs ; Manufacture of yellow ——. P. A. Newto London. From Farbenfabr. vorm. F. Bayer und C Elberfeld, Germany. Eng. Pat. 8415, April 9, 1913.

THE diazo compounds of toluidines or their sulphon acids are combined with 1-chlorophenyl-3-methylpyrazolonesulphonic acids, or the diazo compounds a combined with acetoacetic ester and the resulting co pounds are condensed with chlorophenylhydrazines phonic acids. The products dye wool from acid bat level greenish-yellow shades, fast to light.—T. F. B.

Monoazo dyestuffs ; Process for producing ——. Farb fabr. vorm. F. Bayer und Co. First Addition, dat Oct. 2, 1913, to Fr. Pat. 457,840, April 21, 1913. Un Int. Conv., Oct. 15, 1912.

DYESTUFFS analogous to those described in the princi patent (see this J., 1913, 1004) are obtained by combin with naphtholsulphonic acids, aminonaphtholsulpho acids, etc., the diazo compounds of the aminobenzin azole or *p*-aminophenylazimino derivatives of amisalicylic acid. The benziminazole derivatives may be obtained by condensing aminosalicylic acid with dinitrochlorobenzene, reducing, and treating the resulting 2.4-diaminophenylaminosalicylic acids with acidylating and saponifying agents. The aminophenylazimino compounds may be obtained by reducing 2.4-dinitrophenyl-*p*-aminosulphosalicylic acid to the nitro-amino compound, treating with nitrous acid, and reducing the product. The resulting dyestuffs furnish fast shades varying from yellowish-red to bluish-red and red-violet.—T. F. B.

Vat dyestuffs of the anthraquinone series containing sulphur ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 463,698, Oct. 16, 1913. Under Int. Conv., Oct. 25, 1912.

SUBSTANCES which dye cotton yellow to red shades from the vat, are obtained by the action of a polythiophenol on at least two mols. of a negatively-substituted anthraquinone derivative, or by the action of a derivative of benzene containing two or more halogen atoms on at least two mols. of an anthraquinonyl-mercaptan. The dyestuff from α-chloroanthraquinone and benzene-1.3-dimercaptan gives yellow shades from the vat, whilst that from 1-benzoylamino-4-chloroanthraquinone and benzene-1.3-dimercaptan dyes scarlet shades.—T. F. B.

Vat dyestuffs of the anthraquinone series ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 270,579, Aug. 13, 1912.

AMINOANTHRAQUINONES or their derivatives are treated with oxalic esters in presence of alkaline condensing agents. The products dissolve with difficulty, and may be used as vat dyestuffs.—T. F. B.

Pyridone dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 269,894, Jan. 4, 1913.

α-PYRIDONES are condensed with secondary or tertiary aromatic amines in presence of dehydrating condensing agents. The resulting dyestuffs can be applied to wool and to tannin-mordanted cotton. Orange-red shades are obtained with the products from the simplest pyridones and from the quinolones, whilst blue dyeings are produced with those from the anthrapyridones.—T. F. B.

Polyazo dyestuffs ; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., G. m. b. H., Frankfort, Germany. Eng. Pat. 8984, April 16, 1913.

A *p*-NITROAMINE is diazotised and combined with a naphtholsulphonic acid, the monoazo dyestuff is reduced, diazotised, and combined with 1.6- or 1.7-naphthylaminesulphonic acid, and the product is diazotised and combined with resorcinol : the same result is obtained by saponifying the monoazo dyestuff from an acetyl-*p*-diamine and a naphtholsulphonic acid and then proceeding as above. Identical dyestuffs are obtained by combining diazotised 4-nitro-1-naphthylamine-6- or -7-sulphonic acid or 4-acidylamino-1-naphthylamine-6- or -7-sulphonic acid with an amine having a free *p*-position, diazotising, combining with a naphtholsulphonic acid, reducing or saponifying, again diazotising, and finally combining with resorcinol. Another method for preparing the dyestuffs is to diazotise a monoazo dyestuff of the type, $NH_2.X.N_2$-Clève's acid, combine with a naphtholsulphonic acid, diazotise, and finally combine with resorcinol. The products dye cotton fine greenish to reddish blue shades, fast to washing and to light : the fastness to washing may be improved by after-treatment with formaldehyde.
—T. F. B.

Basic dyestuffs ; Process for preparing ——. L. Cassella und Co. Ger. Pat. 269,802, Jan. 8, 1913.

AMINOACRIDINIUM dyestuffs are treated with aqueous solutions of metallic cyanides, and the products are oxidised. The intermediate compounds possess no tinctorial properties, but oxidation converts them into basic dyestuffs which dye red to violet shades.—T. F. B.

Vat [anthracene] dyestuffs and process for their formation. M. Iljinsky, and R. Wedekind und Co., Uerdingen on Rhine, Germany. Eng. Pat. 19,435, Aug. 27, 1913.

DYESTUFFS containing sulphur, which produce olive and brown shades from the hydrosulphite vat, are obtained by heating with thiosulphates in absence of any solvent or liquid diluent, anthraquinonesulphonic acids or their salts, alizarinsulphonic acids or their salts, sulphonic acids of anthraflavic acid or of *iso*-anthraflavic acid or their salts, or their halogen derivatives, or 2-hydroxyanthraquinone or its 1-chloro- or dibromo-derivatives. All the products are insoluble in sodium sulphide solutions. The dyestuffs obtained by this process from 2-hydroxyanthraquinone, 1-chloro-2-hydroxyanthraquinone, or dibromo-2-hydroxyanthraquinone may be dissolved in concentrated sulphuric acid, precipitated by adding water, and treated with an alkaline solution of chlorine ; this treatment converts the brown dyestuffs into orange-red dyestuffs of very pure shade.—T. F. B.

Polyazo colouring matters ; Process for the manufacture of bronze-brown to olive-brown direct dyeing ——. Chem. Fabrik vorm. Sandoz, Basle. Eng. Pat. 23,119, Oct. 13, 1913. Under Int. Conv., Feb. 12, 1913.

A TETRAZOTISED *p*-diamine of the diphenyl series is combined with one mol. of a phenol-*o*-carboxylic acid and with one mol. of 1.8-aminonaphthol-3.6-disulphonic acid, and the amino group is diazotised and combined with resorcinol ; if this trisazo dyestuff is combined with a nitro-diazo compound of the benzene series in feebly alkaline solutions or in solutions made feebly acid with a fatty acid, polyazo dyestuffs are obtained, which are readily soluble in water and dye unmordanted cotton from neutral or feebly alkaline baths, bronze-brown to olive-brown shades fast to washing. Subsequent treatment of the dyeings with chromium fluoride or with bichromate and acetic acid increases their fastness to washing without appreciably altering the shade.—T. F. B.

Safranine dyestuffs ; Derivatives of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 463,357, Oct. 7, 1913. Under Int. Conv., July 15, 1913.

NEW derivatives of dyestuffs of the Safranine series, which are insoluble or very sparingly soluble in water, can be obtained by treating the dyestuffs or their salts with tannin. The products are especially suitable for use in making colour lakes. *Example :* 1000 parts of Tolusafranine hydrochloride are dissolved in hot water and 500 parts of sodium acetate and then an aqueous solution of 2000 parts of tannin are added. The tannin derivative separates and is filtered, washed with cold water, and dried.—T. F. B.

Condensation products [dyestuffs] from carbazoles and phthalic anhydride. Badische Anilin und Soda Fabrik. Fr. Pat. 463,508, Oct. 10, 1913. Under Int. Conv., Nov. 1, 1912.

CARBAZOLE or one of its derivatives is condensed with phthalic anhydride in presence of concentrated or slightly diluted sulphuric acid. The products which do not contain sulphonic groups are vat dyestuffs, whilst the sulphonated products are direct wool dyestuffs. They are formed by the condensation of one or two mols. of phthalic anhydride with each carbazole nucleus, and are probably anthraquinone derivatives. The products may with advantage be treated with a hypochlorite. The sulphonated product from carbazole and phthalic anhydride, when so treated, dyes wool golden yellow shades fast to washing. The phthalic anhydride may be replaced by its substitution products, such as the chloro derivatives. The new products are different from those formed when condensation is effected in presence of aluminium chloride and the products treated subsequently with sulphuric acid.—T. F. B.

Acridones and thioxanthones of the benzanthrone series ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 269,850, Sept. 21, 1912.

THE products obtained by condensing aromatic amino- or mercapto-compounds with halogenbenzanthronecarboxylic acids, in which the halogen and carboxyl groups are adjacent, are treated with condensing agents in such a manner that the acridone or thioxanthone ring is formed. The products dye indigo-blue to green shades from the vat.—T. F. B.

Indigoid dyestuffs; Process for preparing ——. Kalle und Co., A.-G. Fr. Pat. 463,772, Oct. 4, 1913. Under Int. Conv., Nov. 14 and 19, 1912, and Feb. 15, 1913.

See Ger. Pat. 269,123 of 1912; this J., 1914, 247. The pheno-hydroxynaphthocarbazoles derived from α- or β-naphthylamine may also be condensed with homologues or substitution products (in the position 2) of 2.3-diketodihydro-(1)-thionaphthene and the products treated with halogens. The condensation product from 2.1-pheno-5-hydroxynaphthocarbazole and 2-dibromo-3-ketodihydro-(1)-thionaphthene after bromination dyes cotton violet-blue shades from the vat. Again, products which dye deep blue or green to black shades from the vat, are obtained by condensing α-isatin derivatives with derivatives of naphthols such as arylamino, aryltriazole, aryltriazine, aryliminazole, or arylthiazole derivatives: the tinctorial properties of these products are improved by halogenation. Further, vat dyestuffs which furnish deep blue to black shades are obtained by condensing α-derivatives of isatin with the acidyl derivatives or the ureas of heteronuclear aminonaphthols or their homologues or substitution products; for example, the product obtained by condensing 2-benzoylamino-5-naphthol with isatin-α-anilide in presence of acetic anhydride, dyes textile fibres fast black shades from the vat.—T. F. B.

Monoazo dyestuffs for wool; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 269,799, Oct. 13, 1912.

The diazo compound of an aminodiarylsulphone, aminodiarylsulphoxide, or aminodiarylsulphide is combined with an alkylbenzylanilinesulphonic acid. The products dye wool level yellow to orange-red shades, which are faster to washing and fulling than other known dyestuffs derived from alkylbenzylanilinesulphonic acids.—T. F. B.

Monoazo dyestuffs for wool; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,942, Dec. 7, 1912. Addition to Ger. Pat. 269,799.

The acids obtained by sulphonating dibenzylaniline and benzyl-o-toluidine are used in place of the alkylbenzylanilinesulphonic acid mentioned in the principal patent (see preceding abstract). The products dye wool fast yellow to orange shades. When sulphuric acid monohydrate at 100° C. is used for the sulphonation of the above amines, the products are dibenzylanilinedisulphonic acid and benzyl-o-toluidinemonosulphonic acid.—T. F. B.

Vat dyestuffs of the anthraquinone series; Process for preparing ——. A. Schaarschmidt. Ger. Pat. 269,800, Oct. 5, 1912.

The o-cyanimines or o-cyanothioethers, obtained by condensation of o-halogen-nitriles of anthraquinone or its derivatives with amino- or thio-anthraquinones, are treated with condensing agents. The products, which are vat dyestuffs, consist of dianthraquinonylacridones and dianthraquinonylthioxanthones, respectively.—T. F. B.

2-Thionaphthene-2-indole-indigo or its derivatives; Preparation of transformation products of ——. Ges. f. Chemische Industrie in Basel. Ger. Pat. 270,334, April 6, 1913.

2-Thionaphthene-2-indole-indigo or one of its derivatives is treated with benzoyl chloride or an analogous substance, preferably in presence of a diluent or a condensing agent. Red or violet products are obtained, which have the properties of vat dyestuffs.—T. F. B.

Azo dyestuffs; Process for preparing ——. Anilinfarben und Extrakt-Fabrik vorm. J. R. Geigy. Ger. Pat. 270,831, Dec. 14, 1912. Addition to Ger. Pat. 261,047 (see Fr. Pat. 450,866 of 1913; this J., 1913, 593).

Azo dyestuffs derived from diazophenols or their derivatives are treated in alkaline solution or suspension with an arylsulphochloride. The products are suitable for use in dyeing silk and wool and in preparing lakes.—T. F. B.

Colouring agents and processes for their production. R. Vidal, Asnières, France. Eng. Pat. 17,982, Aug. 7, 1913.

See Fr. Pat. 458,545 of 1912; this J., 1913, 1061.—T. F. B.

Vat dyestuffs; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 22,528, Oct. 6, 1913. Addition to Eng. Pat. 19,599, Aug. 27, 1912.

See Addition of Sept. 24, 1913, to Fr. Pat. 447,592 of 1912; this J., 1914, 247.—T. F. B.

Anthracene dyes and process of making same. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,086,123, Feb. 3, 1914.

See Fr. Pat. 408,787 of 1909; this J., 1910, 621.—T. F. B.

Anthraquinone vat dyes. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,090,621, March 17, 1914.

See Eng. Pat. 21,615 of 1912; this J., 1913, 694.—T. F. B.

Vat [anthracene] dye; Brown ——. A. Lüttringhaus, Mannheim, O. Lohse, and A. Sapper, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,090,636, March 17, 1914.

See Eng. Pat. 28,361 of 1912; this J., 1913, 1004.—T. F. B.

Cotton [azo] dyes. A. Blank, C. Heidenreich, and J. Jansen, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,090,379, March 17, 1914.

See Eng. Pat. 8767 of 1913; this J., 1913, 905.—T. F. B.

Disazo dyestuff. A. L. Laska and A. Zitscher, Offenbach, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,091,148, March 24, 1914.

See Fr. Pat. 461,644 of 1913; this J. 1914, 195.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Artificial silk manufacturing results. Chem. Trade J., April 4, 1914. [T.R.]

The viscose process for the manufacture of artificial silk is making rapid progress among Continental manufacturers, and the financial results of two important concern that have discarded other processes in favour of th viscose process is sufficient to show that the change ha not been made at the expense of the profits. The Fabriqu de Soie Artificielle de Tubize, which has hitherto manu factured by the guncotton process, is increasing its capita by two million francs in order to acquire a controllin interest in a new company which will work the viscos system in Belgium. The last report shows a net profi of 1,088,902 francs, and dividends of 25 per cent. on th preference shares and 20 per cent. on the ordinary shar are being paid. The report issued by the Vereinigt Glanzstoff-Fabriken, Elberfeld, probably the largest pr ducers of artificial silk in the world, shows a net profit

5,743,598 marks, against 3,726,825 marks in the previous year, and a dividend of 34 per cent. is proposed. Up to about two years ago this company worked only the cuprammonium process, but it has since adopted the viscose one, with good results.

Patents.

Medicated fibrous substances. P. H. Head, Horley, Surrey. Eng. Pat. 7650, April 1, 1913.

Wool or other animal fibre is scoured, carded into the state of a flat band resembling wadding, and impregnated with capsicum or capsicin, or other drugs of a stimulating nature such as iodine, iodoform, eucalyptus or terebene. —J. B.

Plastic composition, its manufacture and industrial application; A new ——. Y. Charuel. Fr. Pat. 463,156, Oct. 2, 1913.

The composition contains 4—25 per cent. of cellulose acetate, 60—95 of acetone and 1·5—5 per cent. of refined paper pulp, which may be either moist or dry. It is suitable for packing joints, insulating cables or the manufacture of plates, discs, etc. Neutral bodies, such as resin, shellac, asbestos, etc., may be incorporated for special purposes.—J. F. B.

Artificial silk; Process for increasing the flexibility and strength of articles composed of ——. J. A. E. Friedel. Fr. Pat. 463,160, Oct. 2, 1913. Under Int. Conv., July 31, 1913.

Articles of artificial silk, *e.g.*, stockings, are rendered supple by stretching them upon a block, immersing in water, or steam, not too hot, and then rapidly drying. —J. F. B.

Textile articles from solutions of cellulose or plastic masses; Process and apparatus for producing ——. B. Borzykowski. Fr. Pat. 463,400, Oct. 8, 1913. Under Int. Conv., Oct. 9, 1912.

A thin layer of a solution of cellulose or other plastic composition is discharged from the orifice of a spreading machine upon a smooth surface and is then impressed by an engraved roller, situated in front of the spreading machine, with designs representing a woven fabric or other tissue. A mass composed of cellulose beaten up with caustic soda with the addition of starch and gluten may also be employed; decorative substances and metallic powders may be incorporated with the mass. The depressions on the engraved roll may contain coagulating liquids or other substances. The tissue is neutralised, fixed and purified in subsequent baths.—J. F. B.

Viscose and similar products; Process of rendering impermeable, articles made from ——. P. Lagrange. Fr. Pat. 463,613, Dec. 21, 1912.

Articles of cellulose manufactured from viscose or uprammonium solution, *e.g.*, artificial flowers, leaves, etc., re rendered impermeable by a thin coating of an ester of ellulose.—J. F. B.

ellulose products [*viscose*]*; Manufacture and strengthening of* ——. A. Chesnais. Fr. Pat. 463,693, Dec. 23, 1912.

N the manufacture of cellulose products from the xanthate uitable derivatives of phosphorus, particularly hypohosphorous acid, are employed to dehydrate the cellulose olecule. The hypophosphorous acid may be added to he viscose itself or may be used in the coagulating or xing baths or may be applied to the already fixed roducts.—J. F. B.

elluloid substitute and process of manufacturing same. A. S. von Szolayski. Fr. Pat. 463,906, Oct. 22, 1913.

solution of 3 parts by vol. of gelatin in cold water is corporated with a mixture of 3 parts by vol. of casein d 3 parts of sodium silicate and the whole is hardened alum or equivalent tanning substance.—J. F. B.

Sulphite pulp from resinous woods; Manufacture of ——. O. Carr, Asheville, N.C. U.S. Pat. 1,089,691, March 10, 1914.

Before digesting with sulphite the chips are extracted with turpentine and with an alkaline solvent to remove resinous substances.—J. B.

Paper pulp; Apparatus for straining ——. W. W Beaumont. Fr. Pat. 463,392, Oct. 8, 1913. Under Int. Conv., Oct. 10, 1912.

In a drum strainer, the drum is oscillated silently at a high speed in a circular or elliptical path by means of vibro-motors operating through arms on which the drum is suspended. Silence is obtained by means of springs which take up the reciprocating motion of the articulated joints. Means are provided for rotating the drum simultaneously about its axis, also for regulating the amplitude and varying the path of the oscillatory motion of the arms.—J. F. B.

Paraffined paper, pasteboard, etc.; Process for preparing ——. A. Lutz. Ger. Pat. 269,963, March 29, 1912.

An aqueous emulsion of paraffin is applied to the paper on the machine during the manufacturing or finishing process. In particular, it may be added to the water used for moistening the web.—T. F. B.

Ethers of cellulose, its conversion products and derivatives; Process for the manufacture of ——. L. Lilienfeld, Vienna. Eng. Pat. 6035, March 11, 1913. Under Int. Conv., March 16, 1912.

See Fr. Pat. 447,974 of 1912; this J., 1913, 420.—T. F. B.

Plastic and elastic compositions, artificial filaments, films, coatings, and the like products [*from cellulose ethers*]*; Manufacture of* ——. L. Lilienfeld, Vienna. Eng. Pat. 6387, March 14, 1913. Under Int. Conv., March 16, 1912.

See Fr. Pat. 459,972 of 1913; this J. 1913, 1153.—T. F. B.

Films; Apparatus for the production of ——. B. Borzykowski, Berlin. U.S. Pat. 1,090,649, March 17, 1914.

See Fr. Pat. 454,692 of 1913; this J., 1913, 865.—T. F. B.

[*Paper*] *pulp; Preparing* ——. C. Bache-Wüg, Portland, Maine, U.S.A. Eng. Pat. 944, Jan. 13, 1914.

See U.S. Pat. 1,084,244 of 1914; this J., 1914, 196.—T.F.B.

Extracting resinous and other products from wood, with simultaneous production of paper pulp Fr. Pat. 463,879. *See* XIII.

Imitation rubber with a basis of acetylcellulose. Fr Pat. 463,622. *See* XIV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Glycollic acid and its application [*in dyeing and printing*]. O. Diehl. Färber-Zeit., 1914, 25, 138—141.

Glycollic acid, prepared electrolytically from oxalic acid, is now available for industrial purposes. Its properties are comparable with those of tartaric acid, over which it is stated to have many advantages for use in dyeing and printing. For example, it has a highly solvent action on the tannin lakes of basic dyestuffs and can be advantageously used in the printing of such colours on cloth prepared with β-naphthol. Patterns are given illustrating its use in this way for New Methylene Blue and Para Red effects. In wool printing the use of glycollic acid is said to decrease the marking off which is a defect of the Ponceaux and Bordeaux. In wool printing also the use of ammonium glycollate is recommended instead of ammonium oxalate. Aluminium and tin glycollates are stated to give good results in Alizarin and Alizarin Orange printing, and in printing with chromium acetate the addition of glycollic acid is said to preserve the colour without interfering with lake formation on steaming. The replacement of part of the hydrochloric acid in Aniline Black dyeing by glycollic acid reduces the risk of tendering.—J. B.

Patents.

Bleaching textiles by stearine emulsions. E. Lasbordes. Third Addition, dated Sept. 25, 1913, to Fr. Pat. 399,514, Feb. 8, 1909.

A violet (preferably acid) dyestuff, capable of resisting the action of sulphurous acid, is added to the bleaching agent described in the chief patent and previous additions thereto, and also in Fr. Pat. 400,792 (this J., 1909, 979, 1094, 1122; 1911, 1052).—J. B.

Mercerising; Process for purifying caustic soda solutions used in ——. E. V. Chambers and T. C. Hammond, Huddersfield. Eng. Pat. 3063, Sept. 6, 1913.

Mercerising liquor which has become too impure for further use is carbonated by means of flue gases which have been washed free from acids and dust. The organic impurities are thereby precipitated and after the separation of these the sodium bicarbonate solution is re-causticised by means of lime. Alternatively the carbonation may be carried only to the normal carbonate stage and pure sodium carbonate obtained by crystallisation.—J. B.

Silk weighting with haematoxylin; Process of ——. F. Müller, Zürich, Switzerland. Eng. Pat. 26,735, Nov. 20, 1913. Under Int. Conv., April 5, 1913.

A water-soluble phosphate is added directly to the hæmatoxylin bath, with or without the addition of soap, whereby an increased weighting is obtained; for example, scoured silk, previously weighted as usual with zinc hydroxide, phosphate or phosphate-silicate, is treated with 100 per cent. of hæmatoxylin and 50 per cent. or more of sodium phosphate, the temperature being gradually raised from 50° C. until the required weight is attained.—J. B.

Aniline Black; Process for dyeing ——. A. E. Vergé, Vincennes, France. Eng. Pat. 15,668, July 7, 1913.

The process differs from the known air-oxidation method in the use of a greater proportion of aniline and *p*-phenylenediamine and a smaller proportion of copper salt and metabisulphite, and in the omission of ammonium chloride. After partial drying and a cold air ageing, the goods are "finished" by impregnating in a chromate bath containing about ½ per cent. of aniline and passed over drying cylinders, or the chromate bath itself is heated. The aniline may, alternatively, be applied separately before chroming. (Reference is directed to Eng. Pat. 16,189 of 1907; this J., 1908, 854.)—J. B.

Aniline Black on cotton; Process for producing —— *by the cold process.* K. Biltz. Ger. Pats. 270,059 and 270,060, Nov. 19, 1912, and April 1, 1913.

(1) Cotton is immersed for one hour in a bath containing aniline salt, sodium chlorate, ammonium chloride, copper sulphate, and aluminium acetate, together with an amount of oxalic acid corresponding to 1 to 2 per cent. of the weight of the goods to be dyed; the impregnated fibre is freed from excess of liquid, and then immersed, without drying, for three hours in a bath containing aniline salt, sodium bichromate, and sulphuric acid, together with oxalic acid (5 per cent. of the weight of the cotton). The goods are finally treated with a solution of ferrous-ammonium sulphate, sodium bichromate, copper sulphate, and sulphuric acid. The dyeings are very fast to fulling, and compare favourably with those produced by the usual methods as regards fastness to light, acid, and alkali; they do not bleed on white goods. (2) The second and third baths may be combined, with the result that the entire process only occupies from three to four hours.—T. F. B.

Dyeing and otherwise treating cloth with liquids; Machine for ——. A. J. and J. A. Rau. Fr. Pat. 463,603, Oct. 14, 1913. Under Int. Conv., Oct. 17, 1912.

The machine is a form of jigger, in which the cloth passes through the bath along with an endless apron of woven wire revolving under tension between two rollers, one vertically above the other. A casing encloses the apron, and the dye-liquor is caused to circulate from the outside, through the casing (which is constructed of filtering material) thence through the moving cloth and into the interior of the apron, whence it is returned to the circulating apparatus.—J. B.

Machine for dyeing cotton and linen with vat or sulphide dyestuffs. P. Kaufmann. Fr. Pat. 463,779, Oct. 18, 1913.

The cloth is passed from the preparing bath over a stretcher and into the dyebath, through which it passes along with an endless apron. The dyebath is made deep (2 to 3 metres) and narrow (1 to 1·20 metres) and has a curved bottom on which the cloth is fed in pleats by a pair of rollers fitted to with a scraper to prevent entanglement.—J. B.

Discharging vat and sulphide colours with reducing agents; Process for ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 17,031, July 24, 1913.

In cases where a satisfactory white cannot be obtained in discharging vat and sulphide dyestuffs (*e.g.*, Hydron Blue R, Tetrabromoindigo, etc.) with reducing agents (*e.g.*, Hydraldite CL combined with Leukotrope W), the cloth is padded with a solution of an alkali such as caustic soda, sodium carbonate, borax or sodium silicate, then dried and printed with the discharge.—J. B.

Discharges on indigo and other reducible dyestuffs; Process for producing coloured —— *by means of vat dyestuffs.* Gebr. Enderlin, Druckfabr. u. Mechanische Weberei A.-G. Ger. Pat. 270,124, Aug. 26, 1913. Addition to Ger. Pat. 263,647.

The discharge colours mentioned in the principal patent (see this J., 1913, 1007) are replaced by mixtures containing the vat dyestuff and the discharging agent (*e.g.*, Rongalite CL), together with anthraquinone and zinc oxide; the iron and tin salts are omitted.—T. F. B.

Reserving gallocyanine dyestuffs and their leuco compounds on cotton fibre; Process for ——. Farbwerke vorm. L. Durand, Huguenin und Co. Ger. Pat. 269,933, May 3, 1913.

The fibre is printed with a reserve paste containing chromium phosphate and the chromium salt of a hydroxycarboxylic acid of the aliphatic series, before the application of the dyestuff. Pure white reserves are obtained, even with dark shades.—T. F. B.

Lustre resistant to water and soap; Process for giving cotton goods a silky ——. C. Rumpf. Fr. Pat. 464,114 Oct. 25, 1913. Under Int. Conv., Oct. 28 and Nov. 16 1912.

The goods are moistened with an oxidising agent (*e.g.*, solution of 100 to 250 grms. of potassium bichromate i 100 litres of water, or a solution of 5 to 35 parts of 10 pe cent. by vol. hydrogen peroxide in 100 parts of water) an then hot calendered with pressure. Or, the goods may b treated with the oxidising agent and then dyed an finally calendered; for example, goods are boiled for 45 t 60 mins. in a solution of 15 to 70 parts of hydroge peroxide (10 per cent. by vol.) in 100 parts of water, t which a little ammonia is added, and finally washed, drie moistened and calendered.—J. B.

Dyeing machines. W. Schlbach, Barmen, Germany. Eng. Pat. 13,947, June 16, 1913. Under Int. Conv., June 14, 1912.

See Fr. Pat. 459,196 of 1913; this J., 1913, 1106.—T. F. B.

Dyeing vegetable fibres. J. Turner and H. Dean, Assignors to Read Holliday and Sons, Ltd., Huddersfield. U.S. Pat. 1,090,176, March 17, 1914.

See Fr. Pat. 455,803 of 1913; this J., 1913, 940.—T. F. B.

Dyeing and washing machine. W. Higgins and J. Rhodes, Bradford. U.S. Pat. 1,090,397, March 17, 1914.

See Eng. Pat. 14,190 of 1911; this J., 1912, 638.—T. F. B.

Fabrics; Apparatus for drying —— A. T. Metcalf and H. V. Nunn, Assignors to Bradford Dyers' Assoc., Ltd., Bradford. U.S. Pat. 1,090,934, March 24, 1914.

See Eng. Pat. 8756 of 1911; this J., 1912, 122.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Boric acids; Complex ——. N. Dhar. Z. anorg. Chem., 1914, **86**, 196—200.

The effect of the added glycerol or mannitol in the titration of boric acid is probably to form a complex anion which can unite with the hydrogen ion to give an acid much stronger than boric acid. The salts of the new acid are not hydrolysed to such an extent as the borates so that it is possible to titrate it with alkali in the presence of phenolphthalein. If this view is correct the conductivity of boric acid solution should be greatly increased by adding glycerol or mannitol. This is actually the case and, as would be expected from the law of mass action the increase of conductivity is proportional to the concentration of boric acid and of the hydroxy compound in the solution. —W. H. P.

Ammonia; Direct recovery of —— as sulphate, without distillation. W. Strommenger. Stahl u. Eisen, 1913, **41**, 1694—1697.

For removing tar from hot gases previous to the direct recovery of ammonia as sulphate, the author describes a scrubber composed of two superposed chambers containing washing-tar up to the level of an overflow. The gases, brought to the desired temperature by means of a spray of ammonia liquor, are admitted to a number of inverted troughs immersed in the tar, and having serrated lower edges; two perforated plates are also immersed in the tar in order to ensure intimate contact between the gases and the tar. The gases pass first through the lower and then through the upper chamber, and in the latter there s a filter above the tar level, to retain any tar spray. The washing tar is renewed by the tar separated from the gas, and the surplus runs continuously from the overflows. The apparatus has been in use for some time in connection with 120 coke ovens at Ruhrort. No tar could be detected n the gases leaving the scrubber, and the quantity of ammonia in the gases leaving the saturator was only 0·75 grm. per 100 cb. m. The sulphate of ammonia was of a good grey colour, and contained 25 per cent. NH_3 on leaving the hydroextractor.—A. T. L.

Potassium tetroxide. R. de Forcrand. Comptes rend., 1914, **158**, 843—846.

Potassium tetroxide was decomposed with sulphuric acid, and its heat of formation calculated to be: K_2 sol. + O_4 gas = K_2O_4 sol. + 133·74 cals.; K_2O sol. + O_3 gas = K_2O_4 sol. + 46·94 cals. The heat of formation of sodium tetroxide from the monoxide would probably only be about 29 cals., of which 19 cals. are liberated for the change $Na_2O \rightarrow Na_2O_2$, so that trioxide and tetroxide of sodium must be very unstable substances.—G. F. M.

Barium chloride solutions; Electrolysis of —— with mercury cathodes. P. P. Fedotieff. Z. anorg. Chem., 1914, **86**, 325—337.

The Kellner-Solvay method may be applied with good results to the preparation of pure baryta from barium chloride solution, a given current yield being obtained with smaller cathode density than with the alkali chlorides, owing to the relative stability of barium amalgam. The amalgam is, however, rapidly decomposed by water at 60° C. in the presence of iron, and a solution which, on cooling, deposits crystals of $Ba(OH)_2$, $8H_2O$, is readily prepared. Castner's method is less suitable. An increased cathode density is favourable to a high current yield. —F. Sodn.

Nitrates of potassium, barium, and strontium; Solubility of —— and the stability of the double nitrate of potassium and barium. A. Findlay, I. Morgan and I. P. Morris. Chem. Soc. Trans., 1914, **105**, 779—782.

The results of experiments on the solubility of barium nitrate in the presence of potassium nitrate at 9·1°, 21·1°, and 35° C. are given in a table and a curve-diagram. The double salt, $2KNO_3,Ba(NO_3)_2$, has a wide range of stability which increases as the temperature rises. The positions of the curves show that at the temperatures mentioned and at higher temperatures, the double salt could be crystallised only from solutions containing excess of potassium nitrate, whilst on recrystallisation from water it would deposit barium nitrate first and leave a solution relatively rich in potassium nitrate. Using strontium nitrate instead of barium nitrate no double salt was observed at 20° or 40° C. The only solid phases at 20° were KNO_3 and $Sr(NO_3)_2,4H_2O$ and at 40° C. KNO_3 and $Sr(NO_3)_2$.—W. H. P.

Nitrates; Reaction of —— with formic acid and their determination. U. Molinari. Staz. sperim. agrar. ital., 1913, **47**, 24—32. Chem. Zentr., 1914, **1**, 1221—1222.

Experiments with potassium and barium nitrates and formic acid of different concentrations showed that the method proposed by Quartaroli (this J., 1911, 926) for the determination of nitrates is useless, the gases produced containing varying quantities of nitrous and nitric oxides and carbon dioxide under practically constant experimental conditions.—A. S.

Nitrites; Investigations on ——. M. Oswald. Ann. Chim. Phys., 1914, [9], **1**, 32—112. Chem. Zentr., 1914, **1**, 1151—1154. (See also this J., 1911, 359; 1913, 83.)

The only practical method for the preparation of pure nitrites is by fractional crystallisation of commercial sodium nitrite; silver nitrite is prepared from the purified sodium nitrite and then serves for the preparation of other nitrites by double decomposition. The solubility of potassium and sodium nitrites at different temperatures is as follows:—

Parts of nitrite dissolved by 100 parts of water at:—

	0° C.	10° C.	20° C.	30° C.	40° C.	50° C.	60° C.	70° C.	80° C.	90° C.	100° C.	110° C.	120° C.	130° C.
NO_2 ……	281	291	302	313	325	337·5	351	365	380	396	413	432	451	473
aNO_2 ……	73	78	84	91·5	98·5	107	116	125·5	136	147	160·5	178	198·5	—

The solubility of sodium nitrite is diminished by the presence of sodium sulphate. A solution saturated at 16° C. con tains 42·3 per cent. of calcium nitrite. Silver nitrite forms double salts with some nitrites, viz., $K_2Ag_2(NO_2)_4,H_2O$, $Na_2Ag_2(NO_2)_4,H_2O$ and $BaAg_2(NO_2)_4,H_2O$. The temperatures of decomposition of some nitrites are: $NaNO_2$, 320°; KNO_2, 350°; $LiNO_2$, 185°; $Ba(NO_2)_2$, 235°; $Sr(NO_2)_2$, 240°; $Ca(NO_2)_2$, 220° C. (see also this J., 1905, 26). Nitrogen peroxide acts on alkali and alkaline-earth nitrites in two different ways:—

$$NaNO_2+NO_2=NO+NaNO_3;$$
$$2NaNO_2+NO_2=N+2NaNO_3.$$

Solid alkali and alkaline-earth nitrites are not affected by oxygen at temperatures below their decomposition point. Aqueons solutions, also, are stable, if perfectly neutral, but in presence of acid the nitrites are slowly oxidised by air:—

$$3HNO_2=HNO_3+2NO+H_2O;$$
$$2NO+2O+H_2O=HNO_3+HNO_2.$$

—A. S.

Calcium cyanamide; Presence of nitride in ——. C. Manuelli. Annali Chim. Appl., 1914, **1**, 110—114.

Samples of calcium cyanamide of different origin contained up to 0·56 per cent. of nitride, as determined by distilling with water and magnesia under diminished pressure at 35°—40° C., and absorbing the liberated ammonia.—A. S.

Manganous arsenate jellies; Preparation and properties of ——. E. Deiss. Kolloid-Zeits., 1914, **14**, 139—146.

One part of a solution of manganous chloride (100 grms. $MnCl_2,4H_2O$ per litre) is diluted with an equal volume of water and from 1 to 10 parts of a solution of mono-potassium arsenate (90 grms. per litre) added rapidly: the whole soon sets to a stiff colourless clear jelly. The jelly becomes slightly opalescent on standing, and after some weeks, small pink crystals appear in places and these gradually unite to spherolites of 1—2 mm. diam. The formation of crystals takes place more rapidly if the jelly is heated on a steam-bath, evaporation being prevented: in 4—6 hours, it changes into a mass of light violet-pink leaflets of the composition, $MnHAsO_4,H_2O$, very sparingly soluble in water.—A. S.

Chromium hydroxide; Absorption of carbon dioxide from the air by ——. M. Z. Iovitchitch. Comptes rend., 1914, **158**, 872—874.

Pure chromium hydroxide, precipitated by ammonia, and entirely free from alkali, slowly absorbs carbon dioxide from the air, attaining eventually a constant composition represented by the formula $[Cr_2(OH)_5]_2CO_3,8H_2O$, This monocarbonate loses water but retains its carbonic acid when dried at 100° C.—G. F. M.

Chromous oxide. T. Dieckmann and O. Hanf. Z. anorg. Chem., 1914, **86**, 301—304.

Chromous oxide (CrO) was obtained as a black powder by warming chromium amalgam with dilute nitric acid. It was insoluble in this and in dilute sulphuric acid, but dissolved in dilute hydrochloric acid, with evolution of hydrogen. At 1000° C. carbon monoxide converted it into a mixture of carbide and chromic oxide, and hydrogen reduced it to the metal. Chromic oxide was not affected by hydrogen or carbon monoxide even at 1300° C.

—F. Sodn.

Arsenides and phosphides of chromium; Some ——. T. Dieckmann and O. Hanf. Z. anorg. Chem., 1914, **86**, 291—295.

By heating finely divided chromium (prepared from chromium amalgam) with an excess of the metalloid in sealed tubes (see this J., 1911, 1216), Cr_2As_3 and Cr_2P_3 were obtained, and these yielded CrAs and CrP respectively, when heated in a current of hydrogen. All are grey in colour and insoluble in mineral acids.—F. Sodn.

Scandium. R. J. Meyer, A. Wassjuchnow, N. Drapier, and E. Bodländer. Z. anorg. Chem., 1914, **86**, 257—290.

Scandium oxide is best prepared from the oxide residues (0·3 per cent. Sc_2O_3) obtained in the manufacture of tungstic acid from wolframite from the Erzgebirge district of Saxony. For its preparation in quantity, free from thorium, the sodium carbonate method (this J., 1910, 1008) or the ammonium tartrate method (this J., 1912, 720) is preferred. A number of salts and double salts (complex fluorides, sulphates, and oxalates) are described, and it is pointed out that scandium differs from the other rare earth metals in its more pronounced electronegative character, its salts showing a marked tendency to hydrolyse and to form stable complex double salts.—F. Sodn.

Lead peroxide; The Lux method for the determination of ——. A. Ipiens. Z. anal. Chem., 1914, **53**, 261—265.

The modification of the Lux method recommended by Chwala and Colle (this J., 1911, 802) gives high results owing to the combined influence of the lead nitrate and free nitric acid on the permanganate titration of the excess of oxalic acid. The author recommends neutralisation of the nitric acid with sodium hydroxide, and acidification with sulphuric acid previous to the titration. The electrolytic determination of lead as peroxide also gives high results owing to adhering lead nitrate, or combined water, as suggested by A. Fischer ("*Elektroanalyt. Schnellmethoden*") and R. O. Smith (this J., 1905, 1191), and not to the production of higher oxides of lead as assumed by Hollard (this J., 1904, 207).—G. F. M.

Hydrogen peroxide; Synthesis of 100 per cent. —— *by means of the silent electric discharge.* P. M. Wolf. Z. Elektrochem., 1914, **20**, 204—219.

The experiments extend the data and conclusions of Fischer and Wolf (this J., 1911, 1250). The lower limit of pressure for the explosion of electrolytic gas was about 146 mm. With electrolytic gas below this pressure not more than 17 per cent. of the oxygen could be converted into hydrogen peroxide by means of the silent discharge. The limits of composition for the explosion of hydrogen-oxygen mixtures at ordinary pressure were from 5·45 per cent. to 94·7 per cent. of hydrogen by volume. Working outside these limits with excess of hydrogen the author determined the most favourable conditions for the formation of hydrogen peroxide in his apparatus, viz., low temperature, current exciting the coil 4·6 amp., velocity of gas through zone of discharge 400 c.c. per hour, moist gases, oxygen percentage 3·5 per cent. At —80° C., *i.e.* with gases practically free from moisture, but with the other conditions as described above, a 99·9 per cent. yield of peroxide, which must therefore have been free from water was obtained. Electrolytic gas diluted with carbon dioxide till no longer explosive, gave yields of only about 4 per cent. Very small quantities of hydrogen peroxide were obtained by passing non-explosive mixtures of hydrogen with excess of oxygen over glowing wires of various metals. It is concluded that in the reaction between hydrogen and oxygen, the first stage is the direct formation of hydrogen peroxide, which may be followed more or less completely by secondary reactions producing water.—W. H. P.

Acid tanks; Mastic lining for ——. Min. and Eng World, March 28, 1914. [T.R.]

Trinidad asphalt mastic has been found to be a satisfactory material for lining concrete tanks which are subjected to the action of sulphuric acid. Many other materials were tried, but none was found suitable except the asphalt mastic, which showed no deterioration after a year's test.

Sulphate of ammonia in Germany. U.S. Consular Rept. March 30, 1914.

Active competition has started in Germany between two groups of manufacturers of sulphate of ammonia comprising the German ammonia combination of Bochum on one side and the Badische Company on the other. The Bochum Company, a combination of gas and coke works, produces sulphate in the usual manner while the Badische Company produces it by a new method, and has cut prices, being in a position, it is stated, to produce much larger quantities if a market can be found. At present the Bochum combination is now urging buyers to sign agreements pledging themselves not to deal with middlemen, in return for which they are to be allowed a 10 per cent. discount at the end of the year on running contracts.

The quantities of sulphate of ammonia manufactured in Germany were estimated to have been 500,000 metric tons in 1912, and 418,000 tons in 1911. Of this quantity the German ammonia combination in Bochum disposed of about 300,000 tons in 1912 and about 245,000 tons in 1911. The producing concerns in upper Silesia, Rhineland, and Westphalia are said to be willing to engage in competitive contest, claiming that the cost of manufacturing artificial ammonia is more than the cost of producing ammonia in coke and gas works.

Alkali fusions. [*Formation of acetic acid from acetylene.*] Feuchter. *See* IV.

Determination of free sulphurous acid in the presence of thiosulphate or of sulphuric acid. Sander. *See* XXIII.

Patents.

Sulphuric acid apparatus; Structure for carrying the lead chambers or plates of ——. E. Hartmann (vorm. E. Hartmann und F. Benker) Ges. m. b. H., Frankfort-on-Maine, Germany. Eng. Pat. 17,035, July 24, 1913. Under Int. Conv., July 30, 1912.

The chambers or plates are suspended from trestles, preferably of iron, by means of tension rods which are adjustable as regards length and tension and adapted to engage removable carrying bars on the lead plates.
—F. Sodn.

Hydrochloric acid pickle liquors; Apparatus for treating waste ——. G. H. Starck, Waukegan, Ill. U.S. Pat. 1,090,173, March 17, 1914.

A hearth for containing a liquid, a retort for containing a wet solid, and fire grates are so arranged that flames pass from the grate immediately into contact with the retort and then over the hearth. The retort is open at both ends for the passage of air, the vapours evolved passing with the flames over the hearth. Means are provided for regulating the supply of air and the supply and discharge of solid material. A recovery chamber, fitted with water spray, receives the gaseous products.
—F. Sodn.

Acid liquids; Process for the [*continuous*] *distillation of* ——. W. Hof. Fr. Pat. 463,208, Sept. 19, 1913. Under Int. Conv., Sept. 20, 1912.

The acid flows along a slightly inclined tube of quartz-glass or other refractory glass, in the upper part of which it is vaporised. The lower portion of the tube is cooled and serves as a condenser, the residues and non-vaporised acid being tapped off at a point between the heated and cooled portions.—F. Sodn.

Boron nitride; Processes of making ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 16,468, July 17, 1913.

A mixture of boric anhydride and sodium cyanide or of other boron and cyanogen compounds, is heated at a temperature (about 2000° C.) at which all by-products (such as sodium carbonate) are volatilised, until fumes cease to be evolved. The product is pure and stable.
—F. Sodn.

Aluminium nitride; Process for the manufacture of ——. O. Serpek, Paris. Eng. Pat. 24,731, Oct. 30, 1913.

A current of nitrogen, carrying a mixture of carbon and alumina or aluminous material in suspension, is submitted to the combined heat of an exothermic reaction and of an electric arc. For example, the finely divided mixture may fall into a current of heated air (in which the carbon is partially burnt) and then pass, with the nitrogen and combustion products, through an arc flame.
—F. Sodn.

Nitrides; Process of continuous manufacture of ——. Gebr. Giulini Ges. m. b. H. Fr. Pat. 463,232, Sept. 29, 1913. Under Int. Conv., Dec. 6, 1912.

A mixture of alumina (or corresponding oxide or hydroxide and carbon, together with oxides, hydroxides, or salts of alkali, alkaline-earth, or analogous metals (to facilitate reaction) is heated in a current of nitrogen in an apparatus lined with carbon. The lining prevents fusion.—F. Sodn.

Alumina; Method of making ——. H. T. Kalmus and W. L. Savell, Kingston, Ontario. U.S. Pat. 1,090,479, March 17, 1914.

Aluminous material is treated with sulphur dioxide in presence of water. The alumina dissolves as a relatively unstable compound or compounds with sulphur dioxide, and is precipitated by desulphiting the solution (*e.g.*, by heating). If silica also be dissolved and precipitated with the alumina, the precipitate is again treated with sulphur dioxide and a small amount of water so as to dissolve only the alumina which is then reprecipitated as before.
—F. Sodn.

Nitrogen compounds; Apparatus for manufacturing ——. T. Fujiyama, Tokyo, Japan. U.S. Pat. 1,090,391, March 17, 1914.

Material to be treated is fed, preferably in a thin layer, on to a travelling support within a closed chamber, the space between the support and the wall of the chamber being heated electrically. A discharge conduit, surrounded by a cooling jacket, extends from the chamber, and serves also for the introduction of nitrogen, which flows through the chamber over the thin layer of heated material.—F. Sodn.

(1) *Nitric oxide, by electric oxidation of atmospheric nitrogen,* (2) *concentrated nitric acid, by treatment of the diluted oxides of nitrogen obtained by electric oxidation of atmospheric air,* (3) *concentrated nitric acid, by treatment of dilute nitric acid; Production of* ——. C. Rossi. Fr. Pats. 463,821, 463,825, and 463,830, Oct. 20, 1913. Under Int. Conv., Oct. 22, 1912.

(1) A mixture of oxygen and nitrogen is submitted to the action of arcs, formed between electrodes of silicon and aluminium, or other metals of which the oxides have no destructive catalytic action on the nitric oxide formed. Preferably the electrodes are composed of alloys of aluminium and silicon with alkali and alkaline-earth metals, such as calcium, barium, cerium, rubidium, etc., or with thorium, the oxides of which catalytically promote the formation of nitric oxide. (2) Gases resulting from the combustion of atmospheric nitrogen, or those leaving the absorption towers employed for recovery of the nitric acid produced, are charged with water in an atomised condition and submitted to electrostatic precipitation, with a continuous current at high voltage, *e.g.*, by passage between two aluminium plates, one smooth and the other covered with cotton or asbestos fibre; with a potential difference of 20,000—40,000 volts, nitric acid of any desired concentration up to 42° B. (sp. gr. 1·41) can be obtained. (3) Concentration up to 42° B. (sp. gr. 1·41), with a yield of 98 per cent., is effected *in vacuo*.—F. Sodn.

Zinc; Process for extracting —— *from solutions of zinc sulphate or other zinc salt.* R. D. Lance. Fr. Pat. 463,614, Dec. 21, 1912.

Improvements on Fr. Pats. 437,889 of 1911 and 451,680 of 1912 (this J., 1912, 535 and 1913, 663). The solution is treated with calcium sulphite in presence of an excess of sulphurous acid (*e.g.*, by intimately mixing with the calculated quantity of limestone and treating with sulphur dioxide), in such wise that free lime is at no time in contact with the zinc salt and that all the zinc remains in solution as bisulphite. After filtering, the zinc is precipitated as normal sulphite, preferably with zinc oxide. Pure zinc oxide is obtained by calcining the precipitate.—F. Sodn.

Lyes containing potassium sulphate and magnesium sulphate, obtained in the working up of crude potassium salts and the like; Treatment of ——. Heldburg, A.-G. für Bergbau, bergbauliche und andere industrielle Erzeugnisse. Ger. Pat. 270,620, Nov. 10, 1912.

The lyes are treated with a quantity of calcium chloride or other soluble calcium salt corresponding to their content of magnesium sulphate: $K_2SO_4,MgSO_4+CaCl_2+H_2O=K_2SO_4.CaSO_4,H_2O+MgCl_2$. The precipitated double salt (syngenite) is calcined and can then be used directly as a fertiliser or mixed with high-grade potassium sulphate. —A. S.

Sulphuric anhydride; Process for producing —— according to the contact process. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,165, July 1, 1913. Under Int. Conv., July 13, 1912.

See Fr. Pat. 460,074 of 1913; this J., 1914, 22.—T. F. B.

Acetic acid; Manufacture of ——. Consortium f. Elektrochem. Industrie G. m. b. H., Nuremberg, Germany. Eng. Pat. 17,016, July 24, 1913. Under Int. Conv., Aug. 27, 1912.

See Fr. Pat. 460,971 of 1913; this J., 1914, 42.—T. F. B.

Borax and boric acid; Manufacture of ——. E. L. Fleming, Chester. U.S. Pat. 1,090,526, March 17, 1914.

See Fr. Pat. 442,820 of 1912; this J., 1912, 1032.—T. F. B.

Potassium and sodium compounds; Method for extracting —— from silicates which contain alkalis. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,091,230, March 24, 1914.

See Ger. Pat. 254,544 of 1911; this J., 1913, 194.—T. F. B.

Sulphites or bisulphites; Process of manufacture of ——. *Process of manufacture of solid sulphites or bisulphites of homogeneous chemical constitution.* R. Friedrich, Glösa, Germany, and F. Hirsch, Vienna. U.S. Pats. 1,091,325 and 1,091,429, March 24, 1914.

See Fr. Pat. 421,610 of 1910; this J., 1911, 542.—T. F. B.

Nitrogen; Process of fixing ——. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co. U.S. Pat. 1,091,425, March 24, 1914.

See Fr. Pat. 455,799 of 1912; this J., 1913, 943.—T. F. B.

Method of heating electric furnaces, more particularly applicable to the manufacture of aluminium nitride. Fr. Pat. 463,390. *See* XI.

VIII.—GLASS; CERAMICS.

Specific heats of some ceramic bodies from observations at two temperatures. W. Steger. Silikat-Zeits., 1914, 2, 51—54.

The bodies were heated to 200° C. and to 400° C. respectively, and the final temperature of the calorimeter was approximately 20° C. The specific heats of: a fireclay body with Marquardt-mixture as binding agent (A), hard porcelain (B), Marquardt body burnt at cone 09 (C), the same burnt at cone 15 (D), and a magnesia body (E), were as follows:—

	A	B	C	D	E
200° C. ...	0·209	0·202	0·212	0·212	0·246
400° C. ...	0·228	0·221	0·229	0·229	0·264

—H. H. S.

Patent.

Porcelain articles [insulators]. J. A. and B. A. Jeffery, Detroit, Mich., U.S.A. Eng. Pat. 16,396, July 16, 1913.

"Blanks" of green clay are allowed to stand until they become hard, bone-dry, and non-plastic, and are then shaped by grinding, and fired. Each blank is provided with a central bore, either before or after drying.—B. N.

IX.—BUILDING MATERIALS.

Tar treatment of roads. Revision of Road Board specifications. See III.

Patents.

Bricks, cement, and the like; Process and apparatus for making ——. The Hewitt Patent Kiln Co., Ltd., London, and W. W. Hewitt, Greenhithe. Eng. Pat. 144, Jan. 2, 1913.

Slurry is dried on travelling trays, forming the top of a furnace, and is moulded into bricks or the like whilst hot, the bricks are piled on trucks and heated in a tunnel, and the trucks are conveyed through the furnace to a cooling tunnel, beneath or beside the first tunnel, which is thereby heated.—F. Sodn.

Stones and plastic material; Process for glazing natural and artificial ——. P. Fenaroli, Milan, and Soc. Anon. "Saces," Genoa, Italy. Eng. Pat. 2197, Jan. 27, 1913.

The stone is sprayed with a glazing composition of sodium silicate and pulverised marble or the like, the glazed surface "varnished" with a solution containing sodium silicate, then heated to about 150° C., and submitted to successive treatments with water and slightly acidulated baths containing free acids (sulphuric acid, fluosilicic acid, etc.) or readily hydrolysable salts (preferably of aluminium), whereby soluble salts are removed and the glaze rendered resistant towards atmospheric changes.—F. Sodn.

Tar macadamised roads; Method of preparing stones for making ——. Ges. für Teerverwertung m. b. H., Duisburg-Meiderich, Germany. Eng. Pat. 23,918, Oct. 22, 1913. Under Int. Conv., Oct. 23, 1912.

Drying, cleaning, and tarring is effected in a single operation by treating the cold stones with an excess of hot tar (preferably at 120°—150° C.), the excess being ultimately drawn off for use again.—F. Sodn.

Concrete structures; Processes of hardening ——. S. W. Flesheim, Cleveland, Ohio, U.S.A. Eng. Pat. 24,420, Oct. 28, 1913. Under Int. Conv., Aug. 11, 1913.

A dry mixture of cement and irregular shaped grains of tenacious metal, preferably iron, is applied to the surface of the concrete before its setting, the mixture being thoroughly rubbed into contact with the surface and finally worked to a smooth burnished surface with a trowel. A first troweling, with feeble pressure, is given immediately after the mixture has been floated upon the concrete, and a second troweling, with heavy pressure, after setting has commenced.—F. Sodn.

Portland cement; Process for the application of slags or residues from the preparation of alloys of manganese, silicon and iron in the electric furnace to the manufacture of artificial ——. J. M. Viélajus. Fr. Pat. 463,362, Oct. 7, 1913

The material is incorporated with the required proportion of lime and treated by the usual methods for the production of cement.—W. E. F. P.

Mortar from lime and sand; Manufacture of ——. C. Czarnikow. Ger. Pat. 270,516, Oct. 27, 1912.

The lime is slaked hot in presence of the sand and of cryolite or a mixture of sodium fluoride and aluminium sulphate. The resulting mortar has improved hydraulic properties.—A. S.

Mortar which does not effloresce ; Manufacture of ——. Mörtelwerk Waidmannslust Nester und Co. Ger. Pat. 270,815, Oct. 27, 1912.

A mixture of lime and sand or powdered stone is treated with strontium carbonate and boracite and the lime slaked hot.—A. S.

Cements or agglomerates for constructional purposes. M. J. and G. H. Langlois, Paris. Eng. Pat. 16,636, July 19, 1913. Under Int. Conv., July 20, 1912.

See Fr. Pat. 446,380 of 1912 ; this J., 1913, 144.—T. F. B.

Making non-explosive preparations [nitro-compounds for impregnating wood]. Fr. Pat. 463,288. *See* III.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Phosphorus in iron and steel ; Determination of ——. H. Phillips. Chem. News, 1914, **109**, 170—171.

The greyish stain appearing on the dried filter-paper containing the phosphomolybdate precipitate in the direct gravimetric determination of phosphorus is attributed to slight reduction of the MoO_3, and to obviate it the following modified process is recommended :—The phosphate solution is treated with 30 c.c. of nitric acid (1·2 sp. gr.), 5 c.c. of ammonia (sp. gr. 0·880), diluted with its own volume of water, and 30 c.c. of nitromolybdate solution (Brearley and Ibbotson, Anal. of Steel Works Materials, p. 56). The mixture is vigorously agitated, warmed to 40° C., and after one hour filtered through a 9 cm. close-textured paper. The precipitate is washed free from soluble salts by 2 per cent. nitric acid, then free from acid with water, dissolved by aqueous ammonia, filtered through the same paper into a light weighed dish, evaporated to dryness and the residue dried in the water-oven till of constant weight. The factor 0·0151 is used, instead of 0·0165, as usual.—J. L. F.

Iron, tungsten, carbon, and iron, nickel, carbon ; The chemical and mechanical relations of ——. J. O. Arnold and A. A. Read. Inst. Mech. Eng., March, 1914. [Advance proof.]

Tungsten steels (W 2·38 to 26·29, C about 0·7 per cent.). The carbides were separated and estimated by making the samples anodes in an electrolyte of dilute hydrochloric acid. Steels with W 26·29, 21·15 and 14·96 per cent. gave residues consisting of mixtures of WC and Fe_2W ; with 9·74 per cent. W. the residue consisted of $19WC + Fe_3C$; and with 5·37 and 2·36 per cent. W, of the same carbides with free carbon. The effect of tungsten is similar to, but much less marked than, that of vanadium (this J., 1912, 492) *e.g.* to displace entirely Fe_3C, about 11 per cent. W is required as compared with 5 per cent. V. High tungsten accelerates the segregation of tungsten carbide in sorbitic tungsten pearlite into tungsten cementite, just as high vanadium hastens the segregation of vanadium cementite (V_4C_3). Whilst vanadium pearlite (like iron pearlite) is transformed with a marked thermal abruptness into vanadium hardenite, the transformation of tungsten pearlite spreads over the very wide range of about 300° C. before completion : there was no evidence of the formation of tungsten troostitic pearlite. *Nickel steels.*—In ordinary (somewhat manganiferous) structural steels containing Ni up to about 7 per cent., the nickel is not associated with the carbon, but is alloyed with the iron and manganese. Tests made on very pure iron-nickel alloys indicated the existence of a definite alloy, Fe_7Ni, which is remarkably hard and tough. An alloy with Ni 13 per cent. gave a yield point of 59 tons and a maximum stress of 88 tons per sq. in. Alloys with Ni 7 and 33 per cent. both gave a yield point of about 30, and a maximum stress of about 38·5 tons per sq. in. No evidence of a double carbide of iron and nickel was obtained. There appears not to be a nickel pearlite, the carbide (Ni_3C) always being in solid solution as nickel hardenite, which on annealing or rolling, precipitates practically all its carbon as graphite, owing to the remarkably unstable character of the carbide. Fe_7Ni is very tough though machinable, but a steel with Ni about 13 per cent. and C 0·55 per cent. could not be turned or drilled, being rendered harder by the dissolved Ni_3C.—T. St.

[Gold and silver.] Cyanide precipitate ; Treatment of ——. H. A. Megraw. Eng. and Min. J., 1914, **97**, 505—509, 606—612.

The elimination of the zinc from cyanide precipitate by an acid treatment or volatilising roast is now generally omitted, the material being melted down at once into doré bullion which is parted. Reverberatory lead smelting of the precipitate and cupellation of the lead bullion is practised on the Rand and in New Jersey, U.S.A. ; smelting and cupelling may be carried out in the same furnace by using a different bottom for each operation. The introduction of oil-fired tilting furnaces has resulted in a quicker and cheaper process : the Monarch-Rockwell is a double-chamber furnace heated with an oil burner through a hollow trunnion upon which it turns for discharging the metal. In the Merrill process used at the Homestake Mill, S.D., the zinc is extracted by sulphuric acid ; high-grade precipitate is briquetted and cupelled direct, low-grade material is melted into lead bullion in a circular water-jacketed blast furnace having a lead well ; copper if present is recovered in a forehearth as matte by adding pyrite to the charge. Electric arc furnaces have been successfully applied to precipitate smelting ; the melting is rapid, especially if the material has been previously dried. Working costs of the various methods of treatment are given.—W. R. S.

Zinc ; Electro-deposition of —— *at high current densities.* J. N. Pring and U. C. Tainton. Chem. Soc. Trans., 1914, **105**, 710—724.

At current densities up to 40 amps. per sq. dcm. the satisfactory electrodeposition of zinc can be effected in the presence of free acid up to 15 grms. H_2SO_4 per 100 c.c., at which concentration the efficiency is highest. The potential differences are about 5 volts with lead and 3 with zinc anodes. The presence of colloids causes the production of smooth bright-surfaced deposits and permits the use of higher current densities. A strong retardation of the iron was observed, a deposit containing only about 0·1 per cent. Fe being obtained from an electrolyte containing 1·0 per cent. Fe. (See also Eng. Pat. 7235 of 1911 ; this J., 1912, 780.)—J. L. F.

Delta metal ; Analysis of —— *by the electrolytic method.* R. Belasio and M. Marchionneschi. Annali Chim. Appl., 1914, **1**, 127—133.

One grm. of the alloy is dissolved in 10—12 c.c. of nitric acid of sp. gr. 1·2, the solution filtered, evaporated with 5 c.c. of sulphuric acid (1 : 1), heated with 30 c.c. of water, cooled, and treated with 5 c.c. of 95 per cent. alcohol. After 1 hour, the lead sulphate is filtered off, washed with a mixture of water, alcohol, and sulphuric acid (60 : 10 : 0·5 c.c.), dried and weighed. The filtrate, after distilling off the alcohol, is diluted to 150 c.c., and the copper deposited electrolytically (ND_{100}=0·1—0·2 amp., 1·7—2 volts). Any manganese dioxide deposited on the anode is dissolved by adding a few drops of hydrogen peroxide and heating, and the solution, containing zinc, iron, manganese and aluminium, is concentrated to 30—40 c.c., and added gradually to a solution of 10 grms. of sodium hydroxide in 30—40 c.c. of water, whereby iron and manganese are precipitated. The solution is filtered into 100 c.c. of 20 per cent. sulphuric acid, the precipitate washed with dilute sodium hydroxide, then dissolved and re-precipitated. The iron and manganese may be separated electrolytically (see this J., 1912, 926). The solution is acidified with sulphuric acid, concentrated to 200—250 c.c., made alkaline with caustic soda, and then slightly acid with 20 per cent. formic acid, and the zinc deposited electrolytically at 40°—50° C. (ND_{100}= 1—1·5 amp., 4—5 volts), using a rotating anode. The aluminium is determined as oxide.—A. S.

Aluminium and its light alloys; Analysis of commercial ——. R. Belasio. Annali Chim. Appl., 1914, 1, 101—110.

THE finely-divided sample (2—4 grms.) is mixed with about 5 times its weight of tartaric acid and a few c.c. of water, and dissolved in dilute hydrochloric acid. The solution is heated with 2—3 c.c. of nitric acid, treated with excess of caustic soda and then with hydrogen sulphide to precipitate copper, lead, iron, manganese, zinc and cobalt, whilst aluminium and tin remain in solution. If the sulphide precipitate be considerable it should be dissolved and re-precipitated; the metals present are determined by known methods. The solution is diluted to a known volume, and an aliquot part is treated with 20—25 c.c. excess of hydrochloric acid, the tin sulphide dissolved with the aid of potassium chlorate, 25—30 grms. of ammonium oxalate added, and the tin determined electrolytically at 50°—60° C., using a current density, ND_{100}= 1 amp. at 3—3·5 volts. If nickel be present it is determined with dimethylglyoxime (this J., 1907, 643, 1217), before precipitating with hydrogen sulphide as above. From another portion of the sample, aluminium and iron are precipitated as oxides, the aluminium taken by difference, the iron determined with "cupferron" (this J., 1910, 115, 721). Silicon is determined by Handy's method (J. Amer. Chem. Soc., 1896, **18**, 736) and sodium by Moissan's method (this J., 1896, 136).—A. S.

Silver and tin; The ageing of alloys of ——. W. A. Knight. Chem. Soc. Trans., 1914, **105**, 639—645.

THE ageing of filings of alloys of silver and tin (see this J., 1913, 1112) was not accompanied by a change in weight nor by superficial oxidation. A contraction in volume of about 0·4 per cent., however, was observed.—J. L. F.

Mineral production of Canada in 1913. Canada Dept. of Mines. No. 283 of 1914. [T.R.]

		1912.		1913.	
		Quantity.	Value.	Quantity.	Value.
			$		$
Copper	Lb.	77,832,127	12,718,548	76,975,832	11,753,440
Gold	Oz.	611,885	12,648,794	784,525	16,216,131
Pig iron	*Tons	1,014,587	14,550,999	1,128,967	16,540,012
Lead	Lb.	35,763,476	1,597,554	37,662,703	1,754,705
Nickel	"	44,841,542	13,452,463	49,676,772	14,903,032
Silver	Oz.	31,955,560	19,440,165	31,750,618	18,984,012
Other metallic products		—	864,343	—	1,520,072
Total		—	75,272,866	—	81,671,404
Less pig iron credited to imported ores	Tons	978,232	14,100,113	1,055,459	15,543,583
Total metallic		—	61,172,753	—	66,127,821
Asbestos and Asbestic	Tons	136,301	3,137,279	161,086	3,849,925
Coal	"	14,512,829	36,019,044	15,115,089	36,250,311
Gypsum	"	578,458	1,324,620	639,698	1,477,589
Natural gas	M. ft.	15,286,803	2,362,700	20,345,763	3,338,314
Petroleum	Brls.	243,336	345,050	228,080	406,439
Salt	Tons	95,053	459,582	100,791	491,280
Cement	Brls.	7,132,732	9,106,556	8,658,922	11,227,284
Clay products		—	10,575,869	—	9,673,067
Lime	Bush.	8,475,830	1,844,849	7,671,381	1,605,812
Stone		—	4,726,171	—	5,199,204
Miscellaneous non-metallic		—	3,973,823	—	4,384,001
Total non-metallic		—	73,875,543	—	77,903,226
Grand total		—	135,048,296	—	144,031,047

* Short tons throughout.

Sodium; Studies on the preparation of ——. *II.* B. Neumann. Z. angew. Chem., 1914, 194—200.

CAUSTIC soda containing 12—17 per cent. of sodium carbonate, when electrolysed in the apparatus and under the conditions described previously (this J., 1914, 263), gave current yields of about 63 per cent. The presence of sodium chloride lowered the efficiency. In each case the highest yields were obtained with eutectic mixtures. The theoretical explanation of these results and their bearing on the technical manufacture of sodium are discussed, and it is stated that better results would be obtained if the caustic soda, as free as possible from sodium chloride, were completely dehydrated before use, and more care taken to control the temperature of the bath and removal of water at the anode.—J. L. F.

PATENTS.

Blast-furnaces; Working of ——. C. Semmler. Fr. Pat. 463,524, Oct. 11, 1913.

THE coke is charged into the furnace in a red-hot condition from a closed vessel lined with refractory material. —W. E. F. P.

Cast-iron; Malleable metal product from ——. E. A. Custer, Assignor to The Custer Sandless Casting Co., Philadelphia, Pa. U.S. Pat. 1,086,652, Feb. 10, 1914.

MALLEABLE iron castings are obtained, without annealing, from ordinary molten foundry iron, comparatively high in silicon and low in combined carbon, in a permanent metal mould. After setting, the casting is removed from the mould and allowed to cool under normal atmospheric conditions.—T. ST.

Iron; Method of working pure ——. R. B. Carnahan, jun., Assignor to International Metal Products Co., Middletown, Ohio. U.S. Pat. 1,090,115, March 10, 1914.

THE working of the metal, commenced at a temperature above the zone of non-malleability, is suspended until the metal has cooled to a temperature below this zone, and then continued.—W. E. F. P.

Steel; Refining ——. A. Hethey, London. U.S. Pat. 1,089,410, March 10, 1914.

THE steel is treated in an open-hearth or electric furnace with an oxidising slag, manganese being added from time to time to prevent the formation of iron oxide in the metal; and the slag is then solidified by addition of lime or dolomite and the refining completed at an increased temperature.—W. E. F. P.

Galvanising, or like coating of wire, hoops, sheets, and the like. H. H. Field, Grappenhall, Chester, M. Howarth, Warrington, and E. A. Atkins, Liverpool. Eng. Pat. 27,641, Nov. 30, 1912.

After treatment with acid, the (iron) wire, etc., is subjected to electrolytic action in an aqueous solution of zinc or stannous chloride, and then passed into the bath of molten zinc.—W. E. F. P.

[*Lead pipes, etc.*]. *Pumping apparatus for the manufacture of products of indefinite length from molten lead or other metals or alloys.* H. Debauge, Paris. Eng. Pat. 5639, March 6, 1913. Addition to Eng. Pat. 3944 of 1913, dated March 9, 1912 (this J. 1914, 320).

Molten lead is pumped into a die by pistons worked from a horizontal shaft. In each case the latter actuates a pitman resting in a slide-piston which acts on the forcing piston through the medium of a ball. The upper end of each pitman is constructed with a fork which embraces the lower part of an eccentric on the operating shaft. The pitman thus acts only by thrust, and is raised by a strong spring disposed under the head of the piston. If any piston jams, the action of the others is thus not interrupted. Several cylinders are contained in a single block divided at the upper part to allow the molten metal to surround the cylinders and so obviate the effects of unequal expansion. Means are provided for keeping the pump cylinders vertical during normal working, and for tilting the cylinders and casing enclosing the operating mechanism as a whole about the shaft in either direction, in order to allow of air being replaced by lead in the cylinders and in a bell placed over the die when the pump is started, and also permit of the pump being raised out of the molten bath for inspection during working. Connected with the outlet from the pump cylinders is a cylinder of small section containing a rod, the upper end of which is acted on by a strong spring in compression, the whole acting as a pressure-regulator, pressure-gauge, and safety-valve.—T. St.

Copper; Preparation of finely divided metallic ——. T. J. I. Craig and Peter Spence and Sons, Ltd., Manchester. Eng. Pat. 6161, March 12, 1913.

Finely-divided copper is obtained by electrolysis, using a copper anode, a lead cathode, and an electrolyte containing about 6 per cent. of titanic sulphate and about 6 per cent. of sulphuric acid. The titanic sulphate is reduced at the cathode, and the resulting titanous sulphate is re-oxidised in precipitating the dissolved copper in a finely-divided condition. To ensure the reduction of all the oxidised precipitating agent, current in excess of that passing through the copper may be used. Suitable conditions are:—2 to 4 volts per cell; density 30 to 40 amps. per sq. ft. of anode surface; cathode surface about 20 times as large as the anode surface.—T. St.

Metals or other materials; Means for ascertaining the hardness of ——. Rudge-Whitworth, Ltd., and H. L. Heathcote, Coventry. Eng. Pat. 6622, March 18, 1913.

The working of the various forms of apparatus proposed, depends upon the fact that the friction between the body to be tested and a hard rough surface, such as that of a file, is less for the harder body, the patentees having found that "if one of the surfaces be hard and rough, i.e. ridged or pointed, the friction, and consequently the angle when movement just begins, or continues, depends upon the degree of hardness of the softer surface."—T. St.

Magnetic separators. F. Krupp A.-G. Grusonwerk, Magdeburg-Buckau, Germany. Eng. Pat. 14,427, June 21, 1913. Under Int. Conv., July 15, 1912.

The strength of the magnetic field, across which the material travels, is adjusted by constructing the armature of adjustable disc-shaped members distributed along a horizontal axis about which the armature rotates, and by giving the underlying magnet an upper face inclined longitudinally.—B. N.

Magnetic separation of several kinds of materials in a single operation. F. Krupp A.-G. Grusonwerk. Fr. Pat. 464,156, Oct. 27, 1913. Under Int. Conv., Nov. 27, 1912.

The intensity of the magnetic field increases progressively in the direction in which the material is travelling, so that the latter is attracted to a moving cylinder and forms superposed layers, which fall off from the cylinder in the reverse order as the material passes out of the magnetic field.—B. N.

Metal [*Tungsten*]*; Method and apparatus for sintering* ——. R. B. Walling, Harrison, N.J., U.S.A. Eng. Pat. 14,795, June 26, 1913. Under Int. Conv., Oct. 7, 1912.

In sintering a rod of compressed tungsten by an electric current, in an inert atmosphere, the rod is held without lateral support between two relatively movable contacts, so that the whole of the rod is raised to a uniform sintering temperature. The lower contact is floated in mercury so that it continuously exerts a pressure on the end of the rod as the latter contracts during sintering, and thus maintains good electrical contact. Apparatus is described showing details of mounting. The copper containing bottle and the contacts are water-cooled.—T. St.

Furnace; Metal melting ——. I. Hall, Birmingham. Eng. Pat. 21,158, Sept. 18, 1913.

In a furnace for melting type-metal, etc., by means of a gas flame, the closed chambers above and below the melting pot are connected by external flues, so that the gases from the lower combustion chamber pass continuously over the surface of the molten metal.—W. E. F. P.

Metallurgical furnace. H. D. Hibbard, Plainfield, N.J. U.S. Pat. 1,089,377, March 3, 1914.

The furnace comprises a fire-chamber and a melting chamber, the inclined floors of which merge without substantial break into the floor of an interposed collecting chamber. The fuel is burned in the fire-chamber by a down-draught blast and the combustion gases pass through the collecting and melting chambers to the stack at the upper end of the latter; the floor of the collecting chamber slopes downwards to an outlet for the fused metal. In an alternative form, a combined ore and fuel charge is burned by means of a down-draught blast, and the fused metal received in a similar collecting chamber. The metal is thus removed from the reaction zone immediately after it is melted or produced.—A. S.

Alloy for white metal goods. H. Wilkins, Sheffield. Eng. Pat. 27,406, Nov. 28, 1913.

A hard white metal suitable for hollow-ware is composed of: Sn 100, Cu (2—4) 2·5, Sb (7—10) 8, Ni (0·5—6) 0·5, Mn (0·015—2) 0·125, parts by weight.—T. St.

Titanium and other alloys; Method of making ——. E. Kraus, Lynn, Mass., Assignor to General Electric Co. U.S. Pat. 1,089,773, Mar. 10, 1914.

The process depends upon reactions of the aluminothermic type. For example, alloys of aluminium and titanium are prepared by addition of aluminium to fused titanium oxide.—W. E. F. P.

Zinc furnace with integral condenser; Electric ——. J. Thomson, New York. U.S. Pats. 1,090,427 and 1,090,428, March 17, 1914.

(1) The charge rests on a horizontal resister bed of carbon, supported by a grate, underneath which is a chamber for receiving inert residual matter. The lower inner faces of vertical carbon terminals at the ends of the grate, are in contact with the resister, and are grooved to give an increased area of contact. The inner faces above the resister are separated from the charge by insulating blocks, and the outer faces of the terminals are in contact with the end walls of the resister chamber, the upper ends being connected by metallic electrodes with the power circuit.

(2) Parallel carbon resisters extending longitudinally are made porous so that fumes may pass through, and parallel condensing chambers containing broken coke are disposed in the same horizontal plane to receive the fumes from the resisters. The charge is supplied from galleries or pockets to one of the vertical faces of the resisters, the volatile products passing through the resisters to the condensers, whilst the inert residue falls towards the bottom of the reaction zone. A reservoir for the liquid zinc is provided under the condensers, and the latter have exits for gases at or near the top.—B. N.

Furnace ; Universal electric ——, combined with means for condensing zinc. J. Thomson, New York. U.S. Pat. 1,090,429, March 17, 1914.

The resister, extending in a longitudinal direction, and the transverse form of which is trapezoidal, rests on an open table or grate, towards which the charge-receiving floor slopes in a downward direction. A number of vertical spaced plates, extending transversely, and provided with abutments containing the terminals, rest on the grate, and underneath is a sump.—B. N.

Metals ; Process of precipitating and recovering ——. C. H. Urquhart, Newark, N.J. U.S. Pat. 1,090,661, March 17, 1914.

A solution containing dissolved metals is passed over granulated zinc contained in a closed chamber, the latter being completely filled with the solution to exclude air. The zinc is continuously subjected to agitation in order to remove the precipitated metals by abrasion.—T. St.

Ores ; Process and apparatus for extracting from pyritic and other ——, their metals in the metallic state or in the form of sulphates, sulphides or oxides. R. D. Lance. First Addition, dated Dec. 21, 1912, to Fr. Pat. 458,816, Aug. 17, 1912 (this J., 1913, 1075).

Before treatment with sulphuric acid, the ore is agitated with sulphurous acid to remove oxides, carbonates, etc. ; ores containing ferric oxide are agitated with hot sulphurous acid and air to form ferrous sulphate, which is subsequently calcined to produce sulphur trioxide. Sulphate solutions are treated with calcium chloride and the resulting chloride solution is treated with lime to precipitate compounds of the dissolved metals and regenerate calcium chloride.—W. E. F. P.

Bi-metal, e.g., steel with brass, with nickel or steel with any metal other than copper ; Process for making plates, sheets or leaves of ——. Soc. Internationale de Métallurgie Nouvelle. Fr. Pat. 463,155, Oct. 2, 1913.

Plates of brass, nickel, aluminium, etc., each having a polished face in contact with a thin sheet of copper, are placed in a pack and subjected to hydraulic pressure. The resulting composite plates are rolled into sheets and united (on the copper side) to the steel.—W. E. F. P.

Metals, ores, etc. ; Process and apparatus for the fusion of ——, by means of induced electric currents. S. Guggenheim. Fr. Pat. 463,233, Sept. 30, 1913. Under Int. Conv., Sept. 30, 1912.

The material is disposed between the poles of several magnetic circuits so that it is permeated by lines of force from each and absorbs sufficient energy to cause fusion. When a three-phase current is employed, the differences of phase between the magnetic fields are rendered unequal by means of auxiliary windings by which the directions of the lines of force are influenced locally ; opposite poles of the magnetic circuits have a smaller cross-sectional area than the material under treatment.—W. E. F. P.

Waste heat ; Process and apparatus for the utilisation of the ——, of slags and metallurgical works. C. Semmler. Fr. Pats. 463,298 and 463,300, Oct. 6, 1913.

(1) Molten slag is cooled in receptacles provided with hollow partitions through which water is circulated under a pressure sufficient to prevent vaporisation, the heat absorbed being transmitted to a heat accumulator. (2) A system of heat-absorbing units (similar to the above in principle) provided with a common pressure regulator in addition to the regulators of the separate units. The absorption and transmission of heat are effected in a series of steps corresponding to the different temperatures of the various sources of waste heat.
—W. E. F. P.

Iron and steel ; Prevention of corrosion of ——. H. Hanemann, Berlin-Wilmersdorf, and F. Hanaman, Berlin-Charlottenburg. Eng. Pat. 11,966, May 22, 1913. Under Int. Conv., June 1, 1912.

See Fr. Pat. 458,283 of 1913 ; this J., 1913, 1072.—T. F. B.

Case-hardening iron and steel articles ; Process for ——. C. Burian, Assignor to Gebr. Schubert, Berlin. U.S. Pat. 1,091,286, March 24, 1914.

See Eng. Pat. 13,805 of 1913 ; this J., 1913, 1016.—T. F. B.

Steel and iron ; Method for treating —— in their manufacture. C. R. Gostling, Eustis, Fla. U.S. Pat. 1,091,330, March 24, 1914.

See Eng. Pat. 17,869 of 1913 ; this J., 1914, 318.—T. F. B.

Welding powder for welding iron and steel. E. Eisengräber, Frankfort, Germany. U.S. Pat. 1,091,312, March 24, 1914.

See Eng. Pat. 17,046 of 1913 ; this J., 1914, 319.—T. F. B.

[Metallic] catalysts. K. H. Wimmer, Bremen, Germany, and E. B. Higgins, Wallasey. Eng. Pat. 4144, Feb. 18, 1913. Under Int. Conv., Feb. 19, 1912.

See Fr. Pat. 454,501 of 1913 ; this J., 1913, 870.—T. F. B.

Wires ; Process for sharpening the ends of fine ——. P. Friedrich, Wendenschloss, Assignor to J. Pintsch, A.-G., Berlin. U.S. Pat. 1,090,469, March 17, 1914.

See Ger. Pat. 251,836 of 1911 ; this J., 1912, 1173.—T. F. B.

Minerals ; Apparatus for washing ——. J. Dodds, Rutherglen. U.S. Pat. 1,091,047, March 24, 1914.

See Eng. Pat. 24,406 of 1911 ; this J., 1912, 863.—T. F. B.

Furnace for treating ore and the like. K. J. Beskow and A. Ramén, Helsingborg, Sweden. U.S. Pat. 1,091,182, March 24, 1914.

See Fr. Pat. 442,472 of 1912 ; this J., 1912, 932.—T. F. B.

Metals ; Separation of —— from zinc-bearing ores or compounds. E. A. Ashcroft, Balestrand, Norway. U.S. Pat. 1,091,269, March 24, 1914.

See Eng. Pat. 19,257 of 1911 ; this J., 1912. 931.—T. F. B.

Purification of blast-furnace gas. Ger. Pat. 271,067. *See* IIa.

Application of the slags or residues from the preparation of alloys of manganese, silicon, and iron in the electric furnace to the manufacture of artificial Portland cement Fr. Pat. 463,362. *See* IX.

Apparatus for removing iron from basic slag. Ger. Pat 268,500. *See* XVI.

XI.—ELECTRO-CHEMISTRY.

Alternating currents ; Chemical action stimulated by —— S. G. Brown. Roy. Soc. Proc., 1914, A90, 26—32.

In a simple voltaic cell consisting of a zinc anode ar a carbon cathode, the polarisation which soon ensu when the cell was joined through a low resistance circui was diminished or completely abolished by passing alternating current of suitable value through the cell. When the zinc anode was caused to project only slightly into the solution, something similar to polarisation was produced in an ordinary cell owing to the exhaustion of the electrolyte in the neighbourhood of the anode. This effect was also removed by a superimposed alternating current and the cell gave a greater output of current. Several metals (*e.g.* gold and platinum) normally insoluble in the liquid used were made to dissolve by the aid of alternating current. Similar stimulating effects were observed without the use of fluid dielectric.—W. H. P.

Electrolysis of barium chloride solutions with mercury cathodes. Fedotieff. *See* VII.

Synthesis of 100 *per cent. hydrogen peroxide by means of the silent electric discharge.* Wolf. *See* VII.

Patents.

Electrode holders for electric furnaces. F. Krupp A.-G., Essen, Germany. Eng. Pat. 5414, March 3, 1914. Under Int. Conv., Dec. 13, 1913.

The electrode, which passes with little clearance through a curb ring in the cover of the furnace, is attached to one end of a horizontal arm made in two parts, one portion guiding the electrode holder vertically by means of a standard. The second part is made adjustable so that it can be moved in the longitudinal direction of the arm, and also rotated about the longitudinal axis of the arm, thus enabling the electrode to be adapted to changing positions of the curb ring.—B. N.

Furnaces; Starting the arcs of electric ——. E. K. Scott, Bromley, Kent. Eng. Pat. 6136, March 12, 1913.

In an alternating current furnace, in which the arcs are struck and blown out periodically, the electrodes are provided with a nozzle supported on an insulating tube and with an adjustable diaphragm, for the purpose of admitting air to the arc. The electrodes are at such a distance from each other that the arc cannot be struck or maintained by the voltage of the power circuit alone, and a wire or conductor, supported by the nozzle, is placed in the gap between the electrodes, and connected through a condenser with a high-voltage and high-frequency supplementary circuit, a switch being provided in the latter circuit for striking, maintaining or stopping the arc. —B. N.

Furnace; Electric ——. S. Peacock, Chicago, Ill. U.S. Pat. 1,090,107, March 10, 1914.

The tapered, vertical furnace chamber has two fixed, horizontal electrodes near the base and an adjustable, vertical electrode at the top. The charge is introduced through two inclined pipes at the upper part, and "gas" through a pipe immediately below these. The air-tight outer casing is extended at the lower part to form, below the high-temperature zone of the furnace, a chamber (water-jacketed) provided with an outlet for the gases and from which the solid product is continuously removed by means of a screw conveyor.—W. E. F. P.

Furnaces; Method of heating electric ——, *more particularly applicable to the manufacture of aluminium nitride.* Soc. Générale des Nitrures. Fr. Pat. 463,390, Dec. 14, 1912.

The furnace consists of a slightly inclined rotating tube, through which the charge (a mixture of alumina and carbon, together with an excess of carbon, or iron or copper, to maintain its conductivity) passes downwards, meeting an ascending current of nitrogen. The charge serves as a heating resistance. The terminals are arranged at intervals along the length of the furnace, and are connected alternately with the two poles of the generator, so as to divide the furnace into a number of sections. As the material progresses through the furnace it becomes poorer in carbon, and the intermediate terminals are therefore arranged nearer to each other The intermediate terminals may be in the form of annular diaphragms, with orifices which gradually diminish in diameter, in order to increase the thickness of the layer in treatment as it becomes depleted of carbon and therefore less conductive.—B. N.

Batteries; Electric dry ——. S. Stern, London. From C. Hubert, New York. Eng. Pat. 6950, March 20, 1913.

The manganese compounds, obtained as a by-product in the manufacture of saccharin, are employed in the preparation of the depolarising agent for dry batteries. —B. N.

Battery cell; Electric ——. H. A. Thomas, Springfield, Ill. U.S. Pat. 1,090,763, March 17, 1914.

The anode consists of 92 per cent. of zinc shavings, 0·75 of bismuth, 7 of mercury and 0·25 of platinum, and the electrolyte contains one part of hydrochloric acid, one of sodium silicate, and eight of water, or as an alternative with sulphuric acid in addition, together with a depolarising liquid containing hydrochloric acid, sodium silicate, nitric acid and water.—B. N.

Galvanic elements; Electrolytic material for ——. A Lessing. Fr. Pat. 463,751, Sept. 11, 1913.

The electrolyte comprises zinc and ammonium chlorides together with mercuric oxide mixed with powdered tragacanth or salep, and with substances having the property of absorbing water, such as pumice, clay, etc. —B. N.

Electrode for ozoniser. C. Hemmerlin and J. Simonet. Fr. Pat. 463,711, Oct. 17, 1913.

The surface of a metallic plate is provided with a great number of projecting metallic points. The plate may be cylindrical, and the points, instead of being arranged regularly, may be disposed in appropriate divisions in order to prevent undue heating of the electrode.—B. N.

Gas with preservative properties; Production by means of the electric arc of a ——. International Ionising Process Co. Fr. Pat. 463,728, April 5, 1913.

Air is submitted to the action of the electric arc, and at the same time mixed with vapours of an organic vegetable substance, *e.g.*, such as are obtained from certain kinds of wood and which may be condensed at the ordinary temperature. The vapours are produced by bringing the wood in contact with the arc.—B. N.

Insulating products free from organic materials; Manufacture of light ——. A. C. D. Duchemin. Fr. Pat. 463,949, Dec. 30, 1912.

Volatile salts, such as ammonium carbonate, are mixed with plastic materials, such as plaster, clay, lime, cement, etc., and the mixture heated to about 100° C. to volatilise or dissociate the salts, thus producing a cellular structure in the material.—B. N.

Diaphragm for electrochemical or electro-osmotic purposes Ges. für Elektroosmose m. b. H. Ger. Pat. 271,001, April 15, 1913.

A diaphragm of regenerated cellulose, intended especially as a substitute for parchment paper.—A. S.

Heating articles in electric furnaces; Process for ——. F. Fischer, Charlottenburg, Germany. Eng. Pat. 17,490, July 30, 1913. Under Int. Conv., Nov. 5, 1912.

See Fr. Pat. 460,526 of 1913; this J., 1914, 90.—T. F. B.

Chemical, electro-chemical and electric treatment of plants, fields, sown seeds, crops, etc. Eng. Pat. 11,997. *See* XVI.

Oxidation means and processes [particularly for grains and flour]. Eng. Pat. 5495. *See* XIXa.

[Electrical] Treatment of milk or cream during churning. Eng. Pat. 6418. *See* XIXa.

XII.—FATS; OILS; WAXES.

Arachis oils; Residues from the refining of ——. G. Bouchard. Les Matières Grasses, 1914, **7**, 4027—4028.

In France arachis oils are refined with soda or ammonia The residues from the soda treatment are utilised directly in soap-making, but the paste-like deposit from the ammonia treatment (*pâtes d'arachide*) is treated with a mineral acid to separate the fat, which is then sold as "arachis oil, No. 2." The arachis pastes are soft and have a rancid odour and a green or brown colour; their price is based upon the oil-content. The disagreeable odour usually disappears in the manufacture of soap. "Arachis oils No. 2" are dark brown mixtures of fatty acids and neutral oil. Eight commercial samples gave the following results :—Free acids (as oleic acid) 55·8 to 70·2 per cent.; saponif. value, 192·4 to 195·9; glycerol, 3·18 to 4·60 per cent.; iodine value, 83·4 to 92·2; and unsaponifiable matter, 0·65 to 1·10 per cent. The values given by six samples of arachis pastes were :—Fat, 66·9 to 74·8 per cent. Characters of fat :—Free acids (as oleic acid) 51·1 to 75·9 per cent.; saponif. value, 193·2 to 196·1; glycerol, 2·50 to 5·08 per cent.; iodine value, 80·1 to 93·0; and unsaponifiable matter, 0·50 to 0·98 per cent. There are many abnormal arachis oils on the market derived, in particular, from Coromandel nuts. A few years ago these oils had an acidity of only 13 to 15 per cent. when freshly expressed, with a maximum in winter of 18 to 20 per cent. At the present time the acidity is frequently 27 to 28 and rarely less than 20 per cent., owing to the better quality of kernels being used for food purposes. These oils are sold as "industrial," "red," "soap" oils, "thickened" oils, etc. The "thickened" oils contain from 5 to 50 per cent. of impurities (seed débris) insoluble in carbon bisulphide. The arachis "margarines," which consist of the thick deposits from the oil tanks, contain from 25·3 to 29·4 per cent. of free acids (as oleic acid). As a rule they are darker and more acid than Coromandel oils.—C. A. M.

Fat as a by-product in the manufacture of glue from hide trimmings. H. Dubovitz. Seifensieder-Zeit., 1914, **41**, 341.

Hide trimmings are soaked in weak milk of lime for several weeks whereby a liquor is obtained from which glue is prepared by concentration. The residue is dried and, because of its nitrogen and lime content, is used as manure. It contains about 17 per cent. of fatty acids combined with lime and 6 per cent. of free fat which can be recovered by treating the material with sulphuric acid so as to decompose the lime soap and leave the mixture in a condition in which it can be satisfactorily treated with a fat solvent. This method of recovery is costly and the fat obtained contains about 4·5 per cent. of unsaponifiable matter. It is proposed to cheapen the process of recovery and obtain a fat containing less unsaponifiable matter by treatment with the "foots" obtained in the refining of oils with sulphuric acid, whereby the fatty constituents of both materials would be made available for extraction; by means of the Krebitz process of lime saponification (this J., 1906, 434) whereby the fatty material could be converted into soap; or by using the material as the source of lime required in the autoclave process of fat hydrolysis, its fatty constituents thus forming a proportion of the larger amount treated in the autoclave.—J. A.

Lipase of castor oil seeds; Activity of —— at low temperatures. A. Blanchet. Comptes rend., 1914, **158**, 895—896.

That the enzymic hydrolysis of fats in foodstuffs is possible at the usual refrigerator temperatures, is shown by experiments on the hydrolysis of castor oil by the enzyme contained in a suspension of the crushed seeds. At 0° C., 42 per cent., and at —5° C., 21 per cent. of the oil was hydrolysed in 24 hours.—G. F. M.

Unsaponifiable matter; Determination of —— in oils and fats. H. Salomon. Ber. deuts. Pharm. Ges., 1914, **24**, 189—193.

Klostermann's modification of the method of Marcusson and Schilling (see this J., 1913, 1118) for the detection of vegetable in animal fats can be further modified to allow of the simultaneous determination of unsaponifiable matter. 50 or 100 grms. of the oil are saponified with alcoholic potash, the soap dissolved in water, extracted with ether, the ether distilled off and the residue dried and weighed. The crude phytosterol or cholesterol so obtained is dissolved in hot alcohol and precipitated hot with excess of an alcoholic solution of digitonin, 1 grm. of crystallised digitonin being required for each 0·4 grm. of unsaponifiable matter. The precipitate is separated, acetylated and the phytosteryl acetate recrystallised as described by Klostermann (*loc. cit.*). The liquid unsaponifiable matter can be estimated in the filtrate from the digitonin precipitate by adding water, extracting with ether, distilling off the ether and weighing the dry residue. The relative proportions of solid (precipitated by digitonin) and liquid unsaponifiable matter in a number of oils and fats are tabulated.—T. C.

Patents.

Oil; Method of and apparatus for expressing —— from seeds, nuts and other oleaginous substances, and juice or fluid from fruits, herbs, flowers, peat and the like. A. W. Sizer, Kingston-upon-Hull. Eng. Pat. 29,331, Dec. 20, 1912.

Seeds, or other oil-containing or juicy substances are forced by means of a worm-screw into an annular chamber the walls of which are made up of juxtaposed staves or rings, having scratches or marks upon the surfaces in contact, the purpose of which is to allow the expressed oil or juice to pass through the walls of the chamber, whilst preventing the egress of solid material. The latter, in the form of a compressed mass, exudes through holes in a cap or die-plate on the front of the compression chamber, and may be cut up into lengths by means of a revolving knife rigidly attached to the spindle of the worm-screw and revolving in front of the die-plate.
—E. W. L.

Fats or oils from bones, seeds and other oleaginous substances; Process and apparatus used in extracting ——. W. Schmidt, Leipzig-Plagwitz, Germany. Eng. Pat. 5368, March 3, 1913.

The vaporised solvent leaving the extractor is fractionally condensed in a series of communicating compartments, at a temperature just below the b. pt. of the solvent or the respective fractions thereof, and the condensed liquids are led through pipes in each compartment to a common separator, where the solvent is freed from water before being returned to the extractor.—C. A. M.

Fats, rubber, waxes, etc.; Process of extracting —— by means of solvents. J. Margoles. Fr. Pat. 463,178, July 24, 1913.

The solvent (vapour or liquid) is circulated by aspiration, etc., either continuously or intermittently through the material contained in one or more extractors. It may be condensed, purified, and heated again before each passage through the apparatus —C. A. M.

Oils and the like; Apparatus for treating [hydrogenating] —— with gases, etc. C. Ellis, Montclair, N.J. U.S. Pat 1,084,203, Jan. 13, 1914.

Oil containing a catalytic agent is heated and drawn into an "inductor" at the top of a closed vessel, where it encounters a current of hydrogen, or gas containing hydrogen, under pressure, the mixture being then discharged tangentially against the bottom of the tank.

The application is in part a continuation of U.S. Pat. 1,059,720 of 1913 (this J., 1913, 612).—C. A. M.

Fats and oils; Preparation of a solid or liquid hydrolytic agent for ——. Sudfeldt und Co. Fr. Pat. 463,912, Oct. 22, 1913.

The impurities in sulpho-aromatic fatty acids which give a dark colour to the products of hydrolysis of fats and oils, are eliminated by converting the mixture of sulphonated acids into alkali salts and separating the sulpho-aromatic fatty acids from the sulphonated aromatic acids by the addition of salt. Fatty acids are then removed by extraction with a solvent (*e.g.*, petroleum spirit, carbon tetrachloride). A solid hydrolytic agent is obtained by adding a suitable metallic salt such as barium chloride to an aqueous solution of an alkali salt of a sulpho-aromatic fatty acid, and drying the precipitate.—C. A. M.

Fatty acids, their glycerides and other esters; Process for the preparation of saturated ——. F. Bedford and C. E. Williams, Sleaford, E. Erdmann, Halle, Germany, and Hydroil, Ltd., London. Eng. Pat. 28,981, Dec. 16, 1912. Addition to Eng. Pat. 29,612, Dec. 20, 1910.

See Addition of Aug. 19, 1913, to Fr. Pat. 436,295 of 1911; this J., 1914, 324.—T. F. B.

Preparation of india-rubber substitute. Eng. Pat. 4214. *See* XIV.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Cobalt-magnesium red. J. A. Hedvall. Z. anorg. Chem., 1914, **86**, 296—300.

An examination (chiefly microscopic) of the red products obtained by igniting mixtures of magnesia and cobalt oxide indicated that these, as in the case of Rinman's green (this J., 1914, 363), are solid solutions; the two oxides appear to form solid solutions in all proportions. —F. Sodn.

Oil of turpentine; The "heat number" of ——. A. Heiduschka. Chem.-Zeit., 1914, **38**, 441.

Twenty c.c. of a 2 per cent. solution of the turpentine in chloroform were treated in a vacuum flask, with 1 c.c. of bromine. The rise of temperature was only about 0·8° C. for dextrorotatory turpentine, 23°—24° for French turpentine, about 17° for German turpentine, 23° for rectified oil of turpentine, 13·6° for rosin oil, — 0·85° for ligroin, and 2·3° C. for petroleum. The method is thus valuable for distinguishing dextro- from lævo-rotatory products, and may be of assistance as a rapid method of detecting impurity.—W. H. P.

Linoxyn; Characters of ——. F. Fritz and C. Zymandl. Chem. Rev. Fett Ind., 1914, 21, 43—44.

The following values were obtained with samples of solid oxidised linseed oil :—

Description.	Consistence.	Sp. gr. compared with water at 4° C.	Iodine value (Wijs).	Ash.	Unoxidised fatty acids.	Oxidised fatty acids.	Water-soluble fatty acids.
				per cent.	per cent.	per cent.	per cent.
Walton oil (4 samples)	hard	1·0862 at 15° C. to 1·0734 at 21° C.	61·8 to 65·5	1·16 to 1·41	26·2 to 31·2	46·4 to 56·4	5·5 to 8·6
Rapid oxidation oil (2) ..	very soft	—	96·2 (1)	0·15 (1)	43·5 to 49·4	42·1 to 42·5	2·7 to 5·7
Running (*Ablaufol*) (1) ..	,,	1·0693 at 20° C.	98·4	4·36	50·7	20·0	8·3

—C. A. M.

American colophony; Water-soluble rosin acids of ——. L. Paul. Chem. Rev. Fett Ind., 1914, **21**, 5—8, 36—39, 53—56, 78—80.

American colophony is composed of a portion insoluble in cold petroleum spirit but readily soluble in dilute sodium carbonate solution, and a portion soluble in petroleum spirit, which dissolves with difficulty in the alkaline solution. On treating the sodium carbonate solution with hydrochloric acid a rosin acid separates as a scum. The portion insoluble in sodium carbonate solution dissolves in water, but on the addition of hydrochloric acid forms an emulsion from which the rosin acid separates as a coagulated mass. This acid melts at 74° to 75° C., and is the main constituent (about 80 per cent.) of American colophony: acids of higher m. pt. are only present in small proportion. The amount of insoluble deposit obtained by treating colophony with petroleum spirit varied in one experiment from 18 to 36 per cent., according to the amount of large glassy particles in the sample. This was attributed to intramolecular decomposition of the rosin with the absorption of water, and the formation of a hydrate of the principal acid. The principal rosin acid absorbed water when exposed to the air for a long time and yielded gradually increasing amounts (2·4 to 12 per cent.) of the compound insoluble in petroleum spirit. Other acids were also formed by hydration, and these were present in varying quantities in the original colophony. The products of the distillation of colophony differed considerably from the corresponding fractions obtained by distillation with petroleum, the differences being attributed to the formation of hydration compounds of the main acid. The insolubility of the sodium salt of this acid in 5 per cent. sodium carbonate solution may be used as a test of the presence of the acid in other resins. The hydration of this acid is to be regarded as the cause of the disintegration of colophony into powder.—C. A. M.

Patents.

White-lead; Apparatus for making ——. R. A. Stewart, Los Angeles, Cal. U.S. Pat. 1,088,041, Feb. 24, 1914.

The fumes from lead ore, roasted in a furnace, are drawn, by means of a fan, through a supplementary roasting chamber, provided with baffle-plates, in which the fumes are roasted by means of burning jets of carbonaceous fuel and air, and thence into a collecting chamber in which the white lead is intercepted by filters, from which the white lead is continuously removed.—E. W. L.

Lampblack from hydrocarbons or hydrocarbon mixtures; Process for producing ——. K. Bosch. Ger. Pat. 270,199, Feb. 8, 1913.

Dry and very finely divided lampblack, free from mechanically combined hydrogen, is obtained by introducing the hydrocarbon (*e.g.*, acetylene) into the decomposition chamber through a rotating tube, to give it a circular motion.—T. F. B.

Ink. T. M. Price, Washington, D.C. U.S. Pat. 1,088,840, March 3, 1914.

The ink is composed of lanolin—or other fat, solid at 35° C. (95° F.)—50; glycerin, 10; carbon (or other colouring matter) 40 per cent., worked together into a plastic mass. —E. W. L.

Polishing composition. J. W. Aylsworth, East Orange, Assignor to Halogen Products Co., Glen Ridge, N.J. U.S. Pat. 1,090,440, March 17, 1914.

Chloronaphthalene or other higher halogen substitution compound of naphthalene is incorporated with a fusible soluble phenolic or cresolic resin melting at not less than 100° C. and a volatile solvent, such as acetylene-tetrachloride, or a mixture thereof with a rapidly drying solvent.—C. A. M.

Varnish and the like ; Method of and means for curing and drying articles coated with moist substances such as ——. W. J. Mellersh-Jackson, London. From Greeff Engineering and Manufacturing Co., Newark, N.J., U.S.A. Eng. Pat. 11,193, May 13, 1913.

THE articles are subjected to a current of warm moist air, under pressure, in a chamber with a restricted inlet and outlet. The air may be brought to the required temperature (125° to 126° F., 51·7°—52·2° C.) and humidity (35 to 45 per cent.), by being forced by a blower through an inner vessel surrounded by water heated by means of a steam coil.—C. A. M.

Infusible condensation product of metacresol and formaldehyde. Infusible condensation product. L. H. Baekeland, Yonkers, N.Y., Assignor to General Bakelite Co., New York. U.S. Pats. 1,088,677 and 1,088,678, March 3, 1914.

(1) THE product contains, as an essential constituent, a condensation product of formaldehyde and *m*-cresol, or this product together with a condensation product of formaldehyde and phenol, with or without a filling material, and containing corresponding condensation products of *o*- and *p*-cresol in minor proportions. (2) The product contains as essential constituents the condensation products of formaldehyde and *m*- and *p*-cresol respectively (the former in preponderating proportions) with or without a filling material ; or of the above condensation products together with the condensation product of formaldehyde and phenol (the *m*-cresol and phenol compounds in preponderating proportions), with or without a filling material. —E. W. L.

Plastic masses and method of producing the same. J. W. Aylsworth, East Orange, Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,090,439, March 17, 1914.

A FUSIBLE phenol resin is mixed with inert filling material and with sufficient anhydrous phenol and monochloronaphthalene (or organic fluid containing a condensable compound) to render the mass plastic at low temperatures, together with a hardening agent (*e.g.*, an anhydrous compound containing a methylene group) which will condense the phenol and phenol resin into a hard mass on heating the mixture.—C. A. M.

Resinous and other products ; Process of extracting —— from wood, with the simultaneous production of paper-pulp. Soc. Anon. Le Camphre. Fr. Pat. 463,879, Dec. 28, 1912.

RESINOUS woods are boiled under pressure with a solution of caustic soda containing a large proportion of sodium salts (*e.g.* carbonate, sulphate or a mixture of the two). The oil of turpentine leaving the autoclave is condensed. The residual lye containing alkali resinate is evaporated and decomposed by calcination into rosin oil and alkali, with the formation of methyl alcohol, acetone, tar, etc., as by-products.—C. A. M.

Paints, enamels, and the like ; Method of making ——. A. S. Ramage, Buffalo, U.S.A. Eng. Pat. 13,422, June 10, 1913. Under Int. Conv., Feb. 1, 1913.

SEE U.S. Pat. 1,084,361 of 1914 ; this J., 1914, 208. —T. F. B.

[Resinous] compositions of matter ; Process of manufacturing ——. L. Lilienfeld, Vienna. U.S. Pat. 1,090,730, March 17, 1914.

SEE Addition of June 28, 1912, to Fr. Pat. 417,392 of 1910 ; this J., 1913, 36.—T. F. B.

Derivatives of safranine dyestuffs. Fr. Pat. 463,357. *See* IV.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber ; Decomposition of —— by micro-organisms. N. L. Söhngen and J. G. Fol. Zentr. Bakt. u. Parasitenk., I. Abt., 1914, **40**, 87—98. Chem. Zentr., 1914, **1**, 1231—1232.

MANY bacteria and mould fungi will develop on rubber, in presence of sufficient moisture, at the cost of the protein, sugars, and resins : in some cases red, yellow, black or brown spots are produced, but the mechanical properties of the rubber are not notably affected. Two species of *Actinomyces*, *A. elastica* and *A. fuscus*, usually present in garden soil and canal water, are capable of attacking and assimilating the caoutchouc hydrocarbon. This action is due to the developing organisms, not to a soluble enzyme secreted by them, and hence on plantations the rubber should be dried as rapidly as possible, in order to prevent bacterial growth.—A. S.

Caoutchouc ; Synthetic —— from isoprene. G. Steimmig. Ber., 1914, **47**, 852—853.

IN reply to Harries (this J., 1914, 325), it is pointed out that if on treating the decomposition products of caoutchouc-ozonide with phenylhydrazine acetate and then adding mineral acid, solid phenylmethyldihydropyridazine is immediately formed, this is no proof that acetonylacetone was not present among the decomposition products. To recognise the presence of acetonylacetone it is necessary to distil the mineral acid solution with steam, in order to convert the phenylhydrazine compound into the volatile phenylaminodimethylpyrrole. The isoprene used in the author's previous experiments (this J., 1914, 267) was prepared from isopentane and carefully purified : its b. pt. was 33·5°—34° C. and sp. gr. 0·6785 at 18·5°/4° C. The statement that all caoutchouc-like substances hitherto obtained from isoprene consist of mixtures of polymerides of 1.5- and 1.6-dimethylcyclooctadiene-(1.5) is reaffirmed.—A. S.

Rubber in Namaqualand. Board of Trade J., April 2, 1914. [T.R.]

A COMPANY has been formed with a capital of £6,000 for the purpose of exploiting the *Euphorbia drageana*, which grows wild in the uplands of Namaqualand, and is stated to yield 17·6 per cent. of pure rubber and 70 per cent. of resin. The company holds a concession of some 220 square miles, containing about 6,000,000 bushes of this plant.

PATENTS.

Polymerisation processes and products obtained thereby [Manufacture of rubber-like substances]. E. H. Strange and H. J. W. Bliss, London. Eng. Pat. 3045, Feb. 5, 1913.

THE use of high pressures is claimed in polymerisation processes when the product has a considerably higher specific gravity than the initial material, *e.g.*, in the polymerisation of butadiene and its homologues to caoutchouc substances. The action of high pressure may be combined with that of other means of polymerisation. In order to produce an appreciable effect, it is usually necessary to employ pressures exceeding 500 lb. per sq. inch. In an example of the polymerisation of butadiene, the process is carried out under a pressure of 20 to 25 tons to the square inch, in the form of apparatus described by Hite (Amer. Chem. J., 1899, 80 ; see this J., 1899, 736).—T. F. B.

Rubber-bearing plants ; Process for facilitating the elimination from the bark of landolphia vines and other kinds of —— of the portions which are non-laticiferous. S. Goldreich and J. L. Palmer, London. Eng. Pat. 13,760, June 13, 1913.

THE outer portions of the bark are ground away without materially pressing it, by passing it between a pair of differentially geared fluted grinding rolls, the speed of one roll being about 20 per cent. greater than that of the other and afterwards removing the barren particles by sifting. The material is then pressed into sheets, flakes, etc., between even geared rolls and again sifted to remove any further barren particles.—E. W. L.

Rubber latex; Process of coagulation of ——. C. H. Boehringer Sohn. Fr. Pat. 464,192, Oct. 28, 1913. Under Int. Conv., Oct. 31, 1912.

Latex is coagulated by means of lactates of aluminium, more particularly the normal lactate. 250 c.c. of a 5 per cent. solution of aluminium lactate will coagulate 3000 grms. of latex in 8 mins.—E. W. L.

Gutta-percha; Manufacture of ——. R. B. Ransford, London. From Nederlandsche Gutta-Percha Maatschappij. The Hague, Holland. Eng. Pat. 20,118, Sept. 5, 1913.

The leaves and twigs of the trees are finely ground, mixed with water, stirred, and heated to 70° to 75° C. to extract the gutta-percha.—B. N.

India-rubber substitutes; Process for the preparation of ——. J. R. and M. E. McPhie, Newcastle-on-Tyne. Eng. Pat. 4214, Feb. 19, 1913.

An oil, fat, glyceride or fatty acid is treated with strong nitric acid, and the resulting yellow oil is well washed with boiling water, and purified by repeated solution in alkali and reprecipitation with acid until an elastic mass, unaffected by alkali solution, is obtained. This is washed with warm water and dried below 100° C.—E. W. L.

Imitation rubber with a basis of acetylcellulose, and various materials and fabrics made therefrom. Act.-Ges. für Anilin-Fabrikation. Fr. Pat. 463,622, Oct. 14, 1913. Under Int. Conv., Mar. 22, 1913.

Acetylcellulose is mixed with a substance of low volatility capable of conferring plasticity upon the mass, loading or colouring matters being added as desired. For example: 1 part of nitroacetylcellulose (see Fr. Pat. 449,253 of 1912; this J., 1913, 482) is digested with 2 parts of methyl phthalate. When the temperature reaches about 60° C. the mass swells up and agglutinates. The addition of a small quantity of a volatile solvent, such as acetone, hastens the swelling. The mass may be coloured black by the addition of an alcoholic solution of nigrosine. Or, 5 parts of acetylcellulose may be digested with 10 parts of triacetin and 1 part of amyl alcohol. The mass may be mixed with reclaimed rubber and 7 per cent. of sulphur and vulcanised by heating for 1 hr. at 135° C. It may also be dissolved in 2 parts of acetone and 3 parts of benzine added to the solution, which may then be employed for impregnating fabrics. Or the mass may be run into the form of a thin sheet at 60° C. and under a pressure of 50 to 150 kilos. per sq. cm., and applied to a fabric under pressure. The surface of the fabric should be first prepared with a dilute solution of 1 part of nitroacetylcellulose, 1 part of triacetin and 10 parts of tetrachloroethane or acetone, and dried.—E. W. L.

Rubber and like gums; Method and apparatus for extracting ——*from gum-containing plants.* F. Kempter, Stuttgart, Germany. Eng. Pat. 17,880, Aug. 5, 1913.

See Fr. Pat. 461,093 of 1913; this J., 1914, 93.—T. F. B.

Caoutchouc; Process for manufacturing synthetic ——. C. K. F. L. Gross, Christiania, Norway. U.S. Pat. 1,090,847, March 24, 1914.

See Fr. Pat. 459,987 of 1913; this J., 1913, 1164.—T. F. B.

Extracting fats, rubber, waxes, etc., by means of solvents. Fr. Pat. 463,178. *See* XII.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin; Composition of ——. *III.* L. F. Iljin. Ber., 1914, **47**, 985—993. (See also this J., 1909, 665, 1151; 1910, 504.)

By partial precipitation of a tannin solution with lead acetate, and extraction of the unprecipitated portion with ethyl acetate (Trimble, *The Tannins*, 1892, vol. I., 85), a product of higher rotatory power than the original tannin was obtained, whilst by decomposing the lead precipitate with hydrogen sulphide and extracting with ether, a product of lower rotatory power was obtained. By repeated fractionation in this way products of rotatory power $[a]_D$ = about +29° and +117° respectively, were obtained. By similar fractional precipitation with zinc acetate, the zinc compound being decomposed by the calculated quantity of dilute sulphuric acid, products having $[a]_D = +5{\cdot}16°$ and $+137{\cdot}85°$ respectively were obtained. The former was sparingly but the latter readily soluble in cold water. The product of higher rotatory power yielded gallic acid and dextrose on hydrolysis.—A. S.

Tannin; Constitution of ——. *XI.* A. Geake and M. Nierenstein. Ber., 1914, **47**, 891—898.

The formation of dextrose in the hydrolysis of tannin with acids (compare Fischer and Freudenberg, this J., 1912, 503, 1043) is confirmed. Nierenstein's earlier failure to detect dextrose as a component of the tannin molecule (this J., 1912, 652) was due to the use of alkali for effecting hydrolysis. The dextrose is not present in a free or loosely-combined form: the rotatory power of tannin is not diminished by the action of beer yeast, as stated by Biddle and Kelley (this J., 1912, 737), provided care be taken to prevent infection by moulds (compare Knudson, this J., 1913, 545). By partial hydrolysis (4 hours with 5 per cent. sulphuric acid) of carefully purified tannin, there were produced 2½—4 per cent. of a crystalline substance, not yet identified, which did not yield sugar on hydrolysis, 20—25 per cent. of gallic acid, and 60—70 per cent. of an amorphous substance of almost the same composition and properties as the original tannin, but differing from the latter and from the pentadigalloylglucose of Fischer and Freudenberg (*loc. cit.*) by its considerably higher rotatory power, especially in glacial acetic acid and in alcohol.—A. S.

Fat as a by-product in the manufacture of glue from hide trimmings. Dubovitz. *See* XII.

Patents.

Animal refuse; Thermo-chemical process and apparatus for transforming —— *into fat, flesh powder, gelatin, etc.* J. Margoles. Fr. Pat. 463,179, July 24, 1913.

Animal refuse, etc. is heated with steam under a pressure of 2 to 8 kilos. in autoclaves containing perforated cylinders in which agitators rotate. The decoction of nitrogenous substances, fat and condensation water is continuously drawn off into closed vessels, where the different constituents are separated, whilst the residual nitrogenous matter is dried *in vacuo* in a cylinder provided with beaters and heated by steam coming from the digester. —C. A. M.

Leather scrap; Manufacture of a solid and elastic mass from ——. G. Kraitschier and "Veto Company" Vertriebsges. für Schutzapparate gegen Feuer und Einbruch, G. m. b. H. Fr. Pat. 463,200, Sept. 13, 1913.

Finely divided leather scrap is bleached for 8 hours in a bath of chloride of lime, dried, washed in water, dried again, reduced to powder and mixed with an agglomerant either damp or with a small quantity of fatty material. The material is then moulded by hydraulic presses. The incombustibility may be increased by addition of borax, sulphuric acid or potassium silicate.—D. J. L.

Casein-glue; Process for preparing ——. A. and A. Bernstein. Ger. Pat. 270,200, Jan. 29, 1913.

Casein is treated with free resin acid or with resin containing a large percentage of free resin acid, in presence of hot water, and the mixture is brought to the condition of a colloidal solution by addition of alkali.—T. F. B.

Horn or leather; Manufacture of substances similar to —— from leather or leather scrap. P. P. Damgaard and M. P. Rasmussen. Fr. Pat. 463,596, Oct. 14, 1913.

Leather scrap is treated with alkali to remove tannin and then with a glue solution containing acetic acid after washing away excess of alkali. The mass is filter-pressed, allowed to stand for some time, when it becomes nearly black, and then hardened by means of formaldehyde vapour or solution.—D. J. L.

Leather; Process for the manufacture of artificial ——. L. Lilienfeld, Vienna. Eng. Pat. 28,210, Dec. 6, 1912. Under Int. Conv., April 6, 1912.

See Fr. Pat. 456,261 of 1913; this J., 1913, 953.—T. F. B.

Hides; Method of treating —— before tanning. C. C. Moore and W. Trantom, Lymm. U.S. Pat. 1,091,236, March 24, 1914.

See Eng. Pat. 18,890 of 1913; this J., 1914, 326.—T. F. B.

XVI.—SOILS; FERTILISERS.

Marshy land; Improvement of —— in Finland by addition of sand. A. Rindell. Finska. Moss Kulturforeningens Tidskrift, Helsingfors, 1913. Reprint 8 pp. Biedermann's Zentr., 1914, **43**, 157—159.

Experiments with oats extending over two years showed that loam is much superior to sand as an addition to unmanured marshy land. The addition of sand did not produce any improvement unless more than 400 cubic metres per hectare (5700 cb. ft. per acre) were added. If the land was otherwise provided with phosphates and potash, the difference in effect between sand and loam was not appreciable.—W. H. P.

Phosphoric acid in soils; Determination of ——. R. Hornberger. Landwirtsch. Versuchsst., 1913, **82**, 299—302. Biedermann's Zentr., 1914, **43**, 148—149.

In the analysis of soils the ammonium phosphomolybdate precipitate frequently does not dissolve completely in ammonia, a whitish residue being left. This consists mainly of hydrated titanium dioxide but it may contain as much as 3 mgrms. of phosphoric acid. The precipitate should therefore be fused with sodium carbonate and extracted with water. Sodium phosphate dissolves with the carbonate and the phosphate can be determined in the usual way in the solution. Acid sodium titanate remains undissolved.—W. H. P.

Soils; Presence of some benzene derivatives in ——. E. C. Shorey. J. Agric. Research, 1914, **1**, 357—363.

Eight different samples of a sandy soil from Florida at present devoted to orange culture were examined, the top soil and the subsoil separately. From one subsoil sample *benzoic acid* was isolated (2 grms. from 25 kilos. of soil); from several other samples, principally subsoils, *m-hydroxytoluic acid* (up to 10 grms. from 25 kilos.), and from four samples, *vanillin* (a few mgrms. from 25 kilos.); in all the samples evidence of the presence of small quantities of vanillin was obtained. It seems unlikely that the vanillin exists in the soil otherwise than as free vanillin, and it is concluded that in some of the soils examined, at least a portion of the two acids is present as free acid.—W. H. P.

Winter spraying with solutions of nitrate of soda. W. S. Ballard and W. H. Volck. J. Agric. Research, 1914, **1**, 437—444.

Experiments in 1912 showed that the blossom on Yellow Bellflower apples opened about a fortnight earlier when the trees were thoroughly sprayed with a solution containing sodium nitrate (1 lb. per gall.) and caustic potash (1 lb. per 7 galls.), early in February. The foliage was not stimulated so soon as the blossom, but the yield of fruit from the treated trees was five times as great as from a check row of untreated ones. A single tree receiving 50 lb. of sodium nitrate as root fertiliser gave no increased production. In 1913, although frost spoiled the setting of the crop, it was found that the stimulation of blossom was also produced by calcium nitrate and cyanamide but not by ammonium sulphate. Sulphate of potash had some effect, but superphosphate none. A weaker nitrate solution and nitrate in the absence of alkali were not so effective, but oxalic acid (1 lb. per 2½ galls.) had a similar effect to the alkali. Experiments on a large scale in 1913 gave favourable results with apples and pears, but not with stone fruit such as cherries.—W. H. P.

Sugar cane; Manurial experiments with ——. H. A. Tempany. Imp. Dept. Agric. for West Indies. Report on experiments conducted in Antigua and St. Kitts, 1912-13, 65—94.

The best results were secured when adequate dressings of pen manure and allied fertilisers were applied to fields destined to bear plant canes, while a light dressing of quick-acting nitrogenous manure at the rate of 40 lb. of nitrogen per acre, applied in the early stages of growth, was of benefit to ratoon canes. Applications of artificial manures to plant canes which had received an adequate dressing of pen manure were ineffective in producing further remunerative increases of yield, while the combination of phosphates and potash with nitrogen, and also the use of slow-acting nitrogenous manures was unproductive of profit in the case of ratoon canes. The average profits derived from the use of calcium nitrate were somewhat less than with sodium nitrate, but greater than with ammonium sulphate. The application of nitrolim (crude calcium cyanamide) was attended by financial loss. Small gains ensued from the application of molasses to ratoon canes, but not sufficient to prove profitable unless the value of exhausted molasses was very low.—L. J. de W.

Patents.

Plants, fields, sown seeds, crops, or the like; Chemical, electro-chemical, and electric treatment of ——. R. Mies, London. Eng. Pat. 11,997, May 22, 1913.

The soil is treated with solutions of phosphoric acid, copper and manganese salts, picric acid, sodium chloride, lime, and carbon bisulphide, and then subjected to the action of a current of electricity of 80,000 volts and about 30 milli-amperes, the electrodes being placed in the ground at a depth of about 25 cm. In the case of growing plants, one electrode may be attached to the stem, and the other placed in the soil around the roots; a current of electricity of about 20,000 volts and 25 milli-amperes is then applied at intervals. Various methods of inserting or placing the electrodes in the soil are described.—W. P. S.

Basic slag; Apparatus for removing iron from ——. F. Steinert and H. Stein. Ger. Pat. 268,500, Dec. 6 1912.

The slag is ground in a tube-mill, the discharge end o which is enclosed by a concentric conical screen with it wider end towards the front of the apparatus. The fin material passes through the screen into an outer conica drum tapering in the opposite direction, whilst the coarse portion, including particles of iron, is thrown out at th end of the screen, into a magnetic separator forming a extension of the outer drum and connected therewith b an insulating ring. The particles of iron are retaine whilst the slag travels down the conical drum, and mix with the finer material.—A. S.

XVII.—SUGARS; STARCHES; GUMS.

Slow carbonatation. Clarifying effect. Analysis of scums. H. Pellet. Bull. Assoc. Chim. Sucr., 1914, **31**, 554—563. (See also Stanek, this J., 1913, 1080.)

Slow carbonatation frequently causes difficult filtration in the cane, as well as in the beet factory; silicates gradually pass into solution from the lime and on cooling separate out and clog the pores of the press-cloths. Carbonatation diminishes the polarisation to the extent of about 0·1° V. per 100 c.c., the lime either eliminating the optically active non-sugars, or modifying their rotation. In determining the clarifying effect, trustworthy figures are not given by a comparison of the apparent purity values; and the real purity, which indicates a lower clarifying effect than the apparent, should always be used. The content of organic matter in the scum calculated from the real purity of the juice before and after carbonatation, agrees well with that determined by calcining the scum in a current of oxygen, account being taken of the small amount of carbon always remaining unconsumed. When the lime used contains much magnesia, the weight of the dried scum found will be greater than that calculated from the lime added and from the substances eliminated from the juice, the water of hydration of the magnesium compounds not being expelled at the usual temperature of desiccation, viz., 105°—110° C. Another source of error in determining the dry substance of scum is the presence of calcium hydroxide, which has escaped carbonatation. During desiccation this is gradually carbonated, and a correction should be made after determining the amount present by dissolving a portion of the scum in sugar solution, and titrating with standard acid, a blank experiment being made at the same time using water in place of sugar solution.—J. P. O.

Beet slice dryers; Explosions in ——. Albrecht. Deut. Zuckerind., 1914, **39**, 269.

In the case of a Büttner and Meyer apparatus explosions were traced to the accumulation of dust, but in that of a Petry and Hecking dryer the cause was not ascertained, though owing to insufficient draught and the chimney being placed in the side, and not in the middle of the plant, opportunity was given for the collection of combustible gases, principally carbon monoxide. For the avoidance of such accidents, Köhler recommends the use of a "cyclone" dust separator, and that when the dryer is not in use, banking of the fire should be avoided, the chimney shutter kept open, and the ventilator damper always closed.—J. P. O.

Sucrose determination; Source of error in the Clerget ——. V. Stanek. Z. Zuckerind. Böhm., 1914, **38**, 289—298. (See also Langguth, this J., 1914, 96.)

The Herzfeld constant for the half-normal solution read at 20° C. is stated to be 132·66 provided the reading of the inverted solution is made within 3 to 5 minutes after filling the observation tube. Since this condition cannot always be realised, it is suggested that the polarisations after inversion be made 15 to 30 minutes after filling, when the rotation will have become constant, and that the constant used be 132·95 (say 133·00).—L. J. de W.

Honeys; Examination of Belgian ——. R. Ledent. Bull. Soc. Chim. Belg., 1914, **28**, 73—77.

Nineteen samples of genuine honey contained from 19·81 to 21·13 per cent. of water and from 0·08 to 0·32 per cent. of ash. The volume of the precipitates obtained with Lund's tannin test (see this J., 1910, 105) varied from 1·0 to 1·8 c.c.; this test, and those described by Fiehe and by Jaegerschmidt (this J., 1908, 1127; 1909, 805), are recommended for the detection of added invert sugar in honey (see also this J., 1910, 1072).—W. P. S.

d-Glucosamine; Conversion of —— into d-mannose. J. C. Irvine and A. Hynd. Chem. Soc. Trans., 1914, **105**, 698—710.

Methylglucosamine was converted into benzylideneaminomethylglucoside hydrochloride by interaction with benzaldehyde. Condensation took place only in presence of hydrochloric acid, and the product was exceedingly readily hydrolysed. The amino group was eliminated by treating a solution of 1 mol. of the hydrochloride with 2½ mols. of sodium nitrite: nitrogen was vigorously evolved and after a short time the nitrogen-free product separated as a white solid. This proved to be benzylidenemannose, the yield being about 90 per cent. of theoretical; it was very readily hydrolysed to *d*-mannose. Glucosamine has now been converted into dextrose (Chem. Soc. Trans., 1911, **99**, 250; 1912, **101**, 1128) and into *d*-mannose. Optical inversion must accordingly have occurred in one of these transformations, most probably in the latter during the action of sodium nitrite on the benzylideneaminomethylglucoside hydrochloride.

—J. H. L.

Rice starch; The fractional liquefaction of ——. F. J. Warth and D. B. Darabsett. Mem. Dept. Agric. India, [Chem. series], 1914, **3**, 135—147.

Starches from different varieties of rice can be distinguished by fractional liquefaction at different temperatures. 1 grm. of the material, prepared in a state of fine division by digestion with 1 per cent. potassium hydroxide for 24 hours, is stirred with 70 c.c. of water, and maintained at the desired temperature for 1 hour. The starch liquefiable at that temperature is converted into a paste in which unaltered starch granules remain suspended. The cooled liquid is then treated for 2 hours with 10 c.c. of malt extract at 30° C., at which temperature no appreciable erosion of starch granules occurs. An aliquot portion of the filtered solution is hydrolysed with hydrochloric acid, the dextrose determined by Fehling's solution and a permanganate titration of the cuprous oxide, and the amount of starch liquefied at the given temperature calculated. Very characteristic curves are obtained for various rice starches by plotting percentage liquefaction against temperature.—G. F. M.

Adhesives; Analysis of soluble ——. [Detection of gum arabic in presence of dextrin.] G. Armani and I. Barboni. Annali Chim. Appl., 1914, **1**, 138—142.

The sample is distilled with 12 per cent. hydrochloric acid and the distillate treated with a solution of benzidine acetate: a yellow colouration is produced if dextrin or gum arabic is present. A 30 per cent. solution of potassium hydroxide is then added gradually till a precipitate is produced, and the latter is dissolved by gradual addition of acetic acid: a red colouration, with violet reflex, indicates the presence of gum arabic or similar soluble gum in the original material.—A. S.

Manurial experiments with sugar cane. Tempany. *See* XVI.

Detection of raw beet products in admixture with raw cane products. Ling. *See* XVIII.

Action of invertase on sucrose in methyl and ethyl alcohols of different strengths. Bourquelot and Bridel. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

[Brewing sugars]. Detection of raw beet products in admixture with raw cane products. A. R. Ling. J. Inst. Brew., 1914, 20, 185—195.

Sucrose derived from sugar cane is entirely identical with the sucrose of the sugar beet. The nauseous secondary matters present in raw beet sugars, however, render them unsuited for the preparation of brewing "invert" sugar, whereas raw cane products are eminently suitable on account of their full and luscious flavour. Admixture of partially refined inverted beet products with cane products may be quite undetectable by aroma or flavour, but may lead to yeast weakness and fretty beers. The detection of such admixture by means of the high proportion of calcium salts in the ash of cane as compared with beet products, appears to be no longer possible since lime is used for the defecation of beet juices. The author suggests that a more useful means may be found in the content of albuminoids (nitrogenous matters other than nitrates or nitrites) which is usually much higher in beet than in cane products. Owing to the wide variations which are found in the nitrogen-content of low-grade cane sugars, however, it is impossible to fix rigid limits for the albuminoid-content of invert sugars prepared from cane products, so as to exclude those made from beet, but the author suggests the values 0·3, 0·5 and 0·75 per cent. for invert sugars of grades 1, 2 and 3 respectively. In cases where these limits are exceeded however, additional evidence (odour and flavour) should be adduced before pronouncing that a sample contains beet products. In a number of samples known to be made from beet products, the author found 1·16, 1·38, 1·39, 1·70 and 1·12 per cent. (No. 1 grade) and 2·21 and 2·29 per cent. (No. 2 grade). The nitrogenous matters present in beet, consist largely of betaine, and are in general of lower molecular weight than those of cane, so that in the manufacture of brewing sugars they are less completely removed by the char. Betaine is not assimilated by yeast and may possibly be somewhat toxic; its decomposition product trimethylamine, would certainly impart a very unpleasant odour and flavour to beer.—J. H. L.

Fermentation ; Does the enzyme-theory of —— require limitation? E. Buchner and S. Skraup. Ber., 1914, **47**, 853—870.

THE authors criticise adversely the hypothesis recently advanced by Rubner (*Die Ernahrungsphysiol. der Hefezelle bei alk. Gärung*, Rubner's Archiv. f. Physiol., Suppl. Bd., 1913, 1—369) according to which there occurs in the yeast cell not only an enzymatic decomposition of sugar, but also a decomposition due to vital process not differing from the enzymatic one in its chemical course.—J. H. L.

Reductions ; Phytochemical ——. I. Transformation of the nitro-group into the amino-group. C. Neuberg and E. Welde. Biochem. Zeits., 1914, **60**, 472—479.

NITROBENZENE, added to sugar solutions in course of fermentation by living yeast, is in part reduced to aniline. In one experiment 17·5 grms. of nitrobenzene were added to 5 litres of fermenting 10 per cent. sucrose solution. After 5 days, 10 grms. of unchanged nitrobenzene and 3·9 grms. of aniline were isolated from the fermented liquid. (Cp. Neuberg and Steenbock, this J., 1913, 803.) —J. H. L.

Malt worts and beers ; Temperature corrections to be applied to the specific gravities of ——. F. E. Day and S. L. Amos. J. Inst. Brew., 1914, **20**, 196—198

TABLE I. shows the corrections necessary to convert sp. gravities of malt mash worts, determined in a 50 c.c. bottle at temperatures other than 60° F. and compared with water at the same temperatures, into gravities at 60° F. The table applies only to worts of which the gravities lie between 1024 and 1031, and before the corrections are applied a set of weighings of water and malt extract should be made, in order to be certain that the bottle used is not abnormal as regards expansion with heat.

TABLE I.

Fractions of a degree of gravity to be added or subtracted.

Temp. ° F.		Single degrees Fahrenheit.									
		0	1	2	3	4	5	6	7	8	9
40	Deduct	—	—	—	—	—	0·32	0·30	0·29	0·27	0·25
50		0·23	0·21	0·18	0·16	0·13	0·11	0·08	0·06	0·04	0·02
60	Add	—	0·02	0·04	0·06	0·08	0·09	0·11	0·13	0·15	0·16
70		0·18	0·20	0·21	0·23	0·24	0·25	0·26	0·27	0·27	0·28

Table II. shows corrections to be applied to the apparent gravity of beers when using the hydrometer.

TABLE II.

	Range of apparent gravity, lb.	Corrections in fractions of 1 lb. per barrel.							
		45°	50°	55°	60°	65°	70°	75°	80°
		Deduct.				Add.			
Brass hydrometer	2—5	0·30	0·20	0·10	—	0·15	0·35	0·50	—
,, ,, ...	5—9	0·40	0·30	0·20	—	0·20	0·40	0·60	—
,, ,, ...	9—15	0·50	0·35	0·25	—	0·25	0·45	0·70	—
Glass hydrometer	2—5	0·35	0·25	0·10	—	0·20	0·40	0·60	0·85
,, ,, ...	5—9	0·45	0·35	0·20	—	0·25	0·45	0·70	1·00
,, ,, ...	9—15	0·55	0·40	0·25	—	0·30	0·50	0·80	1·10

—J. H. L.

Invertase ; Action of —— on sucrose in methyl and ethyl alcohols of different strengths. E. Bourquelot and M Bridel. J. Pharm. Chim., 1914, **9**, 321—327.

ONE grm. of sucrose in 100 c.c. of methyl alcohol of 10 t 40 per cent. was completely hydrolysed by invertase a 18°—20° C. in 3 to 19 days. The invertase was prepare from top fermentation yeast (0·2 grm. in each case) whic had been killed by contact with ethyl alcohol for 12 hours then drained and dried in air. The invert sugar wa determined by reduction since it was found that as th percentage of alcohols increased, the rotatory power lævulose decreased and that of dextrose increased. Wit a higher percentage of methyl alcohol than 40 per cen the invertase was destroyed. With ethyl alcohol t action was complete in solutions up to 40 per cent. strengt but beyond this the hydrolysis was incomplete owing the insolubility of the invertase, although after tv months in contact with 90 per cent. alcohol it was st active.—L. J. DE W.

XIXA.—FOODS.

Activity of lipase of castor oil seeds at low temperatur Blanchet. *See* XII.

Patents.

Oxidation means and processes [particularly for grains and flour]. B. I. Levin, Manchester. Eng. Pat. 5405, March 4, 1913.

The electrolyte or mother-liquor used in the electrolytic production of persulphates is added in suitable proportions to grain or flour; when used for flour, a portion of the sulphuric acid in the liquor may be replaced by phosphoric acid, or a small quantity of potassium perchlorate may be added, or the free sulphuric acid may be combined by the addition of calcium phosphate.—W. P. S.

Milk or cream; [Electrical] Treatment of —— during churning. B. Combe, Cheltenham. Eng. Pat. 6418, March 15, 1913.

The milk or cream is subjected, during the churning operation, to the action of a current of electricity. —W. P. S

Foods; Process of treating ——. E. B. Heller, Philadelphia, Pa., Assignor to A. R. Brandly, Little Falls township, N.J. U.S. Pat. 1,090,210, March 17, 1914.

Melted butter (or a liquid fat or oil) is subjected to centrifugal force, with or without simultaneous treatment with a current of air, electrified air or a gas, and is then emulsified with a suitable substance.—C. A. M.

Food fats; Manufacture of ——. P. A. Schmitt, Hamburg, Germany. Eng. Pat. 14,872, June 27, 1913. Under Int. Conv., June 28, 1912.

See Fr. Pat. 460,614 of 1913; this J., 1914, 98.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Lead [in water]; A new, very sensitive reaction for ——. W. N. Iwanow. Chem.-Zeit., 1914, **38**, 450.

A 2 per cent. solution of sodium bisulphite, which should not be acid to methyl orange, can be used for detecting minute quantities of lead in water. The addition of an equal volume of the reagent produces a cloudiness, which, if the quantity of lead is very small (1 in 1,000,000), appears only after some minutes. The presence of copper, silver, nickel, iron, aluminium, magnesium and calcium does not influence the reaction, but barium or tin must not be present. The sensitiveness of the reaction is 1 : 20,000,000.—G. F. M.

Bacteria; The escape of —— into the atmosphere by the spraying of polluted water. L. Cavel. Comptes rend., 1914, **158**, 896—898.

The spraying devices used in some biological purifying stations for distributing polluted water over the bacteria beds are a source of considerable danger. Petri dishes containing sterilised gelatinised bouillon were exposed for specified times facing the direction of the wind, before and after passing over a bacteria bed. After 5 days whilst in most cases the dishes exposed to the air before passing over the bacteria bed remained sterile, those exposed to the air after passing over exhibited numerous colonies, amongst which could be identified some originating from the harmful bacteria normally found in sewage effluents.—G. F. M.

Patents.

[Water] Filter. H. Reisert, Cologne. U.S. Pat. 1,088,929, March 3, 1914.

A number of filter beds are arranged one above the other, conduits leading downward from each bed through the bed or beds beneath to a chamber which receives the filtered water from all the beds. The filtered water can be forced back by compressed air through any bed for cleaning purposes.—H. H.

Plague bacilli; Process for destroying ——. P. Brat. Ger. Pat. 270,076, Dec. 12, 1912.

The infected substances are treated with the vapours of acrolein or similar compounds, especially the distillates obtained by heating rape oil or other substances containing glycerol at temperatures above 350° C. Under these conditions, cultures of plague bacilli on agar were completely killed after 17 hours, whilst treatment with formaldehyde vapour for 24 hours was insufficient for the purpose.—T. F. B.

Sterilising liquids by means of ultra-violet rays; Apparatus for ——. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris, Assignors to the R.U.V. Co., New York. U.S. Pat. 1,091,221, March 24, 1914.

See Eng. Pat. 14,129 of 1910; this J., 1911, 106.—T. F. B.

Sterilising liquids by means of the ultra-violet rays; Apparatus for ——. T. Nogier, Lyons, France. U.S. Pat. 1,091,382, March 24, 1914.

See Eng. Pat. 9660 of 1911; this J., 1912, 356.—T. F. B.

Production, by means of the electric arc, of a gas with preservative properties. Fr. Pat. 463,728. *See* XI.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Solanum angustifolium; Constituents of, and isolation of a new gluco-alkaloid from ——. F. Tutin and H. W. B. Clewer. Chem. Soc. Trans., 1914, **105**, 559—576.

30·92 kilos. of dried leaves, twigs and flowers of *Solanum angustifolium*, Ruiz et Pavon ("*Duraznillo Blanco*") from Peru were extracted with hot alcohol and the concentrated extract distilled with steam. Only a trace of essential oil was obtained. From the aqueous extract the following substances were isolated: quercetin, rutin (quercetin glucorhamnoside $C_{27}H_{30}O_{16},3H_2O$), *l*-asparagine and a new crystalline gluco-alkaloid, *solangustine*, $C_{32}H_{53}O_7N,H_2O$, m. pt. 235° C., which forms a crystalline sulphate insoluble in all solvents except boiling acetic acid. The hydrochloride and nitrate of solangustine are amorphous. On hydrolysis solangustine yields an amorphous alkaloid, *solangustidine*, $C_{27}H_{43}O_2N$, and 1 mol. of dextrose. The hydrochloride, hydrobromide, nitrate and sulphate of solangustidine are crystalline and insoluble in water. The aqueous extract also contained amorphous alkaloidal substance, lævulose and viscid amorphous products which yielded quercetin and 3.4-dihydroxycinnamic acid on treatment with alkalis. The portion of the alcoholic extract insoluble in water yielded triacontane, a phytosterol, $C_{27}H_{46}O$, a phytosterolglucoside, $C_{33}H_{56}O_6$, and a mixture of palmitic, stearic, cluytinic, cerotic, linolic and linolenic acids, as well as a higher fatty acid, probably melissic acid, solangustine, chlorophyll and resinous material. Neither the total extractives (equivalent to 3·5 grms. of the drug), solangustine (0·48 grm.) or the amorphous alkaloidal material had any physiological effect.—T. C.

Daviesia latifolia; Constituents of ——. F. B. Power and A. H. Salway. Chem. Soc. Trans. 1914, **105**, 767—778.

The ground leaves and stems of *Daviesia latifolia*, R.Br. collected in Victoria, were extracted with alcohol, and, after concentrating, the extract was distilled in steam. A small amount of essential oil with a pleasant smell was obtained, which after removing benzoic acid, distilled between 200° and 220° C. The following compounds were obtained from the portion of the alcoholic extract soluble in water: benzoic, salicylic, *p*-coumaric and fumaric acids, *dibenzoyl glucoxylose,* a quercetin glucoside and dextrose. Dibenzoylglucoxylose, $C_{25}H_{28}O_{12},H_2O$, m. pt. 147°—148° C., is the crystalline benzoyl derivative of a new disaccharide, *glucoxylose,* and possesses an extremely bitter taste. Glucoxylose, $C_{11}H_{20}O_{10}$, yields 1 mol. of dextrose and 1 mol. of xylose on hydrolysis. The portion of the alcoholic extract insoluble in water was chiefly resinous material and yielded myricyl alcohol, hentriacontane, a phytosterol, $C_{27}H_{46}O$, m. pt. 135°—136° C., benzoic, palmitic, stearic and linolic acids, and the same dibenzoylglucoxylose obtained from the aqueous extract. The bitterness of the drug is due to the crystalline dibenzoylglucoxylose, which belongs to a class of substances not hitherto observed to occur in nature.—T. C.

Tobacco resins; Chemistry of ——. J. von Degrazia. Fachliche Mitt. der oesterr. Tabakregie, 1913, 109—117. Chem. Zentr., 1914, **1**, 1196—1197.

Seven kilos. of "Turkish Gebitz," consisting of the waste from different Turkish smoking tobaccos, was extracted with warm water to remove tannin and alkaloid salts, dried, and extracted with hot alcohol. The cooled extract was filtered, the alcohol distilled off, and the residue washed with hot water to remove fatty acids. 250 grms. of resin were thus obtained and from it the following constituents were isolated. α-Tabakenic acid, a brittle, dark brown, odourless amorphous mass, sparingly soluble in alcohol when dry, soluble in methyl and amyl alcohols, chloroform, benzene, nitrobenzene, acetone, xylene, glycerin and oil of turpentine, very slightly soluble in ethyl and amyl acetates, insoluble in ether, petroleum spirit, and carbon bisulphide. β-Tabakenic acid, a dark green (probably due to chlorophyll) brittle mass, soluble in alcohol, chloroform, ether, nitrobenzene, amyl alcohol, ethyl acetate, and acetone, insoluble in carbon bisulphide, benzene, xylene, and petroleum spirit. γ-Tabakenic acid obtained as a viscous brown liquid of unpleasant odour; distinguished from the β-acid by not forming a lead salt; soluble in alcohol, ether, nitrobenzene, amyl alcohol, ethyl acetate, and acetone, slightly soluble in methyl alcohol, benzene, and xylene, insoluble in carbon bisulphide and petroleum spirit. Tobacco-resinol, $(C_6H_{10}O)_x$, present in the tobacco as an ester of the β- or γ-acid, forms white flocks of microscopic needles, m. pt. (uncorr. 219° C.), slightly soluble in the common organic solvents; m. pt. of acetyl-derivative, 154° C. Tobacco-resene, $C_{38}H_{64}O_2$, a reddish-brown viscous liquid, which is not attacked by fused alkalis; sp. gr. 0·941 at 18·7° C., n_D^{17} = 1·5169, miscible with most organic solvents, gives a turbid solution with petroleum spirit. The odour of the tobacco resin is due to the resene, which is present in larger quantity than the other constituents. About ½ grm. of essential oil, of pleasant odour, n_D = 1·4882, was also obtained.—A. S.

Phytin and phytic acid. G. Clarke Chem. Soc. Trans., 1914, **105**, 535—545. (See also this J., 1914, 371.)

The phytin was extracted with 4·5 per cent. acetic acid from the seeds of Indian field mustards from which the fat had been previously removed by extraction with petroleum. It was purified by taking advantage of the fact that it separates from a cold 8 per cent. acetic acid solution on boiling, and was obtained as a snow-white, amorphous powder containing carbon, hydrogen, phosphorus, calcium and magnesium. The free acid (phytic acid), prepared by way of the lead and copper salts, contained phosphoric acid in inorganic combination; the ammonium salt obtained from the sparingly soluble strychnine salt contained no phosphate in such combination. The composition of pure phytin corresponded to no calcium-magnesium salt of a simple acid ester of inositol and phosphoric acid, whereas the above strychinne salt, isolated from the mixture of acids, gave analytical results in agreement with salts of such acids. The author concludes that phytin is possibly a complex calcium-magnesium salt of an inositol-phosphoric acid and phosphoric acid, which yields a mixture of the two acids upon removal of the bases.—J. R.

Lophantus rugosus: The essential oil of ——. P. de Vilmorin and F. Levallois. Bull. Soc. Chim., 1914, **15**, 342—345.

The oil (yield about 1·5 grms. from 1 kilo. of the plant) was an amber coloured liquid, solidif. pt. below —15° C., soluble in all proportions in 95 per cent. alcohol, sp. gr. at 15°/4° C., 0·962 to 0·967; $[\alpha]_D$ = +4·89° to +6·19°, maximum saponif. value 3·7, after acetylation 7·4. Distillation at 10 mm. pressure gave the following fractions: 60°—63° C., 8 per cent.; 63°—90°, 2; 90°—94°, 86; residue, 4 per cent. The chief fraction (90°—92° C.) was probably methylchavicol, and was converted into anethol by boiling for 20 hours with alcoholic potassium hydroxide. The lower fractions consisted essentially of terpenes, and limonene was identified by its tetrabromide and nitrosochloride.—G. F. M.

Amber oil. A. Károly. Ber., 1914, **47**, 1016—1023.

Rectified amber oil containing a small proportion of acid and ester was fractionated by distillation. It consisted principally of terpenes boiling between 154° and 177° C., and sesquiterpenes boiling at 240°—260° C. The characters of the terpene fractions were: α_D = 0° to —1° 25′, sp. gr. 0·8473 to 0·8648 at 20° C., n_D = 1·4705 to 1·4818 at 20° C. Treatment with bromine gave a substance, $C_9H_9Br_3$, melting at 242° C., apparently identical with tribromohemimellitene. The terpene fraction was hydrated by heating with a mixture of dilute sulphuric acid and acetic acid to 60° C., when a small proportion of borneol was obtained. Some heptylic acid was produced by oxidising with permanganate at 0° C. Oxidation with nitric acid yielded terephthalic acid, 1.3-dimethylterephthalic acid, and an acid, $C_8H_7O_4N$, melting at 189°—190° C., possibly 2-nitro-*p*-toluic acid. The presence of dihydrohemimellitene and dihydroisodurene in the original oil was inferred.—F. Shdn.

Essential oils; Constituents of ——. *The sesquiterpene, β-gurjunene.* F. W. Semmler and K. E. Spornitz. Ber., 1914, **47**, 1029—1030.

To separate α- and β-gurjunene, the mixture was oxidised with a solution of permanganate in aqueous acetone solution, when the β-gurjunene was left unattacked. After purifying, this sesquiterpene boiled at 113·5°—114° C. at 7 mm., had α_D = +19°, sp. gr. 0·9329 at 20° C. and n_D = 1·50526. It was reduced by means of hydrogen in the presence of platinum black with the formation of dihydro-β-gurjunene, $C_{15}H_{26}$, which boiled at 115°—117° C. at 7 mm., had the sp. gr. 0·9239 at 20° C., n_D = 1·49490, and α_D = —37°. This tricyclic sesquiterpene is distinct from cedrene (this J., 1912, 660), for it yielded no characteristic products after ozonisation.—F. Shdn.

Fenchocamphorone; Total synthesis of —— *and its oxidation with Caro's acid.* G. Komppa. Ber., 1914, **47**, 933—936.

The lead salt of homo-apocamphoric acid (pinophanic acid) was distilled in a current of carbon dioxide when *rac.*-fenchocamphorone was produced (Ber., 1911, 44 1356). The semicarbazone, $C_{10}H_{17}N_3O$, melted at 220° C after crystallising from aqueous alcohol, and the keton regenerated therefrom melted at 110° C. *D-d*-fenchocamphorone prepared from *D-l*-fenchene gave apocampholide when oxidised with Caro's acid.—F. Shdn.

Fenchenes; Ozonisation of certain ——. G. Komppa and S. V. Hintikka. Ber., 1914, **47**, 936—938.

By the action of ozone upon an acetic acid solution of *D-l*-fenchene prepared from fenchylamine (see this J., 1908, 956), *D-d*-fenchocamphorone was produced together with an acid of m. pt. 70°—71° C. The same products were obtained by the ozonisation of *D-l*-fenchene prepared from *l*-fenchyl alcohol, and of *D-d*-fenchene. Wallach's formulæ for *D-l*-fenchene and *D-d*-fenchocamphorone are confirmed.—F. Shdn.

Vanillin. M. Lehmann. Chem.-Zeit., 1914, **38**, 388—389, 402—403.

The adulteration of vanillin is detected, and its amount determined, by estimations of the sintering-point, the melting-point as laid down in the fifth edition of the German Pharmacopæia, *i.e.*, the temperature at which the substance forms a continuous column of liquid containing solid particles, and the point of clear fusion. The author's method for determining these is described, and tables and curves showing the effect of the addition of from 1 to 50 per cent. of guaiacol carbonate, coumarin, heliotropin, benzoic acid, salicylic acid, acetylsalicylic acid, acetanilide, or phthalic anhydride, are given. Coumarin and heliotropin are recognised by their smell. Benzoic acid, salicylic acid, and acetylsalicylic acid with methyl alcohol and sulphuric acid give esters of characteristic smell. Acetanilide gives the isonitrile reaction, phthalic acid forms fluorescein, and sugar may be extracted with water and determined polarimetrically, or the vanillin-sugar mixture fused, when a blue fluorescence is observed if 3 per cent. or more of sugar is present.—O. E. M.

Volatile fatty acids; Solubility of certain metallic salts of —— in organic solvents. Application to the detection of these acids. H. Agulhon. Bull. Soc. Chim., 1913, **13**, 404—408.

The solubility of the coloured copper and iron salts of the lower fatty acids in organic solvents increases with the molecular weight of the acid, and this fact may be utilised for detecting the individual acids in mixtures. The solution of the acids is made neutral to phenolphthalein with caustic soda, and diluted to a concentration of 2 per cent. 2 c.c. are then treated with 1 c.c. of ether, and a 2 per cent. solution of copper sulphate added, drop by drop, with agitation, avoiding excess. If the ether is coloured blue, butyric, valeric, or a higher acid is indicated. Using benzene in place of ether, this is coloured blue if valeric or a higher acid be present, but not if only butyric acid be present. If the ether is not coloured, a similar test is made with ferric chloride solution in presence of ethyl acetate, which is coloured blue if propionic acid, but not if only acetic acid (or formic acid) be present. —A. S.

Catalysis of acids; Use of manganous oxide for the ——: preparation of fatty and aromatic ketones. P. Sabatier and A. Mailhe. Comptes rend., 1914, **158**, 830—835. (See also this J., 1913, 806.)

Manganous oxide is a still more suitable catalyst than iron oxide for the preparation of ketones from both fatty and aromatic acids, or mixtures of both. The vapours of the acid are passed over a layer of oxide 60 cm. long, heated to 400°—450° C. The oxide may be employed repeatedly, and as little carbonisation or polymerisation occurs the yields of the ketones are in most cases almost quantitative. The catalysis of a number of fatty acids is described, including the higher members of the series, and also isobutyric and isovaleric acids which, with other catalysts, had failed to give satisfactory yields of di-isopropyl- and di-isobutyl-ketones respectively. The synthesis of a number of mixed ketones such as phenyl isopropylketone (b. pt. 218° C.), phenyloctylketone (m. pt. 46° C.), and phenylbenzylketone (m. pt. 60° C.), is also described. A number of the latter were converted by reduction over nickel into hydrocarbons.—G. F. M.

Acid catalysts. Catalytic preparation of new ketones. Some applications of catalytic methods. A. Mailhe. Bull. Soc. Chim., 1914, **15**, 321—329.

Contrary to the statement of Senderens (this J., 1914, 160) other oxides than those of thorium and zirconium can be used with excellent results for the catalytic preparation of ketones from acids. Thus cadmium oxide and ferric oxide in many cases give satisfactory yields, and where they fail, as in the case of isobutyric and isovaleric acids (this J., 1913, 806) manganous oxide has given good results (see preceding abstract). Mixed ketones were prepared by directing the vapours of acids over a layer of ferric oxide maintained at 470°—480° C. A mixture of benzoic and phenylacetic acids yielded phenylbenzylketone (m. pt. 60° C.), benzoic and hydrocinnamic acids gave benzylacetophenone (m. pt. 72° C.), and benzoic acid and the toluic acids yielded the corresponding tolylbenzylketones. Acetic and *m*-aminobenzoic acids yielded *m*-aminoacetophenone (m. pt. 90° C.), and the first unsaturated ketone prepared catalytically, cinnamylmethylketone (m. pt. 41° C.), was obtained from cinnamic and acetic acids. Several ketones prepared directly by the catalysis of acids were converted into a variety of allied substances by catalytic methods. The hydrogenation of propione was effected by means of nickel at 150° C. The diethylcarbinol thus produced yielded, in presence of ammonia by catalysis over thoria at 350° C. the primary amine $(C_2H_5)_2CH.NH_2$, and in presence of hydrogen sulphide the mercaptan $(C_2H_5)_2CH.SH$. The hydrogenation of propioneoxime over nickel yielded a mixture of the primary and secondary amines, $(C_2H_5)_2CH.NH_2$, and $[(C_2H_5)_2CH]_2NH$. Butyrone, isobutyrone, and isovalerone yielded a similar series of transformation products.—G. F. M.

Compressed ammonia; Reactions with ——. (Reactions at high pressures, III.) A. Stähler. Ber., 1914, **47**, 909—913.

Using apparatus previously described (Ber. 1914, **47**, 580) the author investigated the action of ammonia at high pressures upon various organic compounds. To avoid corrosion of the autoclave by halogen derivatives its inner surface was silvered. Carbon tetrachloride, in the presence of a little copper and iodine, was converted into guanidine, along with traces of cyanogen, at 140 C. and pressures above 40 atmospheres. Ethyl chloride was completely decomposed in 12 hrs. at 220° C. and about 220 atmosphere pressure, the product containing about 80 per cent. of mono-, 15 per cent. of di- and 5 per cent. of tri-ethylamine. Ethylene dichloride very readily gave good yields of ethylenediamine. Chlorobenzene was not attacked even in presence of copper and iodine after 48 hrs. at 250° C. and 400 atmospheres, and bromobenzene only slightly in presence of ammonium and aluminium iodides. Tetrachloroethylene and hexachloroethane reacted readily with compressed ammonia, but the reaction product was black and apparently consisted of decomposition or polymerisation products together with carbon and ammonium chloride. Dichloroethylene was only slightly attacked. Pure ether was not attacked at 250° C. and 270 atmospheres. The action between aqueous ammonia and highly compressed carbon dioxide in the presence of pumice stone containing iron salts yields urea and hydrocyanic acid. Methyldichloramine also reacted with liquid ammonia at ordinary temperatures giving a product which reduced silver nitrate but not Fehling's solution and had a pronounced burning taste. This was possibly methyl di-imide CH_3N_2H, but owing to the explosive nature of the reaction product (possibly due to traces of nitrogen chloride) the author has not been able to establish its identity.—W. H. P.

m-Xylene, ethyl alcohol, water; The system ——. A. Holt and N. M. Bell. Chem. Soc. Trans., 1914, **95**, 633—639.

Alcohol is miscible in all proportions with *m*-xylene as with water, whilst water and *m*-xylene are immiscible.

The results of the examination of mixtures of the three substances at 0°, 19°, 41°, 63° and 98° C., are given in tables and two curve-diagrams, in one of which are shown isotherms obtained by plotting mols. of water added against mols. of alcohol in 100 mols. of alcohol plus xylene, whilst in the other—a triangular diagram—the results are plotted in vols. per cent. of the components. For alcohol contents up to about 75 per cent. by vol., the isotherms can be closely represented by the formula :—

$$\frac{\text{Percentage of alcohol}}{\sqrt{\text{Percentage of water}}} = \text{constant (K).}$$

The value of K varies with the temperature according to the expression $K_{tx}=K_{to}—0{\cdot}125\,tx$, where K_{tx} is, the constant at a temperature tx and K_{to} the value at 0° C. When water is added gradually to mixtures of xylene and alcohol containing from 75—25 per cent. of xylene by vol., the phase rich in xylene which first separates forms a lower layer, but as the amount of water is increased, a critical point is reached when the phases rich in xylene and alcohol respectively have the same specific gravity, and with still more water the phase rich in xylene forms an upper layer. With mixtures of xylene and alcohol in the proportions 75·11 to 24·89, 50·15 to 49·85, and 25·01 to 74·99 c.c., the xylene phase changed from bottom to top on addition of 4·39, 10·8, and 17·2 c.c. respectively of water.—A. S.

Propane ; Properties of pure ——. J. Timmermans. Bull. Soc. Chim. Belg., 1914, **28,** 71—72.

Propane was prepared by Lebeau's reaction (Comptes rend., 1905, **140**, 1042, 1264) :

$$2C_3H_7I+2NaNH_3=2NaI+C_3H_7.NH_2+C_3H_8+NH_3,$$

and by Frankland and Kolbe's method as modified by Stahrfoss : $2C_3H_7CN+2Na=NaCN+CNC_3H_6Na+C_3H_8$. After purification by suitable chemical treatment and by fractional distillation, it solidified at —187·8° C., and 1 litre of it at 0° C. and 760 mm. pressure weighed 2·0192 grms.—W. P. S.

Patents.

Hexa-amino-arsenobenzene, a triaminobenzenearsinic acid, and a diaminotetranitro-arsenobenzene ; Manufacture of ——. C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. Eng. Pat. 8137, April 7, 1913. Under Int. Conv., March 4, 1913.

The reduction of 4-amino-3.5-dinitrobenzene-1-arsinic acid to hexa-amino-arsenobenzene (see Eng. Pat. 7488 of 1913 ; this J., 1914, 41) can be effected in two or more stages. For example the first reduction may be effected by means of sodium hydrosulphite, when 3.4.5-triaminobenzene-1-arsinic acid is produced ; this may be further reduced by means of hypophosphorous acid to hexa-amino-arsenobenzene. Again, treatment of 4-amino-3.5-dinitrobenzene-1-arsinic acid with 50 per cent. phosphorous acid in presence of alcohol at about 40° C., results in the production of a diaminotetranitro-arsenobenzene, which can be converted into the hexa-amino-compound by means of stannous chloride and hydrochloric acid.—T. F. B.

Arseno compounds ; Process for preparing unsymmetrical ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,254, Sept. 25, 1912. Addition to Ger. Pat. 251,104.

A mixture of an organic arsinic acid or arsenoxide with an inorganic arsenic compound (arsenious or arsenic acids or their soluble salts or esters, arsenious chloride, etc.) is treated with a reducing agent. If more than one mol. of the inorganic arsenic compound is used, the products will contain more arsenic and be darker in colour. The unsymmetrical polyarseno compounds may be used for the treatment of animals infected with trypanosomes. —T. F. B.

Arseno-metal compounds ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 270,253, 270,256, 270,257, and 270,258, Sept. 15, Oct. 5, 8, and 15, 1912. Additions to Ger. Pat. 268,220.

(1.) To prepare arseno-metal compounds other than those described in the principal patent (see this J., 1914, 218), the salts of other heavy metals, such as silver, mercury, or copper, either alone or in presence of a base-metal salt, are treated with 3.3′-diamino-4.4′-dihydroxyarsenobenzene. (2.) The polyarseno compounds, obtained by reduction of a mixture of an arsinic acid and an inorganic arseno-compound (see Ger. Pat. 270,254 ; preceding), are used in place of dihydroxydiaminoarsenobenzene. (3.) Any other arseno-compounds may be used. (4.) Instead of isolating the arseno compounds and combining them with the metallic salts, the requisite organic arsenic acid or arsenoxide is reduced in presence of the metallic salt.—T. F. B.

Arsenic-phosphorus and arsenic-antimony compounds ; Process for preparing metal-addition compounds of mixed ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,259, Oct. 19, 1912. Addition to Ger. Pat. 268,220 (see this J., 1914, 218).

The mixed organic arsenic-phosphorus or arsenic-antimony compounds are combined with metallic salts as described in the chief patent in connection with the arseno-compounds. The salts of silver, gold, copper, or metals of the platinum group may be used.—T. F. B.

Amino derivatives of primary aromatic antimony compounds ; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 270,488, June 9, 1912.

Nitro derivatives of aromatic antimony compounds are treated with reducing agents or the acidylamino derivatives are saponified. The resulting amino compounds possess valuable therapeutic properties, owing to the antimony being more readily split off than the arsenic in the corresponding arseno compound. For example, *p*-acetaminophenylarsinic acid is saponified without further decomposition when boiled with sulphuric acid, but the corresponding antimony compound is completely decomposed.—T. F. B.

Organic arseno-compounds ; Process for preparing reduction products of ——. H. Bart. Ger. Pat. 270,568, Nov. 25, 1911.

Organic derivatives of arsenic acid or of arsenious acid are submitted to the action of an electric current at the cathode, in alkaline, neutral, or acid media. The reduction products are practically free from by-products, such as are formed during chemical reduction. No arsenic is split off during the process.—T.F. B.

3.3′-Diamino-4.4′-dihydroxyarsenobenzene-formaldehyde-sulphoxylates ; Process for rendering stable aqueous solutions of ——. R. Kaufmann and H. Vieth. Ger. Pat. 270,672, Oct. 26, 1912.

The solutions are rendered stable by addition of a sulphite. For dilute solutions, about 0·1 per cent. of sulphite is sufficient to preserve them for a short time, *e.g.*, when they are to be used for injection, but with stronger solutions more is required, up to half the weight of the arseno-compound.—T. F. B.

Pharmaceutical compounds [fatty acid derivatives containing arsenic and phosphorus] ; Manufacture of ——. F. Heinemann, Berlin. Eng. Pat. 10,379, May 2, 1913.

Derivatives of fatty acids of the acetylene series are converted into compounds containing arsenic or phosphorus, in the same manner as is described for treating the free acids in Eng. Pats. 18,732 of 1912 and 10,378 of 1913 (see this J., 1913, 102; 1914, 218). Another process consists in converting the fatty acids containing arsenic or phosphorus into their esters, anhydrides, anilides, or other derivatives, by known methods. The examples given in the specification relate to the preparation of such derivatives of halogenated behenolic or stearolic acids. —T. F. B.

Quinoline-4-carboxylic acids arylated in the 2-position; Manufacture of ——. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 15,481, July 4, 1913. Under Int. Conv., July 6, 1912.

THE 2-arylquinoline-4-carboxylic acids can be prepared by adding pyroracemic acid to a boiling alcoholic solution of a derivative or homologue of aniline and benzaldehyde, piperonal, vanillin, or other suitable aromatic aldehyde. For example, *p*-toluidine, benzaldehyde, and pyroracemic acid furnish 2-phenyl-6-methylquinoline-4-carboxylic acid, and when piperonal is used in place of benzaldehyde, 2-piperonyl-6-methylquinoline-4-carboxylic acid. The use of benzidine or its homologues in a similar manner gives rise to the corresponding diquinolyl derivatives. 6-Methyl-2 (4′-hydroxy-3′-methoxyphenyl)-quinoline-4-carboxylic acid, m. pt. 217°—219° C., obtained from *p*-toluidine, vanillin, and pyroracemic acid, is claimed as a new product.—T. F. B.

Antipyrylquinoline-4-carboxylic acid; Process for preparing 2- or 3- ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,487, Nov. 28, 1912.

ISATIN is condensed with 1-phenyl-2·3-dimethyl-4-aceto-5-pyrazolone or its homologues in alkaline solution. The products may be used in medicine.—T. F. B.

Tetrahydro-isoquinoline derivatives; Process for preparing ——. H. Decker. Ger. Pat. 270,859, Oct. 15, 1911.

THE base of the composition, $C_{10}H_{11}NO_2$, obtained from the condensation product of homopiperonylamine and formaldehyde (see Ger. Pat. 257,138; this J., 1913, 507), is treated with a methylating agent. One methyl group is thus introduced, probably attaching itself to the nitrogen. Oxidation of the salts of the methyl compound results in the formation of hydrastinine salts.—T. F. B.

Carbamic acid ester of a-dichlorhydrin; Manufacture of ——. B. Beckmann and Dr. Bruno Beckmann, Chem. Fabrik G. m. b. H., Berlin. Eng. Pat. 25,971, Nov. 12, 1913.

THE carbamic ester of a-dichlorhydrin is obtained by the action of carbamic acid chloride on a-dichlorhydrin; it forms colourless needles, of m. pt. 82°—83° C., and possesses strong narcotic properties.—T. F. B.

Camphor from pinene hydrochloride, hydrobromide, or hydriodide, or from an oily mixture containing same; Process for the commercial synthesis of ——. M. Hoenicke and H. A. Berens, London. Eng. Pat. 27,317, Nov. 27, 1913.

PINENE hydrohalogenides, or oily mixtures containing them, can be completely dehalogenised by treatment with nitric acid or its salts, at all concentrations; the reaction is facilitated by the presence of certain catalysts, such as metals, metallic oxides, chlorides, etc. The dehalogenation can also be effected by means of a mixture of nitric acid or a nitrate with chromic acid. *Example:* A mixture of 172 parts of pinene hydrochloride, 200 parts of sodium nitrate, and 100 parts of water is heated, with constant stirring, for 5 to 15 hours at 100°—120° C. The resulting camphor nitrate is separated and treated with water to isolate the camphor, which is heated under pressure with 5 per cent. caustic soda solution to remove any acid which remains. The aqueous solution containing nitric acid is concentrated and utilised for a fresh treatment of pinene hydrochloride.—T. F. B.

Bromodiethylacetyl isocyanate. F. Hefti, Altstetten, Switzerland, Assignor to Farbenfabr. vorm. F. Bayer und Co. U.S. Pat. 1,086,294, Feb. 3, 1914.

BROMODIETHYLACETYL isocyanate is a limpid oil, of b. pt. 110°—114° C. under a pressure of 70 mm.; it is soluble in petroleum spirit and benzene. It can be obtained by treating bromodiethylacetyl bromide or chloride with a silver or mercury salt of isocyanic acid. When treated with ammonia it is converted into bromodiethylacetylurea. —T. F. B.

Acetylsalicylic acid; Process for making salts of ——. O. Gerngross and H. Kast. Fr. Pat. 464,081, Oct. 11, 1913. Under Int. Conv., Oct. 11 and 31 and Nov. 7, 1912.

A SUITABLE metallic compound is added slowly, with constant stirring, to an aqueous solution or suspension of acetylsalicylic acid. Metallic oxides, hydroxides, carbonates, bicarbonates, and silicates may be used for the purpose. When it is desired to use the salts of metals with halogen acids or with oxyacids of sulphur, phosphorus, or nitrogen, the reaction must be carried out in presence of an alkali. The resulting salts may be separated from their solutions by evaporation *in vacuo*, or by precipitation with another salt or with acetone or other organic precipitant. In preparing the acetylsalicylates of alkali or alkaline-earth metals, or of magnesium, it is advisable to use a silicate, albuminate, or saccharate to protect the salt against the action of the base employed. The above process is applicable to the preparation of all metallic acetylsalicylates, including those of the heavy metals. —T. F. B.

Sodium acetylsalicylate; Process for preparing ——. J. A. Wülfing. Ger. Pat. 270,326, Feb. 26, 1913.

DRY, finely powdered acetylsalicylic acid is treated with the equivalent quantity of anhydrous sodium carbonate in presence of acetic ester. The reaction is quantitative. —T. F. B.

Oxalates; Process for preparing —— by heating the corresponding formates. Chem. Fabr. Grünau, Landshoff und Meyer A.-G., E. Franke, and W. Kirchner. Ger. Pat. 269,833, Feb. 18, 1912.

FORMATES are converted rapidly and almost quantitatively into the corresponding oxalates by heating them in an apparatus maintained at a temperature between 385° and 400° C.—T. F. B.

Trimethylamine; Process for preparing ——. K. H. Schmitz. Ger. Pat. 270,260, June 3, 1913.

A MIXTURE of a dry ammonium salt with dry trioxymethylene or paraformaldehyde is heated to a high temperature for a short time in an open vessel, preferably provided with a reflux condenser. The mass melts to a homogeneous liquid, and carbon dioxide is evolved; the reaction is complete in one to two hours at a temperature of 120°—170° C.—T. F. B.

Hexamethylenetetramine-methyl thiocyanate; Process for preparing ——. K. H. Schmitz. Ger. Pat. 270,486, June 27, 1913. Addition to Ger. Pat. 266,788 (see this J., 1914, 43).

A SOLUTION of formaldehyde and ammonia or of hexamethylenetetramine is treated with the methylamine salt or the ammonium salt of an inorganic or organic acid, or a solution of a salt of hexamethylenetetramine is heated, with or without addition of formaldehyde; in either case a soluble thiocyanate is added, whereupon hexamethylenetetramine-methyl thiocyanate is separated. Another process consists in treating a solution of formaldehyde and ammonia or of hexamethylenetetramine with hydrothiocyanic acid or its ammonium or methylamine salt, or a solution of hexamethylenetetramine thiocyanate is heated, with or without addition of formaldehyde. In either of the above processes the formaldehyde may be replaced by one of its polymerides.—T. F. B.

Chlorination ; Process and apparatus for ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 879, Jan. 11, 1913.

See Fr. Pat. 453,406 of 1913 ; this J., 1913, 767.—T. F. B.

Acetaldehyde from acetylene ; Process for the manufacture of ——. Consortium f. Elektrochem. Industrie, G.m.b.H., Nuremberg, Germany. Eng. Pat. 16,848, July 22, 1913. Under Int. Conv., July 27, 1912.

See Fr. Pat. 460,553 of 1913 ; this J., 1914, 42.—T. F. B.

Methylhexamethylenetetramine ; Process for the manufacture of sulphocyanide of ——. K. H. Schmitz, Breslau, Germany. Eng. Pat. 30,047, Dec. 31, 1913. Under Int. Conv., Feb. 3, 1913.

See Ger. Pat. 266,788 of 1913 ; this J., 1914, 43.—T. F. B.

Terpene hydrocarbons ; Producing unsaturated ——. E. Bergs, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,091,276, March 24, 1914.

See Fr. Pat. 434,285 of 1911 ; this J., 1912, 257.—T. F. B.

Medicated fibrous substances. Eng. Pat. 7650. *See* V.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic positives ; The production of direct ——. G. A. Perley, T. J. Twomey, and H. A. Robinson. J. Phys. Chem., 1914, **18**, 185—212.

The experiments described previously (this J., 1912, 902) were extended, the quinol being replaced by metol, pyrogallol, ortol, eikonogen, and amidol, and the thiourea by some of its substitution products. The developing agent influences the colour of the positive, but its chief function seems to be to reduce slightly the latent image in order to create a greater difference in the form of the silver halide in the exposed and unexposed parts of the plate. Allylthiourea and ethylthiourea proved to be superior to tetrathiourea-ammonium bromide and thiourea itself in the production of good positives. Excellent results were obtained by using allylthiourea in conjunction with quinol or eikonogen, or ethylthiourea with metol or eikonogen. A formula which gave excellent red to reddish-brown positives was :—metol, 0·032 grm. ; ethylthiourea, 0·0037 grm. ; sodium carbonate, 0·1 grm. ; sodium sulphate, 0·234 grm ; water, 9·3 grms. To avoid the excessive production of a negative, it is necessary to maintain a fairly constant ratio between the exposure and concentration of the constituents of the developer. Sodium sulphite is not essential to the production of positives by this method, but its restraining action improves the quality of the deposit. Sodium carbonate may be replaced by sodium hydroxide in the allylthiourea-quinol developer. The production of positives by developers containing thiourea compounds is attributed to the fact that the unexposed silver complex in the emulsion is much more soluble than the exposed portion. Hence the most efficient substance for the production of positives will be that which exhibits the greatest difference in solvent action towards the unexposed and exposed portions. Support for the above theory was obtained from the fact that positives of fair quality were obtained with the use of metol developers containing ammonia, methylamine, or ethylamine.—T. F. B.

Patents.

Toning photographic prints ; Method of ——. H. M. Ward, Leicester. Eng. Pat. 6026, March 11, 1913. Addition to Eng. Pat. 8002, April 3, 1912 (see this J., 1913, 550).

A silver print is "sulphided" in the usual manner and then toned in a copper toning bath to which is added a suitable silver solvent, especially a thiocyanate, a persulphate, or chromic acid. An alternative method is to tone the silver print with a copper toning bath and subsequently treat the image with an acidified sulphiding solution.—T. F. B.

Photographic developers. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 18,095, Aug. 8, 1913.

4-Hydroxyphenylalkylglycines, of the formula $HO.C_6H_4.N(alkyl)CH_2.COOH$, or their derivatives are powerful photographic developers, which yield clear images ; they may be used in the form of alkaline solutions, preferably containing a preservative. In speed of development they stand between methyl-*p*-aminophenol and *p*-hydroxyphenylglycine. They are prepared by condensing a *p*-alkylaminophenol with a halogen derivative of acetic acid.—T. F. B.

Photographic reproducing processes ; Screens for use in ——. L. Böhm. Eng. Pat. 24,482, Oct. 28, 1913.

The screen apertures consist of irregular polygons of approximately equal area, irregularly distributed over the screen plate, and separated from one another by lines having the same thickness and intensity throughout the screen.—T. F. B.

Photography of colours ; Processes of ——. E. C. G. Caille. Fr. Pat. 463,062, Dec. 7, 1912.

The object to be reproduced is photographed on a panchromatic plate through a selective screen composed of points, lines, etc., of orange-red, green, and violet-blue. This negative, after development and fixation, is then used for the three successive printings on a sensitive support, through subtractive screens so chosen that only one colour is printed at a time. The support is prepared from paper rendered waterproof, for example by coating it with powdered zinc white mixed with a suitable oil varnish, and then provided with a gelatinobromide emulsion. The blue print is made first, the colour being produced by successive treatments with solutions of ferricyanide and ferric chloride ; the support is then re-sensitised by means of bichromate, and the yellow print is made, using solutions of iodine in potassium iodide, tartar emetic, and mercuric chloride. Finally, the red print is produced in the support, after a second re-sensitisation, using any suitable red dyestuff to produce the colour.—T. F. B.

Colour photography ; Processes of ——. E. C. G. Caille. First Addition, dated Dec. 9, 1912, to Fr. Pat. 463,062, Dec. 7, 1912 (see preceding abstract).

The methods of colouration described in the principal patent may be applied in the process in which the colour selection is effected by means of three separate colour screen filters. When the red image is to be printed by means of fatty ink, it is produced in the form of a discontinuous image, *e.g.*, as points or small squares, so as to leave between the coloured surfaces sufficient emulsion to be treated subsequently to produce the blue and yellow images by superposition.—T. F. B.

Photographs in colours; Process for producing ——. The Hess-Ives Co. Fr. Pat. 463,737, July 11, 1913. Under Int. Conv., July 12, 1912.

In the production of colour prints by transferring a coloured image from one support on to another, it is proposed to press together the two dry supports very strongly, with a thin layer of "separating liquid," such as 10 per cent. acetic acid, between them. The support to receive the coloured image is covered with hardened gelatin and is mordanted. The colours used are such as have no specific affinity for gelatin, but which form insoluble lakes with the mordant; thus, alizarin colours may be used in conjunction with an alum mordant. The dyebath used to colour the intermediate support, contains a salt such as potassium citrate which retards the absorption of the dyestuff by the gelatin; it is advisable to use a slightly acid dyebath containing a relatively large quantity of the dyestuff. If the colour of the prints is too intense, it may be reduced by a subsequent treatment with dilute acetic acid or other acid. The several colour prints are finally combined to form the finished photograph.—T. F. B.

Polychrome screen [for photography] and process of making the same. R. Ruth and A. Schuller, Oude-God, Belgium. U.S. Pat. 1,091,443, March 24, 1914.

See Fr. Pat. 449,080 of 1912; this J., 1913, 508.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Heat test as applied to explosives; First report to the Home Office of the Departmental Committee [appointed April 21, 1909] on the ——. (See also under Books Received.)

The report deals with the best means of standardising, with greater accuracy than at present, the apparatus and materials employed in the Abel heat test. The following are some of the chief alterations proposed by the committee. A copper heat test bath is to be provided with a constant level apparatus, with seven holes in the lid at equal intervals from each other and equidistant from the centre, one of the holes being for the thermometer. A cage of two crossed wires is fixed to the underside of each test-tube hole, and unoccupied holes are covered with small discs of copper. The French chalk used for incorporating with gelatinous explosives should not absorb more than 0·5 per cent. of moisture under certain defined conditions, and 50 c.c. should weigh 23·5 ± 1·0 grms. A Wedgwood mortar and pestle are recommended for the incorporation of gelatinous explosives. Specified times are suggested for the incorporation of blasting gelatin (1½ mins.), gelatin-dynamite (1), and gelignite (½ min.) with French chalk. The new mill recommended for grinding cordite can be readily cleaned and the cutting edges can be accurately adjusted and easily repaired. A new design has been adopted for the water oven for drying guncotton, etc., so as to allow a current of air to pass over the sample, and aluminium trays are recommended in place of paper trays. Detailed directions are given for the preparation of nitrocellulose pulp for heat testing. After preliminary pressing the sample is rubbed through a sieve on to an aluminium tray, and, after drying, should be sifted in the nest of sieves as used for ground cordite. The same paper should be employed for filtering operations in connection with the heat test as that used n the preparation of heat test paper. The chemical contitution of the paper and its physical properties, such as hickness, weight, texture, surface, and length of fibre nfluence the result when the paper is sensitised for heat est purposes. Several samples of paper were specially repared, but, with cordite, did not give results conordant with those given by Waltham Abbey batch 8 hich was adopted as a standard. It is not sufficient merely to specify a filter paper, and the method of prearation of a heat-test paper from it. It is essential that the sensitiveness of the finished test paper be verified by a test. At present, batches of heat test papers are tested by the Chief Inspector, Woolwich, for acceptance into the service, by means of a selected sample of guncotton and in comparison with a standard heat test paper. This is not entirely satisfactory, because of the possible variations in both the guncotton and the standard heat test paper used as a control, and the committee recommend the introduction of a test in which the heat test paper to be standardised is exposed to nitrogen peroxide, under standard conditions. This "diffusion test" should be employed concurrently with the standard test. Standard tint papers should be prepared by using a permanent pigment. As light has the effect of reducing the time of the heat test, and as this effect is considerably more marked in the case of cordite than in other explosives, the exposed portion of the heat test tube should be covered with a ventilated cap of black paper. The heat test tubes should be of the best quality soda lime glass, free from lead and without streaks, and should, after heating for 3 hours at a steam pressure of 50 lb. per sq. in. show no more cloudiness than a standard sample so treated.—G. W.McD.

Hexanitroethane. W. Will. Ber., 1914, 47, 961—965.

Hexanitroethane is prepared by nitrating potassium nitroethane with nitric and sulphuric acids. It forms colourless crystals, smelling somewhat like camphor, which melt with decomposition at 142° C., are insoluble in water and nitrating acids, soluble in the usual organic solvents, and give an acid reaction with litmus. It yields unstable red or yellow addition-products with naphthalene, benzene, and toluene, red compounds with phenols, and an explosive compound with o-nitroaniline; it oxidises quinol to quinhydrone, and reacts with acetone, diphenylamine, and dimethylphenylurea. It is much less volatile than tetranitromethane, and hence may be used in explosives; at 75° C. it evolves red fumes in 30 mins. at 50° C. in 20 hours. In the Trauzl block it shows a net expansion of 180 c.c., is very insensitive, and with organic substances rich in hydrogen gives powerful explosives.—O. E. M.

Patents.

Match-ignition composition. H. W. Charlton, Ottawa, Canada. U.S. Pat. 1,089,902, March 10, 1914.

A mixture of phospham (a nitrogenous phosphorus compound) containing stable sulphides of phosphorus as impurities, potassium chlorate, zinc oxide acting as an inert filling material, powdered glass and glue.—A. T. L.

Explosives. F. L. Nathan, W. Rintoul, and F. Baker, Stevenston, Assignors to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 1,090,641, 1,090,642, 1,090,643, and 1,090,644, March 17, 1914.

See Eng. Pats. 12,742, 12,743, 12,744, 12,745, and 12,746 of 1912; this J., 1913, 991.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Picric acid; The use of —— in standardising solutions, and the iodometric determination of acids. A. Sander. Z. angew. Chem., 1914, 27, 192—194.

Picric acid is recommended as a standard substance for iodometry. It is not hygroscopic and gives a very sharp end-point without the addition of an indicator. The following equations illustrate the interactions involved:—

$$6C_6H_2(NO_2)_3OH\text{(or 6HCl, etc.)} + 5KI + KIO_3 =$$

$6C_6H_2(NO_2)_3OK$(or 6KCl, etc.) $+ 3I_2 + 3H_2O$. Iodine is estimated by thiosulphate solution standardised by the picric acid (*N*/25 or *N*/100). The iodide-iodate solution should contain 40 grms. of potassium iodide and 10 grms.

of iodate per litre. It is very stable, but becomes yellow on prolonged exposure to light; sodium thiosulphate is then added until the colour disappears. Many coloured solutions of acids—and bases—may be analysed iodometrically if starch solution be added towards the end of the titration of the iodine. (See also following abstract.) —J. L. F.

Sulphurous acid in the presence of thiosulphate and also in the presence of sulphuric acid; Determination of free ——. A. Sander. Z. angew. Chem., 1914, **27**, 194—195.

The total sulphurous acid and thiosulphate are determined by titration with iodine, and then the sulphuric acid produced by oxidation of the sulphurous acid is determined by adding excess of iodide-iodate (see preceding abstract), and titrating the liberated iodine with sodium thiosulphate, thus :—

$$3H_2SO_4+KIO_3+5KI=3K_2SO_4+3I_2+3H_2O.$$

A mixture of sulphurous and sulphuric acids may be analysed in a similar manner, the former being oxidised by iodine, and the total sulphuric acid then present determined with iodide-iodate solution. Bisulphates behave in an analogous manner.—J. L. F.

Arsenite solutions; Determination of the titration value of ——. E. Deiss. Chem.-Zeit., 1914, **38**, 413—415.

The use of volumetric solutions of iodine for the standardisation of arsenite solutions may lead to erroneous results owing to the presence of iodate, which in the standardisation of the iodine by thiosulphate in acid solution yields its total iodine content as free iodine, but, in the subsequent titration of the alkaline arsenic solution, is entirely unchanged. The measured volume of iodine solution should therefore always be previously acidified with hydrochloric acid to decompose iodate, before adding sodium bicarbonate and titrating with the arsenite solution. In preference to this method the iodometric standardisation with the help of permanganate is recommended. A measured volume of standard permanganate is run into acidified potassium iodide solution, and the liberated iodine, after the addition of bicarbonate, titrated with the arsenic solution in the usual way.—G. F. M.

Arsenic; Determination of traces of —— *of the order of a thousandth of a milligram.* L. Moreau and E. Vinet. Comptes rend., 1914, **158**, 869—871.

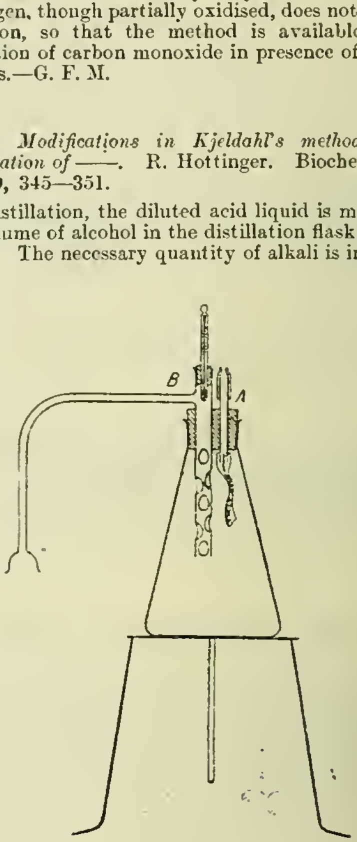
The method is based upon the deposition of a mirror of silver by the action of the hydrogen arsenide upon a solution of silver nitrate contained in a narrow glass tube bent twice at right angles, and comparing the mirrors obtained with standard mirrors. The arsenic hydride is generated in a small U-tube, containing 0·5 grm. of platinised zinc and dilute sulphuric acid. One limb of the U-tube is connected with the above-mentioned glass tube and the other with a dropping funnel containing the solution under test, and with a hydrogen generating apparatus through a second U-tube containing silver nitrate solution; the current of hydrogen is regulated to give 15 to 20 bubbles per minute in the mirror tube. By this method 0·001 mgrm. can easily be detected and estimated, but care must be taken not to use more than the specified quantity of the "purified" reagents.—G. F. M.

Carbon monoxide; Determination of —— *by means of yellow mercuric oxide.* L. Moser and O. Schmid. Z. anal. Chem., 1914, **53**, 217—233.

Carbon monoxide can be oxidised quantitatively by slowly passing it over about 20 grms. of yellow mercuric oxide contained in a U-tube, and maintained at 100° C. in a water-bath, and the resulting carbon dioxide absorbed in standardised baryta water. The mercuric oxide must be precipitated and dried at a low temperature, and protected from the prolonged action of light; oxide precipitated in hot solutions, or the red oxide, is inactive. About 45 mins. is required for the combustion of 100 c.c. of gas. Methane is unacted on by the yellow oxide at 100°C. and hydrogen, though partially oxidised, does not influence the titration, so that the method is available for the determination of carbon monoxide in presence of either of these gases.—G. F. M.

Nitrogen; Modifications in Kjeldahl's method for the determination of ——. R. Hottinger. Biochem. Zeits., 1914, **60**, 345—351.

Before distillation, the diluted acid liquid is mixed with half its volume of alcohol in the distillation flask shown in the figure. The necessary quantity of alkali is introduced through the tube, A, to the lower end of which is attached a lip-valve made by joining the long edges of two strips of india-rubber, 1·5 by 7 cm., by means of rubber solution and lightly vulcanising them with a dilute solution of sulphur chloride in carbon bisulphide. The dephlegmator is entirely within the flask, and consists of a portion of the tube, B, in which a number of recesses, disposed helically at intervals of 120°, have been made by suction of the tube after it has been closed at one end and softened at the respective points by means of a flame. The distillation of the ammonia is complete when the thermometer registers 99° or 100° C. The lip-valve prevents acid from being sucked into the flask through the tube, B. The advantages claimed are increased accuracy, and a great shortening of the time occupied by the distillation. —J. H. L.



Albumin; Colorimetric determination of ——. E. Riegler. Z. anal. Chem., 1914, **53**, 242—245.

The violet colouration produced by dissolving copper oxide in alkaline solutions of albumin, may serve as the basis of a colorimetric method. 10 c.c. of the solution to which 5 c.c. of 5 per cent. β-naphthalenesulphonic aci have been added, are centrifuged, and the clear solutio decanted from the precipitated albumin, which, with th addition of 4 drops of 20 per cent. copper sulphate solution is then dissolved in sufficient 3 per cent. sodium hydroxid to make 10 c.c. After shaking and once more centri fuging, the clear violet solution is compared with a 0·5 pe cent. solution of albumin which has been treated in th same way. Peptone, globulin, casein and other protein may be determined in an analogous way, using th appropriate comparison solution.—G. F. M.

Determination of the self-ignition temperature of motor oils. Constam and Schlapfer. *See* IIa.

Complex boric acids. Dhar. *See* VII.

Reaction of nitrates with formic acid and their determination. Molinari. *See* VII.

The Lux method for the determination of lead peroxide. Ipiens. *See* VII.

Determination of phosphorus in steel. Phillips. *See* X.

Analysis of Delta metal by the electrolytic method. Belasio and Marchionneschi. *See* X.

Analysis of commercial aluminium and its light alloys. Belasio. *See* X.

Determination of unsaponifiable matter in oils and fats. Salomon. *See* XII.

The "heat number" of oil of turpentine. Heiduschka. *See* XIII.

Determination of phosphoric acid in soils. Hornberger. *See* XVI.

Source of error in the Clerget sucrose determination. Stanek. *See* XVII.

Fractional liquefaction of rice starch. Warth and Darabsett. *See* XVII.

Analysis of soluble adhesives. [Detection of gum arabic in presence of dextrin.] Armani and Barboni. *See* XVII.

Detection of raw beet products in admixture with raw cane products. Ling. *See* XVIII.

Temperature corrections to be applied to the specific gravities of malt worts and beers. Day and Amos. *See* XVIII.

Sensitive reaction for lead. Iwanow. *See* XIXb.

Vanillin. Lehmann. *See* XX.

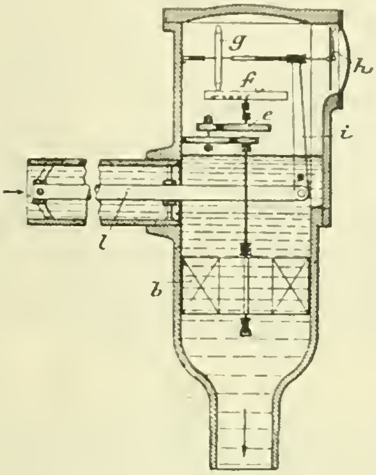
olubility of certain metallic salts of volatile fatty acids in organic solvents. Application to the detection of these acids. Agulhon. *See* XX.

irst report to the Home Office of the Departmental Committee on the heat test as applied to explosives. *See* XXII.

Patents.

Calorimeter for flowing liquids or gases. M. Hottinger, Winterthur, Switzerland. U.S. Pat. 1,088,280, Feb. 24, 1914.

A screw motor, *b*, driven by the fluid, operates a dial hand, *h*, through reducing gearing, *e*, and a friction disc transmission, *f*, *g*. The radial position of the disc, *g*, relatively to the disc, *f*, is determined by a long bar, *l*, of expansible material immersed in the fluid, so that the rate at which the hand, *h*, revolves depends partly on the speed of the fluid and partly on its temperature. —H. H.



Means for ascertaining the hardness of metals, etc. Eng. Pat. 6622. *See* X.

XXIV.—MISCELLANEOUS ABSTRACTS.

High vacua; Production of —— by means of finely divided copper. T. R. Merton. Chem. Soc. Trans., 1914, **105**, 645—646.

Commercial "precipitated copper" absorbs gases—with the apparent exception of helium—with great readiness after being heated to about 250° C. under reduced pressure. Two or three grams of copper will exhaust a small vacuum tube to a non-conducting vacuum. The gases absorbed are evolved again on reheating.—J. L. F.

Gold surface; Electrical condition of a —— during the absorption of gases and their catalytic combustion. H. Hartley. Roy. Soc. Proc., 1914, **90**, 61—68.

Gold acquires a negative charge during catalytic combustion of gases on its surface. The electrical effect probably precedes the actual combustion and is primarily due to occlusion. The metal can be charged negatively by occlusion of hydrogen or carbon monoxide, and positively by the occlusion of oxygen. The charge is probably due to the gas leaving (rather than entering) the metal, since causes (*e.g.* sudden lowering of temperature) which would check the outflow of gas will diminish the intensity of the charge and *vice versa*.—W. H. P.

Enzymes of oxidation ; Contribution to the theory of ——. Peroxidase- and catalase-reactions of formaldehyde and acetaldehyde. G. Woker. Ber., 1914, 47, 1024—1029.

The peroxidase-, catalase-, and reductase-actions of vegetable and animal juices are regarded as reactions of the same substance, which is aldehydic in nature and identical with the oxygenase of Chodat and Bach. In presence of hydrogen peroxide it first forms a secondary peroxide, R.CH(OH).O.OH, capable of reacting with more hydrogen peroxide and liberating oxygen (catalase-action), or of transferring oxygen to chromogens (peroxidase-action). Both these actions may occur at the same time, or, owing to the presence of promotive or inhibitive agents, one or other may be greatly accelerated or completely suppressed. In absence of hydrogen peroxide and atmospheric oxygen, the aldehydic substance may exert a reducing action, *e.g.*, convert colours into their leuco-compounds (reductase-action). Amongst the evidence mentioned in support of this theory are the facts that the catalase- and peroxidase-activities of plant juices are destroyed at the same temperature (78°—80° C.) and cannot be separated by dialysis. Moreover formaldehyde shows quite typical peroxidase- and catalase-actions. Both acetaldehyde and purified benzaldehyde behave as peroxidases (produce a blue colour from benzidine in presence of hydrogen peroxide). Benzaldehyde, however, shows no catalase-action and, indeed, greatly increases the stability of hydrogen peroxide.—J. H. L.

The metric carat. Times, April 1, 1914. [T.R.]

On April 1st, 1914, by an Order in Council of Oct. 14, 1913, the metric carat of 200 milligrammes was ordained the legal standard of weight for precious stones and pearls. By the beginning of 1912 the use of the metric carat had been legalised in fifteen countries, including France and Germany, whilst last year it became the legal standard in the United States (see this J., 1913, 1132).

Books Received.

Heat Test as Applied to Explosives : First Report of the Departmental Committee on the ——. Price 1s. 9d. Wyman and Sons, Fetter Lane, E.C.

The Committee was appointed by the Home Office (1) "To investigate and report on the best means of standardising with greater accuracy than at present the apparatus and materials employed in the Abel Heat Test ; and (2) to examine and report on any supplementary test or tests that might be submitted." The present report deals entirely with the first reference. (See also under XXII., page 441.)

Geology and Petroleum Resources of the Southern Part of Bondoc Peninsula, Philippine Islands. W. E. Pratt and W. D. Smith. Phil. J. of Science, October, 1913, 8, 5.

Monograph of 76 pp., 10 plates, 1 text figure and 1 map. Divided into introduction, geography, geology, occurrence, physical and chemical properties, origin and probable quantity, areas to be prospected, and conclusions.

Patents, Designs, and Trade Marks. Thirty-First Report of the Comptroller-General for the Year 1913, with Appendices. [H.C. 161.] Price 2½d.

This Report deals with the work of the Patent Office during the year 1913. The number of applications for patents and for registration of designs and trade marks during that year, as compared with the two preceding years, is shown by the following table :—

—	1911.	1912.	1913.
Patents—			
Applications	29,353	30,089	30,077
Specifications—			
Provisional	19,524	19,825	19,673
Complete	18,662	18,853	19,309
Sealed	17,164	15,814	16,599
Designs—			
Applications	43,057	43,015	40,429
Registered	41,581	42,077	39,275
Trade Marks—			
Applications	9,743	10,014	9,689
Registered	4,868	4,942	5,07t

The Synthetic Use of Metals in Organic Chemistry. By Arthur J. Hale, B.Sc. J. and A. Churchill, 7, Great Marlborough Street, London. 1914. Price 4s. 6d.

Volume (7⅝ by 5 ins.), containing 165 pages of subject matter and an alphabetical index. The classification of matter is as follows :—I. Sodium and Potassium. II. Copper and Silver. III. Magnesium, Calcium and Barium. IV. Zinc and Mercury. V. Aluminium, Tin and Lead. VI. Iron, Nickel, and Platinum. Appendix (Practical work) (i), Sodium-Potassium. (ii), Copper-Silver. (iii), Magnesium-Calcium. (iv), Zinc-Mercury. (v), Aluminium-Tin-Lead. (vi), Iron-Nickel.

Modern Steel Analysis. A Selection of Practical Methods for the Chemical Analysis of Steel. By J. A. Pickard, Carnegie Research Scholar of the Iron and Steel Institute, etc. J. and A. Churchill, 7, Great Marlborough Street, London. 1914. Price 3s. 6d. net.

Volume (7⅝ by 5 ins.), containing 124 pages of subject matter and ten illustrations, followed by an alphabetical index. The test is classified as follows :—I. General procedure. II. Aluminium. III. Arsenic. IV. Carbon. V. Chromium. VI. Cobalt. VII. Copper. VIII. Hydrogen. IX. Manganese. X. Molybdenum. XI. Nickel. XII. Nitrogen. XIII. Oxygen. XIV. Phosphorus. XV. Silicon. XVI. Sulphur. XVII. Titanium. XVIII. Tungsten. XIX. Uranium. XX. Vanadium. XXI. Note on the estimation of phosphorus in steels containing arsenic. XXII. Solutions. XXIII. Analysis of different steels and alloys.

The Viscosity of Liquids. By A. E. Dunstan, D.Sc. and F. B. Thole, B.Sc. Longmans, Green and Co., 39, Paternoster Row, London. New York, Bombay and Calcutta. 1914. Price 3s.

Volume (8¾ by 6 ins.), containing 36 pages of subjec matter with twelve illustrations, three pages of references and an alphabetical index. The text is subdivided an classified as follows :—I. The development of a workin formula. II. The measurement of viscosity. II Measurement of viscosity of pure liquids prior and sub sequent to 1895. IV. Viscosity of liquid mixtur V. Viscosity of electrolytic solutions. VI. Viscosity colloids. VII. Relation between viscosity and chemic constitution. VII. Some applications of viscosity.

Journal of the Society of Chemical Industry.

No. 9, Vol. XXXIII. MAY 15, 1914. No. 9, Vol. XXXIII.

Birmingham Section.

Meeting held at Birmingham University, on Thursday, March 5th, 1914.

MR. H. T. PINNOCK IN THE CHAIR.

A CHEAP FORM OF ROTATING CATHODE AND ANODE FOR RAPID ELECTROLYTIC ANALYSIS.

BY ERNEST A. LEWIS.

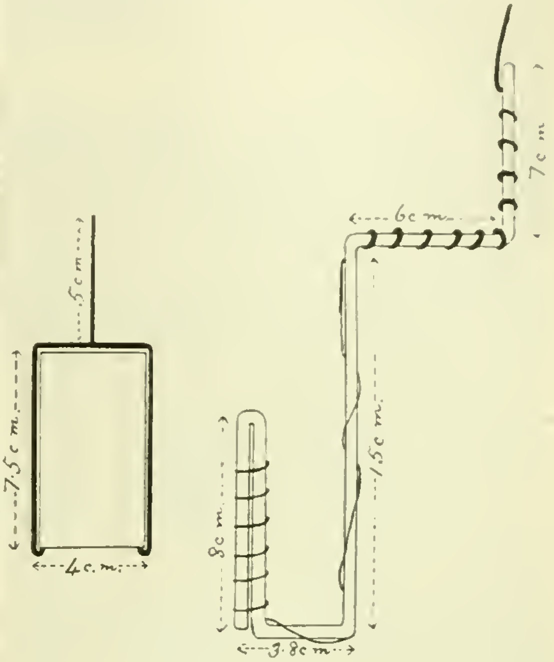
When the rapid method of electrolytic analysis was introduced the apparatus usually contained from 20 to 40 grms. of platinum. I believe that a rotating anode containing about 5 grms. of platinum and made largely of glass is about the smallest weight of platinum recommended. The continuous advance in the price of platinum makes it necessary for technical work to use cheaper metals if possible, and to reduce the weight of platinum in the anode to a minimum. The use of silver and amalgamated brass wire gauze cathodes has been recommended, especially for the assay of zinc. The rotating cathode which I use for zinc determinations is made of copper gauze, 20 meshes to the inch, supported by stiff copper wire which projects from the side and helps to cause vigorous circulation of the liquid. The anode is made of ⅛ in. glass rod, bent to the shape shown in the diagram. 14 inches of platinum wire of the size 1 grain equals 1 inch, are wound round the glass as shown. The platinum wire is connected to some electrical D.C.C. bell wire and the joint is made perfect by a small piece of platinum foil being wrapped round the joint, which is then wrapped round with adhesive electrical tape. The total weight of platinum is about 1 grm. The shape of the anode causes the liquid to thoroughly mix. The apparatus has been used successfully for determining zinc in alloys after the removal of copper, tin and lead. The current used being 2 amperes in a caustic soda solution.

If an ammoniacal solution or acetic acid solution is used the cathode must be of silver or the whole of it must be silver plated.

The apparatus has also been used for determining copper rapidly from a solution containing about 6 c.c. of strong nitric acid and 10 c.c. of strong sulphuric acid in about 150 c.c. of solution; using 3 amperes and heating to about 70° C. before putting in the copper cathode 0·5 grm. of copper is deposited in about 1 hour. It may seem rather unscientific to use copper cathodes to determine copper, but in practice it is quite satisfactory; if the solution is diluted to about 300 c.c. by washing in, about ¼ hour before the end, with cold water, the cathode can be rapidly lifted out and washed without any risk of re-solution; of course the liquid can be syphoned off if preferred, but this complicates the operation. After the cathode is weighed it can be used again for 4 or 5 determinations, when the deposited copper can be carefully dissolved off in dilute nitric acid. It is, of course, not possible to ignite a copper cathode, but it is not necessary. The copper cathodes are easy to make, they cost less than 6d. in material, and the anode only costs about 8s. The anode will safely carry a current of 3 amperes.

I endeavoured to plate a cathode with platinum, but the experiment was not successful, owing to the ease with which platinum is deposited on copper or silver by simple immersion. It is my intention to make a silver cathode and hope to be able to plate it with a thin coating of gold, and then to deposit a thin layer of platinum on the gold. If this is successful the silver cathode will be to all intents and purposes equal to a platinum cathode, and at a fraction of the cost.

It is also possible to use the current direct from the Corporation mains, without the use of accumulators. An 8 lamp accumulator charging board is used, and by the use of 8, 16, and 32 C.P. carbon lamps, giving ⅛, ¼ and ½ ampere respectively, a current varying from ⅛ ampere to 4 amperes can be obtained. The whole apparatus, including motor, cost about £5.



DISCUSSION.

Mr. J. E. STACEY JONES said he had used almost identical cathodes, with the exception that the gauze was replaced by plain foil. He had used brass sheet cathodes, about 32 or 34 standard gauge, and although he had used them chiefly for electrolysis in cyanide solutions, with gold, silver, and other metals, he saw no reason why they should not be used in ordinary laboratory work. Such cathodes were effective and had the advantage that they could be made easily and quickly. The brass foil required little cleaning and retained its brightness. Gold cathodes were effective but not gold anodes, because they would be ineffective if it were necessary to remove the deposit with *aqua regia*. In cathodes gold sheet of 15 c., of about platinum thickness, was cheap and serviceable. Copper could be removed by nitric acid. The objection with gold, however, was that one could not adopt ignition because 15 c. melted at a low temperature. Still a superior 14-carat gold cathode could be obtained for about £1, as compared with £10 for a platinum cathode. The method of obtaining electricity from the Corporation mains by carbon lamps might be convenient, but it was highly expensive.

London Section.

Meeting held at Burlington House, on March 2nd, 1914.

MR. E. GRANT HOOPER IN THE CHAIR.

AN APPLICATION OF CALCIUM CARBIDE IN THE FORMATION OF ALLOYS.

BY W. R. HODGKINSON, PH.D.

THE powerful "reducing" action exerted by acetylene on some salts has suggested that calcium carbide would under suitable conditions be useful in some metallurgical processes. In some early experiments a mixture of carbide and borax or carbide and sodium chloride was found to be a most efficient de-oxidising flux for copper and some copper alloys—as bronzes—cupro-nickel, &c., perfectly bubble-free castings being obtained. About one ounce of carbide to the usual amount of borax, was quite sufficient for each 10lb. pot of metal when added before the last stirring. With brasses, bronzes, or cupro-nickel, a good time to add the carbide-borax was found to be at the first melt when the last portions of copper, &c., were being added.

A considerable number of metallic oxides are reduced to the metallic state by carbide, but unless the metal is very fusible or a large amount of flux—borax—sodium or magnesium or barium chlorides—be employed, the infusible calcium oxide and any separated carbon or free carbide hold up the metal in shots or globules.

Attempts to reduce some of the rarer oxides, as those of cerium, zirconium, &c., and form alloys with copper failed at ordinary coke-furnace temperatures.

It appeared probable, however, that the halides of these rarer metals might be reduced by carbide which would at the same time form a calcium halide capable of acting as a flux. Trials with copper, lead, silver, zinc, and other metallic halides proved that, at suitable temperatures, reduction was complete and the calcium halide (chloride) formed a fairly efficient flux but the separation of the metal was retarded by the liberated carbon. The addition of salt, barium chloride, or borax (none of which has any action on carbide) overcame this difficulty.

The liberated carbon sometimes takes the graphitic form. Experiments with cerium chloride ($CeCl_3$), carbide, and metallic copper showed that cerium was reduced and taken up by the copper, alloys containing 6 per cent. and more of cerium being obtained.

It may here be noted that a convenient method of obtaining metallic chlorides in a state ready for further metallurgical work is to drop a mixture of metallic oxide and ammonium chloride into a red hot crucible, in small portions at a time. A very slight excess only of the ammonium chloride is necessary. In most cases the chloride is obtained in the melted state.

Two methods have been employed for obtaining alloys; one in which the main constituent—say copper—was melted and a mixture of the halide of the alloying metal and carbide then added; and, a better plan, where both, or all, metals for the alloy were in the form of halides roughly mixed with the calculated amount of carbide and in the case of low melting point metals some additional flux—as borax or salt. For alloys of high melting point, such as nickel and manganese, the carbide alone acted perfectly.

The chlorides and fluorides of most of the common metals react energetically with carbide provided the starting temperature is high enough—somewhat like the aluminium thermite reaction. As far as has been ascertained, the best starting temperature is one a little higher than the melting point of calcium chloride or other halide employed. The results have certainly been better where the carbide—metallic halide mixture has been introduced in successive moderate quantities into an already hot crucible than by slowly heating up a cold charge.

Employing this method—the hot crucible—no difficulty has been found in making copper—manganese or copper-nickel of almost any desired content of Mn or Ni, using manganese chloride or nickel chloride and either copper turnings or copper chloride. Similarly with nickel-manganese, or cobalt-manganese both metals as chlorides.

Tantalum, titanium, zirconium, and other metals which form salts of the types, K_2TaF_5 or K_2TiF_6, have been reduced and alloyed with copper. From one product containing above 20 per cent. Ta most of the tantalum segregated out during cooling and was left as a metallic powder on solution of the alloy is dilute acid.

From manganese chloride alloys have been obtained with tin, bismuth, antimony, and lead, employing these metals in the metallic state. The first product with lead, using the metal, contained 5·6 per cent. Mn: using $PbCl_2$ higher proportions of manganese were obtained. (These products from the microstructure seem to be suspensions of metallic manganese in lead.)

The tin and bismuth "mixtures" or solutions of manganese are only so far interesting that with more than 10 per cent. Mn they show decided magnetic properties.*

In cases where iron and aluminium free alloys are required the carbide reduction may be of value. Only in the cases of nickel, cobalt and iron with manganese did there appear to be any carbon taken up. A manganese cobalt alloy for instance, contained, Mn 38, Co. 59 and graphite 3 per cent.

The method and some of the products are being further investigated.

Specimens of alloys, such as Cu-Mn, Cu-Ce, Cu-Ta, Cu-Ti, Bi-Mn, Sn-Mn, Sb-Mn, Co-Mn, Ni-Mn, prepared by the process, and having in most cases atomic proportions of each element, and micro-photographs, were shown at the meeting.

I am indebted to Capts. Hunter and Macrae for analysis and other help..

DISCUSSION.

Mr. E. **GRANT HOOPER** said Professor Hodgkinson had struck out a new line in this utilization of calcium carbide in the preparation of alloys. He thought the paper introduced an interesting and he trusted an important departure in connection with the preparation of alloys.

Professor **HODGKINSON** said he was reserving an account of the properties of some of the alloys. He only spoke of the method because he thought it would be useful, and he was sure there was room for its development. There was a difficulty. Some of the halides were volatile, necessitating a careful adjustment of temperatures, but he thought it was possible in most cases to arrange matters and obtain the product with little loss.

Meeting held at Burlington House, on Monday April 6th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE VISCOSITY OF RUBBER SOLUTIONS.

BY R. GAUNT, M.SC., PH.D.
(Scientific and Technical Department, Imperial Institute).

Considerable interest attaches to the viscosity of rubber solutions, not only because they are colloidal solutions, but also on account of the suggestion put forward first by Axelrod[1] and afterwards by Schidrowitz and Goldsbrough[2] that the viscosity of a rubber solution stands in intimate relationship with the quality and technical value of the rubber.

Schidrowitz[3] regards the so-called "nerve" of rubber as due to three factors:—(a) Mechanical structure as indicated by the film structure of fine hard Para, and brought about by the method of coagulation; (b) physical structure or colloidal aggregation of the rubber particles; (c) chemical structure or molecular complexity.

The mechanical structure of crude rubber is largely broken down in the washing and mixing operations, and is therefore only a small factor in the quality of manufactured rubber. Schidrowitz suggests that viscosity measurements connote the physical and chemical structure of rubber although the exact relation is uncertain. He states[4] that within the same species viscosity measurements are a means of determining strength and vulcanising capacity; comparing species with species, however, this does not hold directly.

Beadle and Stevens[5] however, found that although some relationships can be detected, the general results of viscosity determinations are not in accordance with those obtained by vulcanisation.

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* Their properties will be described in a further communication.

[1] Gummi Zeitung, 1905, **19**, 1053, and **20**, 105.

[2] This Journal, 1909, **28**, 3, "The Rubber Industry," p. 260. (The International Rubber and Allied Trades Exhibition, Ltd. 1911).

[3] "Rubber," p. 163 (Methuen and Co., 1911).

[4] "Rubber," p. 165.

[5] "The Rubber Industry," pp. 260 and 270.

Recently the viscosity of rubber solutions has been submitted to systematic study by G. S. Fol[6] who points out several precautions that must be taken in making viscosity determinations :—

(1) Comparative results can only be obtained by using a viscometer of standard dimensions, the differences in the results obtained with two different viscometers being much greater in the case of concentrated solutions than in the case of dilute solutions.

(2) The determinations must be made at a fixed temperature. The absolute viscosity of a rubber solution diminishes with rise of temperature. The relative viscosity however remains practically constant between 20° and 70° C.

(3) The rubber should be dissolved as completely as possible.[7] When the rubber is only partially dissolved the solution has for the same concentration a slightly less viscosity than when the rubber has been dissolved as completely as possible. This, Fol thinks, is probably due to the fact that the resins dissolve most readily and have very probably a lower viscosity than rubber itself.

(4) Viscosity is influenced by strongly shaking when preparing the solution, presumably, according to Fol, in consequence of the insoluble constituents being suspended in such a finely divided condition in the solution that they cannot be segregated by filtration through glass wool. He concludes that these particles contribute to viscosity in a larger measure than if one introduced into the solution the same weight of rubber.

Recently[8] H. P. Stevens by fractionally dissolving rubber in benzene, obtained fractions of different viscosity but he attributes the variations to differences in the resin content of the various fractions.

In the following experiments on the viscosity of rubber solutions the method of procedure was almost identical with that suggested by Fol. The majority of the experiments were made with the following different kinds of rubber :—

(*a*) A pale thin plantation crêpe Hevea, coagulated by means of acetic acid.

(*b*) Fine hard Para,

(*c*) Castilloa, prepared by centrifugalisation,

(*d*) Funtumia sheet,

(*e*) Ceara biscuits.

These rubbers had the following composition in the dry state :—

	Plantation Hevea.	Fine hard Para.	Castilloa.	Funtumia.	Ceara.
	per cent.	per cent	per cent.	per cent.	per cent.
Caoutchouc	93·8	94·6	85·8	86·2	91·2
Resin	3·1	3·3	13·8	11·9	4·8
Protein	2·7	1·8	0·3	1·7	3·0
Ash	0·4	0·3	0·1	0·2	1·0

The dry rubber was comminuted as finely as possible by means of scissors. A weighed quantity was placed in a stoppered bottle with a definite volume of solvent, shaken for two or more hours, and then allowed to stand over night. Next morning the solution was filtered through cotton wool and the concentration was determined by evaporating 10 c.cm. of the filtered solution *in vacuo* in a tared weighing bottle.

The viscosity was determined by means of an Ostwald viscometer in a thermostat which was maintained at a temperature of 20° C. ± 0·1° C.

The solvents employed were :—

Benzene, purified by repeated shaking with concentrated sulphuric acid, washing with water and alkali, finally drying and redistilling. In some cases the benzene was further purified by freezing.

Ether, purified by shaking with water, then drying by means of calcium chloride, and finally distilling over sodium.

Petrol, redistilled, the fraction distilling below 50° C. was employed.

Toluene, purified by repeated shaking with concentrated sulphuric acid, washing with alkali and water, drying by means of calcium chloride, and redistilling. The fraction distilling between 110° and 111° C. was employed.

Commercial xylene.

Chloroform purified by washing with water, drying and redistilling.

The Solubility of Rubber.

Rubber shows considerable variation in the extent to which it will go into "solution." Thus whereas the Castilloa and Funtumia rubbers examined mix with solvents in all proportions, the Para and Ceara rubbers are only partially "soluble." This fact is of considerable moment when one is drawing conclusions from the viscosity of rubber solutions as to the properties of the original rubber.

The following table shows the extent to which the Para and Ceara rubbers went into solution when the comminuted rubber was shaken with solvents for 2—3 hours and the concentration of the solution determined next day.

Solvent.	Weight of rubber per 100 c.cm. solvent.	Concentration of solution produced (grams per 100 c.cm.).			
		Fine hard Para.	Fine hard Para crêped 45 min. in the cold.	Plantation Para.	Ceara.
Benzene	0·5 grm.	0·24	0·26	—	0·30
	1·0 grm.	0·48	0·56	0·92	0·74
Ether	1·0 grm.	0·41	0·54	0·54	0·72
	2·0 grms.	0·84	1·03	—	1·43
Petrol	1·0 grm.	0·27	0·46	0·32	0·67
	2·0 grms.	0·72	0·99	—	1·59

A noticeable feature of the above results is that the greater quantities of rubber yield a rather more than proportionate amount of dissolved matter to the same quantity of solvent. It would appear therefore that the dissolved rubber causes a partial solution of the insoluble constituent.[9]

Fine hard Para is the most insoluble of rubbers, especially in the unwashed condition. In an experiment in which two grams of resin-extracted fine hard Para were extracted in a Soxhlet with benzene only 1·03 grams went into solution.

As will be seen, however, from the above results passing fine hard Para through the washer for 45 minutes in a stream of cold water raises the solubility considerably. Heating with solvents also increases the amount going into solution, as the following results show :—

	Concentration of solution produced. per cent.
0·5 gram Fine hard Para was shaken with 50 c.cm. xylene	0·49
0·5 gram Fine hard Para was heated to 100° C. for several hours with 50 c.cm. xylene	0·65
0·5 gram Fine hard Para which had been crêped for 45 minutes in a stream of cold water was heated to 100° C. for several hours with 50 c.c. xylene ..	0·75

To explain the partial solubility of rubber in solvents Caspari has recently[10] revived the view of Gladstone and Hibbert[11] and Seeligmann[12] that rubber contains a soluble and an insoluble caoutchouc. According to Weber[13], however, the amount of insoluble matter in rubber can be reduced by successive extractions with chloroform, to a very small percentage, and according to

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[6] India Rubber Journal 1913. **45**, 578 *et seq.*

[7] Fol made all his experiments with a sample of Hevea Plantation Rubber from Java.

[8] India Rubber Journ., 1913, **46**, 345.

[9] Cf. this Journal, 1912, **31**, 518.

[10] This Journal, 1913, **32**, 1041.

[11] Journ. Chem. Soc., 1888, **53**, 679.

[12] Le Caoutchouc et la Gutta Percha, 1896.

[13] This Journal, 1900, **19**, 680.

Spence[14] it consists largely of protein. Even Caspari admits that his "pectous form" of caoutchouc "may conceivably be simply a residue of sol-forming rubber which has failed to burst its way out of a micellular framework possibly consisting of the rubber constituent commonly referred to as protein," but he maintains that there is no proof that the nitrogenous matter encloses rubber particles. And indeed it seems remarkable at first sight that the small amount of protein, if it is actually protein, should prevent twenty to thirty times its weight of caoutchouc from going into solution. However, there is yet no convincing proof that an insoluble pectous form of caoutchouc exists. Indeed the *Castilloa* and *Funtumia* rubbers examined mix completely with solvents and *a priori* one would hardly expect the pectous form of caoutchouc to exist in some species of rubber and not in others. Moreover there is no sharp line of demarcation between the soluble and insoluble forms of caoutchouc, for as is apparent from the above results, crêpeing the rubber as well as heating with xylene causes more caoutchouc to pass into solution; from which one may conclude that the partial solubility of Para and *Ceara* rubbers is due, at any rate to some extent, to the structure of the rubber or state of aggregation of the caoutchouc.

The fact however that part of some rubbers remains undissolved in the usual method of making solutions for viscosity experiments considerably detracts from the value of viscosity determinations unless one can assume that the undissolved portion has the same viscosity as the dissolved caoutchouc. An attempt to ascertain if this was the case by treating the insoluble residue with fresh solvent failed owing to the very slow rate of solution of the residual rubber. H. P. Stevens.[15] however, has determined the viscosity of different fractions of rubber in benzene and finds only small differences which he explains was due to the varying amounts of resin present.

Viscosity of Rubber in Different Solvents.

Rubber produces with different solvents "solutions" of different viscosity. In the following experiments the viscosity of solutions of various rubbers in benzene, chloroform, petrol and ether was determined at different concentrations.

The relation between the viscosity in the different solvents is shown in the adjoined curves (Figs. I.—III.).[16] It will be seen that ether produces solutions of least viscosity. Benzene and chloroform, on the other hand, produce solutions of greatest viscosity. The plantation Para rubber examined gave a solution in benzene of low viscosity; this difference is shown in a greater degree in ethereal solution.

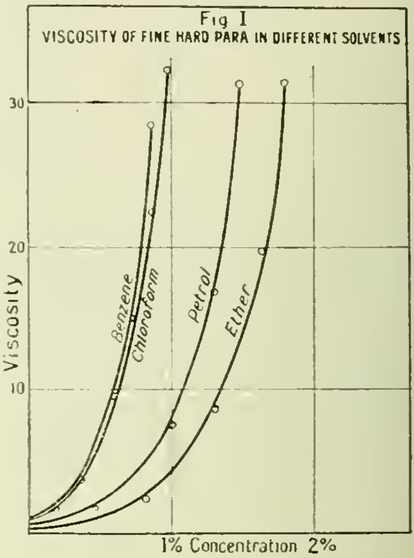

Fig I

VISCOSITY OF FINE HARD PARA IN DIFFERENT SOLVENTS

Viscosity of different Rubbers in Benzene Solution.

In order to compare the viscosity of caoutchouc in different rubbers it is necessary to make a correction for the amount of resin (which may be considerable in the case of *Castilloa* and *Funtumia* rubbers). When this is done and the viscosity is plotted against the concentration, the curves shown in Figure IV. are obtained. The fine hard Para and *Castilloa* curves practically coincide, from which one might conclude that the caoutchouc in the *Castilloa* sample and the soluble caoutchouc in the fine hard Para are of equal quality. When the fine hard Para, however, had been passed through the washing machine for 45 minutes in a stream of cold water it produced solutions of much less viscosity. The *Castilloa* rubber, after washing under the same conditions

Rubber.	Benzene.		Petrol.		Ether.		Chloroform.	
	Concentration (grms. per 100 c.cm.).	Viscosity (water=1).	Concentration (grms. per 100 c.cm.).	Viscosity (water=1).	Concentration (grms. per 100 c.cm.).	Viscosity (water=1).	Concentration (grms. per 100 c.cm.).	Viscosity (water=1).
Fine hard Para....	0·86	28·32	1·52	35·81	1·95	40·68	1·00	32·27
	0·71	13·87	1·30	16·65	1·64	19·72	0·86	22 38
	0·61	9·64	1·00	7·45	1·31	8·63	0·51	—
	0·44	5·12	0·48	1·31	0·85	2·04	0·37	3·74
	0·25	2·23	—	—	—	—	—	—
Castilloa..........	1·00	27·12	1·65	29·37	2·05	36·98	0·96	39·24
	0·83	16·56	1·36	13·15	1·85	22·18	0·87	28·31
	0·61	8·13	1·04	7·23	1·58	12·36	0·70	15 09
	0·38	3·70	0·54	1·31	0·67	1·60	0·41	4·68
Funtumia	1·14	36·14	1·67	35·08	1·57	18·34	1·12	44·70
	0·93	17·04	1·34	15·35	1·24	8·63	0·95	24·40
	0·67	9·34	1·19	10·03	0·95	3·94	0·76	14·20
	0·33	2·77	1·00	6·14	0·40	1·13	0·33	3·40
	—	—	0·58	1·67	—	—	—	—
Plantation Para ..	1·45	33·75	2·72	17·62	3·17	41·42	1·34	34·32
	1·20	19·30	2·32	10·78	2·42	14·16	1·17	20·55
	0·88	9·34	1·77	4·82	1·72	4·88	0·86	9·45
	0·43	2·89	0·96	1·36	0·51	1·48	—	—

Solvent.	Fine hard Para after 45 min. crêpeing in cold water.		Castilloa after 45 min. crêpeing in cold water.	
	Concentration (grms. per 100 c.cm.)	Viscosity (water=1)	Concentration (grms. per 100 c.cm.)	Viscosity (water=1)
Benzene	2·06	32·90	1·67	31·39
	1·80	22·13	1·38	19·11
	1·26	9·64	1·05	10·19
	0·75	3·87	0·54	3·98

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[14] Journ. Inst. Comm. Res. Tropics, 1907, No. 13.

[15] *Loc. cit.*

[16] The curves for Funtumia rubber are similar to those fo Castilloa, and are omitted.

produced solutions of lower viscosity, but the change was not so marked as in the case of fine hard Para.

In order to compare numerically the viscosities of different rubber solutions two methods have been suggested. Schidrowitz suggested drawing a tangent to the curve at 1 per cent. concentration and taking the tangent of the angle which this line makes with the abscissa as a measure of the viscosity. Fol on the other hand suggests taking the area enclosed by the curve, ordinate, abscissa, and a line drawn from the curve at 1 per cent. concentration perpendicular to the abscissa. Both these methods are arbitrary, and moreover it will be seen from the curves (Fig. IV.) that in the case of the fine hard Para and *Castilloa* rubbers the viscosity of the solution will become practically infinite before 1 per cent. concentration is reached.

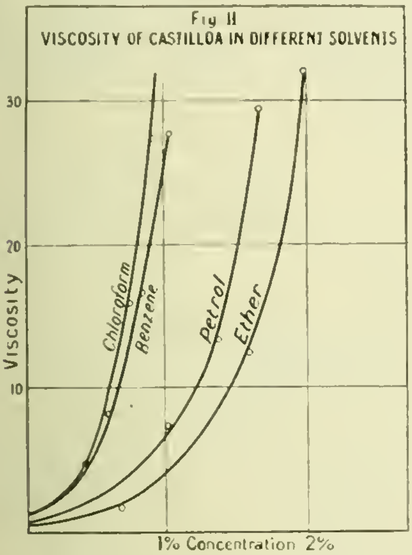
Fig II
VISCOSITY OF CASTILLOA IN DIFFERENT SOLVENTS

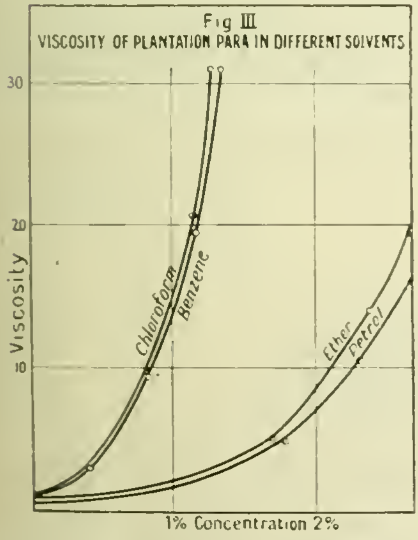
Fig III
VISCOSITY OF PLANTATION PARA IN DIFFERENT SOLVENTS

A simpler method of comparing the results would be to find the relation between viscosity and concentration and express this as a straight line.

Various formulæ[17] have been proposed for connecting the viscosity of solutions with the concentration, but they have had only a limited application.[18]

The viscosity of rubber solutions, however, appears to obey a logarithmic equation, such as[19]

$$\eta = k^{x}$$

(where η_x = viscosity at concentration x, x = concentration, and K = constant), for when the log. viscosity is plotted against the concentration in benzene solution in the case of the rubbers examined the straight lines shown in Fig. V. are obtained.

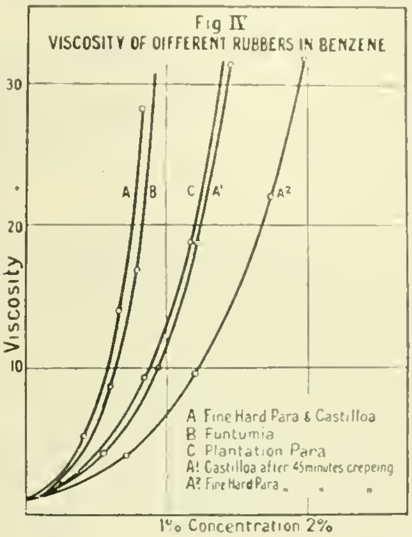
Fig IV
VISCOSITY OF DIFFERENT RUBBERS IN BENZENE

The inclination of these lines with the abscissa would seem to be the simplest way of numerically comparing the viscosity of rubber solutions.

The actual figures given by the three methods are the following :—

	Schidrowitz.	Fol.	Proposed method.
Fine hard Para	∞	∞	68
Castilloa	∞	∞	66
Funtumia	6000	390	65
Plantation Para	1300	180	55
Fine hard Para after 45 min. washing	1000	120	43

It will be noticed that the proposed method does not show such great differences between the rubbers examined as the other two methods. If viscosity connotes the quality of rubber one would expect small differences, as the rubbers were all of very good quality. Judging from the viscosity of fine hard Para after washing, the plantation Para probably owes its position to the fact that it had been crêped.

Change in Viscosity of Rubber Solutions.

It is well known that rubber solutions are liable to change in viscosity. The first mention of the fact was made by Woudstra,[20] who observed that toluene solutions diminished in viscosity on standing. Fol[21] attributes this change to the gradual deposition of insoluble matter in suspension which passes through the filter. Gorter[22] observed that solutions of rubber in benzene exposed to sunlight diminished rapidly in viscosity, and showed that this was accompanied by oxidation. He found also that benzene solutions of rubber diminish slowly in viscosity even in the dark and when access of air is prevented.

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[17] Arrhenius, Zeitsch. physikal. Chem., 1887, **1**, 285; Rudorf, Zeitsch. physikal. Chem., 1903, **43**, 257; Fawsitt, Proc. Roy. Soc. Edin., 1904, 25; Dunstan and Wilson, Journ. Chem. Soc., 1907, **91**, 83; Hatschek, Zeitsch. Chem. Ind. Kolloide, 1913, **12**, 238.

[18] *Vide* Powell, Journ. Chem. Soc., 1914, **105**, 8.

[19] Arrhenius, *loc. cit.*

[20] Z. Chem. Ind. Kolloide, 1909, **5**, 31.

[21] *Loc. cit.*

[22] Mededeelingen over Rubber Nos. 1 (1911) and 2 (1912) (Departement van Landbouw, Nijverheid en Handel, Java).

In a preliminary experiment the writer observed a solution of rubber in commercial benzene left exposed in the laboratory to diminish 30 per cent. in viscosity at ordinary summer temperatures.

Heat as well as light appears to increase the diminution in viscosity of rubber solutions.

A solution of plantation rubber in commercial toluene was divided into two portions, each of which was maintained at 40° C. in a thermostat, one portion being protected from the light. It was found that the viscosity diminished as follows :—

	Times of efflux in seconds.	
	Protected solution.	Exposed solution.
Initial	260	260
After 6 days	150	119
After 12 days	129	88

At higher temperatures the diminution in viscosity is more rapid. Schidrowitz and Goldsbrough[23] found that the viscosity of benzene solutions of rubber in some cases sinks to half its original value on heating for two hours on the water-bath.

At high temperatures the effect of light, or at any rate of ordinary daylight, on the viscosity of rubber solutions appears to be less marked than that of heat.

A solution of plantation rubber in commercial toluene was divided into two portions, each of which was heated in a conical flask under a reflux condenser on the water-bath, one of the flasks being protected from the light by means of a tin cone. The viscosity of each portion was determined at the commencement and at stated intervals with the following results :—

	Times of efflux in seconds.	
	Exposed solution.	Protected solution.
Initial	80·5	81·0
After 30 minutes	63·0	63·0
After 2 hours	53·0	55·0
After 4 hours	46·0	51·0
After 14 hours	39·0	45·0

The effect of light only begins to make itself felt after two hours ; at the commencement the solutions diminished in viscosity with the same velocity.

In the following experiments a solution of plantation rubber in commercial toluene[24] contained in a conical flask and protected from the light by means of a metal cone was heated under a reflux condenser on the water-bath. At the commencement of the experiment and at stated intervals the viscosity was determined at 20° C. The following results were obtained :—

	Times of efflux in seconds.					
	I.	II.	III.	IV.	V.	VI.
Initial	84	86	77	78	82	82
After 1 hour	62·5	61	60	58	61	60·5
After 3 hours	49·5	50	51	50	52	49
After 5 hours	44·5	46	47	46	47	42·5
Concentration (grams per 100 ccm.)	0·48	0·49	0·44	0·44	0·45	0·45

At higher temperatures the fall in viscosity is still more marked. A solution of rubber in toluene was heated in a sealed tube at 125—130° C. for six hours. The time of efflux fell from 220 seconds before heating to 29 seconds after heating.

In Gorter's experiments on the diminution of viscosity under the influence of light the rubber underwent oxidation. Bernstein[25] states however that xylene solutions of rubber diminished in viscosity under the influence of an ultraviolet light even in the absence of oxygen.

It was also found that heat alone in the absence of air caused diminution in viscosity of rubber solutions, as the following experiment shows :—

Test tubes were completely filled with xylene solutions of rubber, and closed with corks through which passed small glass tubes to allow for the expansion of the solution. They were then placed in boiling water and as soon as the expansion had ceased the openings of the glass tubes were closed by rubber caps. The solution thus out of contact with air was heated for two hours and the viscosity determined.[26]

	Times of efflux in seconds.		
	Fine hard Para.	Plantation Para.	Ceara.
Before heating	87	125	318
After heating	27	44	96

Rubber solutions therefore on heating diminish considerably in viscosity, apart from any oxidation which the caoutchouc may undergo.

Considering the magnitude of the change it is also difficult to believe that it is due to the separation of adventitious insoluble particles which have passed through the filter.

The phenomenon seems most easily explained by assuming that rubber in solution tends to undergo a physical change, the so-called "depolymerisation," slowly at ordinary temperatures, but much more rapidly as the temperature rises.

The rate of diminution of viscosity also varies with the time of heating, being greatest at the commencement. This is shown in the following experiments where the viscosity was measured at regular half hour intervals.

A was a solution of plantation Para rubber in toluene, heated under reflux on the water bath and protected from the light

B was a solution of *Castilloa* rubber in xylene heated in boiling water and also protected from the light.

	Times of efflux in seconds.	
	A.	B.
Initial	80·0	160
After heating 30 minutes	50·5	135
After heating 60 minutes	41·5	124
After heating 90 minutes	38·0	117
After heating 120 minutes	35·0	110
After heating 150 minutes	33·0	107
After heating 180 minutes	32·0	104

These results are shown graphically in Fig. VI.

The change in viscosity appears to follow the law :

$$x = a + b \log t$$

(where x = diminution in viscosity in time t.
a = diminution in the first time unit, 30 minutes,
b = increment of diminution with time).

For when the viscosity is plotted against the logarithmic value of the time straight lines are obtained (Fig. VII.). It is interesting that this relation is the same as that given by Schwartz[27] between extensibility and time in hysteresis measurements, namely the increment of extension plotted against the logarithm of the number of the cycle is a straight line.

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[23] The Rubber Industry, p. 260.

[24] Toluene was used for studying change in viscosity at high temperatures in preference to benzene, because the ebullition of the latter is a disturbing factor.

[25] These results are not comparable amongst themselves as the concentrations (undetermined) are obviously very different.

[26] Zeitsch. Chem. und Ind. Koll. 1913, **12**, 193.

[27] The Electrician, 1910, **54**, 585 and 629.

FIG. V

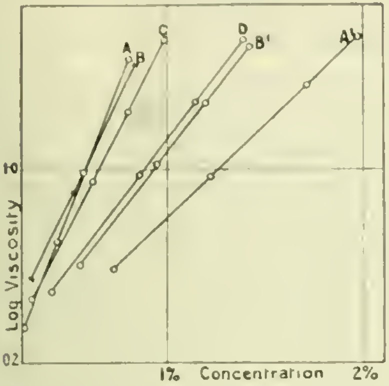


Fig. V—A. Fine hard Para, B. Castilloa, C. Funtumia. D. Plantation.
A' Fine hard Para after 45 minutes crêpeing in cold water.
B' Castilloa after 45 minutes crêpeing in cold water.

FIG. VI

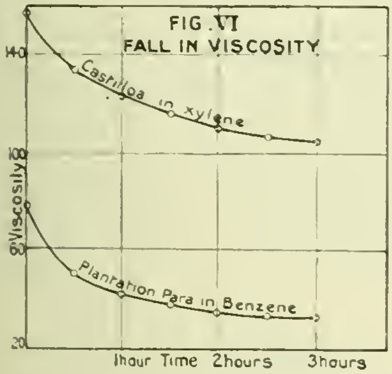
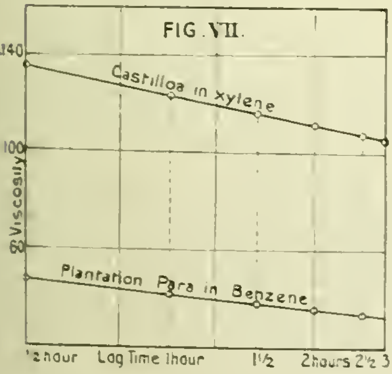


FIG. VII.



This is not surprising seeing that both phenomena are the result of internal work performed on the rubber, but the point of interest is that Schwartz found that when he examined various samples of rubber, and plotted the maximum extension per cycle against the logarithm of number of cycle, the rubbers arranged themselves in the order of their quality, the maximum extension with succeeding cycles being greatest in the case of fine hard Para. It would appear that the phenomenon is due to a property of rubber which persists not only in solution but also throughout vulcanisation.

Effect of Concentration on the Change in Viscosity.

The following experiments show the relationship of change in viscosity to the concentration.

Solutions of plantation Para in commercial xylene at different concentrations were heated in small flasks (closed with corks) in a water bath maintained at a temperature of 80° C. The viscosity was determined at the commencement and at stated intervals with the following results :—

	Times of efflux.					
Initial	61·5	73·0	87·0	104·5	138·0	187·0
After 30 min...	53·0	62·0	74·0	89·5	120·0	161·0
After 1 hour..	51·0	60·0	70·0	81·5	111·5	148·0
After 2 hours	46·5	57·0	64·0	73·5	105·0	132·0
After 3 hours	44·0	56·0	62·0	69·0	98·0	124·5
Concentration (grams per 100 ccm.)	0·4	0·48	0·54	0·60	0·73	0·82

The relation between these results is best seen in Fig. VIII., where the times of outflow are plotted against the logarithmic value of time of heating.

FIG. VIII

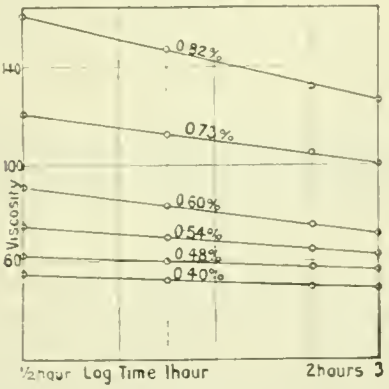


Fig. VIII. Showing rate of diminution of viscosity at different concentrations (Plantation Para in xylene at 80° C.)

Change in Viscosity of Rubber in different Solvents.

The following experimental results show the change in viscosity of plantation Para in different solvents, when heated to 80° C.

	Times of efflux.					
	Purified benzene solutions.		Purified toluene solutions.		Commercial xylene solutions.	
	I.	II.	I.	II.	I.	II.
Initial	87·5	75·0	87	84·5	91	87·0
After 1 hour..	74·5	67·0	—	—	69	70·0
After 2 hours..	72·5	66·5	77	76·5	61	64·0
After 3 hours..	72·0	66·0	73	72·5	57	60·0
Concentration (grams per 100 c.c.)	0·43	0·40	0·42	0·44	0·50	0·51

It is noteworthy that the change is more marked in the case of xylene solutions than in the case of the benzene and toluene solutions. In purified toluene solutions the diminution in viscosity appears less than in commercial toluene (cf. the results on p. 450) though this may be explained by the fact that toluene solutions on the water-bath will attain a higher temperature than 80° C. A similar difference is observed between solutions in pure benzene and solutions in "90 per cent. benzol" on the water bath, as is seen in the following results :—

	Times of efflux.	
	Pure benzene.	Commercial benzene.
Initial	80	77
After heating 1 hour	73	64
After heating 2 hours	71	62
Concentration (grams per 100 ccm.)	0·40	0.40

The effect of the addition of small quantities of the usual impurities in benzene (carbon bisulphide, thiophen xylene) was also studied. With the exception of xylene they did not cause any increased diminution in viscosity. A solution of rubber in pure benzene was divided into two portions. To one portion 0·5 per cent. commercial xylene was added, and both heated on the water bath.

	Times of efflux.	
	Pure benzene.	Pure benzene + 0·5% of xylene.
Initial	71·5	71·5
After 1 hour	65	61
After 2 hours	63	58

It would seem therefore that the presence of xylene or higher hydrocarbons in commercial benzene may affect the viscosity of rubber solutions. Hence the importance first indicated by Schidrowitz, of working with pure solvents.

Change in viscosity of different rubbers in solution.

The simplest way of comparing the diminution in viscosity of different rubbers is to take solutions of equal or approximately equal viscosity and to determine the extent to which the viscosity is destroyed by heat.

This has been done for the rubbers examined. Care was taken that the solutions were made under as near as possible the same conditions. The comminuted rubber was shaken 2½—3 hours in a rotatory shaker with the quantity of xylene necessary for the production of a solution of definite viscosity. The same sample of xylene was used throughout.

After determining the viscosity the solutions were heated in boiling water for two hours and the viscosity redetermined. The following results were obtained :—

	Time of efflux in seconds.		Percentage diminution.
	Before.	After.	
Fine hard Para	103 111 105	46 46·5 48	57
Plantation Para	108 109 115	68 65 72	37
Fine hard Para which had been crêped 45 minutes in the cold	118	81	30
Funtumia	104 101 100	78 70 81	26—30
Castilloa	111 107	80·5 78·0	28
Ceara	118	90	23

The order in these results is quite different from that obtained when comparing the viscosity of rubber solutions at different concentrations, all the Hevea rubbers showing higher percentage diminution in viscosity than the other species.

The explanation of the change in viscosity of rubber solutions depends on the one hand on the nature of viscosity and on the other hand on the structure of the rubber gel. Assuming as is generally supposed that viscosity is due to friction of the ultimate particles[28], and assuming also that rubber consists of aggregated caoutchouc micelles[29], it is only necessary to suppose that the caoutchouc goes into "solution" in a more or less aggregated condition, with a tendency to de-aggregate or "depolymerise."[30] In this case the high viscosity of rubber solutions is due to the presence of large aggregates, which are disrupted by heat, and the percentage diminution in viscosity of different rubbers on heating will be a measure of the proportion of large aggregates in the solution. The larger the aggregates the more heterogenous the "solution," hence the difficulty of obtaining absolutely concordant results for the initial viscosities of solutions even of the same rubber and of the same concentration unless one works under absolutely uniform conditions.

The phenomenon of "de-aggregation" is not limited to the solution.[31] Bernstein has shown that when rubber is heated in the absence of air, the viscosity of the solution is less than that of the solution of the initial rubber. Crêpeing brings about "de-aggregation" in the same way.

The so-called hysteresis of vulcanised rubber is probably due to "de-aggregation," for it follows the same law, which would give some theoretical justification for supposing that the diminution in viscosity which a rubber solution undergoes on heating indicates at any rate one important factor in the quality of rubber, for one might conclude from Schwartz' results that although during washing and mixing the rubber may become "de-aggregated," the better rubbers do not do so to the same extent as the inferior rubbers or that, during vulcanisation, the better rubbers return to a higher state of aggregation.

Manchester Section.

Meeting held at the Municipal School of Technology, on Friday, April 24th, 1914.

MR. JULIUS HÜBNER IN THE CHAIR.

A CONTRIBUTION TO THE HISTORY OF DYEING, WITH SPECIAL REFERENCE TO SCOTLAND.*

BY JULIUS HÜBNER, M.SC.TECH., F.I.C.

When I concluded my first paper on the History of Dyeing†, I had some doubt as to whether research with regard to the history of industries would be appreciated. Soon after its publication, however, any such doubt was dispelled by the many kind and complimentary comments which I received, and nothing could have more strengthened my decision to proceed with this work than the letter addressed to me by Mr. Rhys Jenkins of the Patent Office, in which he not only expressed his appreciation but showed his sincere interest and sympathy in this work by placing at my disposal a large amount of information upon the history of dyeing in England which he had collected during many years. The new sources of information which had thus to be investigated in order to present the history of dyeing in England in a complete form, soon forced the conclusion upon me, that this part of the work, which I intend to prosecute, will of necessity extend beyond the scope of any paper.

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[28] *Vide* Powell, Journ. Chem. Soc., 1914, **105**, 1.

[29] *Vide* Svedberg Ber. d. d. Chem. Gesell., 1914, **47**, 12.

[30] The use of the term "depolymerisation" for denoting this change is open to criticism, because one generally understands by the expression a quite different phenomenon. For this reason the writer suggests the use of the word "de-aggregation" instead.

* See this Journal, Nov. 29, 1913, pp. 1043 *seq*.

† A Glossary and the complete titles of publications from which extracts have been quoted will be found at the end of the paper. The latter are referred to in the text by corresponding numbers.

I, therefore, devoted in the first instance my attention to the history of dyeing in Scotland, which I hope to present in this paper in a fairly complete form.

A large influx of Flemings into England occurred as early as the 12th century, and, encouraged by Henry I., many went from England to Scotland.[12]

Chalmers informs us that from the beginning of the Scoto-Saxon Period "Scotland . . . enjoyed the benefit of a domestic manufacture. Many of the new settlers in the towns during this time were named from the nature of their trades. Thus Ernulf the *dyer*, Arnald the *dyer* and William the *dyer* were all burgesses of Perth during the reign of William the Lion,[*] and William the *dyer* lived in Kelso during the same reign.[†]

Chalmers[9] proceeds to state that "her people manufactured the wool of their flocks. Their woollen fabrics were regulated by the assize of David I. The charter of King William the Lion to Inverness speaks of cloth dyed and shorn, which should not be made without the borough, contrary to the assize of David.[‡] The *constitutio nova* of Glasgow also speaks of cloth dyed and shorn. Much wool was however exported. They manufactured their own flax and their own leather, and Dyers and Goldsmiths were in every town."

Fordun informs us that David I. "enriched the ports of his kingdom with foreign merchandise, and to the wealth of his own land added the riches and luxuries of foreign nations; that he changed its coarse stuffs for precious vestments and covered its ancinet nakedness with purple and fine linen."[12]

We also find in a charter[11] of Philip Earl of Flanders, who fell at the siege of Acre in 1191, that he granted he monks of Melrose a passage through his territories free of toll or exaction.[§] The brethren of Melrose, and also he monks of Scone, took over the raw Scotch wool from heir monastery lands to the woollen manufactories of Flanders, and their wool became widely known and much alued by the Flemish weavers.

Of the crafts and occupations prosecuted in the burghs f the 12th century, the old laws and form of procedure nention bakers, brewers (male and female), fleshers, millers, fishers, tanners, skinners, shoemakers, dyers of loth, maltmakers, wine-taverners, tailors, saddlers and vool-combers.[8] During this century considerable attention was paid to the promulgation of laws regulating he woollen manufacture of Scotland, and from these ocuments authentic information is obtained that dyeing was actually practised at this early period. Thus we find hat a custom of 1d. was imposed on each bundle of madder imported.[5]

"The Lavves and Constitvtions of Burghs, made be King David the first, at the new Castell, vpon the Vater of Tyne," contained the following regulations with regard to the buying of wool and cloth:—"Ane tranger Merchand sovld buy from Burgessis.[¶] Na tranger marchand nor aliene may buy wool, hydes, nor ther merchandise, or without borgh, bot fra ane urges;"[15] and no one but a burgess could buy wool to dye, or make or cut cloth [8] (**20).

In the Acts of Parliament of Scotland[6][††] we find under makyn of cloth and littyn of woll," that the dyeing of wool and the shearing of cloth was also confined to urgesses:—"Na man bot burges sall by woll to lytt a clathe to mak ne schere."

During the 12th century "the mercantile classes became ealthier and more important; the handicraftsmen eame more and more confined to the poor and the ufree. The merchant-guild made the practice of certain trades a ground of exclusion from the fraternity."[8] This was by no means confined to Scotland, because we find that Dutch, German and Belgian Guild Statutes ordain that no one with "dirty hands," or with "blue nails," should be a guild brother.

The latter prohibition no doubt refers particularly to woad dyers.

Among a few other trades in Scotland, dyers are specially referred to in chapter 94. I. 351,[6] in which it is set forth that they must not put their hands into the woad if they belong to the guild. "Of thaim that may nocht be in the gylde. It is to wyt that no thir lytstar . . . may be wythin the fredome of the gylde but gif he sal sorsuer to do that craft wyth his awne propir handis bot wyth servandis undir hym."

This law was rigorously enforced. We find in the "Articuli Inquirendi"[*] that it was "to be inquired be secret inquisition, and punished be the law . . . Give Litsters, or Sowters, quha are brether of the Gild vses their offices with their proper hands . . . and of Litster Burgesses quha puts their hands in the wadd."

A burgess was not allowed to work outside the burgh as long as there was work to be obtained within the burgh. This is especially set forth as regards woolcombers.[15][†] "Of Kemesters. Gif the Kemester passe forth of the burgh a landwart, thero to worke, and to vse their offices, hauand sufficient worke to occupie them within burgh; they sould be taken and imprisoned."

Special attention was also paid to the weavers who evidently had been accused of various offences which were considered against the interest of the burgesses:—"Wobsters[15][‡] sould be challenged, that they make over many lang thrummes, to the hurt of the people. 2). Quhen they take in claith with wechtes, and give. out againe the samine be wecht; they make the claith wak and donke, casting vpon it washe, vrine, and other thinges to cause it weight, and thereby halding a great quantitie of it to themselves. 3). They take evill and rotten zarne, and puttes it in the wob for hnist."

It is doubtful whether trades such as dyeing, weaving, shearing, etc., were at that time practised by the Scotch inhabitants in the burghs, because we find that the population was a very mixed one as far as nationality was concerned. When Edward I. made his progress north to receive the submission of the burghs, the names of the burghers were largely English and Flemish, and a grant of Earl David, brother of William the Lion, in conveying lands, addressed it "omnibus probis hominibus totius terrae suae, Francis, Anglis, Flamingis et Scottis."[12]

During the reign of William the Lion, Dundee had nine incorporated trades; among these are mentioned weavers and fullers, but not the dyers.[7]

In the Assize of Weights and Measures[5] mention is made of woad, madder and dyed wool in the following entry:—"Of walde." "And gyf ony schyp cum wytt walde he sal gyf for ilk frael at the entre twenty and twa penniis and at the furth passyng twenty five penniis and for ilk mesure that is callyt a settyng (a weight in Orkney, containing 24 marks) a half penny, and swa for ilk frael remaynand in the burgh of strange mannys vnsauld atoure the feste of Sanct Mertyn it sal gyf auchten penniis for the retret wardis," and further "of a foume of madyr or wauld or wauld on a hors 1d. Of a byrthing of madyr or walde to sel a halfpenny" and "of a staen of lyttyt wol a half penny."

Among the different burghs, Aberdeen played a most prominent part and valuable information as regards the early history of industries is to be found in its Records.[7] On the 12th February, 1222, Alexander II. granted a charter to Aberdeen:—"I likewise grant to the same, my burgesses of Aberdeen, that they have their Merchant Guild, the waulkers and weavers being excluded. . . . I likewise strictly forbid any one dwelling outwith my burgh Aberdeen within the Sheriffdom of Aberdeen to make or cause to make cloth, dyed or shorn, within the Sheriffdom of Aberdeen, save my burgesses of Aberdeen who are of the Merchant Guild. . . .

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[*] Chart. Balmer, 25—7.

[†] Chart. Kelso, 2.

[‡] Wight on Elections, p. 411.

[§] National Manuscripts of Scotland, Vol. I, 43.

C. I. 668.

[¶] Chap. 18, Iac. 4, parl. 4, c. 41; Iac. 6, parl. 12. c. 152.

[**] Leges Quatuor Burgorum. c. 20, I. 336.

[††] The Chalmerlane Air, Stat. Wilh., c. 35, 15, *75, 11.

[*] Chap. 109.

[†] Chap. 25.

[‡] I. 670, Appendix III.

I strictly forbid anyone within the Sheriffdom of Aberdeen to make cloth, dyed or shorn, on pain of my full forfeiture. If however, any person's dyed or shorn cloth shall be found made in despite of this protection, I command my Sheriffs to seize the cloth, and to do therewith as was the custom in the time of King David my great-grandfather."

An exception to fullers and weavers is also made in a charter granted by Alexander II. to Perth and Stirling. Edward I. attempted the same exclusion in London, Winchester, Marlborough, Oxford and Beverley. From this one may trace the first instances of the long-standing conflict between the more plebeian crafts and the more wealthy merchant burgesses. In all countries, the weavers and their fellow craftsmen, the fullers and dyers, were the first to make their existence known as a combined body, and it is thus interesting to note that in Scotland as far back as the 12th century they were specially mentioned in a charter excluding them from the same privileges as the Merchant Guild.

The Burgh Laws, as regards the manufacture of cloth, seem to have been fairly uniform throughout Scotland because we find[9][*] that according to the *constitutio novo*, "no one could have a malt-kill without the burgh of Glasgow . . . no one without the burgh could make any cloth, either dyed or shorn."

No manufactured articles seem to have been exported from Scotland during the 13th century because we are informed[12] that "before the War of Independence the chief articles of export appear to have been hides, wool and salted fish. From a very early list of goods brought to Bruges from various countries Scottish exports at that time would appear to have consisted of "lainnes, cuir, fromaige et sui."[†]

Towards the conclusion of the Scoto-Saxon period, the Flemings had placed a commercial factory at Berwick-on-Tweed,[‡] and a commercial treaty with the court of Flanders during the year 1297 (Edward I.) stipulated that the Flemings should have free and secure trade in Scotland.[9][§]

The author has not been able to obtain much authentic information as regards dyeing and dyers during the 14th century.

In 1340[10] we find according to the Exchequer Rolls that a dyer "Stephen Tinctor" was Provost of Banff, whilst[||] a dyer "Ralph Tinctor" was one of the collectors of the new custom of the burgh of Linlithgow.

Chalmers[9] informs us with regard to Berwickshire, that "in this shire, like every other, there must have always been a domestic manufacture for private uses. In 1371 there existed a fulling mill at Lauder, which had perhaps come down from the Morvilles of the 12th century and was certainly forfeited by their representatives, Alan Le-Zuche and John Baliol.[¶]

Some information about the various guilds[7] during the 15th century may be gathered from records dealing with the custom of presenting miracle plays at certain church festivals. Bain informs us that these plays formed an important feature during the 15th century. Nearly every large city had its own company of performers, generally composed of the various trade corporations. In Aberdeen, as early as 1440, a leader was appointed, called Abbot of Bon-Accord, to conduct the play of Halyblude. Two years after his appointment an edict was issued, calling on the craftsmen to appear annually at "the offerand of Our Lady" at Candlemas:—"The Littistaris sal fynd, The Empriour and twa Doctouris and alsmony honeste Squiares as thai may. . . . The Wobstaris and Walkares sal fynd, Symion and his disciples. . . ."

In the Exchequer Rolls.[10][**] under Aberdeen, we find reference to a dyer (1416)—Alexander tinctor Burgess of Aberdeen, in connection with wool of the Sheriffdom of Banff and another one in 1448[10][*] with regard to an allowance for expenses "in the pursuance and dyeing (tincture) of woollen and linen garments for a play before the King."

When the crafts began to assume a position of importance in the burghs, the Legislation took more particular cognisance of them and for their better organisation and "conduction," the second Parliament of James I., held at Perth, passed an Act on 12th March, 1424, in which the weavers but not the dyers were included.[7]

In the Edinburgh Records, 18th May, 1451, "one Rede, a dyer, was admitted a burgess as in right of his father and he gave wine and spices."[8]

About the middle of the 15th century the exportation of wool and linen cloth was prohibited by Parliament. Thus under[15] "Crimes Qvhilk are nether capitall, nor pecvniall bot are punished be ane vther paine, as be escheit of moveable gudes, or vther wayes" among "Forbidden gvdes, the Paine of transporting of the samin, and ane catalogue thereof . . . wool[†] . . . and Linning claith,"[‡] and further restrictions were imposed upon merchants in regard to the selling of tapistry, silk and woad, etc., in the following act:—"Na persons dwelland outwith burrowes, vse ony merchandice, nor taip . . . silkis . . . wadd[15][§] . . .

A Statute of James II., passed 6th March, 1457, declared it to be "sene speedful that lit be cryit up and vsyt as it was wont to be, and that na litster be draper, nothir to by claytht, nor yet tholyt to sell, vnder the payne of eschet thairof."

In 1475[13] the "Websters" of Edinburgh petitioned the Common Council to "erect them into a Society." Their request was granted.

James III. granted two Charters of the 6th November, 1482, to Edinburgh which contained among other valuable privileges "to take Custom of several Sorts of Merchandise at their Port of Leith." Among the articles specified we find:—For one Tun of Wad . . . 13s. 4d., For a Pack of Wad . . . 1s. 0d., For a Pack of Cloth . . . 0s. 8d.

During the 15th century the trade between Scotland and the Netherlands was already of considerable import ance and in order to further encourage it "the Scot were allowed to send cloth of any measure to be dyed i Flanders and to be taken back to their country, but n cloth at all was to be sold there.[11] (1469.) The state o affairs cannot be more fittingly described than i Davidson's words in "The Scottish Staple at Veere."[1]

Scotland has in the Convention of the Royal Burghs for many centuries the governing authority in all matter of trade and commerce, "the oldest existing representativ body in Europe," and in the Staple, the organisatio of foreign trade, Scotland maintained in full force unt the end of the eighteenth, and endeavoured to reviv in the 19th century, an institution to which in oth countries parallels can be found only in the middle ages.

The first "Conservator of the Privileges of the Scot Nation in the Netherlands" was Andrew Halyburt and some valuable information has been obtained fro his Ledger.[2] This Innes describes as "our oldest exta Ledger or merchants' account book." This book h been in the General Register House at Edinburgh for long time. It is a thick folio, beautifully preserved in i original dark leather binding, and having the ba strengthened with bands and parchment thongs, ve much in the style of modern account books. Nea all the entries are written by Halyburton himself. Ea account is solemnly preceded by the names of "Jhesu and the money, where not otherwise expressed, is in common currency of the Netherlands and counted pounds, li; shillings, s; and groats, g. Halyburto residence was probably Middleburgh, a place of m importance to traders, during the period covered by Ledger, *i.e.* 1492 to 1503.

The following extracts have been selected as pa cularly suited to convey some idea of the prices, quality and quantity of merchandise sent by Halybur to Scotland as well as of those exported from Scotland to Holland. "Item in Apryll anno 94, bocht in Bery betwix Lorens and me a stek welwat blak lang 30½, pris of the ell 11s. 8g. Som, 17li. 15s. 10g." "li. 12. Anno 94 in Schir Thomas Todis schip. for a ton of Vaid lyk as he sellis the laif." "Item the 14 day of November anno 95, bocht in Medylburgh . . . 6 barellis of saip, ilk barrell cost 14s."

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[*] Chart. Glasgow, 23 of 1242.

[†] Estaple de Bruge, I., p. 19. According to the editor of Hansisches Urkundenbuch, this probably dates from the last third of the 13th century. Hansisches Urkundenbuch, iii., p. 419.

[‡] Lord Hailes's An., i. 236.

[§] Rymer's Fœd., i. 740.

[||] Vol. I., p. 82.

[¶] Robertson's Index, 92, Parl. Rec.

[**] Vol. IV., p. 248.

[*] Vol. V., 318.

[†] Jac. 6, parl. 7, c. 113; parl. 10 c. 15; parl. 15 c. 250.

[‡] Jac. 6, parl. 4, c. 59.

[§] Jac. 4, parl. 6, c. 84.

In 96 "3 ton of waid, ilk ton 8li." "In Dysember anno 96 . . . bocht in Bery . . . and schepit . . . a kark of alom, cost 38s.," whilst "in Dysember anno 98 . . . a cark of alm cost 58s."

Under "Jhesus Anno 98, in Fewirzer" we find "a pip of wad, cost with the costis 3li. 15s. 10g."

A Scottish dyer had evidently visited Halyburton, because in 97 (October) he sends "Andro Elphynstonne to Aberdeen in Wyllykin Lychtharnes with And° Lytstar" some old French crowns.

In August 98 he sent to Andro Cullan "a bayll of madir weand 850 li. the C. cost 8s. 4g., ". . . bocht in Handwarp."

Under "Aprvll anno 99" there are two entries. "Item paid for 2 ball' of mader in Handwarp 13li. 2s. 8g.," and "Item for ij ton of waid 15li."

The prices paid for English white cloth and for scouring, dyeing and shearing the same, are given under "the 26 day off Jun anno 99 in Medylburgh" in an account with Alexander Lawder :—"Item paid for hym for the quarter off a stek of iij Ingill quhit . . . 2li. 10s. Item for redyn' of it or it was lyttit, ilk ell 6g., 11 ell 5s. 6d. Item for lettyn off iij ell rossat and viij ell of blak, ilk ell 12g. Item for scheryn eft(ir) the lyttin, ilk ell ijg. Item 3 ell off canvas to pak in, 9g. Som of thir 11 ell with costis 3li. 9s. 1g."

On the 10th of July 99 he "bocht in Medylburch . . . a pyp of waid, cost the furst bying 3li. 15s." and in October a "pyp of wad, cost . . . 3li. 15s.," for which the "oncostis" amounted to 10g., whilst in September 98 he "sald . . . a town of wald for 7li. 15s." A "pyp" seems therefore to have been equal to half a ton.

Woad had evidently become much cheaper in 1502, because Halyburton sold "a tone off vaid ffor to pay at Mech(el)mes in the Handwarp mercat for vij li."

In March of the same year we find the account for dyeing a piece of cloth red :—"Item lyttyt a stek of quhit of his, red, the quhilk cost 4g. the ell, haldand 35 ell." It was dyed in "Medylburgh."

The following are names and prices of some of the cloths imported and exported by Halyburton :—

11 ellis off claith, blak, price of the ell 17 sturis—Som 30s. 2g.

5 ell of Rowanis clath—1li.

Half a stek of bron cost—3li. 5s.

A stek gren chamlet—26s.

A stek tany—26s.

Paid in Handwarp for 11 ell' of Engllis clath for to mak his son a gon—4s. 8g.

The entry made in November 1496 shows that some loth called forrest cloth was sent from Scotland and sold n Holland :—"Item racauit . . . out of the samyn chip . . . a pak of (claith) forest. Item sald a stek her of in Brugis for 12 gret the ell, haldis 32 ellis. Som 2s. Item sald a othir stek for 9s. dossin, haldand 35. om of that stek, 26s. 3g. Item sald the ramanand to ornellis Classon for 5s. the (dozen), with 6 ellis to bat, aldis 57 dossyn ellis." From this we may conclude that he cloth, probably linen not woollen, must have been arse and that it had to be sold at a low price. Cloth alled "Scottis gray" was sold at about the same price.

A stek of Ryssyllis blak, cost 9li. 15s.

A stek of rownd holland 44 clath, cost 14g. elk ell. om 2li. 11s. 4g.

3 stekis of lynnyn clath, haldand 125 ellis, price of the l 6g. Som 3li. 2s. 6g.

6 stekis say, 3 red, 3 gren, cost 23s. the stek. Som 6li. 18s.

3 ellis cramysse sattyn, ilk ell cost 17s. Som 2li. 11s.

According to Maitland[13] the Fullers claimed that "the embers of this Company of Wakers, from a Petition esented to the Common Council of Edinburgh in the year 1500 (20th August), are of opinion that their Craft was incorporated before that Period ; nay very soon after the Foundation of the City." Maitland does not believe that a company had been formed at this early date but that possibly regulations existed for Masters and Journeymen of this Craft.

The following clauses in the Charter granted to the fullers are of interest :—"That each Member of the Company, before he begin Business on his own Account, be examined by four Masters of the Trade, concerning his Qualifications in his Art, to prevent People's being imposed on by ignorant Persons ; and if approved of, to pay the Sum of Five Crowns Scottish to the Corporation as upsett Money." In this we find a striking resemblance to the laws in Germany concerning apprentices in early times. "That each Person, at his entering on Business for himself, be worth three Pair of Sheets, and of Ability to pay for one Stock of white Cloth, whereby he might be in a Condition to make good Damages to those who imploy him." No mention being made of shearers in this clause, we may presume that the fuller also did the shearing whilst the term "one Stock," no doubt refers to milling stocks, *i.e.*, the fuller had to possess sufficient capital to pay, if necessary for the contents of one stock.

"Whatever Person of the Craft be found working with cards in the Country, shall, for every such Offence, forfeit the Sum of Fifteen Shillings Scottish Money, to be equally divided between the work of St. Giles' Church, the aforesaid Altar, and the Informer." Evidently fullers who were burgesses were not allowed to exercise their trade outside the burgh. "Working with cards" no doubt refers to the use of teasels.

"And as the County Wakers and Sheermen receive much Work from Edinburgh, without contributing to the great Expense . . . all Unfreemen who are imployed in this way, shall weekly pay one Penny each, towards the Support of the said Altar."

In Aberdeen, according to Bain,[7] "the litsters formed themselves into a society about as early as any other body of craftsmen in the town. In 1501 their Deacon was presented to the Council to be sworn, and to have his election confirmed ; but it does not appear that they ever applied for a Seal of Cause, as was done by the other crafts about this period. On the contrary the dyers seem to have held aloof from the rest of the craftsmen and at times claimed an equality with the merchant burgesses, an equality which however was never acknowledged by the merchants or craftsmen. When the question of procedure was rife at times of religious pageants, the litsters frequently claimed a superior place, but in 1546 they were definitely instructed to furnish their banner and take part in the Corpus Christi and Candlemas procession along with the rest of the craftsmen. On 25th June 1546 "the haill litstaris of this burgh chesit Alexander Fresser, litstar, their dekyne."

A statute regulating the order in which the craftsmen had to walk in the procession was given in 1501 (January 30th). The "flesseris" were first, the "barbouris" second, 11th came the "walcaris." 12th the "litstaris," 13th the "wobstaris," the procession finishing with the blacksmiths and hammermen. It was further ordained that "the craftismen sal furnys the Pageants ; the cordinaris, the Messing ; wobstaris and wolcaris, Symeon ; . . . the litstaris, the Emperor.

This order did not give satisfaction to the skinners. They rebelled and in a new regulation issued 28th May 1507 we find that "nixt thame the tailyoris, efter thame the vobstaris, valcaris and litstaris togidder." According to this new regulation the crafts had to furnish :—"Litstaris Sanct Nicholess wobstaris walcaris and bonet makaris Sanct John."

An important change in the character of these displays took place in 1508, when the Abbot and Prior gave place to "Robyne Huyd and Litile Johnne," but the order of precedence as regards the craftsmen remained the same.

The contribution paid by a craftsman to his craft was very small because we are informed that it consisted of "quarter pennies."

From a charter[13] granted to the Bonnet-Makers of Edinburgh on the 31st March, 1530, it appears that they were united with the Fraternity of "Wakers" and "Sheermen." "The Bonnet-Makers in Edinburgh by the great Use of Hats, were reduced to so low a Condition, that they were neither able to support their Families, or the Expense of their Company, without the assistance of another Trade being annexed to them; wherefore by Consent of the Fraternity of Litsters or Dyers, they applied to the Common Council of the City to have the said Craft united to them.*

The following paragraphs taken from the Charter granted are of interest:—"1). Incorporation of the Bonnet-Makers and the Litsters, Burgesses of this City." This is followed by elaborate instructions as regards the election of "Deacons," etc. "5). The Counsell, be thir Presents, in all Tyme comeing, prohibits and discharges all Litsters whatsomever, except the persons above named, who are Freemen Litsters of this Cittie, to exerce and profess the said Trade and Airt of litting and dyeing within this Cittie, unless they be admitted Freemen of the said Incorporation be the fore said Persones, present Litsters, and ther Successours that shall be lawfullie admitted Freemen of the said Incorporation, with Advice and Consent of the said Bonnet-Makers to take Tryall of the Sufficiencie of the Worke and Cullour dyed and litted by any of the intrant Freemen of the said Incorporation of the Litsters that shall heirafter be admitted, and to make Acts and Statuts amongst themselves for improveing of the said Airt, conforme to the foresaid Act of Parliament in favour of the Litsters."

That the Bonnet-Makers did not confine themselves to the making of bonnets only but that they also practised dyeing is shown in the following paragraph;—"6). It is stated and ordained conforme to the foresaid Agreement, that the Bonnet-Makers and ther Successors, shall in no Wayes incroach upon the Airt of litting of Cloathes and Stuffs, which is only proper to be dyed, litted and drest by the Litsters; and that non of the said Freemen Litsters, . . . shall medle with, nor incroach upon the making and dyeing of Bonnets, Nightcaps, or any other things that they bein in use to work and dye. . . ."

"7. The Council statuts and ordains, that, in no Tyme comeing, any Litster shall have Liberty to exerce the Airt of Litting and Dyeing within this Cittie or Priviledges therof, but such as are actuall Dyers and Litsters, Burgess of Edinburgh at present, or have been already bound Prentices, and are booked in the Dean of Gild's Books as Litsters; and those shall be obliged, before they can exerce ther Art, to byde Tryall as to ther Qualifications, before they be actually admitted to the Exercise of the said Airt. . . ."

"8. That no other Persones in any Tyme comeing are to be admitted Freemen of the said Incorporation, as Litsters, wer they never so weill qualified, unless they serve a Freeman Litster of the said Corporation for five years at leist . . . unless he be a Freeman's Son, or marie a Freeman's Daughter of the said Incorporation of Litsters." Provision was however made in the Charter so that merchants were not prevented from importing "any Cloaths, Stuffs, Stockings, or any other Wair in use to be dyed from any forraigne Cuntrie, of whatsomever Dye or Collour . . . or what else is in Use to be dyed or litted within this Kindom . . ."

"10. It is declared, that no Persone whatsomever, have Liberty to sett up a Lithouse in any of the Suburbs of the good Town . . . or exerce the said Airt of Litting or Dying. . . ."

Some further provision is made in 11, that people may send out cloth to be dyed and that they are allowed to bring it back into the citty "as they have been in use to do."

In 1540[6] [19]† an Act of Parliament was passed dealing with "Drawaris of Claithe," with dyers of false colours and with "Flaland Claith." "It is Statute and Ordainit anent drawers of claith and litstars of fals colours that in every borough there be a qualified man chosen to seal all cloth and he shall have for his labour of every steik seling XII d., and if any drawer of cloth be apprehended that one half to be our Sovereign Lord eschewed and the other half to the borough and the said drawer within borough for the first fault to tyne their freedom for year and day and for the second fault for ever and also of them outside the borough 'dingand calk cresche or flaland claith' that the same be eschewed and those holding to refund 'scait,' to the owners and if the said sealer be found culpable sealing insufficient coloured or 'drawin' cloth he to tyne his freedom and to be punished in his person and goods."

The drawing of cloth was no doubt a stretching operation in order to lengthen the cloth and to make the measurement more than it ought to be. In a poem, entitled "A Concise Poem on . . . Shepton Mallet,"* the various stages of the manufacture of woollen cloth are explained, the drawing of cloth is however described as mending of cloth which had been torn in the manufacture.

> "The Drawer last, that many faults doth hide
> (Whom merchant nor the weaver can abide)
> Yet is he one in most clothes stops more holes
> Then there be stairs to the top of Paul's."

Other illegal practices were apparently employed for thickening cloth, so as to make it appear of a better texture than it really possessed; they are mentioned in the same act under "dingand calk cresche or flaland (or cardand) claith." According to Jamieson,[19] dingand means beaten or knocked about; calk corresponds to chalk; cresche to greasy and flaland either beaten with a flail or some similar instrument or cardand the application of cards or teasels in order to improve the surface of the cloth. Whilst some of these expressions may be applied to the treatment which woollen piece goods may have undergone, it might also be suggested that flaland and calk had reference to the treatment of linen cloth. A picture of a bleach field, in the Encyclopédie Méthodique, Diderot and d'Alembert (1791), clearly shows men in the act of beating rolls of linen cloth with a kind of flail, prior to washing it in the river. This was no doubt done in order to remove impurities, and may have been the forerunner of the washing stocks.

The Edinburgh Records[12]† show that in 1546 John Gaittis, an Englishman, obtained a licence to "brew saip," but he was only allowed to sell it to freemen of the borough and in wholesale. Regulations were also issued‡ in the same year for the manner in which strangers should sell to freemen of the town:—"Silkis and claytb to be sawld in haill steiks . . . item mader to be sawld in polks: item allum to be sawld in cark. . . ."

In 1552 an Act of Parliament[14] was passed limiting the number of coloured cloths to "scarlet, red, crimson, murray, pink, brown, black, green, yellow, orange, tawny, russet, marble, grey, sadnew colour, asemer, watchett, sheep's colour, lion colour, motley, or iron grey." In the reign of William and Mary, the list was extended by the following additions:—Violet, azure, friar's grey, crane, purple, and old medley.

In order to defend the city in 1558[13]§ the Crafts of Edinburgh each agreed to furnish a number of men among these the weavers sent 13 masters and 13 men, the walkers 28 masters and 15 men.

In 1564[13] the litsters and weavers were again accuse of fraudulent practices. "The Litsters, in Conjunctio with the Weavers and Wakers, having committed grea Frauds in their respective Occupations, to the grea Hurt, and almost Ruin of the Woolen Manufactures. New Regulations were, therefore, issued by the Tow Council of Edinburgh. "The Litsters of this Citi . . . voluntarily appeared before the said Council, and gave an undertaking to act in accordance wit the regulations,‖ an abstract of which follows:—"Th thay now nane of thame, in ony Tyme cuming, sall lit ony manner of Cullor of *Muster de Villois*, French Gray, or Russatis, with Brissell or Ursell, nor lit ony Blakis with Cuppruss, Gallis, Allerbarkis, or sicklike fals Cullors, bot the samyn to be littit with Mader, Alme, Glew, and sic trew Cullors as has bene, and is usit amongis Men of Honestie, Experience, and gude Concience of the said Craft, under the Pane of Five Pund for the first Falt, Ten Pund the next Falt, to be disponit to the common Workis; and, the third and last Falt, to be baneist the Toun and Fredome thairof for ever. And sa oft as sall happin ony of the saidis Littisteris or utheris of that Occupatioun, or taking that Craft upon thame, to spill in thair Defalt, the Claith or Woole gevin the thame to lit, to pay to the Awiner the uttermaist Availl and Pryce that the samyn wald gif, in cace it wer perfitelie, compleitlie and sufficientlie wroucht and littit, provyding the spilt Claith and Woll be gevin to the Littisteris Spillaris thairof, the uttermost Availl, as said is, beand payit."

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* 1684, Coun. Regist. vol. xxxi., f. 126.
† Acts Ja. V.

* By Richard Watts; printed in The Young Man's Looki Glass, in 1641. English Industries in the Middle Ages. Sa mann.
† II., 205.
‡ II., 125.
§ Counc. Reg. f. 132, 10th June.
‖ Counc. Reg., Vol. IV., f. 114.

The next paragraph deals with the stamping of dyed cloth:—"that thair be made ane Stamp, and the Tounis Arms thairupon, quhilks sall be given in keiping to ane honest, trew sworne Nichtboure, of Experience in making and colouring of Claith." The Stamper had to stamp each piece of cloth made in the burgh, and for his trouble he received "twa Pennies allanerlie" for each piece.

The "Stamp-keiper" had to be ready at all times to stamp the cloth, "and gif it happyns the said Stamp-keiper to stamp ony Maner of Claith, not sufficiently coucrit, to pay Five Pund for everie Falt. . . . and to be puneist in his Bodie at the Will and Plesoure of the Provost, Baillies and Counsale for the Tyme. And farder, That na Maner of Man no Woman within this Burgh, take upoune thame the Occupatioun of Litting bot sic as be Burgesses and Fremen and before their Admissioun, that they mak thair Assay of Colouris, and deliver the samyn to the Provost . . . of this Burgh, and thay to call in before thame the honest Nichtboures, with the said Oversear, and tak thair Jugement of the Wordyness of the said Assaygevar, and of the Justnes of the Coloure, under the Pane of baneishing of the Toun."

The law made in 1457[6*] "Lit to be cried up and used as before," and the "article for exporting and importing country lit," were remitted to a commission in 1567[6†] and in 1581[6‡].

On the 23rd September, 1569[2], when the guilds had to elect their new "Counsale for the Yeir to cum," we find that the occupation of the dyer was still considered a "rude" one, because "na cordineris nor littistaris, nor vtheris of sic rude occupatioun, aucht to be vpon the counsale."[§]

A curious complaint[1] was made at Holyrood House on the 13th of February, 1581, by Claude le Liernero, Fader Persone-Petir Bursier, Stevin Solge, merchandis of Pareis, Peter Thomas and other merchants:—"The personis abouewritten having laidnit at Burdeaux, in the moneth of Maii last wes, the nowmer of ane thowsand ane hundreth and foure scoir ballis of waid, . . . in the schippis callit Esperance of Oleron (and others) . . . to have bene transportit to the partis of Rowan in France, Antwerp and Middleburgh in Flandirs and Zeland, the said schippis were interceptit in the way be certane Scottis pyrattis . . . and brocht in be thame to the raid of Kirkcudbricht, quhair they sauld and disponit the saidis guidis, for the maist part, to the liegis of this realme . . . the said James Craig . . . was sent for recoverie of the said waid." He recovered however only "to the nowmer of thre hundreth and fiftie bollis waid."

The following regulations as regards apprentices were issued in Edinburgh in 1583:[13] "If any Man be an Prenteis heirefter, and not put in the said Buik, his Prenteiship sall be to him of nae Effect. Alswa, be reasone evrie Industrie is not of lyk Valour and Substance, it is declairit, what ilk Rank or Degrie of Prenteisses sall pay." It is here stated that there were fourteen Crafts, and among these "The Prenteis to an Wobster, Waker . . ." had to pay "at his Entrie, Ten Shillings, and for his Upsett, Fyftie Shillings."

In the year 1587 the "Act in favour of the craftismen flemygis was passed."[6*] "That is to say the said craftismen sall remane w^{t}in this realme for the space of fyve yeiris at the leist after the dait heirof and salbring within this realme the nowmer of XXX personis of wabsteris walkaris and sic vtheris as may wirk and pforme the said work as alsua ane litstair or mafor litting and pertitting of their said warkis and . . . Sall mak and pfite ye steikis and peeces of warkis according as the samin ar or hes bene maid in flanderis holland or Ingland kepand lenth breid and fynes conform to the rule."

In the same year an act was also passed for "regulation of Flemish wobsters, waulkers, and litsters and the appointment of an overseer of their work,"[6†] and in 1597[6‡] it was forbidden to bring any more craftsmen into the country for the working of wool.

The importation of English cloth was considered the cause of the unemployment of women, and in order to remedy this the Convention of Burghs prohibited in 1578 the import of such cloth[§]:—"Because the samyn is ane greit hurt to the realme, and is the occasion of mony vagabund wemen to pas ydill thairin for laik of woll, laubouring and making of clayth."

This prohibition was endorsed in 1597[12] in the following words:—"The same claith haveand onlie for the maist parte ane outwarde shaw, wantand the substance and strenth quhylk oftymes it appeiris to have."[∥]

in dyeing during the period extending from 1580 to 1618.

"The Inventair of the guidis and geir deliverit furth of the schip callit the Thomas of Dundee[8] (August 1591)" enumerates all the materials which the ship contained, and among these we find:—"ane barrell, with ane punsioun of mader, all weyand, with treis pokis and towis, ii^{c}lxxxxiiii stane Scottis wecht." Then follows a statement that many of the goods had been spoiled by water and were, therefore, sold by auction. The madder contained in the said inventory "being watt with sey watter, wes thocht to be in point of tinsaill, . . . the said provost, bailies, and council had caused Patrik Durhame, and William Newtoun, 'listaris,' burgesses of the said burgh, to value the same: who had declared upon their conscience that the same could be of no use for their occupation, and therefore they could not say what it was worth."

Another ship with a cargo of madder gave cause for the following complaint[1]:—"Anthony Briegers master of the ship 'The Great Jonas of Dantzig' complained about goods belonging to Ferdinand Grand Duke of Tuscany having been taken from his ship when it was driven by stress of weather into the harbour of Gritingue Viage in Shetland in the spring of 1591; the ship was boarded by Jarmirus Unfreii, governor of the island and others and they demanded in the king's name a surrender of all the 'papistical' goods."

From a detailed account[12] given by Fynes Moryson, a student of Peterhouse, in 1598, it is seen that the quality of cloth made in Scotland at the time was poor, because he informs us that "the Eastern Scots carry into France coarse cloathes both linnen and woollen, which be narrow and shrinkle in the wetting."

The Shipping List of Dundee[17] provides another source from which valuable information may be obtained as regards the imports into Scotland of materials employed

In order to present the matter in a concise form, in case each only the date of the arrival of the ship and that special part of the cargo which is germain to our subject, will be given.

"Sexto Decembris Anno D^{ni} 1580 . . . fra flanders ane ball of mader."

"Nono die mensis Januarij 1580 . . . fra burdeaux conteanand fyftie aucht twnnis . . . vad"

"Undecimo Jenuarij 1580 . . . fra burdeaux . . . thrie scoir and thrie twnnis and ane half . . . waid."

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[*] C. 9, II. 49.
[†] Jacobi VI., c. 25, III., 30b.
[‡] C. 9, III., 214b.
[§] C.R., Vol. IV., fol. 246. Extracts C.R., Vol. III., p. 263.

[*] Jacobi VI.
[†] C. 119, III. 507.
[‡] C. 21, IV. 119, 135.
[§] Conv. Rec. I., 76 and II., 202, 203.
[∥] Acts IV., 119.

In January, February and March of 1583 "maldir, malder, mader, vaid, and waid" are again among the goods imported.

The cargo of a ship coming from "Danskene" in August 1588 contained dyestuffs and dyed linen:— "v lastis lit . . . xvj lastis lit lynt . . . xv lastis lit for lynt."

In January 1588 a large quantity of waid and a small quantity of "maydr" and in February a special kind of woad under the name of "sma waid" are imported whilst in March and then up to December 1589 we find numerous entries of "gaid."

The second volume of the Shipping List begins in March, 1612 and imports of woad under the name of "wayid" are found frequently up to 1614.

The cargo of a ship which arrived in May, 1614, is of special interest because it contains alum, Brazil wood, starch, madder and soap:—"tua bailes of mader . . . thrie twne of alme . . . tua hundreth wecht brissell . . . tua last of seip . . . ane trie of stiffeng."

An old account book in which the entries extend over the period between 1587 and 1630 "The Compt Buik of David Wedderburne Merchant of Dundee,"[17] is another source of valuable information. The following extracts have been taken from it. On one occasion Wedderburne sent cloth to Rouen to be dyed "fyn scarlit to be my lassis weylecottiz." In February, 1591, a commission was given to Peter Man to sell one last of herring and to expend the money received "on lynt hattis with veluit about the browis on 2 stikis fusteonis of trym collouris and the remanent on stainings." On May 7th, 1610, "Send with Alexander Broun teylzeour to Londoun xij ellis narrow blew clayth Item 7 ellis bred blew clayth thikit to be littit violat And hes send with him 19 spynellis of yarn lyning Ilk spynell cost me 28s. to sell it and to pay the lit." An account for bleaching of linen is entered under "Primo June 94 Send with William Ker of Rossy four /do/small lyning to bleitsche. Item /2/ Tuilden to bleitsche receavit. . . . Item xv ellis smal lyning to bleitsche All markit with netteis mark. Item 24 elnis eln bred smal lyning markit all blak silk with red silk to bleitsche except ane with red," and on 12th January, 1614, "Send with Alison to Bleitsche in Petkerro Item xxij ells lyning to bleitsche payit Issobell Cokburn 3 lib. thair for . . . Item the sarkis yit bleitsching receavit and payit 8s. therfor."

As regards prices paid for dyeing wool we find the following entries:—"xv August 91 Receavit . . . Item x s. Item v lib. Item vj lib. xvj s. ij d. for woll litting is 7^{xx} 18 lib. ij d. Item receavit 30 d. restis xx lib and I am awin yow for half a stane of woll litting quhilk I have payit . . ." "3 October 1591 All the former obligatione payit and all thingis comptit betwix us allowit and payit Except xx lib quhilk the said Henry is awin me and I awin him for the litting of half a stane blew woll litting."

The name of a dyer is mentioned under "xxv February 96. All comptis betwix David Melvill litster and me is comptit and all payit and I gef him a pynt of wyn."

Another reference to a dyer and dyeing is found under December 7, 96, when Wedderburne gave "James Lindsay litster 5lib. . . . David Melvill a promes to lit for wryttis at Witsonday nixt. . . . David Melvill lit conforme to his present and lvj lib." From the foregoing we may take it that Wedderburne not only sent the cloth to be dyed but he also supplied Melvill the dyer with the necessary dyestuffs.

Scotch linen cloth was exported to Spain on 3rd of October. The quantity was however small, amounting to about 113 "ellis" usually "eln bred," the prices ranging from 7s. to 24s. "the eln." In addition 42 yards of "half lyning" at from 5s. to 6s. 8d. per yard. The latter material probably consisted of linen and wool or hemp.

Although the accounts prove beyond doubt that some of the cloth was dyed in Scotland, special colours, for the dyeing of which high prices had to be paid, were sent to France. Thus on the 21st December, 1613, were sent "with Robert Auchinlek to Deip or Rwen 4 ellis 6 quarter bred blew clayth to be Littit of a said and grave cullour the exemple I pressit it on his commissione and hes gifin him xij s stirling to pay thairfor."

It seems rather curious that the pieces sent had already been dyed blue and one may, therefore, presume that the Scottish dyer was unable to obtain the particular shade required.

On August 20th, 1590, another quantity of linen cloth, both bleached and unbleached, was sent abroad and instructions were given to buy for half the money received for it "gude vaid and to be send hame on the Falcon Or utherwayis gif be cum hame the hie way Haill on vaid of the best sort $4^{xx}7$ lib. 12s."

Cloth to be dyed scarlet was sent to London in 1621, "with James Annand in Dauid Corfittis crear to London 4 ellis a half sewin quarter bred quhit clayth to littit to be my wyf and Magdalen Weyllcottis skarlett."

A few of the many entries of prices of woollen and linen cloths which Wedderburne bought in fairly large quantities and which he retailed in Scotland will show the cost of these articles:—bred clayth . . . 9s. 6d. the eln; narrow clayth . . . 4s. 3d. the eln; small lyning . . . 6s. the eln.

The Trades House of Glasgow, established in 1605, consisted of 56 members, and was composed of the deacon-convener and collector, with deputies from each of the fourteen incorporated trades; the dyers at that time being still joined to the bonnet-makers. Whilst the weavers had the right to send four representatives, the Bonnet-makers and dyers were only allowed to send two.[18]

In "The Letter of Gildry" given "At the Burgh of Glasgow, the 6th Feb. 1605 years" it is stated in Clause 24 that "it shall not be leasome to a single burgess, who enters hereafter, to be burgess, and becomes not a gild-brother, to tapp any silk, or silk-work, . . . no lawns or cambricks, nor stuffs above twenty shillings per ell. . . . not to tapp hemp . . . waid, grain, indego, nor any other kind of litt."[18]

In the same year King James VI. threatened to take the control of the Flemish weavers out of the hands of the burghs. The burghs preferred to live "cheifly by thair negotiatioun," *i.e.* by trading, and they went so far as to assert that they had suffered loss by the manufacture of cloth.[12]

The following entry under "6 Aprilie anno Domini 1610" in the "Liber Secrety Sigeley,"[3] refers to the import of indigo, azure, starch and soap, and in it encouragement is given to the manufacture of these articles in Scotland. "Ane letter maid making mention that oure souvrane lord considderung the gret sommes of money that from tyme to tyme are wasted bestowed upon Indigo and Azure to mix or stiffing and upon soap for washing of cloathis within his highness kingdome of Scotland which being brocht from forane nations are sold to the Lieges at gret rates and pryces albeit their mecht be als good (or rather better) made within the same and sold cheaper. Therefore his majesty having due regard to the common wealth of the said realm proffitt and comodity of the Lieges within the same ordaineth a letter . . . to Johno Nasmyth Chyrurgino to his majesty, granting to him by himself his servants and others in his name full liberty and privilege to make and cause to be made the said Indigo and azure, hard and soft and soaps for washing of cloaths of such colours and quantities as they shall hold fit and expedient and to sell the same at there pleasure in time coming during the whole space years and terms of 21 years next after the date hereof with power to the said Johno Nasmyth and his foresaids during the said space in case they shall happen to make more of the said Indigo, Azure and Soap than may conveniently serve his highness lieges to carry and transport the same out of the kingdom . . . during the space of all making of the said soap, azure and indigo hard or soft of any colour." In the manuscript the "hard and soft" refers to indigo, whilst it would naturally suggest itself as referring to the manufacture of soap.

Dyed English cloth was frequently smuggled into the country. On March 15th, 1609, the searchers found anc seized " within a chalmer of the dwelling house of Stewart . . . threttenen wobis of Inglishe cloath of divers collouris."[1]

Among " the goods broeht in within the burgh of Ayr betwix 1617 and 1621 "[2] we find " Imported from Flanderis in the ' Flower da lice ' of Ayr . . . from Campveir in the ' Gift of God ' . . . lit (new lit and orchard lit)," whilst in the Customs on imports on the south side of the Forth, " brissel," alum and " blue medoun veyade " are mentioned.

Innes[2] informs us that Customs tables, such as the Assisa de Tolloneis and the Chapters de Custuma Portuum* existed in the twelfth century. A table which however is more complete was decided upon in a Convention of Estates held at Dundee in May 1597. The prices given in these tables are of secondary value only, but they give us complete information as regards the articles of commerce in that time. The tables are entitled " Inuarde Custumes The Waluatioun and prices of mechandries broeht within this realme Quhairof xij d. for ilk Pund of the price thairof suld be taken wp in name of custume. 22. Maij 1597." Among tho articles enumerated we find :—

Brissell the j^{c} wecht thairof	xv li.
Claith serg and steming the eln thairof	v li.
Stiffine callit Amedoue the stane thairof ..	xl s.

A much more compelete list of articles of import and export is however given in the Tariff or Table of Rates of Custom, and Valuation of Merchandises, settled by Royal Warrant, in 1612.[2] Among the exports are found articles such as Brazil wood. From this we must conclude that many of the export duties are rather transit dues and not common customs of export. Some idea of the number of entries may be formed when it is stated that 220 different medicinal and chemical substances, among which " Mummia " is naturally not absent, are mentioned The following is a list of a few of the articles of interest :— The customs to be paid are fixed at " tuelf pennys for every pundis worth," but as regards the valuation of the different articles it is difficult to say definitely as to whether it is in pounds Scots or Sterling.

IMPORTS.

Allome	rough the hundreth weght	viii li.
	Plume the pound weght	viii s.
	Anneill of Barbarie for litsteris the pound weght	xviii s.
Copperas	grene the hundreth weght	iii li.
	white the pound weght	iiii s.
	arthamus seid the pound weght	viii s.
	Flory the pound weght	xxiiii s.
	Gum lack the pound weght	xii s.
	Mirabolanes the poond weght	xij s.
	Mirabolanes condited the pound weght	xx s.
	Mummia the pound weght	viij s.
	unders reid alias stock the i^{c} weght	xlviii li.
	Turmerick the pound weght	xxiiii s.
	Vitriolum Romanum the pound weght	vi s.
	akes the hundreth weght	xxiv s.
Grane	powder the pound weght	iiii li.
	of Civile in berreis and Grane of Portugall or Rota the pound weght	xl s.
	ndicoe of Torkie and of the West Indeis or Ritch Indicoe the pound weght	iii li.
	yme for litsters the barrell	xl s.
	itt callit orchard litt the barrell	xii li.
	itmus for litsters the hundreth weght	vi li.
	ader the hundreth weght	xii li.
	rchall for painteris the hundreth weght	xii li.
aip	of the low cuntreyis the barrell	xiii li. vi s. viii d.
	of Castile or Venice the hundreth weght	xx li.
	hears for walkeris the pair	iii li.
	hoomak or blacking the hundreth weght	viii li.
	malts or blew stiffing the pound weght	iiii s.
	alkeris earth the hundreth weght	xl s.
oad lled	Iland grene woad or stra wod the tun contening tuentie hundreth weght	l^{c}xx
oad	Tholouse woad the pok	xxx li.
lled	English woad the hundreth weght	vi li.
	oadnettis for litsteris the hundreth weght	vi li.
oode	Brissile or Fernando buckwode the hundreth weght	xxiiii li.
lled	Fustick or blew Brissell the hundreth weght	vi li.

Of the great variety of cloths only a few can be mentioned here :—

	Bottanos or pecels of linning litted blew the peice	xl s.
Buckram	of Germany . . . the peice	iii li.
	of Frenche making the dozen peces	xviii li.
	Calico copboord claithis the peice	xl s.
	Claith of the seall, searge of Florens, claith of John Nicoll and counter tute searge of Florens the eln	v li.
Clothe	skarlett cloth the eln	x li.
of	Broad English claith the eln	vi li.
woll	Deushire carsages the peice	xxiiii li.
called	Peonystone freise the eln	xl s.
	Cottoun freise the eln	xx s.
	Kelt callit Kendal Kelt the eln	xiiis. iiii d.

Among " Fusteans " are found :—

Amsterdame Hollaod or Dutch 15 ells	xvi li.
Barremillanes Milan Culen and weazell the peice	xvi li.
Jeanes the peice	lx li.
Naples fusteanes tripe or velure plane 15 ells	xx li.
Groganes called Lilles worsett and moccadoes the narrow peice	xli li.

Other kinds came from England and from Flanders.

In addition to the above, thirty-nine different kinds of linen cloth are rated, such as :—

Canves 100 elnis	l^{c}xx
Spruce xxviii elnis	vi li.
Callicoe fyne the peice	vi li.
Cambrick 13 ells	xl li.
Lawnes 12 ells	xl li.
Damask, Boord clothing of Holland the eln	iiii li., etc.

" Claith of the seal " no doubt denotes that the cloth had been dyed in fast colours and we find only in the case of " Veluotts " made of silk another reference to fast and loose colours.

" Veluotts "—of all collouris oute of grane the elln	x li.
Right crymosine or purple in grayne the elne	xvi li.
Figored of all collouris out of grayne the elne	x li.
Figored ryght crymosin or purple in grayne the eln	xvi li.
Cloth called wollen cloth and plading of Scottish making the eln	xx s.

Compared with the list of imports, that of the exports is very small. Under cloth there is only one entry :—

Wollen hois maid in Leith wynd and other places of this kingdom 1^{c}	iii li.
Worset hois the hundreth	l^{c} lxxx li.
Sayes of Scottish making the peice	iiii li.
Woll caryed out of the cuntrey vpoun licence the stane weght	vi li. xiii s. iiiid.
Yarne called Scottis linning yaroe transportit vpoun liceoce the hundreth weght	lxxx li.

In 1617[1] Johnne Hammiltoun, " littistair in the Cowgait," was convicted for shooting. James Hereot, " litster," burgess of Edinburgh, is mentioned in connection with a suit against Sir James Home of Broxmouth, knight, who owed the dyer some money; and Patrik Broun, assisted by Johnne Wilsoun, littistair in Haddingtoun, rescued a rebel and " conveyit him in at ane chalmer and oute at ane back dure." In 1620, Alexander Findlater, " littister," was convicted for assault. These facts are mentioned in order to show that all the names of these dyers are of Scottish origin, in contradistinction to the fact that at a similar period in England most of the names of dyers are of foreign origin.

Charles I. in 1619 granted privileges to Nathaniel Udwart for a soap manufactory at Leith*, and in 1621[1] (4th July, Edinburgh) at a Meeting of the Committee of Council it is stated with regard to the soap made at Leith " anent the soape maid be Mr. Nathanaell Uddart, and having fund his greene soape to be as goode and sufficient as the soape of that kynd broght frome Flanderis, . . . the baillis of Edinburgh " shall try the soap twice or three times a year. Black soap being evidently employed at the time in bleach works, Udwart is advised to manufacture this also :—" Anhairas it hes bene objectit aganis the restrante of importatioun of foreyne soape that in some pairtis of the West Cuntrey, especiallie abonte Loichquhinyeaugh [Lochwinnock], the blaitcheing of cloathe is commonelie maid with blak soape."

Bremner[14] informs us that the earliest indication of the manufacture of wool in Galashiels occurs in a charter, dated 1622. In it we find "waulkmills" mentioned. The population numbered about 400, the bulk of the people were "mailin' men" of whom probably enough enjoined to their labour on their "crofts" the arts of dyeing and weaving the produce of the cottagers' spinning wheel.

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* Acta Parl. Scot., Vol. I., and Preface.

* The Domestic Annals of Scotland, R. Chalmers, Vol. I, p. 510.

I think it is safe to presume that the question of water pollution by dye-house effluents received serious consideration for the first time in Aberdeen in June 1632[1]*. "Anent the supplication presentit to the Lords of Secreit Counsell be the provest, bailleis and counsell of the burgh of Aberdein makand mentioun, that where they having takin to thair consideratioun the great necessittie wherein thair toun stood throw want of pure and cleane water and how that the water wherewith thair toun wes served come from ane little loche at the side of thair toun whilk is so filthie defyled and corrupted not onelie by gutters daylie running in the loches but alsua by the litsters who washe all thair cloathes in the said loche . . ."

The Burgh Records of Peebles (272) inform us that in 1633 the Magistrates of Peebles, anticipating the policy of the trustees of the linen manufacture nearly a century later, resolved to have spinning regularly taught to children of burgesses by a qualified mistress,[16] and in 1641[6]† an Act set forth :—"In every shire a school to be erected, to which each Parish shall send one or more boys to be apprenticed for seven years to learn cloth making." These may be considered as the first attempts to establish technical schools for spinning and weaving in Scotland.

The shrinking of linen cloth in bleaching caused the passing of an Act of Parliament in 1641[6] (Caroli I.). "Lining cloth is become ane of the pryme commodities of this kingdome whereby many people are put to worke and money is brought within the same Wich pairtly throughe the deceet vsed by the bleicheres in lymeing therof and pairtly by the uncertanties of the breadth Is lyklie to come in contempt abroade to the great prejudice of this kingdome . . . no makeres of Lining cloath nor no otheres whatsoever present to merket . . . make or sell any lining cloath of the pryce of ten shillingis the elne or above of les breadeth than ane elne."

The following Acts of Parliament indicate the strong desire on the part of the Government of Scotland to establish and to foster the dyeing industry.

1641.[4] (c. 100. v. 412) Litsters wares may be imported custom free for fifteen years by those who erect manufactories.

1641.[4] (c. 272. VII. 252) 3 oz. of bullion silver xiid. fyne to be brought to the mint for each cwt. of indigo exported.

1661[4]. (c. 272. VII. 253) 2 oz. of bullion to be brought to the mint for each cwt. of new lit exported, 2 oz. of bullion to be brought to the mint for each cwt. of madder exported and 2 oz. for each 3 cwt. of fat madder exported.

1663[6]. (c. 52. VII. 485) Individuals or societies establishing manufactories are empowered to seize beggars, vagabonds and idle persons, and employ them in their works.

1669[6] (VII. 560 a) Every thousand weight of madder imported to be liable in 5 oz. bullion as custom.

In 1672[4] (c. 5. VIII. 63 b) "the wholesale trade and the importation of wald" and other materials for dyeing was confined to the royal burghs, and in the same year[6] (VIII. App. 23 b.) James Lockhart of Cleghorne petitioned for liberty to establish a manufactory of alum.

A recommendation to the Magistrates of Edinburgh, to incorporate the dyers with some other trade, or else to make them an incorporation by themselves, was made in 1681[4]‡, and issued as "Act of Recommendation in favor of the Litsters of Edinburgh," as follows :—"a Petition by William Phin and John Smibert for themselves and in name and behalf of the haill Litsters freemen Burgesses within the Burgh of Edinburgh . . . petitioners having been at a very great and considerable expense in setting up of work-houses ffats presses and other requisite for the due and perfect exercise of their trade of Litting, and having attained to that perfection in their Trade that all Colours asweill plaine as ingrained are dyed, and the Cloath and Stuffs pressed and stamped asweill by them as they are or can be either in England ffrance or Holland Nevertheless the Petitioners are exceedingly discouraged and prejudged by severall ignorant persons, who without due knowledge or experience of the said Trade, take upon them to keep privat Litthouses And who doe lykways abuse the Leiges by insufficient work and Collours which doe immediately cast and staine." They pray to either include them "with some Incorporations or Deaconries of Trade or Grant them privilege to meet amongst themselves."

In "The Account Book of Sir John Foulis of Ravelston," which covers the period from 1671 to 1707*, reference is made to fulling mills under May 5, 1703 :—"receaved of the walkers of ye wester milne ther 1701 yeirs rent 100$^{\text{mks}}$, by Jannie Gray ;" further under June 13, 1705 :—"I have cleared w$^{\text{t}}$ deacon Crysticson for the 3 yeirs tack-dewtie of the westerwakmilne," and finally under 1 July, 1706 :—"walkers of the east wakmilne, 3 yeirs rent for s$^{\text{d}}$ milne to whits."

In 1641 an Act of Parliament[6] was passed to encourage the production of fine cloth† and factories were started at Bonnington, Ayr and New Mills near Haddington. None of these undertakings seems to have flourished, because skilled labour was difficult to obtain. In 1681, the Duke of York, afterwards James II., visited Scotland, and in order to encourage the Scottish industries the Privy Council[6]‡ prohibited the importation and wearing of foreign manufactured goods. The Duke of York favoured a plan of establishing a manufactury for the production of fine cloth, and he "invited and encouraged" the undertakers, some of whom were Englishmen of substance.[16]

This resulted in the foundation of the "Scottish Cloth Manufactory," at New Mills, on May 10th, 1681. The chief promoters of the Company were Robert Blackwood, an Edinburgh merchant who was afterwards Master of the Merchant Company, and Sir James Stanfield. The latter had acquired property near Haddington, then known as Newmills (now Amisfield), which formerl belonged to the local monastery. He leased to th Company his fulling mills, office-houses, etc. Som valuable information as regards cost of production materials used and the management of the Compan has been obtained from documents found amongst paper relating to the estate of Sir James Stanfield, and furth from the minutes of the "managers," the first part which extends from 1681 to 1691, the second part fro 1701 to June, 1703. These have been edited by W. Scott for the Scottish History Society, from which public tion the following abstracts have been taken.[16]

The Company was managed by five officials call "managers," corresponding to modern directors, t chairman was known as the "praeses" and the manag of the works as "master." The people of Scotla soon expressed doubt as regards the wisdom of prohibiti the import of manufactured articles, especially when it w found that all the skilled labour had to be imported higher wages than those ruling in England. Against t it was urged that in order to sell home-made broad cl eventually as cheaply as that made abroad, patrio Scotsmen should be content with a cloth "a little d at first," owing to the great cost of "importing looms a procuring foreign workmen, besides the many losses a inconveniences attending beginners."

Whilst in October, 1681, only two looms were in ope tion at New Mills, the number had increased to 27 1683, and the manufacture of fine cloth had by t time been firmly established. Military uniforms w then beginning to come into vogue in Scotland. reason for this was very quaintly given in the follow words :—"In order to distinguish sojers from other skulking and vagrant persons."*

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* Fol. 184, a and b.
† V. 657, b.
‡ C. 144, VIII., 365.

* Rev. A. W. Cornelius, Scottish History Society, 1894.
† Vol. V., p. 497.
‡ Acts of the Privy Council, General Register House, E burgh ; Acts of Parliament, Vol. VIII., p. 348 ; Acts Encouraging Trade and Manufactures.

The Company made every effort to secure the Government contracts, but the price demanded was much higher than had to be paid for English cloth; the Government, therefore, gave special licences for the importation of cloth from England. Later on, the Company however had practically a monopoly of supplying cloth for the Army. In 1704 the export of wool from Scotland was again permitted, and when, after the *Union*, cloth was again freely imported into Scotland, some of the early manufacturers turned their attention to the production of inferior cloth. The New Mills Company however does not seem to have adapted itself to the changed circumstances, and it was, therefore, wound up in 1713.

In "Documents relating to the Foundation of the Company" we find a particular account of the workpeople and necessary servants employed in a cloath Manufactory to keep 20 broad looms at work :—

	Per diem. Men.	lib. 2 per week is	Scotts lib. s. d.
For the dye house and mylne	8 : 0		16 : 0 : 0
To a large new copper and a smaller for dyeing the wooll estimat			500 : 0 : 0
To ane additional tenter for watring and dyeing the cloath			80 : 0 : 0
Charges computed for oyll dying stuff and Allicant soap 9 llb. weight on each part cloath 332 peeces is			2988 : 0 : 0

In the minutes (5) it is stated that "George Home being ordered to look for a copper for dyeing, reports that the copper he was ordered to inspect ryses in the bottome, and for deying it must be other wayes." This being evidently unsatisfactory, Samuell McCleland and Hugh Blair are appointed "to try whatt a copper kettle will stand the pound weight in Holland, and to enquire here also how soon the two kettles could be made." But the price must have been too high, because (11) "as to the kettle its found considering the charges that it is best to cause make itt heire, butt yett the said person to try againe, and however, to delay the makeing till the master come." The order for making it is definitely given on July 15th, 1681, (12) "Immediately to cause be made ready one copper of sixty gallon and one of thirty gallon and send them out. Two dying fatts, each of them to be six foot high quhere of one to be made with one lead bottom quhich a plummer is to make befor itt be bound with timber, the other to be made by the wright att New Mills. (13) For makeing these fatts is to be provided 10 wainscot of 10 foot in lenth; its to be considered thatt the fatts are to be 3 inches thick. (14) Ane pomp of 11 foot long to be provided att Lieth, and sent to New-Millns, for conveying water to the copers and fatts."

On August 15th, 1681, instructions were given that "the dyhouse must be presently finished, that if the Lady and John Angly will not consent to give us in the brew house in place of the inlardgement conditioned then that presently the inlargeing of itt to the 28 foot in lenth to be sett about, and if John Angly want money, that money be advanced on his recept thatt lights be made in itt."

That dyeing must have been considered a fairly simple operation by the directors is shown in a minute of August 24th, that "it is to be considered what way blacks and reds may be dyed to save the charge of mentaineing a dyer."

The work produced by the dyer having evidently been of an unsatisfactory nature, it was "ordered that directions be given to the master that care be taken that the next reds be a better brighter color."

John Angly was written to on October 13, "to flagg the dyehouser" and instructions were given "to try whatt a blew fatt can be made for 3½ inches thick in the staffes, 5½ foot deep, 5 foot brood in the bottom, 4 foot brod in the top."

On the 26th we first find mention of the dyer. "Agreed with Robertt Young to goe out to New-Millns and make the blew fatt, we are to furnish all timber and he is to have dayes wages as John Gibson dyer payes him and he is make her sufficient work."

The first entry as regards materials used in dyeing is found under November 23 :—"it is ordered Mr. Robert Blackwood with the first write to Gawin Lowrie anent the shoe-mack," an order being given at the same time that "the master dey all Mr. Blackwoods stockens at 2s. sterling." On December 30, instructions were given "to write to London or Holland for oyle, tessels, argell, mather and shoe mack," and on January 4, 1682, "to London for 200 lb. weight famiconnidigo . . . and 100 more of Argall from Holland." At a later date we find an order for Jamaica Indigo, and presumably "famiconnidigo" means the same.

On November 15th, there is an entry *re* some cloth of "Robert Blackwood haveing had five ells dyed at New-Millns quhich he complains of as being damnified in the deying . . . they ordaine him get back his cloth without paying any thing for dyeing."

The dyer had evidently not been successful in dyeing silk in colours, because on December 13, 1682, it was "ordered thatt the next parcell of silk be all dyed att London except what is for black quhich is alsoe to be boyled off there as well as can be."

Amongst other materials, the following are ordered for the dyehouse on February 27, 1683 :—"500 weight of fastick, one hogshead of galls, 100 of compeach wood to be bought here 200 weight matter."

That both loose wool and pieces were dyed at the time is shown in another minute of the same date :—"Mr. Spurrway present is advysed to forbear mixing ony stone grayes for ane months tyme," and he is also "ordered to put in hand as much Spanish wool as be six peeces of cloath for black or scarlett."

The names of two other dyers are mentioned in the minutes of March 29th, 1683, in which some of the directors are asked "to agree with James Lamb anent the dyeing the scarlet cloth" and "to give Prescook dyer two dozen of silk stockens to dye black and are content to give ten pence sterling per pair for the dyeing them."

The price charged for dyeing scarlet was about 4s. 2d. per pound (325) "to pay James Lamb fyfety shilling Scotts for each pound weight deying scarlet cloath."

The minutes of 18th July, 1683, contain some interesting information as regards "ane accompt of the expense and pryce of the severall cloath mad at the manufactorie." According to this, four kinds of cloth were made, "a super fain cloath all Spanish, . . . the secund sort Spanish half Inglish, . . . the threed all Inglish, . . . the fourt sort of common mixtours and whyt." These cloths differed from each other chiefly with regard to the kind of wool used, and it will, therefore, be sufficient to give one of these accounts, the values being in £ s. d. sterling.

"A super fain cloath all Spanish costs as followeth :—

70lbs. fult Spanish wooll cost 26d. per pundis	7	11	8
For scuring and daying at 3d. per lb.	0	17	6
For spinning rekoning 67 lb. at 10d. per lb.	2	15	10
For piking scribbling and oyll 4d. per pund	1	6	3
For warping boboning 2s. 6d. for listing 1s. 6d.	0	4	0
For weveing 46 ell row at 12d. per ell	2	6	0
For burlling 12s. for woking and sop 6s. for dressing and finnishing	2	18	0
For wast and cords and wheills	0	03	0
For proportion of selleries	1	05	1
	19	07	7

This pis will hold at leest 27 ell and will stand 14s. 4d. per ell."

The charges for dyeing and scouring are certainly very low. In this case probably the loose wool was dyed and used in mixtures with white for greys or other colours.

Another charge for dyeing piece goods is also remarkably low (363): "to deliver to Galloway whyts Carthcart, dayer at Leith, to be dayed and dressed at 3s. 10d. Scots per ell."

The managers discovered that the cost of dyeing had been calculated too low, because on the 13th of May, 1684, it is "ordered that heirafter the mester deliver noe dying stuffs to the dyer for cloath untill it be first entered in the book, and that Mr. Marr may not forgett that at every time a not be given him therof shewing it is for dying cloath that we may know what the dyeing of every ell of cloath stands us . . . and what is given out for dying of wooll James Marr may have a tickit therof that the concerned may know how the dying stuff is consumed."

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* Rec. Privy Counc., quoted by Chambers, Domestic Annals of Scotland, Vol. II. p. 419.

Both silk and worsted stockings were made at New Mills, and from two entries (465 and 467) some information is obtained as regards the different shades which had to be dyed. "Take soe much of each of the light collours of silk as be three or four pairs of womans stockins and of such collers as are very currant and good as grein masarein, blew, hair collour, gold and chirie collour ane dozen of each sort" and "orders all maner of collours of worset to be dyed presently as good reids, gold, hair, grein, buff and blew and what other collours shall be thought fit," and further "that white worsted may be prepared for working whyte worsted stockens quhich is to be dyed black."

The first information regarding prices paid for dyeing materials is found in minute 482 of 4th June, 1684 :—

1000 lb. crop mather	£30
300 lb. argall about	£09
200 lb. potasses about	£6
2 hilds of coperas about 40 stivers	£4
30 lb. cusheneill about 26s. sterling the lb.	£39
200 lb. fussick	£00 16s.
200 lb. fanandybuack	

The last item I suppose means Pernambuco wood, the price of which is however not given.

In minute 505 instructions are given to induce a dyer at Kinross to enter the services of the Company :—"That Joseph Young be desired to speak with the dyer at Kinross to try his humor, character, pairts, knowledg, sobriety, how he is imployed if he would remove, and for what."

On 16th July, 1684, we find the name of another dyer who had got into trouble concerning the price and results produced :—"Haveing considered Mr. Cathcart accomptt for dyeing and finds that the charges 4d. per ell for Galloways when it is alledged ther was but 3s. 10d. offered yet finding they are well done they are content to allow him the said four shillings Scotts (4d. sterling) provyding he doe all the rest he is now doeing to content and for the scarlet cloath he soyled in the dyeing apoints to give hime two ells of it to make a tryall for recovery of it and if he doe it to pay him as Lamb was payed, and if he doe it not, to pay hime his dye stuffs provydeing they do not exceed the half of the soume he charged in his accompt quhich is sixty-one$^{\text{lb.}}$ 10s. Scots."

In minute 523 it is stated that the dyer at Kinross had been willing to change his position :—"that Joseph Young write to the dyer at Kinross to come south that we may conclude with him," and in 536 "he writt to John Home the covenants with John Bairns the dyer."

Although large quantities of soap were at the time imported into Scotland, the New Mills works seems to have made some of the soap required, because in minute 556 it is stated "that Perie the sope boyler and Richard Coln the drawer be dealt with to take prentices."

The following delivery of dyestuffs was made on the 29th of April, 1685 :—"ordered Mr. Spurroway and James Marr to deliver to David Maxwell the following dye stuffs, allum, pottasshes, argall, coperas, gall, crop-mather, mull-mather, shoe-make, tarmanick, logwood, wead what of them they can spare . . . and this day considering the loss, trouble, and time is spent in weighing out to David Maxwell the dyeing stuffs in small by the mester and Mr. Marr therfor orders as is above written and that ane abliedgment be given to David Maxwell to take back what he leaves of the said dyeing stuffs at the expireing of his contrack being not within twenty pounds weight, and that notwithstanding of receiveing them he shall have paymentt of the one half of what he dyes and the other to go towards the payment of the dyeing stuffs."

The entry made on 5th September, 1685, is of special interest, because Indigo is definitely mentioned for the first time :—"Orders the writteing for . . . five hundred weight of logwood, ane hogshead of coperas . . . eight hundred weight of shoe-make, to writt to Holland for . . . fivetein pound of aqua fortis . . . and for the price of cusheneill and barbatas and Jameca indigo."

On the 3rd March, 1687, the prices to be paid for dyeing wool were arranged ; David Maxwell had to be paid "for mains two pence per pound ; for mixtures of all collours (in green only excepted) three pence per pound, for woaded blacks three pence per lb. and for ingreen collours twenty pence per pound." These prices must have been in pence sterling, and "ingreen" no doubt has reference to ingrain.

On the same day an order was placed for "makeing ane wadd fatt about fifty gallones."

The minutes of May 12th, 1687, inform us that Robert Debnam, junior, was to sort and also to dye all the wool which his father required, "and for the well dying therof he is to have as followeth viz. :—

For maines 2s. 6d. per score	Trone pound of dyed wooll.
For mixtures 3d. per pound	
For waded black not with indigo but wade 3d. per lb.	
For ingrained collours 18d. per pound	

"These are to be per pound so dyed as to hold in the milne, and if they fade he is to be brought upon rebate."

The dyeing of blacks must have given trouble, on account of the Indigo- or Woad-bottom not having been dyed deep enough, because Maxwell is ordered "anent fyne blacks viz. :—to make the best stall as deep ane blue as is made in England for the best blacks."

Later on it is ordered that Maxwell is to be also paid a better price for these blacks than had been arranged.

On the 21st of June, 1687, the manufacture of "whyte light cloaths" was discontinued, and orders were given for the "dying of whyte searge that lying at Newmilns a scarlet."

It was agreed on the 2nd May, 1688, that Maxwell be paid "fourteen pens per ell for quhich he oblidges himself to dye the best and highest stall of England," or the "fyne blacks," and that he should provide his own materials required for dyeing.

Besides Maxwell, there were however at least two other dyers employed by the firm (minute 1111) :—"Orders that what dye stuffs are to be written for heirafter that they be bowght at Holland for six months time and at London for nyne monthes tyme and what dye stuffs are upon Mr. Maxwaal's accompt be keeped distinctt from the rest of the dye stuffs that are for Mr. Spurways and Debnam's use."

The dyestuffs were evidently supplied by William Blackwood, because on 4th August, 1688, he presented an account for "one hundred pound indigo and fifty pound cousheneill."

In the minutes of 22nd January, 1701, mention is made of weld :—"To desyre David Foullis to wryt to his father to send noe fullers earth and to hasten the strae uald."

The dyers do not seem to have been over anxious to take anybody into their confidence or to accept apprentices, for on April 8th, 1701, the directors deputed two of their number to go to the works and "to treat and speake with the master of the work to prevaill with him to take apprentices to learne his art of dying."

Some information as regards dyeing and dyestuffs used in Kirkcudbright may be gathered from Chalmers[9][*]. "In Galloway they must always have manufactured the wool of their flocks into garments. At the end of the 17th century, they even sold their surplus fabrics of wool to their less industrious neighbours." This is also borne out by Symson who says that in 1684, the country people manufactured much more woollen cloth than they wanted for their own use, and that they sold the surplus at the fairs of Wigton and other parts of the country, to those who could not supply themselves.[†] "The woollen cloth was manufactured from the raw material in its natural hue. The cloth for the men's coats was sometimes made from a mixture of white and black wool, which gave the fabric a very mottled appearance." (Stat. Acc., ix. p. 325.)

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[*] V. 295.

[†] MS. Account.

Symson further informs us that "in 1684 the people gathered an excrescence which grew on the craigs in the parish of Minigaff, and which they formed into balls that they used for dyeing a purple colour; this they called *corklit*. They gathered another excrescence from the roots of trees, which they called *woodraw*, a kind of forg with a broad leaf; and this they used for dying a kind of orange or *philamort*."

The Acts of Parliament, 1685[4]*, contain a "Ratification of the seal of cause . . . in favour of the litsters of Edinburgh." and in 1686[4], the duty on Madder was raised to £3 Scots per thousand weight.†

In order to encourage the linen manufacture, an Act was passed in the same year,[6]‡ setting forth that "the dead were to be burried in Scotch made linen."

In 1695[6]§ "the Waksters and Litsters of the said Burgh of Dundee protest against the said Ratification in favour of the Nyne Trades within the Burgh of Dundee," because the weavers and the fullers were included but not the dyers. In response to this protest the Act was ratified, and the dyers were incorporated with the fullers under the name of "the waulker trade." Against this decision the town and the trades of Dundee however lodged a protest.

The words "lit, litting, litster," in their various ways of spelling are so frequently quoted in this paper, that an attempt to explain their proper meaning will not be out of place. In the first instance, *lit* or *let* means a dye, a colour, a tinge, a hue, or a stain, but it is difficult to state definitely whether it means a particular kind of dyestuff or whether it was used in a generical sense. The word may have been derived from Litmus, but it is also probable that it is an abbreviation of lichen. It is remarkable that the word lichen has not been found in any of the records which have been examined, although the author feels that it is safe to assume that lichens must have been the principal raw material for the supply of dyestuffs in Scotland in early times. In some of the records we find "bleitsching" in place of bleaching, and if we assume that lichen may have been similarly spelled, the above suggestion does not seem unreasonable.

It is likely that "country lit" refers to this kind of dyestuff, but it is more difficult to explain the meaning of "orchard lit," unless it has been derived from the walnut or some other kind of tree growing in orchards. "New lit" may possibly have meant the lichen before it was prepared for dyeing, whilst "corklit," which was found on rocks, without doubt refers to a kind of lichen similar to Archil.

In Wright[20] we find the following references to lit:—"The *Lichen Tartareus* yields a lit or dye;"—"It's like Pathhead lit, soon on, soon aff;"—"The *Purpura* that lives *in Mari Euxius*, if the fishers strike it on the head it renders out all its blood, and it is an excellent litt;"—"His hands deep dyed in darkest lit;"—"Nouthire to toly ne to taunde transmitte we na vebbis, To vermylion ne violett ne variant littis;"—"Of nae ither litt but the hue of the ewe:"—"The dyster . . . . lost his shop an' a' his claith. His bowies, pots, an' lit."

Only one quotation is given which might be considered as a justification of the statement that lit means "an indigo dye":—

"Dyster Cave, wi' his darkest litt, keeps dippin' awa."

To litt (*litt* or *let*) means to dye or to tinge, *littit* or *littyt* means dyed, and *litting*—dyeing. In the following references the word is used in a general sense:—"Coarse home-made plaiding, litted blue;"[20]—"Wi' a hap o' Sibbie's an' my muckle blue lit froke inunder her head an' shooders;"[20]—"I heve some garne to send with thee to lit";[20]—"Thies clathis sente he hedire to mee For to litte thayme,"[22] and in this paper the word is frequently used in connection with the dyeing of red, violet, blue, scarlet and black.

We have, however, proof in the following references that the word was used distinct from and in addition to the word dyeing, and that in these cases it referred to the dyeing of fast colours only, chiefly Indigo or Woad:—"He'll die all manner of colours but blue, and that is gone to the titting;"[21]—"Weel dy'd and litit through and through;"[22]—"The Woll (shall) . . . bee first dyed and litted and coulered withe the coulour blue;"[22]—"The broo (broth) that they lit the black claith wi'."[20]

From the foregoing we should however not be justified in assuming that litting was applied in general to the dyeing of fast colours, because in this paper references are made to "litstars of fals colours," and further also that "to let is to dye, but not in fast colours."[20]

The word *litster* or *litstar* in place of dyer was no doubt chiefly used in the North, and particularly in Yorkshire and in Scotland. Wright informs us that "The Tinctors were dyers, or in the vernacular of the north 'litsters,'[20] and further that in Yorkshire the word was applied to a female dyer,[20] whilst in some parts of Scotland a dyer was known as "Littie."

In the following, reference is made to a dyer and to the use of argol in dyeing:—"Tak the greia of the Wyne that mene fyndis in the tounnes, that litsters and goldsmythes uses."[21]

As has been shown in the case of the two words litting and dyeing, the words litster and dyer are also frequently found side by side in one and the same record, and whilst the proofs brought forward do not show in every case that the occupation of the litster was distinct from that of the dyer, the author feels justified in suggesting that in many cases such a distinction did actually exist and that the litster occupied a similar position to that held in early times in France by the "teinturiers en bon teint," whilst the dyer might be compared with the "teinturiers en petit teint."

The word lit was also used in a number of compound words, such as "lit- fatt, -fat, -falt," a dye vat; "lit-house, -hous, -hows," a dye house. In Banffshire[20] the "lit-pot" at one time seems to have been an indispensable article in every home:—"Beside the fire stood another pot covered with a slab of stone. It was the lit-pot, *i.e.*, a pot used for the dyeing of wool, *for the most part* of a blue colour, and giving forth when the wool was turned a very strong smell of ammonia."

In the Aberdeen Records we find reference to dye vats in the following:—"Ane gryt *litting leid* price tuenty poundis, ane litil *litting leid* price sax poundis,"[19] and according to a communication received from Mr. Edge, the word "lit-pig" denoted a vessel which was employed in Scotland for the preparation of orchil.

The most important information contained in this paper has been derived from records connected with the burghs on the east coast of Scotland, and particularly with those shipping towns which in the earliest times had an active trade with the Continent and especially with Holland and France. It is probably correct to assume that in these towns materials were employed in dyeing which were unknown in most of the other parts of Scotland, but it would be incorrect to infer from this, that dyeing was necessarily confined to these places. Dyeing, like spinning and weaving, was without doubt practised in the earliest times in every part of the country, and as we have seen from some of the records, the "lit-pot" formed an indispensable article in every home, but as the population increased and as the laws of the burghs became less stringent, dyeing became a distinct occupation in many places outside the burghs.

The author desires to express his thanks to Mr. R. K. Hannay, M.A., and to Mr. C. W. Yule, M.A., of the Historical and Antiquarian Department of H.M. General Register House, Edinburgh, for their kindness in pointing out sources of information and for placing the records in the Register House at his disposal; to Mr. Charles W. Sutton, M.A., Chief Librarian of Manchester, for giving him every facility for consulting the many valuable works in the Manchester Free Reference Library; and last, but not least, to his friend and colleague Mr. T. W. Fox, M.Sc.Tech., for the interest which he has taken in this investigation.

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* C. 87, VIII. 534.
† 38, VIII., 604a.
‡ C. 28, VIII. 598.
§ Acta Parl. Gulielmi, c. 134, IX. 513.

Discussion.

Mr. Hannay observed that as far as his knowledge went, one pound Scots, far from being two shillings sterling, was five pounds sterling. He was surprised to find that in the values read out pounds Scots were given both for wages and for prices paid for materials. Even at the present time in Scotland when a juryman failed to answer to his summons he was fined five pounds Scots (£25 sterling). The lecturer had referred to the privileges of the incorporated trades in Scotland, one of which was to send the deacon of the trades as a representative to the Town Council. That privilege still survived. Year by year in Glasgow, Aberdeen, and other cities the Trades Council met after the November elections, and appointed their deacons for the year, who afterwards went in a body to the Council to be sworn as members of the Town Council. The Dean of Guild, who had charge of all the building operations in the City, was the head of the Trades Council, and was appointed by the brethren of the amalgamating trades. It was a pity that such positions were now sometimes filled by men who had no connection whatever with the trades they represented. For instance, the Deacon of the Dyers and Bonnet Makers in Glasgow for several years had been a lawyer. The industry of bonnet making and bonnet dyeing was a very important one in the west of Scotland until as late as the early 19th century, the burgh of Kilmarnock being recognised as the centre of the industry. Even at the present day he believed Kilmarnock bonnets were made and dyed in the burgh itself. An interesting reference had been made to the circumstance that cloth was made from the wool of white sheep and black sheep. The cloth so woven was known in Scotland as hodden grey (*anglice* homespun). Scottish literature contained many references to characters "clad in hodden grey." Many a Scottish housewife had reason to thank her forbears for weaving so much cloth in the past, much of it having been transmitted in the form of dowries.

Mr. Hübner, replying to Mr. Hannay, said that in the translations of the records referred to one pound Scots was given as 1s. 8d.

Dr. G. J. Fowler said that the primitive methods of the old Scottish dyers were similar to those even now carried on in India. The variety of dyes used by them was very considerable, among them being some which were now in use in India for the finest carpets. Though Indian carpets exhibited a great variety of beautiful designs only three dyes were employed in their manufacture, *i.e.*, lac, indigo, and turmeric, the dyes being considerably "faster" than anything yet produced on the Continent. An old native Indian dyer obtained the most perfect tints with his various dyes by apparent rule-of-thumb, but really as the result of an extraordinary educated knowledge and experience of the effect of different weights of dyes variously applied. While some of the processes they had heard of might appear crude it was well to remember that the personal equation was proportionately great. In modern times everything was made as fool-proof as possible.

Mr. J. H. Reynolds said that some of the methods of the old handicraftsmen, if thoroughly studied, might throw light upon modern methods. He knew not whether the dyestuffs used by the handicraft dyers in India were as fast as modern artificial dyes, but he thought there was substance in the statement that when the fine carpets of Persia or India did fade, if they faded at all, they did so harmoniously and pleasantly, the colour schemes obtained in the fabrics being a delight and a beauty far different to the brilliant effects produced by artificial dyestuffs.

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Glossary.

Airt, art.
Allanerlie, only; solely.
Aller barkis, elder bark.
Allum; Alm; Alme; Alom, alum.
Als, as.
Amedoue, starch.
Anhairas (Anherd), to consent.
Anneill, Indigo.
Argell, argol.
Atoure, beyond, as to time; exceeding.
Aucht, ought; should; eight.
Awin, owing.
Awiner, owner?

Ball; Ballis; Bollis, bale.
Baneist, banished.
Barbatas, Barbados.
Barbouris, barber.
Bleicheres, bleachers.
Bleitsche, to bleach.
Bleitcheing, Bleitsching, bleaching.
Blew fatt, blue vat.
Boboning, winding.
Bocht, bought.
Breid, width.
Brissell; Brissele, Brazil wood.
Bron, brown.
Brugis, Bruge.
Byrthing, size; bulk; burden.

Campveir, Veere.
Carsages, Kersey.
Cast, to fade.
Chalmer, chamber.
Chamlet, camlet, a cloth.
Chirie, cherry.
Claith; Clathe, cloth.

Claith serg, serge.
Compeach wood, Logwood.
Conduction, the act of hiring in general.
Copers; Copper, dye vat.
Costis, duty.
Cottoun, cotton.
Cramysse, crimson; also any rich silk.
Crear, a kind of lighter.
Cryit up, proclaim; to call.
Crymosin, crimson.
Culen; Cullan, Cologne.
Cuppruss, coperas.

Danskene, Denmark.
Dayer, dyer.
Daying, dyeing.
Defalt, to adjudge as culpable.
Dekyne, deacon.
Donke, damp; perhaps mouldiness.
Dossin, dozen.
Drawaris, drawers.
Drawin, drawing.

Ell; elne, a measure containing 37 inches.

Faine, fine.
Falt, fault.
Fastick; Fussick, Fustic.
Fatts; Ffats, dye vats.
Feste, feast.
Fewirzer, February.
Flanderis; Flandirs, Flanders.
Flemygis, Flemish.
Flesher; Flesseris, butcher.
Flory, the flurry of the Indigo- or Woad-vat.
Fourt, forth.
Fra, from.
Fre.se, frieze.
Fusteonis, fustian.

Gaid, woad.
Gallis, galls.
Geir, accoutrements.
Gef, gave.
Gif, if; to give.
Gon, gown.
Grane, Cochineal.
Gren, green.
Gudes, provisions; goods.

Haist, the harvest.
Haldand, holding.
Handwarp, Antwerp.
Hoise, hose.

Ilk, each; every.
Ingill, English.

Kark; Cark, a package (of alum).
Kelt, a cloth with a nap.
Kemester, wool comber.
Kettles, dye vats.

Laidnit, loaded.
Laik, gift; pledge; lack.
Last; lastis, a weight or measure.
Lenth, length.
Lettyn; Litting; Lyttin, dyeing.
Lining; Linning; Lyning; Lynnyn, linen.
Lit; Lytt, dyestuff.
Litstair; Litstar; Litstaris; Litster; Littistair; Littisteris; Lytstar, dyer.
Litthouses, dye houses.
Littit; Lyttyt, dyed.
Lyk, like.
Lynt, lint.

Mader; Madir; Madyr; Maldir; Malder; Mather; Matter, Madder.
Mailin' men, farmers.

Mecht, might.
Medoun, meadow ?
Mercat, market.
Messing (Messingerie), the office of messenger-at-arms.
Milne, fulling mill.

Na, nor.
Ne, neither; no; nigh.
Nichtboure, neighbour.
Nocht, not.
Not, note.

Oncostis, expenses.
Or, before.
Oyll, oil.

Pis, piece.
Pok; Pokis; Polks, poke.
Prenteis, apprentice.
Punsioun, puncheon.
Pyp, pipe.
Pris, price.
Pyrattis, pirates.

Quha, who.
Quhilk, which; who.
Quhit, white.

Redyn, clearing; scouring.
Retret (retrett), repealed; reversed.
Rossat; Russatis, russet colour.
Rowan, Rouen.
Rowanis clath, cloth of Rouen.
Rownd holland, rone-skin ?
Rwn, Rouen.
Ryssyllis, a cloth, perhaps named from Overyssell, or from Rousselaere.

Saip; Seip, soap.
Sald; Sawld, sold.
Sarkis, shirting.
Schere, to shear.
Scheryn, shearing.
Schir, Sir.
Schyp, ship.
Scribbling, teasing of wool.
Secund, second.
Seid, seed.
Selleries, salaries.
Sene, since.
Serg, serge.
Sewin, seven.
Sey, sea.
Sheermen, shearers.
Shoe mack; Shoe make, sumac.
Sic, such.
Smal (small), inferior.
Sowters, shoemakers.
Speedful, expedient.
Spill, destroy; spoil.
Stainings, dyestuffs.
Steikis; Steiks; Stek, pieces.
Steming, the cloth now called tamine or taminy.
Stiffinc; Stiffeng, starch; stiffening.
Strae, straw.

Tailyoris; Teylzour, tailor.
Taip, tapistry,
Tany, tawney.
Tarmanich, turmeric.
Tessels, teasels.
Thir, these.
Thalyt, to endure.
Threed, third.
Thrummes, drums (warp beams).
Tinsaill, loss.
Tone; Towis; Town; Twnnis, a ton.
Toun, town.
Treis, barrels.
Trew, to trust.

Trie, a stick.
Tua, two.
Tyne, to lose.

Uald, weld.
Ursell, Orchil.
Utheris, others.

Vad; Vaid; Veyade, woad.
Vebstaris, weavers.

Wabstaris; Wobstaris; Wobster, weaver.
Wad; Wade; Wadd; Waid; Wead; Wod, woad.
Waded, woaded.
Wak, moist; watery
Wakers; Waksters; Walkaris; Walkers; Waulkers; Wolcaris, fullers.
Walkmilne; Wakmilne, fulling mill.
Wald; wauld, weld or perhaps woad.
Washe, stale urine.
Wast, waste.
Watt, wet.
Watter, water.
Weand, weighing.
Weazel, Wesel.
Wecht; Weght, weight.
Welwat, velvet.
Wester, western.
Wheills, wheels.
Whilk, which.
Whyt, white.
Wirk, work.
Wob, web.
Wobis, webs.
Wont to be, a custom or practice that prevailed in former times.
Worset, worsted.

Zarne, yarn.

Newcastle Section.

Meeting held at Armstrong College, on Wednesday, March 18th, 1914.

MR. E. F. HOOPER IN THE CHAIR.

THE USE OF COAL TAR CREOSOTE AND NAPHTHALENE FOR PRESERVING WOODEN FENCES.

BY S. H. COLLINS, M.SC., F.I.C., AND A. A. HALL, PH.D., M.SC.

Although there is no lack of literature on the subject of creosote yet there is so much difference of opinion about what is necessary and what unnecessary that it is difficult to obtain much useful information on the subject. A very fine abstract of recent work may be found in Allen's Commercial Organic Analysis, Vol. III., but the contradiction on the subject may be well illustrated from that work. On page 368 occurs the statement "naphthalene is volatile at all temperatures and will disappear entirely from the wood in course of time," but on page 371 may be read "The naphthalene of coal-tar creosote volatilises only from the superficial strata of the timber." Further, although much work has been carried out on the subject of the determination of tar-acids and tar-bases and much importance has been attached to those bodies, yet Charitschkoff* considers that although the phenols and nitrogenous compounds by themselves exhibit considerable antiseptic properties, their presence in creosote only slightly increases the antiseptic power of the latter.

Probably this contradiction is due to excessive generalisation, and the authors propose to restrict themselves to a study of the processes of creosoting so far as they apply to small timber such as is used in estate fences, where the posts are subjected to different conditions of air and soil.

PART I.

The usual method for the assay of coal tar creosote consists in taking the specific gravity at 60° C. and then taking 100 grms. of the creosote in a tared 250 c.c. distillation flask, and distilling with the bulb of the thermometer opposite the mouth of the outlet tube. The water is estimated by collecting that fraction boiling under 180° C. in a graduated cylinder and mixing with an equal bulk of benzene and then measuring the water.

The distillation is then continued up to 316° C., the distillation taking about 15 minutes, the total volume of distillate is noted and the residue in the flask after cooling is weighed. During the distillation note is taken of the amounts coming over at different temperatures, particularly at the temperatures of 205° C., 215° C., 220° C., 245° C., 271° C., 300° C., and 316° C.

The tar acids are determined in the whole distillate by extraction with three lots of warmed 12 per cent. caustic soda of 25 c.c., 15 c.c., and 10 c.c. respectively. The caustic extract is washed three times with ether, the ether collected and washed with 5 c.c. of the soda solution, which is then mixed with the main quantity of the soda extract; this is placed in a 200 c.c. burette and heated on the water-bath until all the ether is expelled, cooled and 50 per cent. sulphuric acid added until the whole is acid, the burette is then allowed to cool and the volume of the tar acids is read off. If desired the tar bases are estimated in a similar manner by extraction with sulphuric acid.

The naphthalene is determined either by direct filtration, or by precipitation with picric acid. This latter method gives the total hydrocarbons (naphthalene and others) capable of yielding insoluble picrates. The precipitation is carried out on a portion of the distillate from the crude creosote by diluting with glacial acetic acid and then adding a large excess of a saturated solution of picric acid warmed to 80° C. After cooling the precipitate is filtered off, washed with picric acid solution, and dissolved in $N/10$ NaOH. The excess of caustic soda is then estimated by titration with $N/10$ H_2SO_4. If most of the insoluble picrate were due to naphthalene each cubic centimeter of $N/10$ alkali used would be equivalent to 0·0128 grm. naphthalene. The authors attempted to estimate the tar acids directly by taking 5 c.c. of the original creosote, diluting with 50 c.c. ether and extracting successively with 10, 5, and 4 c.c. of 12 per cent. NaOH. This was washed into a Gerber tube, the ether boiled off and 3 c.c. conc. sulphuric acid added, the tube was then spun and the volume of the tar acids read off.

This method was found to give much lower results than the previous one. This is due apparently to the large excess of ether used, as was proved by an experiment in which low boiling petrol was used instead of ether. The petrol method gave a higher result, but not such a high result as the direct extraction of the distilled creosote.

In order to test the value of the picric acid method for the estimation of naphthalene, the naphthalene was estimated in a sample of creosote by this method and also by very careful distillation of the creosote with a Young's "rod and disc" still head of twenty discs. The latter method gave results on an average 20 per cent. lower than the picric acid method. As in this second method the naphthalene was isolated and its melting and boiling points taken, and as the distillation was carried out in such a way that no naphthalene could be lost, it was decided that the second method gave results more approaching the truth than the first method. There was a possibility that some of the naphthalene had been decomposed by over-heating, so the experiment was made of fractionating some creosote, collecting the fractions, mixing them together and re-fractionating. This was done four times, and it was found that the fourth distillation gave the same quantities of distillate at the different fractions as the first, showing that neither the naphthalene nor the other constituents of the creosote were decomposed.

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* See this Journal, 1912, 456.

Experiments were also carried out to see if it were possible to separate out some of the constituents of the creosote by distillation in steam. It was found that the creosote was only very slightly volatile in steam, and that the distillate was almost as great a mixture as the original creosote itself.

These experiments show that the best method for the assay of creosote is to carefully distil it, using a long still head of the "rod and disc" type up to a temperature of 271° C., and then a shorter one until the temperature reaches 316° C. The naphthalene comes over between the temperatures of 205° C. and 220° C. These fractions solidify in the receiving vessels, and on cooling can be weighed and the melting point taken. The liquid fractions coming over above and below these temperatures yield some more naphthalene on refractionation. But this error never amounted to more than one per cent.

Part II.

Experiments have been made to study the quantity and quality of the preservative left in the wood after treatment and after many years use. For this purpose large wooden posts that had been treated with preservative were examined in the following manner. Ordinary commercial methylated ether was purified by fractionation through a Young's "rod and disc" still head of about one meter in height. To avoid risk of fire, the heat was supplied by a 32 candle carbon filament lamp surrounded with asbestos. Only the fraction, 28° to 36° C. was used, the remainder serving for cleaning. The ether so purified was used for extracting the wood in a large extractor on the principle of the well-known "Soxhlet." The wood selected for examination was shaved with an ordinary carpenter's plane set to cut .coarse shavings. About 150 grms. of such shavings were placed in the extractor which had a capacity of about one litre and was connected up with a flask of about 1½ litres capacity, containing about 1¼ litres of ether. A large tin condenser served to return the ether to the extractor. The colour of the extract readily indicated when the extraction was finished and as a rule a fresh charge of wood shavings was put in as soon as the former charge had been completely extracted. By these means an extract from about 150 to 600 grms. of wood was obtained. The ether was then distilled out again by the same method of heating and fractionation as was used for preparing the rectified ether of low boiling point and the extract was then weighed and bottled for further examination. By no means had the whole of the ether been removed at this stage, but a further treatment was needed and was supplied along with the fractional distillation of the extract. The ether that had been recovered was tested for naphthalene by the picric acid test with negative result.

The fractional distillation of the crude ether extract was conducted with a "rod and disc" still head of about three decimetres in height, with a condenser only in use during the first part of the fractionation. Everything distilling under 100° C. was considered as ether, all above that temperature was considered as preservative. As may be seen from the accompanying figures the separation was quite sharp, indeed in most cases nothing measurable came over between 70° C. and 170° C. The original weight of crude ether extract had then to be corrected for the amount of ether in that extract so as to give the figures called preservative in the Table I.

The fractionation was continued up to 316° C., for which purpose a nitrogen filled thermometer was used. The results were plotted as curves, but for the purpose of this paper only the most salient points on those curves are noted in the tables.

The first column in Table I. shows the results obtained from an ash post that had been treated with creosote and had been in the ground for one year. The amount of preservative in the wood when air dry was 10·72 per cent. and of this amount none distilled at low temperatures, nor could any naphthalene be found. Somewhat similar results were obtained from a beech post shown in the second column.

The third, fourth and fifth columns show the results obtained from a post of Scots pine which had been treated with creosote fourteen years before and had been used in a light sandy soil. This post was cut into three lengths and each portion shaved as before. It is noteworthy that the middle portion, which stood just about the ground level, kept its creosote much better than either of the other two portions and further that the creosote so kept retained a much higher proportion of light boiling fractions. The creosote appeared to have leaked out of the point to some extent and to have evaporated or been washed out of the top. Unfortunately we have not been able to obtain samples of the creosote actually used, but all samples of creosote used at present and all such old samples as we can obtain show the presence of naphthalene from about 5 to 15 per cent. It will be noted that in all these cases where creosote was used no naphthalene was found.

The remaining six columns in Table I. show results obtained from the treatment of wood with naphthalene. The naphthalene was melted in open tanks and the posts submerged, covered and allowed to soak for some hours. The post of Scots pine recorded in column 6 had been preserved fourteen years before, but had never been used. The very large amount of preservative still left in the wood after all these years shows that naphthalene does not evaporate so very fast, so long as it is imprisoned in the wood. Observation of the posts showed that the naphthalene had evaporated from the surface, but that at a little depth the naphthalene was still there. In columns 7 and 8 are shown the results from a post that had been twelve years in mossy ground. Similarly columns 9, 10 and 11 refer to a post that had been 13 years in light gravel. In all cases the proportion of oil other than naphthalene is far too high to belong to any naphthalene crystals likely to have been used. That such concentration of oils should have originated in simple evaporation seems improbable. Is it possible that naphthalene could oxidise or polymerise in many years time in the pores of the wood? Further, one must consider the disappearance of the naphthalene from the creosoted wood. Is this loss due to evaporation? Might it not be due also to some other cause as suggested above. Further experiment is necessary to settle such a point. Sycamore wood contains nothing soluble in ether, although the Scots pine might have a small amount.

Table I.

	1 Ash.	2 Beech.	3 Scots pine. Top.	4 Scots pine. Middle.	5 Scots pine. Bottom.	6 Scots pine. (unused).	7 Sycamore. Middle.	8 Sycamore. Bottom.	9 Sycamore. Top.	10 Sycamore. Middle.	11 Sycamore Point.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent
Preservative per 100 parts of wood	10·72	15·77	19·85	30·55	17·67	31·66	33·07	32·39	31·05	37·90	34·60
					Fractions per 100 parts of preservative.						
Temperature °C.											
100—170	0	0	0	0	0	0	0	0	0	0	0
170—205	0	0	0	5·2	1·0	0	0	0	0	0	0
205—245	11·3	14·1	35·8	20·0	22·2	83	78	86	86·0	85·1	89·5
245—271	12·4	11·4	13·0	15·1	24·2	9	10	7	4·0	5·6	6·5
271—316	76·3	74·5	24·2	24·4	30·0						
Pitch			27·0	35·3	22·6	8	12	7	10·0	9·3	4·0
Naphthalene	0	0	0	0	0	83	78	86	86·0	85·1	89·5

Table II.

	Creosote before and after use.					
	Before.	After.	Before.	After.	Before.	After.
	Open.		Open.		Pressure.	
°C.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Water	0	0	0	0	0	12·5
100—170	0	0	0	0	6·5	6·9
170—205	16·6	15·0	6·0	2·0	15·5	2·2
205—245	19·3	36·0	33·0	33·1	35·5	31·8
245—271	13·4	15·4	20·0	17·2	10·5	19·5
271—316	50·7	33·6	41·0	47·7	24·0	19·2
Pitch					8·0	7·9
Naphthalene	much	trace	—	—	6·0	5·5

The alteration in composition of the creosote as a result of treatment of timber is shown in Table II. The more volatile portions of the creosote show a tendency to be lost during treatment, especially during open tank treatment.

Conclusion.

The only satisfactory method of determining naphthalene in creosote is by fractional distillation with a "rod and disc" still head.

Crude naphthalene is a splendid preservative for timber, but so much is absorbed that the expense is great. Evaporation of naphthalene seems limited to the surface of the post.

Creosote disappears from the exposed parts of a post and also from the point, but the middle part where decay is most likely to occur keeps its creosote fairly well.

The more volatile portions of creosote are easily lost.

Part of the expense of this investigation has been defrayed from a special grant by the Board of Agriculture.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Multiple effect evaporation; An experimentol study in ——. N. Deerr. Hawaiian Sugar Planters' Assoc., Bull. No. 42, 1914, 1—47.

The calculated effect of self-evaporation in a multiple-effect evaporator is never realised, owing to the superheating of vapours and loss of steam with the incondensable gases. The rate of evaporation is influenced not only by the gross temperature difference, but also by the absolute temperature prevailing, increasing as this increases. Increase of the gross temperature difference by decreasing the temperature at the cold end down to that corresponding to a vacuum of 27 inches, gave a material increase in the rate of evaporation, but not so great as that obtained by increasing the temperature (or pressure) of the direct steam at the hot end. The heat-economy of quadruple effect evaporators in practice was found to be between 0·8 and 0·9. A vertical submerged tube apparatus with 5 lb. gauge pressure in the first cell (227° F., 108·3° C.) and not less than 26·5 inch vacuum in the last cell (127° F., 52·8° C.) should evaporate not less than 9 lb. of water per sq. ft. per hour, with juice entering at 212° F. (100° C.), and should evaporate 4·2 lb. of water per lb. of steam. If these conditions are not realised, foul heating surfaces, too slow removal of condensed waters or incondensable gases, may be suspected. A horizontal tube film evaporator had a much greater rate of evaporation than vertical submerged tube evaporators.—L. J. de W.

Patents.

Drying, revivifying and decarbonising bone-black; Apparatus for —— *or for treating other granular or finely-divided materials.* J. Wetter, London. From M. Weinrich, Yonkers, N.Y., U.S.A. Eng. Pat. 6347, Mar. 14, 1913.

The treatment is effected, as usual, in a revolving cylinder provided inside with projecting radial or slightly inclined blades, but to increase the working capacity of the cylinder the blades are made of greater width; and near their free ends they are provided with longitudinal slots through which the material falls in fine streams; the passage of the material through the slots may be facilitated by a tapping device. At the discharge end of the cylinder is a retaining rim having outlets which can be opened or closed as desired.—A. S.

Drying and heating sand, grit or like materials; Method and means for ——. T. and F. Coleman, Derby. Eng. Pat. 20,161, Sept. 6, 1913.

A fixed horizontal circular plate is arranged above a similar rotating plate. Annular plates project upwards with an outward inclination from the lower plate and other annular plates, vertical or inclined inwards, depend from the under side of the upper plate into the spaces between the upstanding plates. The material is fed from a hopper on to a distributing plate just above the centre of the rotating plate and is driven outwards by centrifugal force, a current of heated air being at the same time passed through the spaces between the plates.—W. H. C.

Smoke; Means for washing ——. J. D. Jackson, Kensington, Victoria, Australia. Eng. Pat. 19,762, Sept. 1, 1913.

The process described in Eng. Pat. 4636 of 1913 (this J., 1914, 341) is improved by providing means for heating the washing liquid and for adjusting the spraying devices both vertically and horizontally.—W. H. C.

Dust from air or vapour; Process and apparatus for extracting ——. J. Herbing, Halle a/Saale, Germany. Eng. Pat. 20,700, Sept. 13, 1913. Under Int. Conv., April 14, 1913.

The dust-laden air or vapour is passed in succession through a series of hemp filters, of increasing fineness, arranged at an angle of at least 60° within a casing. —W. H. C.

Gas; Apparatus for subjecting —— *to the action of liquids.* F. H. Wagner, Assignor to The Bartlett Hayward Co., Baltimore, Md. U.S. Pat. 1,091,464, March 24, 1914.

In each of a series of superposed chambers is a rotary device fitted with vanes designed to carry up and spray the liquid in the chamber. A partition extends under and partly round each rotating device, so that the gas may pass up at one side thereof, be acted upon by the sprayed liquid and pass out at the opposite side, the washing liquid being circulated in the contrary direction.—J. L. F.

Gases; Purification of —— [*from suspended particles*] *by formation of mist by supersaturation.* E. Möller. Ger. Pat. 270,757, Feb. 7, 1912.

The gas is first subjected to electrical discharges, or washed or otherwise treated to remove impurities capable of interfering with the subsequent supersaturation. A mist is then produced by supersaturation of one of the constituents or of an added gas, and the particles forming the mist are rapidly separated by the action of electrical discharges, centrifuging, or the like. The supersaturation-mist may be produced by the interaction of two gases, the saturation temperatures of which are higher than that of the reaction product, or by alteration of the thermodynamic condition of one of the constituents. The gases may be circulated alternately through a chamber in which the mist is produced and a device in which the particles are separated. For example, for purifying burner gases for use in the contact process for the manufacture of sulphuric acid, sulphuric acid mist is produced by periodically adding steam and sulphur trioxide to the gases at a suitable temperature; whilst for obtaining germ-free air, water-mist is repeatedly produced and separated in chambers the walls of which exert an antiseptic action.—A. S.

Purifying gases; Disintegrator-like device for ——. J. Hartmann. Ger Pat. 271,201, April 1, 1913.

The gas passes through annular chambers formed by concentric perforated drums and is brought into intimate contact with water spray by centrifugal devices rotating in the chambers. The centrifugal device in each chamber rotates in the opposite direction to that in the adjacent one.—A. S.

Steam and air dryers, oil separators and the like. J. E. L. Ogden, Liscard, Cheshire. Eng. Pat. 21,731. Sept. 26, 1913.

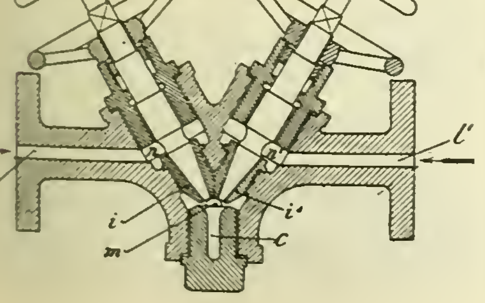
The steam or air is passed through a number of parallel narrow curved pipes, having slots at frequent intervals on the outer side of the curve. The metal of the pipe is pressed inwards at the slots so as to form sharp edges, which project into the tubes and arrest the liquid particles. —W. H. C.

Mixing or agitating device or apparatus. B. Goldman and Galvanische Metall-Papier Fabrik A.-G., Berlin. Eng. Pat. 24,587, Oct. 29, 1913.

The mixing vessel is divided into a number of unequal compartments by radial, vertical partitions, which are recessed at their outer ends near the wall of the vessel. The mixing device or stirrer may be below or above the partitions, or it may be situated at about the middle of the vessel, with partitions both above and below.—W. H. C.

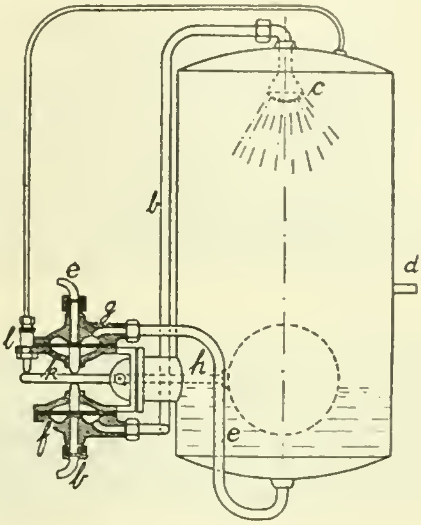
Mixing liquids and rendering them homogeneous; Process for ——. F. M. Berberich. Ger. Pat. 271,432, July 26, 1912.

The apparatus is shown in the figure. The liquids entering respectively through l and l^1, pass into the annular passages, n and n^1, and thence through the narrow channels between the conical plugs, i and i', and their seatings. The issuing jets of liquid are directed into the passage, c, from which the mixture flows into the discharge channel, m.—A. S.



Mixing liquid with gas; Automatic regulation of the supply of liquid to, and discharge of liquid and removal of gas from, pressure-vessels for ——. W. Noll. Ger. Pat. 271,641, May 9, 1913.

The liquid enters the pressure-vessel through the tube, b, and rose, c, and the gas through the tube, d, whilst the liquid saturated with gas is discharged through the pipe, e. The ball-float and lever, h, k, act on the diaphragm-valves, f, g, and the blow-off valve, l, so that as the float rises, the liquid supply and blow-off valves are closed, and the liquid-discharge valve opened, whilst as the float sinks, the valves are operated in the reverse manner. —A. S.



Coal, ores, etc.; Method of and means for separating different kinds of minerals such as ——. J. W. Blackhurst, Chesterfield, and I. C. Blackhurst, Sheffield. Eng. Pat. 26,418, Nov. 18, 1913.

The material is dropped from a suitable height into a vessel containing a running stream of water, which carries the substances of lower specific gravity further from the vertical line of descent. Scraper-conveyors at the bottom of the vessel collect separately the lighter and heavier substances. These conveyors may comprise grids running in troughs so as to separate the smaller from the larger pieces of the substances having similar specific gravity. Jets of air or steam may be blown through the falling material in order to remove dust.—A. T. L.

Furnaces; Process of lining ——. B. E. Eldred, New York. U.S. Pat. 1,091,567, March 31, 1914.

For making and repairing furnace linings a mixture of fine refractory material, such as dolomitic lime, with a carbonaceous substance, *e.g.* tar, is projected against the wall of the furnace by a jet of gases, *e.g.* combustion gases, capable of protecting the material from combustion. —A. S.

Retort or still. J. H. Castona, Laine, Miss., Assignor to Castona Improved Process Co., Gulfport, Miss. U.S. Pat. 1,092,018, March 31, 1914.

A cylindrical retort is closed below by a removable bottom above which is a fixed false bottom, the intervening space forming a water-jacket, which is provided with a valved overflow pipe. The counterbalanced lid of the retort fits in an annular groove in, and is pivoted to, an abutment ring, fixed to the top of the retort. Inside the retort is a removable cage, the perforated bottom of which is spaced away from the false bottom of the retort to form a collecting chamber. A steam-supply pipe extends upwards within the cage and through the lid of the retort, to which it is detachably connected. A drain pipe from the collecting chamber passes out through the water-jacket and is jacketed by the water-supply pipe. A second water-supply pipe is connected below with the water-jacket and above with the upper part of the retort.—A. S.

Extracting apparatus. J. H. Castona, Gulfport, Miss. U.S. Pat. 1,092,019, March 31, 1914.

A car travels upon rails laid in a horizontal casing, the open end of which can be closed by a door. A perforated pipe, mounted on uprights, extends along the car and carries a perforated cage, open at the top, which can be tilted to discharge spent material. On the bottom of the casing, between the rails, is a heating coil. A heating or extracting fluid is supplied to the perforated pipe through a pipe passing through the door of the casing, and in the upper part of the casing, above the open top of the cage, are a solvent-supply coil and a perforated solvent-discharge coil.—A. S.

Metallic vessels for alcoholic fermentation and for the transport and storage of liquids; Manufacture of——. H. Held. Fr. Pat. 464,337, Oct. 31, 1913.

The vessel, containing sand or similar material, is rotated, rolled or oscillated about its longitudinal axis, then washed with weak acids or other cleansing agents such as milk of lime, and the interior surface coated successively with tin or zinc, with copper, and with silver or gold.
—J. H. L.

Crystallisation; Apparatus for continuous——. F. A. Bühler. Fr. Pat. 464,548, Aug. 13, 1913. Under Int. Conv., Aug. 16, 1912, and Feb. 8, 1913.

See Ger. Pat. 268,409 of 1912; this J., 1914, 188. The agitator blades may be prolonged to meet the central shaft, so that as they rotate, the material slides over their entire length. The ends of the blades may be provided with tooth-like projections.—T. F. B.

Filter-presses; Chamber-plate for——. J. Trommer. Ger. Pat. 271,527, Sept. 25, 1913.

A sheet of wire gauze stretched in an iron frame is provided on both sides with a layer of filtering material ("*Steinmasse*"), recessed so as to form filter-chambers when a number of the plates are assembled in a press.
—A. S.

Catalytic reactions; Process for carrying out——. E. W. Andersen, Glostrup, Denmark. Eng. Pat. 7839, April 3, 1913. Under Int. Conv., May 14, 1912.

See Fr. Pat. 457,569 of 1913; this J., 1913, 999.—T. F. B.

Drying chambers. J. J. F. Balés, Talence, France. Eng. Pat. 8509, April 10, 1913.

See Fr. Pat. 455,223 of 1913; this J., 1913, 859.—T. F. B.

Drying air; Process and apparatus for——. F. A. Daubiné, Auboué, France. U.S. Pat. 1,092,434, April 7, 1914.

See Fr. Pat. 411,270 of 1910; this J., 1910, 959.—T. F. B.

Furnaces; Regenerative gas——. F. K. Siemens, London. Eng. Pat. 17,956, Aug. 6, 1913. Addition to Eng. Pat. 10,824, May 7, 1912.

See Fr. Pat. 461,938 of 1913; this J., 1914, 342.—T. F. B.

Evaporator. F. Schulz, Weetzen, Germany. U.S. Pat. 1,091,897, March 31, 1914.

See Ger. Pat. 254,486 of 1911; this J., 1913, 184.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke-ovens; The heating of——by foreign gas. R. Biermann. Stahl u. Eisen, 1914, **34**, 620—624.

In view of the high thermal value of coke-oven gas, it is more economical to use poorer gases (*e.g.*, blast-furnace gas and producer gas from coke breeze) for heating the ovens. Comparative data obtained when using blast-furnace gas and coke-oven gas with similar ovens are given. The chief difference in working is that the blast-furnace gas as well as the air is preheated in regenerators. The gas is freed from dust down to 0·03 grm. per cub. m. Blast-furnace gas has the advantages of being free from tar and naphthalene, and of not sooting the burners.
—T. St.

Asphaltums; Differentiation of natural and oil——. E. C. Pailler. J. Ind. Eng. Chem., 1914, **6**, 286—289.

For distinguishing natural asphaltums (Trinidad and Bermudez) from those prepared from asphaltic petroleum, the author makes use of the fact, observed by Marcusson (this J., 1911, 480), that the first portions of distillate from the former contain organic acids or acid salts and saponifiable oils. 30 grms. of the asphaltum are distilled in a small retort at the rate of about 1 drop in 2 seconds, and two 5 c.c. fractions are collected in tared weighing bottles. Each fraction is dissolved in 10 c.c. of ether, washed with water, treated with 75 c.c. of alcohol and the acid value (calculated to mgrms. KOH per 1 grm. of distillate) determined by titration with $N/10$ sodium hydroxide, using 5 c.c. of a 1 per cent. alcoholic solution of "alkaline blue" as indicator. To determine the content of saponifiable matter, a solution of 5 grms. of the ash-free asphaltum in 30 c.c. of benzene is boiled with 50 c.c. of $N/1$ alcoholic potash under a reflux condenser, cooled, treated with 250 c.c. of 95 per cent. alcohol, and titrated with $N/1$ sulphuric acid, using "alkaline blue" as indicator: the titration is continued until the colour change is not affected by heating the solution on the water-bath. A blank test must be made. Some results obtained are shown in the following table:—

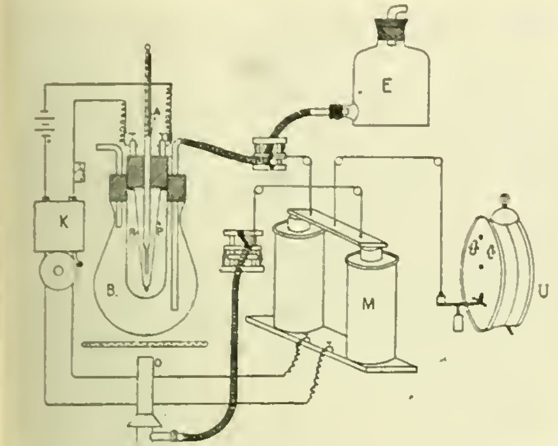
Kind of asphaltum.	Acid values.		Saponif. value.
	1st Dist.	2nd Dist.	
Trinidad	15·7—16·2	7·9—8·4	40·0
Bermudez	9·6—9·8	3·2—3·6	28·0
California	0·11—0·19	0·04—0·07	12·0
Maltha flux	0·12—0·16	0·19—0·25	8·0
Bermudez maltha	9·8	2·3	—
Mexican	0·22—0·24	0·05—0·09	10·5
Bermudez + California (1 : 1)	4·9	1·2	20·5
Bermudez + Mexican (1 : 1)	5·4	2·0	19·7
Trinidad + California (1 : 1)	—	—	26·9
Trinidad + Mexican (1 : 1)	—	—	24·9
Bermudez + California + maltha	5·5	1·7	—
Bermudez + Mexican + maltha	5·15	1·22	—

—A. S.

Asphaltum; Determination of the melting point of——. L. Schanin. Z. angew. Chem. 1914, **27**, 215—216.

The apparatus used is shown in the figure. The asphaltu or pitch is introduced while molten into a capillary porti at the lower open end of a tube, A, and allowed to solidif

A layer of mercury about 5 mm. thick is introduced above the solid pitch. The tube, A, is then supported above the metal plates, P, which are separated by about 1 mm. at the lower end and are in circuit with a bell, K, a battery, and an electro-magnet, M. The bulb of a maximum thermometer is supported near the capillary tube, which together with the plates, P, is enclosed in a test-tube supported in a flask, B. The flask is about one-third full of water and is heated gradually. When the pitch melts, the mercury runs through the capillary tube and completes the circuit between the plates, P, whereupon the bell, K, rings, and the electromagnet is energised so as to shut off the gas supply to the burner, D, and admit cold water from a vessel, E, to the flask, B. The apparatus is thus cooled and the maximum thermometer indicates the melting point. The electro-magnet may also be arranged to stop the clock, U.—A. T. L.



Gas standards. Decision of House of Lords Committee. Times, May 1, 1914. [T.R.]

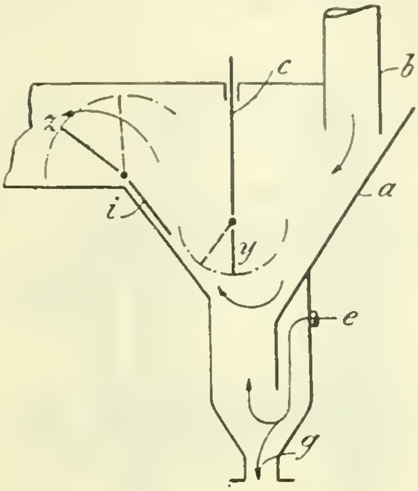
THE Select Committee of the House of Lords has considered the Bill promoted by the Gas Light and Coke Company to abolish the test of the illuminating power of gas supplied and to insist only upon compliance with a standard of calorific value, and has decided to abolish the illuminating test for penalties, but to maintain that test for the purpose of information. They have also decided that the calorific value of the gas supplied by the company shall be one of 540 British thermal units gross, with an allowance of 7½ per cent. to cover lapses or errors in production. Penalties will not be imposed unless the gas falls below the minimum standard of 495·5 British thermal units. Seventeen other gas companies who are promoting Bills in the present Session have agreed to be bound by the decision of Parliament in regard to the Gas Light and Coke Company's Bill.

Oil resources of the Empire. Perkin. *See* XII.

PATENTS.

Washing coal and other minerals; Apparatus for ——. P. Habets, Montegnee, and A. France, Liege, Belgium. Eng. Pat. 17,011, July 24, 1913.

THE coal or other material is delivered by a stream of water through the pipe, *b*, into a hopper, *a*, and is met, at the restricted passage formed by the partition, c, by an upward flowing stream which enters at *e*. The heavier particles are discharged with part of the water at *g*. The partition, c, is adjustable, the areas of the passages or the two streams being varied simultaneously, in order hat the velocity of the downward stream may be reduced o a minimum consistent with the maintenance of a sufficient velocity in the upward stream to carry away the lighter particles. A finer adjustment is effected by means of a hinged flap, *y*, at the bottom of the partition, c.



An inclined shutter, *i*, with hinged flap, *z*, in the delivery side of the hopper removes any suspended particles which accumulate there. In a modification, several ascending streams enter through passages in the bottom of the hopper, a solid inclined flap is arranged at the inlet side of the partition and small flaps are arranged, behind the solid flap and separated from it, above each of the vertical passages. (See also Eng. Pats. 22,655 of 1912 and 5519 of 1913.)—A. T. L.

Briquetting coal with waste sulphite-cellulose lyes and an inorganic substance. B. Grätz. Ger. Pat. 271,479, Dec. 17, 1912.

THE inorganic substance used is aluminium hydroxide, preferably in the gelatinous condition.—A. S.

Coke-oven; Regenerative —— with accessible conduits in the foundation. C. Still. Ger. Pat. 271,515, June 24. 1913.

THE arches supporting the ovens are closed against the accessible conduits below by a horizontal course of bricks. Air is circulated through the passages between the latter and the arches and then passes to the regenerators. Excessive rise of temperature in the conduits below the horizontal course of bricks is thus prevented and these remain accessible while coking is proceeding.—A. S.

Coal-gas; Apparatus for the manufacture of ——. R. C. Congdon, Atlanta, Ga. U.S. Pat. 1,090,813, March 17, 1914.

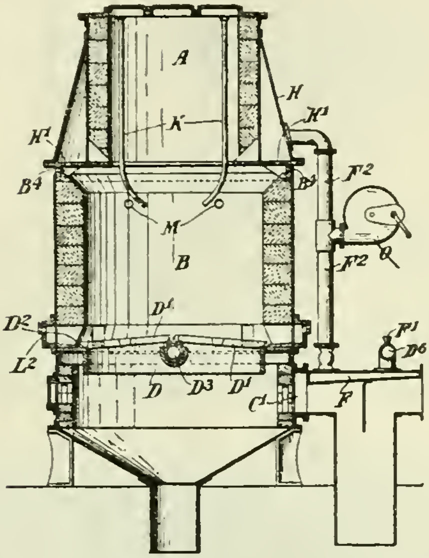
EACH group of retorts is connected with a common stand-pipe sealed in liquid above and below and through which the gas is withdrawn. Liquid is caused to flow down through the stand-pipe without entering the retorts.
—W. H. C.

Generating gas; Apparatus for ——. D. D. Barnum, Worcester, Mass., and H. A. Carpenter, Sewickley, Pa., Assignors to Riter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pat. 1,091,111, March 24, 1914.

BENCHES of gas retorts consisting of two vertical rows of retorts, the long axes of those in each row being in the same vertical plane, are connected, the one row of one bench and the adjacent row of the next bench, to a vertical stand pipe, which is placed between them. The stand-pipes are connected to the "foul main."—J. L. F.

Gas-producers. W. R. Degenhardt. Fr. Pat. 464,265, Oct. 30, 1913.

In a down-draught suction gas producer for continuous working, the fuel-chamber, A, above the producer-chamber, B, is surrounded by an annular chamber, H, for the distribution of air and steam through a ring of holes, H¹. The grate consists of separate perforated bars, D^1, which fit against one another, without intervening spaces, and are supported by a ring, D, and a hollow bar, D^3, which passes diametrically across the producer. The outer ends of the grate bars can be raised and lowered by a tool inserted through holes, L^2. Air is drawn through the hollow bar, D^3, into a vaporising chamber, F, heated by the gas as it leaves the space beneath the grate. Water is admitted continuously to the vaporiser at F^1, and the mixed steam and air pass through the pipe, F^2, to the distributing chamber, H. This chamber may be replaced by an annular pipe outside the producer casing, connected with a similar perforated pipe within the casing, or by an annular chamber within the producer casing surrounding the upper part of the producer chamber. A further supply of air is admitted through pipes, K, extending vertically downwards through the fuel-chamber. Poking holes, B^4, are provided at the top of the producer chamber.—A. T. L.



Gas for lighting and heating ; Production of —— by the action of steam above 800° C. on a mixture of fuel and lime. L. Vignon. Fr. Pat. 465,129, Jan. 29, 1913.

The process described in the Third Addition, dated Feb. 6, 1911 to Fr. Pat. 416,699, Aug. 12, 1909 (this J., 1912, 481), is effected at a higher temperature, viz., above 800° C., and if desired up to 1100° C. or 1200° C. The reaction is: $2CaO+3C+4H_2O=2CaO+2CO_2+2H_2+CH_4$. The higher temperature increases the velocity of the reaction, and prevents the formation of calcium carbonate. Part of the carbon dioxide is reduced to carbon monoxide, and small quantities of hydrocarbons other than methane, such as ethylene, are formed. The carbon dioxide may be removed from the gas by washing, and the carbon monoxide may be converted into methane as described in Fr. Pat. 416,699 (this J., 1910, 1366).—A. T. L.

Oil-gas ; Process for obtaining —— of uniform quality during the whole of the gas-making period in producers. J. Pintsch A.-G. Ger. Pat. 271,270, May 11, 1913.

The oil-supply pipe is fitted with a throttle-valve which is gradually and continuously closed during the gas-making period, so that as the temperature falls, the supply of oil is diminished. In this way 80 per cent. or more of the calorific value of the oil is recovered in the gas instead of 60 per cent. as usual.—A. S.

Ammonia and combustible gases ; Conversion of animal substances [waste leather] into ——. A. T. Smith, London. Eng. Pat. 5348, Mar. 3, 1913.

Waste leather is mixed with coal, slack, or coke, and limestone or lime, in any of the usual types of gas producers, operated with a mixture of air and steam. About 70 per cent. of the nitrogen contained in the leather is evolved as ammonia, which is absorbed in the usual way, the unabsorbed, combustible gases being utilised in any desired manner.—O. R.

Ammonia from gases ; Removal of ——. J. Marr, Sheffield. Eng. Pat. 6291, Mar. 13, 1913.

Gases from the dry distillation of coal or the like, are cooled to condense tar and gas liquor, and the latter is treated with steam and an alkali. The steam and ammonia evolved are mixed with the residual gases from the first condensation, passed through a water separator, to remove the water fog together with any tar which may still be present, and finally to a saturator.—O. R.

Condensers used in gas works. G. F. H. Beard, J. W. Scott and R. and J. Dempster, Ltd., Manchester. Eng. Pat. 26,970, Nov. 24, 1913.

Inside a vertical casing having an inlet and outlet for the gas, are vertical water tubes fixed at the lower end to a stationary, and at the upper end to a movable tube-plate, to permit of expansion. The upper tube-plate has a flange extending downwards from its periphery and sealed in a water trough. The water passes up through the tubes and flows over the upper tube-plate into the water-seal which is provided with an overflow. The flange may extend downwards nearly to the bottom of the condenser, thus providing a large additional cooling surface.—A. T. L.

Separating dust, etc., and sulphur compounds from producer-gas, water-gas, and the like ; Purifier for ——. Berlin-Anhaltische Maschinenbau A.-G. Ger. Pat. 271,122, Dec. 12, 1912.

Within and spaced away from the wall of the purifier is a retort packed with turnings of iron or other metal capable of combining with sulphur compounds. Except at the two ends the wall of the retort is porous. The gas enters the purifier, and passes through the porous wall of the retort, which retains dust, etc. A blast of air may be passed into the purifier to bring it to, and maintain it at, the requisite temperature for the retention of the sulphur compounds by the iron turnings.—A. S.

Blast-furnace gases ; Purification of ——. W. Schwarz. Ger Pat. 271,303, April 24, 1912.

Lime-water or other suitable solution is added to the water used in the known forms of purifiers (centrifugal washers, disintegrator devices, etc.), so that in addition to dust and the like, carbon dioxide is also removed from the gas.—A. S.

Mineral oil into volatile spirit ; Apparatus for converting ——. The New Oil Refining Process, Ltd. and J. L. Rossini, London. Eng. Pat. 13,726, June 13, 1913.

In carrying out the process described in Eng. Pats. 13,675 of 1908, 28,460 of 1911 and 20,074 of 1912 (this J., 1909, 133 and 1913, 937), the decension pipe by which the vapours leave the horizontal or inclined retorts i which the oil is "cracked," passes down into a safety box from which the vapours pass to the condensin apparatus. When it is necessary to clean out the retort the end of the decension pipe is sealed by running wate into the safety-box, so preventing any flame from enterin the condensers. Steam connections are provided a the rear end of the retorts for blowing out the vapours after the doors have been slackened but before they are removed.—W. H. C.

Still [for petroleum]. C. L. Turner, New York, Assignor to S. H. Hart, Houston, Tex. U.S. Pat. 1,091,781, March 31, 1914.

The crude oil flows from a supply tank successively through a basin, a heater, a series of evaporators, and back to the supply tank. The evaporators each consist of a supply trough and a delivery trough, with an intervening spreading floor on which the oil is distributed in a thin layer; and are heated by radiators through which steam passes in a direction opposite to that of the oil. The steam supply to the radiators, one beneath and adjacent to the floor of each evaporator, can be independently regulated. The vapours from the evaporators pass to condensing coils, disposed within the basin, and serve to preheat the crude oil; means are provided for accelerating the passage of the vapours from the evaporators to the coils.—A. S.

Mineral oils, ozokerite, etc.; Removal of acid from —— after treatment with sulphuric acid. A. Burkhardt. Fr. Pat. 464,566, Oct. 7, 1913.

The crude oil, etc., after treatment with sulphuric acid, is heated and a current of air is passed through it until all sulphur dioxide is expelled. The temperature should not be high enough to cause any carbonisation. The oil is then allowed to stand, drawn off from the "acid tar," heated with a dehydrating agent such as calcium sulphate (calcined gypsum) to break down any emulsion of oil, water and tar, and then neutralised with alkali and refined in the usual way.—A. T. L.

Alcohols for industrial use; Carburetting —— during manufacture. G. Boulais and P. E. Lefèvre. Fr. Pat. 465,243, Jan. 31, 1913.

Alcohol for use in internal-combustion engines is enriched with acetylene, ethylene, or ether, in order to increase its calorific power. The alcohol vapours from the still are passed through layers of calcium carbide, whereby the alcohol is dehydrated and acetylene is generated and passes with the alcohol through the rectifying column and condenses with it in the receiver. The alcohol may in addition be saturated with oxygen and nitrous oxide, or preferably, with ethylene. The ethers which separate during distillation of the alcohol are freed from acids and mixed with the alcohol. Crude ether containing alcohol and water is also added in order to bring the alcohol to a standard calorific power.—A. T. L.

Coke; Utilisation of the waste heat of caked ——. C. Semmler, Wiesbaden, Germany. Eng. Pat. 23,274, Oct. 15, 1913.

See Fr. Pat. 463,299 of 1913; this J., 1914, 411.—T. F. B.

Gaseous mixture; Process and apparatus for producing combustible ——. A. Rosenberg. Fr. Pat. 464,357, Oct. 31, 1913. Under Int. Conv., Nov. 2, 1912.

See Eng. Pat. 25,165 of 1912; this J., 1913, 1149.—T. F. B.

Gas producer. T. de Fontaine. Fr. Pat. 464,549, Aug. 13, 1913. Under Int. Conv., Aug. 13, 1912.

See Eng. Pat. 18,413 of 1913; this J., 1914, 411.—T. F. B.

Distilling mineral oils and the like; Process of and apparatus for ——. K. Kubierschky, Eisenach, Germany. Eng. Pat. 15,300, July 2, 1913.

See Fr. Pat. 460,156 of 1913; this J., 1914, 68.—T. F. B.

Mineral oils; Method of treating ——. M. Melamid, Freiburg, Germany. U.S. Pat. 1,092,448, April 7, 1914.

See Eng. Pat. 5484 of 1913; this J., 1913, 1000.—T. F. B.

Mineral wax; Process for refining and decolourising ——. E. C. W. A. von Boyen, Barmstedt, Assignor to Wachs und Ceresinwerke zu Hamburg, J. Schlickum und Co., Hamburg, Germany. U.S. Pat. 1,092,629, April 7, 1914.

See Fr. Pat. 425,401 of 1911; this J., 1911, 882.—T. F. B.

Acid sludge and liquors produced as by-products during the washing of mineral oils; Process for working up the ——. W. Pau and P. Eberhardt, Grabow, Assignors to Rütgerswerke A.-G., Berlin. U.S. Pat. 1,092,386, April 7, 1914.

See Ger. Pat. 261,777 of 1911; this J., 1913, 904.—T. F. B.

Separating different kinds of minerals, such as coal, ores, etc. Eng. Pat. 26,418. *See* I.

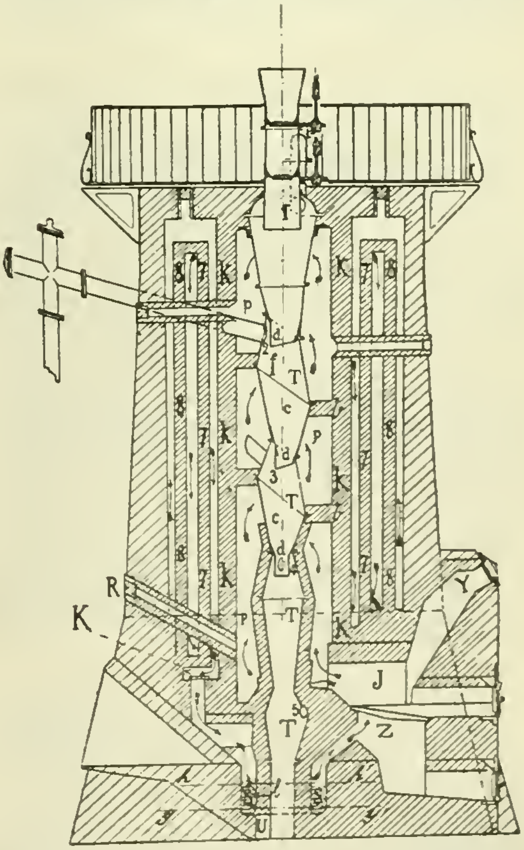
Manufacturing a binding or covering medium from waste sulphite lyes. Eng. Pat. 7324. *See* V.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Regenerative oven for carbonisation of peat, lignite, wood, sawdust and all solid fuels which do not swell when distilled, and for the recovery of by-products. G. Guardabassi and P. Goulliard. Fr. Pat. 464,591, Oct. 25, 1913.

A vertical retort is composed of elements, T, each consisting of two truncated conical portions such as *f*, *c*, having inclined, elliptical bases at both the larger and smaller ends. The longer axis of each large ellipse is in a different vertical plane, these planes all containing the



vertical axis of the retort and making equal angles with one another and a total angle of 360° from the lowest element to the uppermost. The two lowest elements are protected by firebrick, the others being of cast iron. The elements fit together at the small ends, and an extension-piece, *d*, is provided at the bottom of each to protect the gas outlets, 1, 2, 3, 4, 5. The peat, etc., passes downwards through the retort as the coke is gradually withdrawn from the chamber, *l*, at the bottom, and the gases from each element pass to separate condensers. The retort is heated by gases from the furnace chamber, J, where fuel is fed continuously on to the grate from an inclined chamber, Y. The hot gases circulate around the retort and then pass downwards between the walls, 7, 8, to the chimney. The air supply for the furnace chamber is drawn in at the bottom of the annular flue which surrounds the wall, 8, passes up and down the length of the retort and then through dampers, K, to the chamber, Z, beneath the grate. This chamber contains water normally at the level, h, h^1, and serves to generate steam for mixing with the air supply. In starting the retort, the water level is lowered to y, y^1, in order to admit air from openings normally sealed. This water also seals the opening, U, from which the coke is withdrawn, and serves to quench the coke, the steam and ammonia formed thereby passing to a condenser through the outlet, 5.—A. T. L.

Gas mantles; Manufacture of incandescent ——. J. I. Robin, London. Eng. Pat. 28,285, Dec. 8, 1913.

The fabric for making the mantles, whether upright or inverted, is knitted or woven from two or more threads, one or more of which is previously impregnated, whilst the remaining threads are not impregnated and are burnt entirely away during incineration. Unevenness of the fabric of the mantle after incineration is thus prevented. The different threads may be given distinctive colours.
—A. T. L.

Incandescence bodies [of boron] for electric lamps, furnaces, etc. E. Podszus. Fr. Pat. 464,552, Aug. 21, 1913. Under Int. Conv., Aug. 21, 1912.

Incandescence bodies or filaments of pure or almost pure boron are claimed. They may be formed from very finely divided boron nitride mixed with a suitable binder, which is removed by heating, the filaments being converted into pure boron by heating above 2000° C. in a current of ammonia. A small quantity of finely divided carbon may be added to act as a catalytic agent and facilitate decomposition of the nitride. Amorphous boron, which if pure and highly compressed, has a sufficiently low resistance, may also be used for preparing the filaments. It is obtained by the action of metallic vapours (mercury, copper, silver, sodium, calcium, etc.) on volatile compounds of boron, such as the chloride, sulphide or phosphide. For example, the vapours of pure boron chloride may be passed through a tube in which a long steady arc is maintained between electrodes of tungsten and mercury. Boron and mercury chloride are deposited on the cool parts of the tube, and the chloride is removed by heating.—A. T. L.

Distillation retorts; Feeding and distribution of charges in vertical ——. *Distillation of bituminous matters.* J. G. Aarts, Dongen, Holland. Eng. Pats. 17,611 and 17,661, July 31 and Aug. 1, 1913. Under Int. Conv., Aug. 1, 1912.

See Fr. Pat. 463,739 of 1913; this J., 1914, 412.—T. F. B.

Carbonaceous substances; Process for treating [destructive distillation of] ——. O. J. Parker. Fr. Pat. 465,262, Nov. 24, 1913. Under Int. Conv., Dec. 11, 1912.

See Eng. Pat. 28,582 of 1912; this J., 1913, 647.—T. F. B.

Charcoal powder; Process for making active ——. L. Pilaski, Warsaw, Poland. Eng. Pat. 19,228, Aug. 25, 1913.

See Ger. Pat. 267,443 of 1912; this J., 1914, 216.—T. F. B.

Charcoal; Manufacture of ——. O. Wright, Pennant Hills, N.S.W. U.S. Pat. 1,092,418, April 7, 1914.

See Fr. Pat. 447,307 of 1912; this J., 1913, 225.—T. F. B.

Graphite conductor [filament]. W. C. Arsem, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,091,616, March 31, 1914.

See Eng. Pat. 13,021 of 1911; this J., 1912, 21.—T. F. B.

Distilling crude pyroligneous acid. U.S. Pat. 1,089,417. *See* VII.

III.—TAR AND TAR PRODUCTS.

"Free carbon": its nature and determination in tar products. J. M. Weiss. J. Ind. Eng. Chem., 1914, 6, 279—285.

Results of experiments are described showing that benzene, toluene, chloroform, carbon bisulphide, and glacial acetic acid in contact with tar form insoluble compounds, the amount increasing with the period of contact: the residues obtained with chloroform and carbon bisulphide contained chlorine and sulphur respectively. No such insoluble compounds appeared to be formed with pyridine and aniline respectively, but these liquids are considered unsuitable as solvents for the determination of "free carbon," for which purpose digestion with toluene on a steam bath for not more than 30 mins. and extraction of the insoluble residue with benzene under standardised conditions is recommended. For asphaltums extraction with cold carbon bisulphide, using a Gooch crucible, is more rapid and gives results equally accurate.
—A. S.

Determination of the melting point of asphaltum. Schanin. *See* IIa.

Patents.

Coumarone-resin from heavy benzol of b. pt. 160°—180° C.; Production of a high-grade, pale ——. M. Wendriner. Ger. Pat. 270,993, Aug. 20, 1912.

The heavy benzol, after separation of tar acids and bases, is mixed with 3—5 per cent. by vol. of sulphuric acid of 60° B. (sp. gr. 1·71) and then treated, with continuous stirring, with, at the most, 0·25 per cent. by vol. of concentrated sulphuric acid, in a thin stream, until the temperature rises to 110°—120° C.; the acid (free from resin) is then separated, and the residual oil neutralised and distilled, whereby there are obtained a pale coumarone-resin and colourless solvent naphtha which has a pleasant odour and does not darken on exposure to light. It is not essential first to separate the tar acids and bases, but if this be not done, about 0·5 per cent. of concentrated sulphuric acid must be used, and the coumarone-resin obtained is not so pure.—A. S.

Diamino-di-p-xylylmethane from technical xylidine; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,663, Feb. 9, 1913.

The mixture of diaminodixylylmethanes, obtained by treating "technical" xylidine with formaldehyde, is converted into the hydrochloride, which is dissolved in water and decomposed by means of a soluble sulphate. The sulphate of diaminodi-*p*-xylylmethane, which is practically insoluble in water, is thus separated from th sulphates of the other bases.—T. F. B.

Condensation products of the anthraquinone series containin nitrogen; Process for preparing ——. Farbwerke vorm Meister, Lucius, und Brüning. Ger. Pat. 270,78 Dec. 14, 1912.

α-Anthraquinonylarylglycines (see Ger. Pat. 270,79 following) are treated with acetic anhydride. Yello

substances are obtained, which dissolve in alcohol and chloroform and exhibit a strong yellowish-green fluorescence. Their constitution has not been determined.
—T. F. B.

Condensation products of the anthraquinone series containing nitrogen ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Bruning. Ger. Pat. 270,790, Oct. 30, 1912.

α-Halogenanthraquinones or their derivatives or substitution products are heated with salts of aromatic glycines in presence of copper or its salts and of an indifferent solvent or diluent, at a temperature above 100° C. The products are anthraquinonyl derivatives of arylglycines of the general formula, $\mathrm{Aryl.N(R)CH_2.COOH}$, where R represents the anthraquinonyl nucleus.—T. F. B.

Tars from coal, petroleum or shales ; Conversion of —— into pitch by means of air under pressure. Soc. Anon. des Combustibles Industriels. First Addition, dated Jan. 4, 1913, to Fr. Pat. 443,207, July 8, 1911.

See Eng. Pat. 28,973 of 1912 ; this J., 1914, 246.—T. F. B.

Pitch ; Method of making a hard commercial ——. Barrett Manufacturing Co. Fr. Pat. 464,675, Nov. 8, 1913. Under Int. Conv., April 10, 1913.

See U.S. Pat. 1,088,635 of 1914 ; this J., 1914, 413.—T. F. B.

Arylamines of 2.3-hydroxynaphthoic acid ; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 464,478, Nov. 6, 1913. Under Int. Conv., July 18, 1913.

See Eng. Pat. 23,732 of 1913 ; this J., 1914, 70.—T. F. B.

Polynitrocarbazoles ; Process for preparing ——. L. Cassella und Co. G. m. b. H. Fr. Pat. 464,538, Jan. 15, 1913.

See Ger. Pat. 268,173 of 1912 ; this J., 1914, 193.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo ; The process of oxidation of —— [by permanganate]. H. E. Wagner. J. prakt Chem., 1914, **89**, 377—414.

In the oxidation of indigo by permanganate, as is known, less of the oxidising agent is used than is required by theory for the conversion of indigotin into isatin, necessitating a correction of 12·6 per cent. This correction remained constant for concentrations above 1 : 4000 in the case of commercial synthetic indigo, or 1 : 5000 in the case of the natural product. The permanganate consumption was not affected by atmospheric oxygen, nor by addition of small quantities of manganese sulphate. When indigo solution was added, drop by drop, to acid permanganate, nearly theoretical results were obtained, whilst quicker addition caused an acceleration towards the old result. The excess of indigo used over the theoretical quantity could be raised to 12—13 per cent. by having present from the beginning an addition of isatin or isatinsulphonic acid. The author's experiments point to the formation of a labile primary oxide by the isatin or isatinsulphonic acid being the cause of the phenomenon, this oxide entering into the reaction and causing the acceleration which accounts for less than the theoretical amount of permanganate being required.—J. B.

Madder extract "Meissonier" ; Manufacture of ——. N. Bell. Bull. Soc. Ind. Mulhouse, 1914, **84**, 39—43.

This extract was manufactured by the firm of Meissonier according to the process of P. Schützenberger during the period 1867 to 1893. Garancine was extracted with hot benzene in a special form of reflux still and the solid, more or less crystalline product which separated on cooling was purified by dissolving in concentrated sulphuric acid, precipitating with water and washing free from acid.—J. B.

Examination of saffron. Krzizan. *See* XX.

Detecting magnesium sulphate in saffron. Nestler. *See* XX.

Patent.

Condensation products of the naphthazarin series and process for making them. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 464,464, Jan. 13, 1913.

Naphthazarin or its homologues, analogues, or substitution products, or the substances obtained by heating these compounds with solvents or diluents, with or without addition of alkalis, alkali or alkaline earth sulphides or salts, or polyhydric alcohols (glycerol, etc.), are heated either with primary, secondary, or tertiary amines, or with thiophenols, or with compounds containing one of the groupings, $\mathrm{CH_2.CO}$ or $\mathrm{CH : C(OH)}$, such as indoxyl, oxythionaphthene, phenols, naphthols, anthranol, anthrol, etc., in presence of a solvent or diluent. Naphthazarins may be replaced by the corresponding arylido derivatives obtained by treating the naphthazarin with aromatic amines or their sulphonic or carboxylic acids. Similar compounds are obtained by heating these arylido derivatives of naphthazarin with a solvent or diluent, with or without an alkali, an alkali or alkaline-earth sulphide or other salt, or a poly-alcohol. All of these condensation products are readily converted into halogen derivatives. Some of the products obtained in this manner are dyestuffs, whilst others are suitable for use in preparing dyestuffs.
—T. F. B.

Furfuran derivatives, especially furfural ; Use of —— for producing black colouring matters. A. and E. Lederer. Fr. Pat. 464,622, Nov. 6, 1913. Under Int. Conv., March 11, 1913.

Derivatives of furfuran, especially furfural, are converted into substances which dye black shades on unmordanted fibres, by heating them with sulphur in presence of an alkali, an alkaline earth, or a metallic oxide such as lead oxide. For example, one part of caustic soda is dissolved in one part of water, one part of furfural is slowly stirred into the solution, one part of powdered sulphur is added, and the mixture is heated in an autoclave for two to four hours under a pressure of 3 to 5 atmospheres.—T. F. B.

Dyestuffs of the anthraquinone series ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 465,069, Nov. 19, 1913. Under Int. Conv., Dec. 5, 1912.

Acid dyestuffs for wool are obtained either by condensing anthraquinone-mercaptans with halogenated anthraquinonesulphonic acids, or by condensing anthraquinone-mercaptansulphonic acids with halogen-anthraquinones. The dyeings produced by these substances vary from yellow, red, brown, and violet to blue, and are distinguished by their fastness to chroming, fulling, and light.—T. F. B.

Disazo dyestuffs for cotton ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,669, Nov. 24, 1912. Addition to Ger. Pat. 257,193 (see third Addition to Fr. Pat. 376,888 ; this J., 1913, 131).

The monoazo dyestuff obtained by combining a diazo compound with *p*-aminobenzoyl-2.5.7-aminonaphtholsulphonic acid, is again diazotised and combined with 2.8.6-aminonaphtholsulphonic acid or its derivatives containing an acidyl group attached to the nitrogen.
—T. F. B.

Vat dyestuffs; Process for preparing blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat 270,885, Sept. 15, 1911.

Quinone or a halogen derivative of quinone is condensed with the mercaptans of *p*-aminodialkylphenylamines or their derivatives. When halogen-quinones are used, addition of sodium acetate is advisable. The condensation can be effected in presence of water, but the use of alcohol or glacial acetic acid is preferable. The products are easily converted into vats, in which cotton is dyed blue. —T. F. B.

Vat, pigment, and acid dyestuffs; Process for preparing yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,943, June 18, 1911.

The condensation products obtained from indigo and benzoic anhydride or one of its derivatives according to Ger. Pat. 250,744 (see this J., 1912, 1025), are heated with condensing agents to high temperatures, with or without addition of a solvent or diluent.—T. F. B.

Dyestuffs of the fuchsin series; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,930, Jan. 10, 1912.

Aromatic glycines are fused with primary aromatic bases which do not contain an alkyl group in the *p*-position, or with their salts, in presence of aromatic nitrohydrocarbons and iron or an iron salt.—T. F. B.

Polyazo dyestuffs; Production of substantive ——. Fabr. de Prod. Chimiques ci-dev. Sandoz. Fr. Pat. 464,576, Oct. 16, 1913. Under Int. Conv., Feb. 12, 1913.

See Eng. Pat. 23,119 of 1913; this J., 1914, 415.—T. F. B.

Azo dyestuffs; Process for producing diazotisable ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 465,347, Nov. 26, 1913. Under Int. Conv., Dec. 27, 1912.

See Ger. Pat. 268,792 of 1912; this J., 1914, 195.—T. F. B.

New colour lakes. Eng. Pat. 15,557. *See* XIII.

Making azo dyestuffs containing the arseno group. Ger. Pat. 271,271. *See* XX.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silk: Wild —— from Mexico. Bull. Imp. Inst., 1914, **12**, 45—47.

Wild silk is obtainable in large quantities in the States of Vera Cruz and Oaxaca, where the Indians use it for rope-making. The sample examined consisted of a flat loosely-spun web-like nest 12 by 18 in. The web, amounting to 24 per cent. of the whole sample, when separated as far as possible from extraneous matter, and degummed by boiling soap solution yielded a grey to greyish-brown silk of good lustre and strength. It is unlikely that the material could be used commercially owing to the low yield of degummed silk (about 10 to 15 per cent.), and the difficulties of cleaning and carding.—R. G. P.

Fibres from various sources. Bull. Imp. Inst., 1914, **12**, 32—42.

Jute from India. Four samples of jute grown experimentally at Dacca, Bengal, were examined with a view to determine the relation between strength and chemical properties. The strength as tested by hand was found to increase with increasing cellulose content and decreasing loss on hydrolysis.

Malachra capitata, *Urena lobata*, and *Sida* fibres from India would all be saleable as jute substitutes at prices close to those of "first marks" Calcutta jute.

"*Rama*" *fibre* from Northern Nigeria, is derived from *Hibiscus lunariifolius*, and it is said that an increasing quantity is now being shipped. One sample (*a*) was too harsh for use as a jute substitute and was valued at £12 per ton with "common" jute at £11—£12 per ton; the other (*b*) was valued at £16—£17 per ton as a jute substitute, with "first native marks" jute at £14 7s. 6d. per ton.

"*Crowa*" fibre from British Guiana, possibly from a species of *Ananas* or *Karratas*, was suitable for rope making and was valued at £24 per ton (Oct. 1909). The results of the chemical examination of some of the fibres are given in the following table :—

	Malachra capitata.		Rama.		Crowa.
	1	2	*a*	*b*	
	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture........	11·1	10·8	8·5	10·5	9·9
Ash	0·8	0·4	0·4	0·8	0·6
α-Hydrolysis, loss	10·0	9·7	7·4	9·5	12·3
β-Hydrolysis, loss	15·0	13·3	10·2	12·8	16·1
Acid purification, loss	0·9	0·4	0·4	1·1	1·8
Cellulose........	74·4	75·1	76·8	77·0	84·1
Length of ultimate fibres	—	0·06—0·1 in. average 0·08 in.	—	—	0·20—0·44 in. average about 0·3 in.

—R. G. P.

Cellulose compounds; Analysis of ——. V. Hottenroth. Chem.-Zeit., 1914, **38**, 515.

In the determination of impurities (*e.g.*, sulphuric acid in cellulose acetate), destruction of the organic matter by hydrolysis with strong hydrochloric acid is recommended. After standing, hot, for several hours, the solution may be diluted without separation of hydrocellulose; the sulphuric acid is determined in the usual manner. —W. R. S.

Nitrocellulose; Viscosity of solutions of —— in alcoholic camphor solutions. H. Nishida. Caoutchouc et Gutta-percha. 1914, **11**, 8103—8115, 8200—8207.

The measurements were made with an Engler viscosimeter. Nitrocelluloses which were unstable or contained free acid had always a very low viscosity. The viscosity was increased by organic bases, fatty oils, fatty acids, and especially by phenol, whilst it was lowered by addition of various solvents (except camphor and camphor substitutes) to the alcohol, by aromatic acids, and by rise of temperature. After a certain time, long standing had no appreciable effect: the solutions did not "ripen" as did those of viscose. Cold washing of nitrocellulose, to remove free acid, raised the solubility and lowered the viscosity. Prolonged nitration usually gave nitrocelluloses of low viscosity, as did nitration at high temperatures, when the yield was poorer. The percentage of water in the nitrating acid was not of great importance, but 18 per cent. gave the best results. The ratio nitric : sulphuric acid was important; the ratio 0·25 : 0·35 gave the most viscous nitrocellulose. The nitrogen content of the nitrocellulose did not affect the viscosity. Bleaching often lowered the viscosity and tended to formation of oxycellulose. Treatment by metallic salts often affected the viscosity, which was usually lowered by any increase in stability. The viscosity of a nitrocellulose was higher, the lower the content of water. The viscosity of a mixture of two nitrocelluloses of known viscosities could be calculated from the additive law. These results show that viscosity measurements can be employed for purposes of control.—H. E. P.

Acetylnitrocelluloses and their utilisation for celluloid. H. Nishida. Kunststoffe, 1914, **4**, 141—142.

Three methods for the preparation of mixed acetonitric esters of cellulose were investigated. The nitration of cellulose acetate by the action of nitric and sulphuric acids is difficult practically owing to the dense structure of the acetic ester, and the products are not homogeneous. The acetylation of nitrocellulose in the form of tissue paper by an acetylating mixture containing sulphuric acid is practicable, but entails a loss of reagents, the gelatinous product absorbing acetic anhydride which can only be removed by washing. Starting with a nitrated paper containing 12·42 per cent. N, the author obtained a mixed ester, with a yield of 169 per cent., showing on analysis 4·8 per cent. N and 29·7 per cent. CH_3CO. The ester was only slightly inflammable. The best method for preparing these mixed esters was by simultaneous esterification by the "single bath" process. A whole series of esters of different compositions were obtained by varying the proportions of reacting acids. The most satisfactory product for celluloid manufacture was obtained with a mixture of concentrated sulphuric acid, 98 parts by vol.; nitric acid (1·5 sp. gr.), 52·5; acetic anhydride, 50. Six grms. of cotton wool were steeped in 300 c.c. of this mixture for 1 hour at 30° C. The product, which was obtained with a yield of 167 per cent., contained 9·8 per cent. N; it was completely soluble in alcohol and camphor, was non-inflammable by heating and only ignited by direct contact with a flame. When converted alone, or in admixture with nitrocellulose, into a celluloid mass, it yielded products more stable and less inflammable than ordinary celluloid.—J. F. B.

Pine waste; Chemical utilisation of southern ——. M. C. Whitaker and J. S. Bates. J. Ind. Eng. Chem., 1914, **6**, 289—298.

The results are given of laboratory tests of a method of utilising waste resinous wood (long-leaf southern pine, *P. palustris*) by digesting first with dilute caustic soda under a low pressure to extract the rosin and turpentine and then with stronger alkali under a higher pressure to convert the wood into paper pulp. The experiments were made with "box-face slabs" containing about 32 per cent. of rosin, 8·4 of volatile oils (turpentine and pine oils) and 5·2 per cent. of moisture. For the first digestion satisfactory results were obtained by working at 15—20 lb. pressure for 3½—4 hours and using about 7·2 per cent. of caustic soda (reckoned as Na_2O on the weight of wood) at a concentration of 1·5—2 per cent. Na_2O. Most of the oil of turpentine was obtained in the first hour and without excessive consumption of steam: the condensed oil became heavier as distillation proceeded, so that it would be possible to effect directly a preliminary fractionation into "wood turpentine" and "pine oil." After draining off the dilute alkaline liquor, the residual "chips" were washed by boiling for a short time with water, and rosin soap was "salted" out from both the alkaline liquor and the wash liquor by adding caustic soda so as to bring the concentration up to 6—8 per cent. From 75 to 85 per cent. of the rosin contained in the wood was recovered in the form of rosin soap, which after purification by dissolving in water and re-precipitation with caustic soda, could be used directly for the preparation of size. The liquor was decanted or siphoned from the rosin soap precipitate and used in the subsequent digestion for converting the resin-free wood into paper pulp. This second digestion was effected at 100 lb. pressure for 2¼—4 hours, using 16½—35 per cent. of caustic soda (reckoned as Na_2O on the weight of wood) at a concentration of 1·8—4·2 per cent. Na_2O: about 25 per cent. of pulp (reckoned on the raw wood), of good strength and flexibility, composed of fibres 4—6 mm. long, was obtained. —A. S.

Nipa palm leaves for paper-making. Bull. Imp. Inst., 1914, **12**, 42—44.

The midribs of the leaves of the nipa palm from Sarawak yielded 33 per cent., while the leaves alone only yielded 20 per cent. of unbleached pulp calculated on the material dried at 100°—110° C., compared with 32·3 per cent. from Algerian esparto grass. The ultimate fibres of the midribs were equal in average length to those of esparto grass, those from the leaves were shorter. Both the midribs and leaves could be readily converted into a brown pulp which yielded fairly good paper. Though too bulky and giving too small a yield of pulp to allow of export to Europe, it might be possible to use them locally in Sarawak for paper-making or for the manufacture of "half-stuff" for export.—R. G. P.

Scilla rigidifolia leaves from Swaziland (for paper-making). Bull. Imp. Inst., 1914, **12**, 44—45.

Scilla rigidifolia grows in large quantities in Swaziland and the leaves contain a fair amount of fibre, which is, however, weak and could not be extracted profitably for textile use. The leaves yielded 35·4 per cent. of unbleached pulp calculated on material dried at 100°—110° C., compared with 32·3 per cent. from Algerian esparto grass; the ultimate fibres of *S. rigidifolia* were shorter than those of esparto grass. The leaves might be used locally in S. Africa for the manufacture of pulp.—R. G. P.

PATENTS.

Wool or other fibrous substances, skins, hides or textile fabrics; Method of treating —— to destroy anthrax or other disease germs. W. Rhys-Davies, Bradford. Eng. Pat. 5924, March 10, 1913.

Liquid or gaseous formaldehyde is injected by means of superheated steam or hot compressed air through the material, which is contained in a steam-jacketed chamber having a perforated false bottom, and filled with carbon dioxide. (Reference is directed to Eng. Pat. 23,954 of 1907; this J., 1908, 1173.)—J. F. B.

Textile fibres; Process of treating —— with soap-baths in the form of froth, particularly for the degumming of silk. C. Ris. Fr. Pat. 464,969, Nov. 15, 1913. Under Int. Conv., Nov. 22, 1912.

In treating fibres in a bath of froth from a boiling soap solution the operation is carried out in a closed vessel under reduced pressure, at a temperature below the normal boiling point of the liquid.—J. F. B.

Wicks for candles, wax matches, tapers and the like; Manufacture of ——. A. Wilson, London. Eng. Pat. 5170, Dec. 23, 1913.

The wicks are prepared from filaments or threads of cellulose produced from a solution of viscose by squirting it into a solution of sulphuric acid of about 10 per cent. strength.—J. F. B.

Cellulose or the like; Apparatus for pumping or regulating the flow of solutions of ——. J. E. Criggal, Wolverhampton. Eng. Pat. 9758, Apr. 25, 1913.

The apparatus is of the type in which two or more revolving cylinders are employed, the operative strokes of the plungers of which are effected by a stationary cam. The gearing for rotating the disc carrying the pump cylinders is arranged to permit of the easy removal of the disc. —J. F. B.

Artificial silk; Machines for spinning ——. V. Martin, Lille, France. Eng. Pat. 18,680, Aug. 16, 1913. Under Int. Conv., Aug. 16, 1912.

A number of thread-drums are mounted on a vertical or horizontal rotatable member, each drum being provided with a vertical shaft and friction cone. When one of the drums is full, the member is rotated and another drum comes under the spinning guide from which the thread is being delivered; at the same time the cone on the shaft of the new drum engages with the friction disc of the main driving shaft and the drum revolves, the friction disc being held in engagement by a spring mechanism.—J. F. B.

D

Cellulose esters and products derived from them; Manufacture of ——. Farbenfabriken vorm. F. Bayer und Co. First Addition, dated Oct. 21, 1913, to Fr. Pat. 417,274, June 18, 1910. Under Int. Conv., Oct. 31, 1912 (this J., 1911, 19).

For the preparation of cellulose acetates soluble in acetone, the acid sulphates of primary aromatic amines (*loc. cit.*) may be replaced by neutral sulphates of amines. Example: 50 parts of cellulose are acetylated by a mixture of 250 parts of acetic anhydride, 200 of glacial acetic acid and 20 of methylamine sulphate or *o*-toluidine sulphate, at 30°—60° C.—J. F. B.

Plastic masses; Manufacture of extra-supple ——. Soc. Anon. Nouvelle L'Oyonnithe. Fr. Pat. 465,345, Nov. 26, 1913.

Extra-supple plastic masses of a basis of nitrocellulose or cellulose acetate are made by incorporating with the usual solvents a very high proportion (50—70 per cent. of the weight of cellulose ester) of castor oil, "manol," acetin, etc., with or without pigments or metals, the material being prepared in sheets not exceeding 2 mm. in thickness. Textile fabrics may be combined with these sheets on one or both sides.—J. F. B.

Lignocelluloses; Separation and recovery of volatile acids, methyl compounds and furfuran bodies from hydrolysed ——. A. and E. Lederer. Fr. Pat. 464,608, Jan. 16, 1913.

The volatile products formed in the hydrolysis of lignocelluloses are removed by distillation under pressure from the mass in course of hydrolysis. The condensed liquid is fractionated by subsequent distillation, volatile acids, furfural, methyl alcohol and acetone being obtained. The volatile products still remaining in the hydrolysed mass are separated by drying the latter *in vacuo* at not above 80° C. until it contains only 5—10 per cent. of moisture. No destruction of sugar takes place at this temperature, but if a higher temperature be desired, calcium acetate may be added to neutralise the mineral acid present.—J. F. B.

Pulp for the manufacture of paper; Means and method of bleaching ——. P. Couper, Oakenholt, Flints. Eng. Pats. 9442 and 20,355, Apr. 22 and Sept. 9, 1913.

Dilute pulp from a tank is passed through a concentrator, whence the concentrated pulp is conveyed on a band to a funnel in the cover of a second tank, having a conical copper hood concentrically mounted near the top for distributing the flow of pulp uniformly. When the second tank is charged with pulp and bleach liquor, the funnel is removed, the cover closed and the pulp circulated from the bottom of the tank to the top of the copper hood by means of a pump and pipe outside the tank. During this process compressed air is admitted to the closed tank so that bleaching takes place under pressure. Subsequently the bleached stock is pumped over into a series of open tanks of similar construction, from which it is passed to a second concentrator.—J. F. B.

Paper and the like; Manufacture of —— [*regulation of flow of pulp*]. J. H. Wallin, Kopmanholmen, Sweden. Eng. Pat. 26,242, Nov. 15, 1913.

Variations in the quantity of water running from or pressed out of some part of the wet portion of the paper-machine are caused to act upon a registering device for indicating the thickness of the pulp or upon a regulating device for controlling the supply of pulp to the machine. For instance, the water flowing from the first wet press is collected and delivered through a flexible tube into a vessel provided with an outlet near the bottom. The size of the outlet in relation to the inlet is so adjusted that variations in the rate of water entering the vessel produce variations in the height of the water in the vessel. These variations act upon a float which in rising and falling operates an indicating lever showing the thickness of the pulp. This lever may constitute a movable electric switch, closing in its two extreme positions two separate electric circuits which cause the engagement of one or other of two pawls on a reciprocating rail with a ratchet wheel controlling the supply of pulp.—J. F. B.

Paper, pulp and similar mills; Apparatus for clarifying the back-waters of ——. E. Mann und Co. Fr. Pat. 464,483, Nov. 6, 1913. Under Int. Conv., Nov. 7, 1912 and Jan. 27, 1913.

The settling apparatus consists of two tanks arranged one behind the other and communicating with each other at their lower portions. The back-waters enter the first tank, which is of great length and has a slightly inclined front wall. The second tank, which serves for the discharge of the clarified water, is enlarged towards the top in the form of a hopper. The wall which forms the partition between the two tanks is inclined towards the end at which the liquid enters, and its angle of inclination may be altered. The back-waters entering the first tank may be directed downwards in a thin, wide stream by a baffle-plate situated near the point of entry.—J. F. B.

Bookbinding material; Production of waterproof ——. B. Hansel, Vienna. Eng. Pat. 23,957, Oct. 22, 1913.

The fabric is impregnated with a paste prepared from starch which has been hydrolysed by the action of cold alkalis or acids, and is then treated with a dilute solution of oil-varnish lacquer before applying a waterproof coating (*e.g.* nitrocellulose).—J. F. B.

Waste sulphite lyes; Process for manufacturing a binding or covering medium from ——. P. G. Müller, Berlin-Friedenau, Germany. Eng. Pat. 7324, Mar. 27, 1913.

Waste lyes from the manufacture of sulphite cellulose are concentrated and then incorporated by prolonged stirring with carbon bisulphide; the material is suitable for use as a varnish, paint, covering or binding medium for briquettes. In the manufacture of coal briquettes with this material, oil, resin, wax, paraffin, camphor, etc., may be added with the carbon bisulphide in the dissolved state, as a protection against moisture and disintegration in the fire.—J. F. B.

Retting of flax and like straws. W. J. Fernie, Newark-on-Trent. Eng. Pat. 11,384, May 13, 1912.

See Fr. Pat. 460,092 of 1913; this J., 1914, 19.—T. F. B.

Wool or similar substances; Process for degreasing raw —— *by means of fat solvents.* C. Netz und Co., and F. Koch. Fr. Pat. 464,400, Nov. 4, 1913. Under Int. Conv., Feb. 14, 1913.

See Ger. Pat. 267,487 of 1913; this J., 1914, 72.—T. F. B.

Washable materials having little or no flammability, and process for obtaining same. A. Eichengrün, Berlin. Eng. Pats. 7418, March 28, 1913 (under Int. Conv., April 9, 1912), and 7899 of 1914, date of appl., March 28, 1913.

See Fr. Pat. 455,811 of 1913; this J., 1913, 939.—T.F.B.

Paper pulp and liquids containing suspended matter; Centrifugal apparatus for purifying —— H. N. Fearnley and B. Geen. Fr. Pat. 464,660, Nov. 8, 1913. Under Int. Conv., Nov. 11, 1912.

See Eng. Pat. 25,849 of 1912; this J., 1913, 1104.—T.F.B.

Briquetting coal with waste sulphite-cellulose lyes and an inorganic substance. Ger. Pat. 271,479. *See* IIa.

Production of glucose and ethyl alcohol from sawdust or othe cellulosic material. Fr. Pat. 464,502. *See* XVIII.

Production of organic solvents [for nitrocellulose]. Eng Pat. 29,963. *See* XX.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Chromium oxide ; The destructive action of bleaching liquor on cotton containing ——. W. Thomson. J. Soc. Dyers and Col., 1914, **30**, 142—143.

A cloth containing two sets of black threads dyed Aniline Black by different dyers was found after bleaching to have become tendered in one set of black threads but not in the other. Analysis showed that the tendered threads contained an excessive amount of chromium oxide. Experiments with cloth on which varying amounts of chromium oxide had been fixed, showed that bleaching produced a degree of tendering roughly proportional to the amount of chromium on the fibre. Copper had a still more injurious influence on cotton in the presence of bleaching powder solutions. In the discussion it was stated that goods dyed with Green's Aniline Black, which contained a high proportion of chromium, did not tender in schreinering.—J. B.

Wool ; The development of the amino group in ——. C. M. Whittaker. J. Soc. Dyers and Col., 1914, **30**, 149.

After prolonged exposure to light wool has an increased affinity for basic dyestuffs, a generally decreased affinity for acid dyestuffs and cannot be so readily diazotised and combined with a-naphthylamine. The results would appear to indicate that the amino groups in wool are destroyed by the exposure, but this is opposed to the experience of garment dyers, who find that faded portions of garments always come out darker in re-dyeing.—J. B.

Neutral salt reactions with reference to their influence in the acid dye-bath. A. Herz and C. E. Barraclough. J. Soc. Dyers and Col., 1914, **30**, 135—141.

The authors dispute the work of Fort on the neutral salt reaction and its application to explain the tendering of unions dyed in the piece in the neutral Glauber's salt bath (see this J., 1913, 359, 483). Both pure sodium sulphate crystals and carefully cleaned wool gave an alkaline reaction with cochineal as indicator. Even with alizarin wool showed an alkaline reaction and experiments with wool, alizarin and sodium sulphate gave results contrary to those obtained by Fort. The supposed decomposition of Glauber's salt by wool, with absorption of the sulphuric acid by the latter, was disproved by quantitative experiments ; wool boiled with a solution of Glauber's salt under a reflux condenser absorbed no sulphuric acid. The experimental results of Lloyd (this J., 1912, 1076) by which he attempted to explain the tendering of cotton warps in lustre union goods which were dried without complete removal of the bath liquor (sodium sulphate and an inorganic acid) could not be confirmed. Patterns kept over the week-end at 70° C. were not tendered, and only the most minute traces of sulphuric acid could be detected. Lloyd's statement that nitric acid is produced by boiling potassium nitrate and acetic acid in the presence of wool was not confirmed. In the discussion the authors' criterion of purity for the wool experimented on was criticised. It was also argued that in a solution containing an organic acid and a neutral salt of a mineral acid a certain amount of mineral acid must be produced according to the dissociation constant. In the presence of wool this production of mineral acid would tend to increase owing to preferential absorption of the mineral acid by the wool.—J. B.

Naphthol AS and its application in dyeing and printing. F. Kunert and E. Acker. J. Soc. Dyers and Col., 1914, **30**, 128—134.

Naphthol AS is an arylide of 2.3-hydroxynaphthoic acid (see Eng. Pat. 17,279 of 1913 ; this J., 1914, 73), and by using it in conjunction with various diazo compounds brilliant dyeings of all shades except a pure yellow and green can be produced on yarn, cops, cheeses, pieces, etc. in a manner similar to that used in the case of β-naphthol, over which it possesses great advantages in the greater fastness of the dyeings and in the ease of its application. A feature of its application is the omission of drying after padding (except in the case of piece goods), this being possible on account of the quickness of combination with the diazo compound and also because of the substantive-dyeing properties of the Naphthol AS. The method of application varies in detail for the different developers (nitranilines, nitrotoluidines, nitroanisidines, dianisidine, etc.) and a special form of Obermaier apparatus is recommended. Piece dyeing requires special precautions and drying is necessary, preferably in the hot-flue, after preparing. There is no risk of sublimation as with β-naphthol. In printing the new process can be applied in any of the styles usual for the β-naphthol process. Dianisidine Blue produced with Naphthol AS or with a newer product, Naphthol NA, which gives redder shades, is particularly interesting for discharge work. Pinks can be produced which surpass Alizarins in brilliancy. All the shades appear to be fast to bleaching ; it is claimed that the blue from dianisidine is faster even than Hydron Blue to chlorine. The fastness to rubbing is good and the fastness to light of some of the reds approaches that of Alizarin. A black, obtained by developing separately with the Fast Orange R Base and with dianisidine, is said to be faster to chlorine than Indanthrene Black. Generally the new colours will not stand pressure in kier boiling.

—J. B.

Dianisidine Brown (Ortamine D Brown). H. Schmid. Bull. Soc. Ind. Mulhouse, 1914, **84**, 44—51.

The brown is produced by padding with o-dianisidine (Ortamine D) dissolved in hydrochloric acid and formic acid together with sodium chlorate and a small quantity of an activator, *e.g.*, potassium ferrocyanide or ferrous sulphate. The goods are dried, printed with the ordinary reserves for Paramine Brown, steamed three to five minutes in the small Mather and Platt, and finally degummed in a dilute bath of Solvay salt (sodium carbonate) at 50° C., washed and soaped. Tendering is avoided by the use of the formic acid in the place of part of the hydrochloric acid necessary for solution of the base. Vanadium cannot be used as a catalyst as it causes premature oxidation. By the use of considerably larger quantities of potassium ferrocyanide than are necessary for the production of the ordinary Ortamine Brown, the shade is considerably changed, becoming brighter and ranging in tone from reddish brown to maroon and orange-brown. The more ferrocyanide is used the more orange the shade. This property allows of the printing of semi-reserves, *i.e.*, after padding with the ordinary Ortamine liquor containing a small amount of ferrocyanide, a paste containing more ferrocyanide is printed. White reserves are obtained readily, for example, with a mixture of Rongalite C, potassium sulphite and sodium acetate. Illuminated effects can be produced by printing a mixture of sodium chlorate and potassium ferrocyanide on cloth padded with a mixture containing a large proportion of ferrocyanide. Dark brown effects are thus obtained on a lighter, orange-brown ground. Ortamine D can be employed in printing silk and half-silk.—J. B.

Printing ; A new fixing agent for use in ——. L. Baumann, G. Thesmar and S. M. Jones. Sealed note No. 2204, dated Sept. 18, 1912. Report thereon by M. Battegay and F. A. M. Noelting. Bull. Soc. Ind. Mulhouse, 1914, **84**, 52—56.

The new fixing agent is the condensation product formed by heating phenol and formaldehyde in the presence of a condensing agent, *e.g.*, sodium carbonate, sulphite, hydrosulphite, phosphate, acetate, etc. The resulting viscous yellow fluid is printed together with the metallic powder or colouring matter and an addition such as acetin. The print is fixed by steaming in the small Mather and Platt for four minutes, or by treating for one hour in a large steamer, finally soaping. (Compare M. J. Stéphan, this J., 1913, 422, and J. Heilmann et Cie., H. Wagner and M. Battegay, this J., 1913, 696.)—J. B.

Silk; The fading [discolouration] of dyed ——. A. Jones and G. W. Parr. J. Soc. Dyers and Col., 1914, **30**, 147—149.

The discolouration took place in pure silks on storage in diffused light or in the dark, reddish brown spots (the "red spotting" of Sisley; see this J., 1902, 1328) being usually produced. The discolouration was always followed by tendering and was attributed to oxidation, restoration both in appearance and in strength resulting when the fault was treated with reducing agents, *e.g.*, hydrosulphite, sulphurous acid or Rongalite (sodium formaldehyde sulphoxylate). Three factors were always present—traces of iron or copper, sodium chloride and "scroop acid." Free acid was always found in the discoloured places in greater amount than in normal places. The immediate cause was assumed to be the dissociation of sodium chloride and oxidation of the liberated hydrochloric acid to chlorine by means of atmospheric oxygen. Generally speaking the amount of tendering was proportional to the amount of sodium chloride present, and copper was a much more effective catalyst than iron. A similar destruction of wool takes place during bleaching by means of hydrogen peroxide in the presence of a copper or iron catalyst (see Lloyd, this J., 1913, 908).—J. B.

Fastness to light of dyed cotton; Influence of finishing on the ——. E. Schmidt and B. Gabler. Färber-Zeit., 1914, **25**, 153—155.

An investigation of the effect of various additions to the finish on the fastness to light of direct cotton dyestuffs (compare Jones, this J., 1910, 752). The effect varies with different dyestuffs but by careful choice of the dressing it is possible considerably to increase the fastness to light of many cheap direct dyeings. The additions found to have the most marked effect are aluminium sulphate, sodium metaphosphate (see Ger. Pats. 255,117 and 257,876; this J., 1913, 360 and 484), and aluminium thiosulphate. These increase in a remarkable manner the fastness to light of such dyestuffs as Diamine Pure Blue FF, Diamine Blue BX and Columbia Brown R. Sodium thiosulphate (see Fr. Pat. 455,804; this J., 1913, 940) and sodium phosphate also have a good effect. A dextrin finish is recommended as most suitable, whilst "Apparatin" (a starch preparation) had a harmful effect, despite additions. In the main alkaline finishes have a negative effect. Finishes prepared from soluble starch vary according to the method of rendering the starch soluble; the use of perborate and formic acid gives the best products. The best result in the experiments was obtained with a dressing of starch (rendered soluble by perborate or formic acid), glucose, glycerin, salt and aluminium sulphate or sodium metaphosphate. Similar dressings increase the fastness of the fugitive Sulphur Browns, of basic dyestuffs, and of direct dyeings topped with basic dyes.—J. B.

Patents.

Mercerisation; Process and apparatus for —— *and for the recovery of the caustic soda.* W. Brächter. Fr. Pat. 464,730, Nov. 10, 1913. Under Int. Conv., Nov. 14, 1912.

A process for the continuous recovery of the mercerising lye, the cloth being passed under tension through a series of superposed horizontal baths through which flows a stream of warm water in a direction contrary to that of the cloth. A concentration of 12° to 15 B. (sp. gr. 1·091—1·116) can be attained in the last bath.—J. B.

Dyeing and bleaching textiles; Apparatus for ——. P. M. Havez. First Addition, dated Oct. 3, 1913, to Fr. Pat. 438,504, Dec. 27, 1911.

A variation on the method of building up the stacks of bobbins on the plate of the dyeing machine described in the principal patent (this J., 1912, 637). Instead of conical tubes for the bobbins, which slide each into the tube below it, cylindrical tubes are used, connected with each other by means of flanges, or by making alternate tubes slightly narrower than the ones above and below.—J. B.

Green dyeings; Process for producing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 270,661, Dec. 6, 1911.

A tetrazotised diamine is combined on the one hand in acid solution with 1.8-aminonaphthol-3.6- or -4.6-disulphonic acid and on the other with a primary or secondary amine; when textile fibres are dyed with these products and developed with a diazo compound, very fast green dyeings are produced, which can be discharged to pure white.—T. F. B.

Sarees, scarves, shawls and the like; Machines for printing ——. The Calico Printers' Assoc. Ltd., Manchester, and J. Muir, Glasgow. Eng. Pat. 10,962, May 9, 1913.

In machines in which a separate timing cam plate and timing shaft are employed for each tappet shaft, each timing cam plate is formed in two or more parts, one of which is graduated and adjustable relatively to the others, and is set relatively to the zero timing cam, for the purpose of changing the respective motions when a change is made in the length of the article to be printed.—J. F. B.

"*Col marin et divers*"; *Application of* —— *to cotton fabric by printing.* A. Louppe et fils. Fr. Pat. 465,108, Oct. 25, 1913.

Covers the application of "*Col marin et divers*" to cotton fabrics by printing (roller or block) in direct or discharge styles.—J. B.

Brown or grey prints on vegetable fibre; Process for producing fast ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,252, Jan. 24, 1913.

The goods are printed with a caustic alkaline solution of an aminonaphthol, which may also contain formaldehyde, acetone, or alcohol, and the colour is developed by steaming or by suspending in the air. The shades may be deepened by after-treatment with bichromate. Formaldehyde accelerates the formation of the dyestuff and thus reduces the time of development, whilst the addition of acetone or alcohol keeps the printing colour fluid for a longer time.—T. F. B.

Metallisation of sheets, films or threads of cellulose; Process of ——. E. Crumière et Cie. Fr. Pat. 464,344, Jan. 10, 1913.

The cellulose material (cotton, linen, etc., or artificial cellulose) is coated with a solution of a natural or artificial resin in oil of turpentine or other solvent (*e.g.* benzene) with which is mixed the metallic powder. A softener, for example dicresyline, may be added.—J. B.

[*Waterproofing*]. *Treatment of fabrics and other materials with viscous substances and means therefor.* A. M. Hart, London. Eng. Pat. 18,279, Aug. 11, 1913.

In a machine for applying viscous or semi-liquid substances to fabrics, paper, etc., the scraper consists of several edges of different cross-section, and is mounted so that when turned on its axis any one of the edges may be brought into use. The edges have a hollow space running along their length through which a heating fluid can be circulated.—J. B.

Dressings [*for textiles, etc.*] *stable towards water and moisture Process for preparing* ——. E. T. J. Watremez. Ger. Pat. 271,251, Jan. 26, 1913.

Chromed gelatin treated with sulphurous acid is used alone or with other dressings, for application to texti fabrics, paper, wood, and leather; the chromed gelati is fixed on the goods by drying.—T. F. B.

Finishing material from gelatin, resistant to water. E. T. J. Watremez. Fr. Pat. 464,729, Nov. 10, 1913. Under Int. Conv., Nov. 11, 1912, and Jan. 11, 1913.

See Ger. Pat. 271,251 of 1913; preceding. When soap is added to the finishing bath, it combines with the chromium, forming a metallic soap which improves the resulting finish.—T. F. B.

Brown shades on fibre; Process of producing ——. H. Schmid, Mülhausen, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,092,542, April 7, 1914.

See Fr. Pat. 447,991 of 1912; this J., 1913, 423.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid manufacture; The chamber process of ——. W. Hempel, F. Heymann, J. Richter, and Hering. Z. angew. Chem., 1914, **27**, 218—223.

Experiments by Richter showed that in the determination of nitrous oxide in gaseous mixtures, the method used by Hempel and Heymann (this J., 1906, 845) gave high results and the method of Inglis (this J., 1904, 643; 1906, 149; 1907, 668) low results. Percentages of nitrous oxide ranging from *nil* up to 0·012 per cent. were found in the gases from chambers working normally at Muldenhütten, but the higher values found previously by Hempel and Heymann (*loc. cit.*) were undoubtedly due to irregular working. Experiments in a small glass apparatus in which mixtures of sulphur dioxide, oxygen (air) and steam were allowed to interact in presence of different oxides of nitrogen, and at different temperatures, showed that the reaction was more rapid with N_2O_3 (dissociated into NO_2 and NO) than with N_2O_4, indicating that the process is not one of simple oxidation, but that an intermediate product is formed. The reaction proceeded more readily the larger the proportion of steam and of nitrous gases present, and with a high concentration of nitrous gases the best temperature was 70° C.; in this last set of tests the gas mixture consisted of approximately 9·67 c.c. SO_2, 27·32 c.c. H_2O, 61 c.c. air, and 10·39 c.c. NO. With a large excess of sulphur dioxide *e.g.* with a mixture of 240 c.c. SO_2, 15·9 c.c. NO, and 10 c.c. H_2O, after 24 hours at 73° C., nearly all the nitric oxide was reduced to nitrous oxide and nitrogen was not formed or at the most only in very small quantity.—A. S.

Arsenic acid; Reduction of —— to arsenious acid by thiosulphuric acid. R. M. Chapin. J. Agric. Res., 1914, **1**, 515—517.

Arsenic acid is reduced to arsenious acid by a mixture of sodium thiosulphate and mineral acid, the reaction being quantitative in 2½—7½ mins. with the following quantities:—10 c.c. of $N/10$ solution of arsenic acid, 15 c.c. of water, 20 c.c. of $N/10$ thiosulphate and 10 c.c. of $N/10$ hydrochloric acid. After addition of a little potassium iodide, the excess of thiosulphate is titrated with $N/20$ iodine, then sodium carbonate is added, and the arsenious oxide titrated with $N/20$ iodine. The formation of tetrathionic acid appears to be the essential reaction of the reduction with thiosulphuric acid. If the mixture, after the second titration, is heated with sodium carbonate a quantity of thiosulphate, nearly equal to that originally added, is formed (cp. Stiasny and Das, this J., 1912, 755). The reaction is not suitable for accurate work, but may serve for approximate determinations of arsenic, *e.g.*, in arsenical baths used for dipping cattle, and for reducing arsenic to arsenious acid prior to precipitation with hydrogen sulphide.—L. E.

Telluric acid; Preparation of ——, and a test for associated tellurous acid. P. E. Browning and H. D. Minnig. Amer. J. Sci., 1913, **36**, 72.

Telluric acid can be prepared by passing chlorine into water holding amorphous tellurium in suspension. The element slowly dissolves, and when a portion of the solution, after rendering alkaline, ceases to give a precipitate on acidification with acetic acid. When a precipitate is no longer formed in this test, the oxidation to telluric acid is complete. The test will detect one part of tellurous acid in presence of 200 parts of telluric acid. From the solution the telluric acid is obtained in crystalline form by precipitation with acetone or ethyl alcohol.—C. F. M.

Ammonia-soda process; A new theory of the ——. W. Mason. Chem.-Zeit., 1914, **38**, 513.

When carbon dioxide is passed through the ammoniacal solution of sodium chloride, a precipitate of sodium carbonate is sometimes formed. It is suggested that the reaction: $2NaCl+(NH_4)_2CO_3=Na_2CO_3+2NH_4Cl$ takes place; in concentrated solution a certain amount of sodium carbonate would separate as such, the bulk being precipitated as bicarbonate on further treatment with carbon dioxide.—W. R. S.

Potassium trioxide and the stability of alkali peroxides. R. de Forcrand. Comptes rend., 1914, **158**, 991—994. (See also this J., 1914, 419.)

Potassium trioxide is most readily obtained by heating the tetroxide (K_2O_4) to 480° C. *in vacuo*. Dissolved in excess of dilute sulphuric acid to form potassium hydrogen sulphate, hydrogen peroxide, and oxygen it evolves 43·554 Cals. per grm.-mol. which gives for its heat of formation from its elements 124·336 Cals., and from potassium monoxide and oxygen 37·536 Cals. When it is converted into K_2O_4 9·404 Cals. per grm.-mol. are evolved. The reaction $K_2O+O=K_2O_2$ is thus accompanied by the evolution of about 22 Cals. Comparison of these results with similar ones for oxides and peroxides of the other alkali and alkaline-earth metals indicates (1) that the heats of formation of the trioxides of sodium, potassium, rubidium, and cæsium are all about 126 Cals., and (2) that the heat of reaction in the conversion of monoxide into dioxide increases in the following order:—Calcium 4·11, lithium 7·97, strontium 13·07, barium 18·36, radium 18·7, sodium 19·03, potassium 22·0, rubidium 24·1, cæsium 25·0 Cals.—W. H. P.

Aluminium hydroxide; Acidic and colloidal properties of ——. R. E. Slade and W. G. Polack. Faraday Soc., April 22, 1914. [Advance proof.]

Following criticism of the work of Mahin, Ingraham, and Stewart (J. Amer. Chem. Soc., 1913, **35**, 30), who concluded that aluminium hydroxide has no acidic properties and that so-called solutions of sodium aluminate are really colloidal solutions of aluminium hydroxide in sodium hydroxide, conductivity experiments with solutions of sodium aluminate of different concentrations and at different temperatures are described. The change of conductivity as hydrolysis proceeded proved, as previously shown by Hantzsch (Z. anorg. Chem., 1902, **30**, 289) that aluminium hydroxide behaves as a monobasic acid, but no evidence could be obtained of the formation of colloidal aluminium hydroxide as the first stage of the hydrolysis, as suggested by Hantzsch; whenever hydrolysis took place crystalline aluminium hydroxide was deposited. When examined in the ultra-microscope sodium aluminate solutions showed about the same number of sub-microns as did the sodium hydroxide solution from which they were prepared, but no definite conclusions as to the presence or absence of colloidal aluminium hydroxide could be drawn from this, since in colloidal aluminium hydroxide solution prepared by Crum's method of hydrolysis of aluminium acetate, the number of sub-microns was of about the same order, the colloid being mainly in the form of amicrons.—A. S.

Alumina; Precipitation of —— in presence of fluorides. H. Cavaignac. Comptes rend., 1914, **158**, 948—950.

In presence of fluorides, alumina is not completely precipitated by ammonia. Thus, from a solution of ammonium aluminium fluoride, ammonia precipitates only 84—98·6 per cent. of the alumina at the ordinary temperature and less than half at 100° C. The precipitate, also, is contaminated with fluoride.—L. E.

Explosion of acetylene [from calcium cyanamide] in Trieste Harbour. G. Morpurgo. Mitt k. k. Techn. Versuchsamtes, 1914, **3**, 60—62.

A report on a violent explosion which occurred on Jan. 17th last, on a ship having on board 600 sacks of calcium cyanamide. Eight samples of the calcium cyanamide yielded, on treatment with water, quantities of acetylene corresponding to from 1·28 to 9·35 per cent. of calcium carbide. The hold in which the sacks were stored was only half full and was not ventilated, and the explosion was evidently due to the liberation of acetylene from the carbide present in the calcium cyanamide by the action of moisture. It has been ordered that in future calcium cyanamide must always be packed in iron drums for transportation. The author has found that if jute sacks which have been impregnated with rosin solution be used and filled whilst still damp, the rosin solution combines with the calcium cyanamide with which it comes in contact and forms a perfectly watertight coating.—A. S.

Copper carbonates; Basic ——. V. Auger. Comptes rend., 1914, **158**, 944—946.

In presence of carbon dioxide at pressures exceeding 3—4 atmospheres, amorphous basic copper carbonate, $8CuO.5CO_2.7H_2O$, is slowly converted into azurite, $Cu_3(CO_3)_2(OH)_2$. A mixture of equal parts of azurite and freshly prepared basic carbonate (in the form of a paste in the liquid from which it has been precipitated) is completely converted into azurite without the aid of carbon dioxide under pressure. Azurite is readily obtained by adding a soluble copper salt, in small portions, to a suspension of azurite in a solution of sodium carbonate and bicarbonate: the precipitated basic carbonate is allowed to change into azurite before addition of further portions of copper salt, and the liquid is kept distinctly alkaline. The interaction of malachite and carbon dioxide to form azurite and water, appears to be reversible: a mixture of azurite and malachite rapidly absorbs carbon dioxide in presence of water.—L. E.

Silver nitrate; Preparation and testing of —— for use in the silver voltameter. E. B. Rosa, G. W. Vinal, and A. S. McDaniel. Bull. Bureau of Standards, 1913, **9**, 524—551.

The most injurious impurities of silver nitrate to be used in a standard voltameter are reducing substances (especially colloidal silver) and uncombined acid or base. For determining the latter, 10 c.c. of the silver nitrate solution are treated with just sufficient of a 10 per cent. solution of pure potassium chloride in "conductivity" water to precipitate the silver, the silver chloride filtered off on asbestos or finely-divided platinum, and the solution titrated with N/1000 acid or alkali, using an ethereal solution of iodeosin as indicator. Control determinations must always be made. For use in the voltameter silver nitrate should be neutral or very slightly acid (0·0005—0·005 per cent.). For determining colloidal silver and other reducing impurities, 10 c.c. of a 66·6 per cent. solution of the silver nitrate are acidified with 1 c.c. of concentrated nitric acid (free from reducing impurities), and N/1000 permanganate is added, 0·5 c.c. at a time, until the pink colour persists undiminished in intensity for 5 mins. or longer. The permanganate test should be applied to the silver nitrate before and after fusion of the latter: organic impurities are partially oxidised during the fusion, with production of colloidal silver, which reacts very readily with the permanganate. Silver nitrate recrystallised from neutral water is slightly basic. The best method of purification is to recrystallise from strongly acid solution, until 10 c.c. of a 66·6 per cent. solution reduces not more than 1 c.c. of N/1000 permanganate, and then eliminate the nitric acid by fusion. When recrystallising, higher yields are obtained by dissolving in water and then adding the acid to the partially cooled solution. Fusion is effected at 250°—300° C., the nitrate being removed from the furnace as soon as melted.—A. S.

Samarium; Double sulphates of —— with sodium and ammonium. D. B. Keyes and C. James. J. Amer. Chem. Soc., 1914, **36**, 634—638.

An investigation of mixtures of samarium sulphate, sodium sulphate, and water, at 25° C., showed that only one double salt exists at this temperature, probably $2Sa_2(SO_4)_3,3Na_2SO_4,6H_2O$, whilst with ammonium sulphate the existence of the salt, $Sa_2(SO_4)_3,(NH_4)_2SO_4,7H_2O$ was indicated. Both salts were prepared.—F. Sodn.

Yttrium from yttrium earths; Separation of ——. H. C. Holden and C. James. J. Amer. Chem. Soc., 1914, **36**, 638—646.

A comparison of various methods of fractional precipitation showed that yttrium is most efficiently separated from solutions of rare earth metals in the form of chromate or phosphate.—F. Sodn.

Radioactive products; Action of colloids on —— in solution. T. Godlewski. Phil. Mag, 1914, **27**, 618—632.

It was shown previously (Le Radium, 1913, 250) that on passing an electric current through a solution of radium emanation together with its successive disintegration products, the radioactive substances were deposited almost exclusively at the cathode when the medium was acid or in presence of polyvalent cations and at the anode when the medium was alkaline or in presence of polyvalent anions. This suggests that the radioactive products are present as colloidal hydrosols and that the process is one of electrophoresis rather than electrolysis. Further experiments in which various colloids were added to the solution confirmed this view, and it was found possible to concentrate powerful radioactivity on a few mgrms. of a coagulated hydrosol (*e.g* colloidal gold or platinum coagulated by aluminium sulphate). Positive colloids can be precipitated merely by filtering through paper or glass-wool and in this way radium B and some radium C can be separated from water saturated with radium emanation, the greater part of the β-activity from dilute solutions of uranium nitrate (up to 10 grms. per litre), and some of the disintegration products of thorium and actinium. If a small quantity of aluminium sulphate be added to water containing radium emanation, the negative hydrosols become inversely charged, and all the products (RaA, RaB and RaC) are then retained by a paper filter. —A. S.

Patents.

Nitric acid; Process for concentrating ——. E. Collett, Christiania. Eng. Pat. 7597, Mar. 31, 1913. Under Int. Conv., April 3, 1912.

Nitric acid is concentrated in an evaporator, and the vapours are passed over a water-absorbing agent, such as sulphuric acid, in a drying apparatus; at one or more points, between the point of connection of the evaporator and dryer, and the point where the concentrated vapour escapes, regulated quantities of cooled sulphuric or nitric acid are introduced.—O. R.

Nitric acid; Process for concentrating ——. E. Collett, Christiania. Eng. Pat. 22,746, Oct. 8, 1913. Under Int. Conv., Oct. 30, 1912.

Dilute nitric acid is concentrated gradually by means of a number of communicating evaporating vessels, the escaping vapours, containing nitric acid, being introduced into a dephlegmation apparatus at suitable points one above the other. Nitric acid, preferably of 15 to 20 per cent strength, is continuously run in at the top of the dephlegmating column, and the acid to be concentrated may be introduced at a point slightly below the entry of the additional acid.—O. R.

Sulphuric acid [by the chamber method]; Apparatus fo producing ——. The British Thomson-Houston Co. Ltd., London. From General Electric Co., Schenectady N.Y., U.S.A. Eng. Pat. 15,293, July 2, 1913.

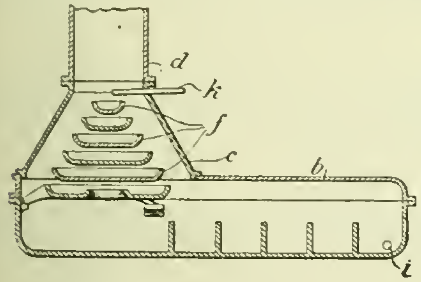
Proper movement of the gases through the system i secured by means of a centrifugal blower which acts b induction on the column of gases flowing from the last chamber, the speed of the blower being controlled by a device responsive to variations in the volume of gas passing out of the chamber. For example, the blower is arranged to supply air to an injector nozzle which projects into the stack connected with the exit pipe from the chambers, and the speed of the motor driving the blower is regulated by a float riding upon the column of gases in the exit pipe. —F. Sodn.

Sulphuric acid; Manufacture of —— and apparatus therefor. J. Mackenzie, Middlesbrough. Eng. Pat. 19,084, Aug. 22, 1913.

A series of tunnels is used instead of the usual arrangement of Glover tower, lead chambers, and Gay-Lussac towers. The sides, upper parts, and connections of the tunnels are made of acid-resisting and heat-proof bricks, which are set in lead saucers and lined with acid-resisting metal. At suitable intervals throughout the whole series of tunnels are special spraying nozzles through which acid is forced by centrifugal pumps.—O. R.

Sulphuric acid; Concentration of —— in cast-iron apparatus. Galizische Karpathen - Petroleum - A.-G. vorm. Bergheim u. MacGarvey and A. Gellen. Ger. Pat. 271,625, June 13, 1912.

The concentrating vessel, *b*, is heated by direct fire, and the combustion gases are led around the outside of the hood, *c*, in order to prevent condensation of weak acid in this part of the apparatus. The weak acid is introduced through *k*, and flows down over the series of dishes, *f*, or over a cascade, heated by the vapours from *b*. The concentrated acid is run off at *i*, and the acid vapours escaping through *d* are led to a condenser or the like.—A. S.



Catalytic agents [for the manufacture of ammonia, etc.]; Preparation of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Germany. Eng. Pat. 12,977, June 4, 1913.

Asbestos, meerschaum, etc., are soaked in a solution of alkali osmate, or alkali ruthenate, and dried. The contact mass thus obtained can be employed for catalytic purposes either directly, or after being heated, or acted upon with acid or reducing agents.—T. St.

Pyroligneous acid; Process for distilling crude ——. M. Klar, Marquette, Mich. U.S. Pat. 1,089,417, March 10, 1914.

The crude acid is preheated to a relatively high temperature, the tar and precipitated impurities removed, and the acid then passed continuously through a series of stills, working under progressively reduced pressures and temperatures, each still being heated by the vapours escaping from the preceding still.—O. R.

Ammonium sulphate; Process for the production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 463,487, Oct. 9, 1913. Under Int. Conv., Dec. 9, 1912 and March 4, 1913.

A concentrated, slightly ammoniacal solution of ammonium sulphite is treated at about 80° C. with air under a pressure of 20 atmospheres or more, in the presence of a catalyst, such as *e.g.* porous earthenware impregnated with manganese hydroxide.—O. R.

Nitrogen; Process for the fixation of —— by means of ferro-aluminium or other ferro-compounds. Soc. Générale des Nitrures, Paris. Eng. Pat. 28,071, Dec. 5, 1913. Under Int. Conv., Nov. 20, 1913.

Ferro-aluminium (45 per cent. Al), to which have been added alumina and carbon, is heated to about 1200° C. and treated with nitrogen. The reaction between ferro-aluminium and nitrogen is sufficiently exothermic to raise the whole mass to a temperature high enough (about 1850° C.) to convert all the aluminium into nitride. In the place of ferro-aluminium, an alloy of iron and any element capable of fixing nitrogen, such as boron, silicon, etc., with the corresponding oxide and carbon may be employed.—O. R.

Nitrogen simultaneously with oxides of nitrogen; Process of obtaining ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 28,737, Dec. 12, 1913. Under Int. Conv., Dec. 12, 1912. Addition to Eng. Pat. 3662 of 1913, dated Feb. 19, 1912 (this J., 1913, 1011).

The process described in the original patent is modified by introducing an indifferent gas, such as nitrogen, into the mixture of ammonia and air entering into reaction, whilst maintaining the requisite proportions of ammonia and air necessary for combustion.—O. R.

Baking salt. A. E. Berry, London, and A. Schaumlöffel, Stratford, Essex. Eng. Pat. 17,941, Aug. 6, 1913.

A mixture of sodium chloride, acid phosphate, and free phosphoric acid, prepared by incorporating common salt with purified phosphoric acid (preferably 16 per cent.) and drying the product.—F. Sodn.

Salt; Apparatus for making ——. C. L. Weil, Assignor to Diamond Crystal Salt Co., St. Clair, Mich. U.S. Pat. 1,091,721, March 31, 1914.

A brine preheater is combined with a series of successive heaters, to which heated brine may be supplied under pressure, and a succession of devices for producing self-evaporation of the heated brine. Means are provided for removing deposited salt and for leading the vapours produced during evaporation to the preheaters.—F. Sodn.

Sodium and potassium salts; Process of recovering —— from mixtures thereof. C. E. Dolbear, Assignor to E. H. Merrill, Berkeley, Cal. U.S. Pats. 1,088,216 and 1,088,333, Feb. 24, 1914.

(1). A solution containing sodium carbonate, sodium biborate, potassium chloride, sodium sulphate, and sodium chloride, is evaporated above 33° C. to separate sodium chloride and sulphate, cooled to not below 18° C. to separate sodium carbonate, sodium biborate, and potassium chloride, and then mixed with a fresh quantity of the original solution and the two processes repeated. The mixture of deposited sodium carbonate, sodium biborate, and potassium chloride is redissolved in water and treated with carbon dioxide to precipitate sodium bicarbonate, and the residual solution is treated with a "more or less soluble compound of an alkaline-earth metal" to precipitate the corresponding biborate, the remaining solution being evaporated to recover potassium chloride. (2). The steps of the preceding process are performed in the following order: (*a*), treatment with carbon dioxide; (*b*), treatment with alkaline-earth compound; and (*c*), evaporation above 33° C. and 18° C. respectively. In the absence of sodium carbonate and sodium chloride, treatment with carbon dioxide may be omitted.—O. R.

Sodium and potassium salts; Process of separating ——. Process of obtaining potash from felspar. H. P. Bassett, Assignor to The Spar Chemical Co., Baltimore, Md. U.S. Pats. 1,091,033 and 1,091,034, March 24, 1914.

(1). Sodium chloride is added to a substantially saturated solution of sodium and potassium sulphates, the mixture is heated to 60°—107° C., the sodium salts which crystallise out are withdrawn and introduced into a saturated solution of sodium sulphate, and crystals of the latter are recovered from the last-named solution at 60°—107° C. (2). Felspar, 40 parts, sodium bisulphate, 40 parts, sodium chloride, 14·4 parts, and carbon, 1—3 parts, are heated to a bright red heat for 1—2 hours, and the resulting mixture of sodium and potassium sulphates is separated from the insoluble portion of the fused mass, the two soluble constituents of the mixture being then separated from one another as above.—O. R.

Sodium hypochlorite; Apparatus for the manufacture of ——. A. Champ. First Addition, dated Oct. 9, 1913, to Fr. Pat. 454,751, Feb. 24, 1913 (this J., 1913, 910).

The use of the apparatus described in the principal patent is extended to the separation of any two substances of different densities.—O. R.

Crystallisation of hot-saturated saline solutions, especially solutions of potassium salts; Apparatus for the ——. G. Sauerbrey Maschinenfabrik A.-G. Ger. Pat. 271,246, Dec. 9, 1911. Addition to Ger. Pat. 257,685.

An improved form of the apparatus described in the chief patent (this J., 1913, 487), the plates on which the crystals are deposited being horizontal or nearly so, and enclosed in a casing through which a current of cooled air is forced by a fan. Various mechanical means of tilting the plates in order to discharge the deposited crystals are also claimed.—A. S.

Alunite; Method of calcining, and apparatus for treating ——. H. F. Chappell, New York. U.S. Pats. 1,089,109 and 1,089,110, March 3, 1914.

(1). The lower part of an upright column of alunite is heated externally by furnace gases to 900°—1000° C., and the gases are then admitted into the upper part of the column, whereby preliminary calcination takes place at about 600° C. The gases evolved from the lower portion of the column are withdrawn for the recovery of sulphuric acid. (2). An upright retort or muffle is surrounded by a heating chamber and surmounted by a supply shaft, down which the material descends into the muffle, the heating chamber communicating with the shaft, so that the latter is traversed by the furnace gases from the former; conduits are provided for withdrawing the gases from the muffle, and the furnace gases are prevented from being drawn into the muffle by means of a pipe admitting compressed air or steam at a point above the exit for the muffle gases.—O. R.

Magnesium chloride: Process for the production of ——. J. C. Graves and A. E. Schaefer, Saginaw West Side, Mich. U.S. Pat. 1,090,125, March 10, 1914.

A solution of calcium and magnesium chlorides is evaporated and subjected to fractional crystallisation; each step in the crystallising process is arrested before the solution has been cooled to the critical temperature, below which calcium chloride crystallises more readily than magnesium chloride.—O. R.

Core compound. H. K. Moore, Berlin, N.H. U.S. Pat. 1,091,690, March 31, 1914.

A homogeneous mixture of a soluble silicate (*e.g.*, sodium silicate) and neutralised waste acid liquor from the manufacture of sulphite fibre. The silicate is mixed with the neutralised liquor after evaporating at a low temperature, preferably *in vacuo* at about 90° F. (32° C.).—F. Sodn.

Fluorspar; Process of purifying ——. E. Bidtel, Golconda, Ill., Assignor to M. Eyssell, St. Louis, Mo. U.S. Pat. 1,091,795, March 31, 1914.

Fluorspar is treated with a solution of caustic alkali (preferably under pressure and with agitation), and the soluble products and slime resulting from the decomposition of the associated gangue (silica and silicates) are removed by washing.—F. Sodn.

Perborate preparations; Manufacture of easily soluble, stable ——. Ver. Fabriken für Laboratoriumsbedarf Ges. m. b. H. Ger. Pat. 271,194, May 17, 1911. Addition to Ger. Pat. 261,633.

Instead of adding to the perborates neutral salts of organic acids capable of forming complex salts with borates, as described in the chief patent (this J., 1913, 827), the corresponding acid salts, or solutions of the same may be used, but only in sufficient quantity to saturate not more than one-half of the base of the perborate. The mixtures obtained as described above or in the chief patent may be moistened with water or dilute alcohol and partially or completely dehydrated by drying or by fusing, with continuous stirring, at the temperature of the water-bath.—A. S.

Persulphates; [Electrolytic] Preparation of —— from sulphates or bisulphates, without the use of a diaphragm. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 271,642, April 18, 1913.

Cathodes of tin or aluminium are used.—A. S.

Zinc sulphate from [silicious] zinc ores; Process of preparation of ——. S. Araki. Fr. Pat. 464,038, Sept. 2, 1913.

The ground, calcined ore is decomposed with a 20 per cent. solution of sodium bisulphate, heavy metals are precipitated by zinc foil or dust, then the greater part of the iron and manganese by caustic alkali and an oxidising agent, such as air or calcium hypochlorite, and the remainder by boiling with hydrated silicic acid, formed by the addition of alkali silicate and sulphuric acid. After filtering, excess of alkali silicate is neutralised with an acid, the solution is boiled to render colloidal silica insoluble, and filtered.—O. R.

Zinc oxide; Process for obtaining pure —— from crude oxides containing lead oxide. H. Heimann. Ger. Pat. 271,136, Nov. 14, 1912.

The lead oxide is extracted from the crude oxide by a solution of caustic potash, and the solution is electrolysed with insoluble electrodes, whereby spongy lead is deposited at the cathode and an insoluble lead compound (probably $3PbO+2PbO_2+3H_2O$) at the anode, leaving nearly pure caustic potash solution for use again.—A. S.

Metallic oxides and hydroxides; Process for obtaining practically pure ——. F. Cochlovius. Fr. Pat. 464,016, Aug. 22, 1913. Under Int. Conv., May 13, 1913.

Solutions of salts, *e.g.*, of copper, zinc, etc., are treated with the equivalent quantity of quicklime, the solution filtered, and the precipitate heated to about 500° C. to decompose oxychlorides, and washed with water.—O. R.

Phosphorus pentoxide; Process of hydrating ——. S. Peacock, Chicago, Ill., Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,089,784, Mar. 10, 1914.

Phosphorus pentoxide is treated with water at 90° C. until a solution of 1·2° B. (sp. gr. 1·009) is formed, the temperature being then raised to above 100° C., but below the boiling point of the solution.—O. R.

Sulphur [from pyrites, etc.]; Commercial preparation of ——. W. A. Hall, New York. Eng. Pat. 29,365, Dec. 20, 1912.

Part of the sulphur is distilled by the application of a direct reducing flame, and the rest is removed as sulphur dioxide by roasting, the sulphur dioxide being subsequently converted into hydrogen sulphide (preferably by passing it through the producer employed in generating the gas required for the reducing flame), which is burned in the reducing flame, so that the contained sulphur is liberated in the free state and mixes with that passing off by distillation. The distilling and roasting operations are preferably conducted in two superposed furnaces. The process is a modification of that described in Eng. Pats. 20,758 and 26,595 of 1912 (this J., 1914, 77, 135). —F. Sodn.

Sulphur; Production of —— from pyrites and other metallic sulphides. W. A. Hall, New York. Eng. Pat. 8279, April 8, 1913.

Metallic sulphides are heated directly by a reducing flame, produced by the combustion of a gas rich in hydrogen with sufficient air to give the best combustion possible without the flame losing its reducing character. The sulphur vapour formed is forced to the top of the furnace and is discharged at a level above that at which the air is admitted.—T. St.

Sulphur dioxide; Method of producing ——. H. K. Moore and R. B. Wolf, Berlin, N.H. U.S. Pat. 1,091,689, March 31, 1914.

Combustion products containing sulphur dioxide are passed through a solution of calcium chloride or other solvent, cooled to about 32° F. (0° C.), and the sulphur dioxide is subsequently extracted from the refrigerated solution and liquefied, *in vacuo*. The solvent is preferably circulated continuously from an absorbing chamber to a vacuum chamber, and *vice versa*.—F. Sodn.

Hydrogen or hydrogen-containing gas mixtures: Process of bringing —— to reaction and apparatus therefor. M. Pier, Zehlendorf, Germany. U.S. Pat. 1,090,874, Mar. 24, 1914.

The gaseous mixture containing hydrogen is subjected to pressure in an inner, non-metallic vessel, which is proof against chemical action and leakage of hydrogen, and is contained inside an outer metallic vessel. The outer vessel is heated, and the space between the two is maintained under a pressure different from that of the inner vessel. this difference of pressure in the two vessels being utilised to equalise the pressures in both.—O. R.

Density regulator for use in the manufacture of sulphuric acid and other purposes. L. Santa, Turin, Italy. Eng. Pat. 18,615, Aug. 15, 1913.

See Fr. Pat. 461,641 of 1913; this J., 1914, 199.—T. F. B.

Nitric acid or nitric acid monohydrate; Impts. in, and apparatus for, the distillation of ——. Verein Chem. Fabriken in Mannheim, Mannheim, Germany. Eng. Pat. 20,189, Sept. 6, 1913. Under Int. Conv., Sept. 16, 1912.

See Fr. Pat. 462,290 of 1913; this J., 1914, 311.—T. F. B.

Nitric acid; Process for concentrating dilute ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 463,859, Oct. 21, 1913. Under Int. Conv., Oct. 30, 1912.

See Eng. Pat. 22,746 of 1913; preceding.—T. F. B.

Nitric acid; Process for the continuous manufacture of ——. Saccharin-Fabrik A.-G. vorm. Fahlberg, List und Co. Fr. Pat. 464,561, Sept. 30, 1913. Under Int. Conv., Sept. 30, 1912.

See Eng. Pat. 3264 of 1913; this J., 1913, 909.—T. F. B.

Sulphate furnaces; Rakes or scrapers for stirring apparatus in ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 16,999, July 24, 1913. Under Int. Conv., Feb. 14, 1913.

See Fr. Pat. 460,484 of 1913; this J., 1914, 23.—T. F. B.

Sodium bisulphate in a directly calcinable form; Process for the manufacture of ——. Akt.-Ges. Dynamit Nobel, Vienna. Eng. Pat. 24,604, Oct. 29, 1913. Under Int. Conv., Jan. 22, 1913.

See Ger. Pat. 263,120 of 1913; this J., 1913, 909.—T. F. B.

Oxides or hydroxides; Process for the manufacture of metal ——. F. Cochlovius, Frankfort, Germany. Eng. Pat. 19,340, Aug. 26, 1913. Under Int. Conv., May 13, 1913.

See Fr. Pat. 464,016 of 1913; preceding.—T. F. B.

Ammonium sulphate; Producing ——. A. Mittasch and H. Morawitz, Assignors to Badische Anilin und Soda Fabrik, Ludwigshaten on Rhine, Germany. U.S. Pat. 1,091,234, March 24, 1914.

See Fr. Pat. 463,487 of 1913; preceding.—T. F. B.

Ammonia; Process for preparing ——. R. W. Wallace and E. Wassmer. Fr. Pat. 464,692, Nov. 10, 1913.

See Eng. Pat. 18,450 of 1912; this J., 1914, 22.—T. F. B.

Nitrous vapours; Process and apparatus for absorbing —— in the dry and with heat by the aid of a base such as lime. A. T. Schloesing, Paris, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,092,295, April 7, 1914.

See Fr. Pat. 441,607 of 1911; this J., 1912, 922.—T. F. B.

Alkali chlorides; Treatment of —— to obtain useful products. J. A. Kendall. Fr. Pat. 465,229, Nov. 22, 1913. Under Int. Conv., Nov. 22, 1912.

See Eng. Pat. 26,896 of 1912; this J., 1914, 22.—T. F. B.

Gases [oxygen] from solid substances; Apparatus for extracting ——. C. Weston. Fr. Pat. 464,446, Nov. 5, 1913. Under Int. Conv., Nov. 5, 1912.

See Eng. Pat. 25,326 of 1912; this J., 1914, 24.—T. F. B.

Purification of gases [from suspended particles] by formation of mist by supersaturation. Ger. Pat. 270,757. *See* I.

Conversion of animal substances [waste leather] into ammonia and combustible gases. Eng. Pat. 5348. *See* IIA.

Production of alloys of alkali metals by electrolysis of fused alkali hydroxides, and production from these alloys of alkali metals or their compounds. Fr. Pat. 464,951. *See* X.

VIII.—GLASS; CERAMICS.

Tiles; Splitting of —— by frost. C. Rad. Tonind.-Zeit., 1914, 38, 649.

Glazed tiles with strongly porous edges are split by frost, whereas unglazed tiles made of the same clay are not affected Glazed bricks are more resistant than glazed tiles. The difference is attributed to the greater thickness and less exposed situation of the bricks, owing to which not so much water is absorbed, whereas thin, flat, roofing-tiles become fully saturated.—O. R.

Patents.

Melting glass or other fusible substances ; Furnace for —— and method of working it. Higham Manufacturing Co., Ltd. Fr. Pat. 464,993, Nov. 17, 1913. Under Int. Conv., Nov. 18, 1912.

See Eng. Pat. 26,494 of 1912 ; this J., 1914, 354.—T. F. B.

Kilns for making tiles, pottery, and similar articles. C. Dressler. First Addition, dated Oct. 16, 1913, to Fr. Pat. 432,427, July 21, 1911. Under Int. Conv., Oct. 18, 1912.

See Eng. Pat. 23,863 of 1912 ; this J., 1913, 1094.—T. F. B.

Glazes ; Process for making white or coloured, opaque ——. O. Völkel. Fr. Pat. 464,417, Nov. 4, 1913.

See Ger. Pat. 267,191 of 1912 ; this J., 1914, 137.—T. F. B.

IX.—BUILDING MATERIALS.

Concrete ; Electrolysis in ——. E. B. Rosa, B. McCollum, and O. S. Peters. Technol. Papers of the Bureau of Standards, Washington, 1913, No. 18, 137 pp.

Cracking of reinforced concrete is brought about by electric currents owing to oxidation of the iron (acting as anode) with the formation of oxides, having 2·2 times the volume of the original iron. Non-corrodible metals do not cause cracking. Corrosion of iron anodes, even in wet concrete, is very slight below 45° C., owing to the inhibiting effect of slaked lime and other alkalis, the passivity of iron in concrete being chiefly due to the calcium hydroxide present. The addition of a small amount of salt (to prevent freezing whilst setting) greatly accelerates corrosion and tendency to crack, reinforced concrete structures which are in contact with salt water, being consequently the most susceptible to electrolytic troubles. A distinct softening of the concrete occurs near the cathode, completely destroying the bond between the reinforcing material and the concrete. Whilst the anode effect becomes considerable only with comparatively high voltages, the cathode effect develops at all voltages at a rate approximately proportional to the voltage, but becomes serious only where the concrete is wet and the potential difference rather high. The softening is due to the gradual concentration of sodium and potassium ions near the cathode, until the free alkali attacks the cement. Non-reinforced concrete structures are immune from troubles caused by electrolysis.—O. R.

Patents.

Iron or steel or like structures ; Composition for covering ——. N. J. Porter, Belfast. Eng. Pat. 14,182, June 19, 1913.

The iron or steel surface is coated successively with a bituminous paint, and one or more coats of mineral rock asphaltum applied in a plastic state. It is then roughened, or gritty material applied, to form a bond for a magnesite and magnesium chloride, or similar composition, which is laid on in a plastic condition. The combined covering adheres to the steel without the use of holdfasts or cleats. —T. St.

Heat-insulating material ; Process of producing ——. J. A. Scharwath, Cranford, N.J. U.S. Pat. 1,092,402, April 7, 1914.

A mass consisting essentially of alkaline silicates is heated in an open mould, and is agitated and the solid crust removed, until a porous solid product is obtained.—A. T. L.

Cement-manufacturing apparatus. F. Worm, Assignor to German-American Portland Cement Works, La Salle, Ill. U.S. Pat. 1,092,551, April 7, 1914.

Between the feed-end of the kiln and the stack is a dust-collecting chamber of greater cross-section than the kiln and stack, and increasing in cross-section towards the stack. The chamber communicates with the stack through a passage of reduced cross-section, which has an inclined lower wall rising from a dust-collecting pocket in the foot of the chamber. Air is admitted to the stack at a point opposite the passage from the dust-chamber. —A. T. L.

Bricks, artificial stone, and similar products ; Manufacture of ——. L. F. Kaye, New York, and British Silicate Engineering Co., Ltd., London. Eng. Pat. 10,288, May 1, 1913.

See Fr. Pat. 457,664 of 1913 ; this J., 1913, 1012.—T. F. B.

Plaster ; Process for making ——. W. M. Brothers. Fr. Pat. 465,146, Nov. 20, 1913. Under Int. Conv., Jan. 9, 1913.

See Eng. Pat. 639 of 1913 ; this J., 1913, 604.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Titaniferous iron ores ; Smelting of —— in the blast furnace. O. Simmersbach. Stahl u. Eisen, 1914, **34**, 672—674.

In smelting titaniferous iron ores the aim should be to obtain all the titanium in the slag, as it does not improve the quality of pig-iron. Ores mixed so that the slag does not contain more than 2 per cent. Ti, can be smelted in the same way as titanium-free ores ; and provided that the slag contains under 6 per cent. MgO, its melting point will not be inconveniently high. Examples of titaniferous iron ores smelted in America are given, with analyses of the ores, slags, etc.—T. St.

Iron ; Embrittling of —— by caustic soda. J. H. Andrew. Trans. Faraday Soc., March, 1914. [Reprint, 14 pages.]

Wrought iron corrodes slowly, becomes highly crystalline and eventually brittle, by immersion in a concentrated aqueous solution of caustic soda at 100° C. for several months. The corrosion is attributed to electrolytic action between the two phases, crystalline and amorphous, of which the metal is constituted, iron going into solution at the anode (forming sodium ferrite), hydrogen being liberated at the cathode. Part of the hydrogen is occluded by the metal, being first absorbed by the amorphous constituent, thereby forcing the crystals apart, and ultimately causing the iron to become crystalline and brittle. The brittleness decreases with time, an equilibrium being finally established between the metal and the gas, and is due rather to molecular rearrangement induced by occlusion or evolution of hydrogen than to the mere presence of the latter in solution. The potential difference between the amorphous and crystalline phases and hence the rate of corrosion decrease as the latter phase becomes hydrogenised, the passivity of iron produced by immersion in caustic soda being due to this cause. Similar results were obtained with electrodeposited iron, but steel containing 0·5 per cent. C was much less affected by caustic soda solution. The recrystallisation of electrodeposited iron upon cooling through the Ar_3 point is also considered to be due to evolution of hydrogen.—W. E. F. P.

Iron nitride. G. Charpy and S. Bonnerot. Comptes rend., 1914, **158**, 994—996.

Iron nitride (Fe_2N), obtained by heating finely-divided iron in a rapid current of ammonia at 650°—700° C., is completely decomposed when heated in nitrogen above 600° C., even at pressures as high as 18 atmospheres. Below 600° C. only about half the nitrogen is expelled, which suggests the existence of a more stable nitride Fe_4N. Iron does not combine directly with nitrogen even at pressures of 18 atmospheres. Having regard to its properties, iron nitride probably does not exist in metallurgical products; the nitrogen often found in iron may be either occluded or combined with some element other than iron.—W. H. P.

Iron in soils; Electrolytic corrosion of ——. B. McCollum and K. H. Logan. Technol. Papers of the Bureau of Standards, Washington, 1913, No. 25, 69 pp.

Two kinds of corrosion are distinguished, (1) electrolytic corrosion due to external electric currents, and (2) self-corrosion due to currents originating, from whatever cause, within the corroding system itself. The "efficiency of corrosion" (*i.e.* ratio of actual corrosion to that theoretically possible for a given current) is greater the lower the current density, is practically independent of the voltage, and increases with the moisture content, up to saturation, of the soil. Corrosion of iron embedded in earth is always greater in open vessels than in sealed vessels. There is no material difference in the "efficiency of corrosion" of various kinds of iron used for underground pipes. The electrical resistance of the soil varies greatly with the temperature, being over 200 times greater at −18° C. than at +18° C.—O. R.

Steels; Equilibrium of carburisation of —— *in fused mixtures of chloride and cyanide of potassium.* A. Portevin. Comptes rend., 1914, **158**, 1025—1027.

Steel (C 0·78 per cent.) and pure iron were immersed in molten mixtures of potassium chloride and cyanide containing 25, 50 and 75 per cent. KCN, respectively, for periods varying from 9 mins. to 5 hrs. at 900° C. The depth of decarburisation of the steel (maximum 0·75 mm.) and of carburisation of the iron (maximum 0·62 mm.) were measured and the percentage of carbon in the surface layer determined in each case. The mean results in the 5 hour tests were 0·25 per cent. C for the decarburised and 0·26 C for the carburised layers, the two phenomena apparently tending towards a common limit irrespective of the proportion of cyanide in the bath.—W. E. F. P.

Nickel-steel; Influence of gases on rich ——. W. Froehlich. Stahl u. Eisen, 1914, **34**, 723—724.

The gases, especially hydrogen, present in rich nickel-steel could not be completely removed—even by fusion in a 6-mm. vacuum. Metal treated in this manner absorbed hydrogen when subsequently ignited in a current of the gas; chilling slightly increased the hydrogen content of the metal. Mechanical tests showed that rich nickel-steel, unlike steel and iron, was not adversely affected by contact with gases during the manufacturing process.—W. R. S.

Cobalt in steel; Determination of ——. P. Slawik. Chem.-Zeit., 1914, **38**, 514—515.

1—2 grms. of drillings are dissolved in dilute hydrochloric acid, oxidised with potassium chlorate and the excess of acid evaporated. The solution is treated with zinc oxide emulsion, added in small portions at a time, carefully avoiding excess, until the precipitate coagulates. The volume is made up to 500 c.c., and 250 c.c. are filtered. The solution, containing only cobalt, nickel and manganese, is concentrated to 100 c.c., treated with 20 c.c. of strong hydrochloric acid, and the cobalt precipitated by 30 c.c. of a 2 per cent. alcoholic solution of nitroso-β-naphthol. The precipitate is strongly ignited and weighed as Co_3O_4. In the case of nickel steel the ignited precipitate should be dissolved and the precipitation repeated.—W. R. S.

Gold and platinum metals; Method of assaying concentrates and battery chips for ——. A. F. Crosse. J. Chem., Met., and Min. Soc., S. Africa, 1914, **14**, 373—374.

The lead button obtained in the ordinary pot assay is cupelled at a fairly high temperature, 2—4 grms. of (standard) silver added, and the resulting bead alloyed with about 3 times its weight of cadmium, the latter being fused under potassium cyanide in a porcelain crucible at a low red heat, the silver bead added, and the charge shaken to produce a homogeneous alloy. From the cooled melt the cyanide is removed by warm water, and the alloy digested with dilute nitric acid (1 : 3). The insoluble portion is collected on a filter, the paper incinerated at a low temperature, and the residue fused at a dull red heat with potassium bisulphate. The cooled melt is dissolved in warm water, filtered (the filtrate may contain rhodium and palladium), the filter paper gently incinerated and the residue digested with cold *aqua regia*; the insoluble osmiridium being filtered off, ignited and weighed. The *aqua regia* solution, containing gold and platinum, is twice evaporated to dryness on the water-bath (a few drops of hydrochloric acid being added each time) and the final residue dissolved in a little water: gold is precipitated from the solution by a slow current of sulphur dioxide, and then platinum by means of magnesium. Synthetical tests with gold and platinum gave satisfactory results.—W. E. F. P.

Mineral production of the United Kingdom in 1913. Board Board of Trade J., April 23, 1914. [T.R.]

The following tables, showing the output of coal and certain other minerals in the United Kingdom at mines worked under the Coal and Metalliferous Mines Act (the returns from quarries under the Quarries Act are not yet available) during the year 1913, with comparative figures for the preceding year, are extracted from an advance proof of tables prepared for the Mines and Quarries General Report and Statistics for 1913:—

I.—Output of minerals under the Coal Mines Acts.

	1912	1913.
	Tons.	Tons.
Barium (compounds)	4,712	4,610
Coal	260,398,578	287,411,369
Clay and shale, other than fire-clay and oil shale	399,033	457,244
Fire-clay	2,287,719	2,585,763
Igneous rocks	268	688
Iron pyrites	8,442	8,964
Ironstone	6,744,258	7,709,624
Limestone	12,009	7,525
Oil shale	3,184,826	3,280,143
Sandstone (including "Ganister")*	152,156	144,923

* The quantity of ganister obtained was 143,076 tons in 1912, and 141,349 tons in 1913.

II.—Output of certain minerals under the Metalliferous Mines Regulation Acts.

	1912.	1913.
	Tons.	Tons.
Arsenic	2,193	1,694
Barium (compounds)	38,055	43,408
Bauxite	5,790	6,055
Chert, flint, etc.	4,787	5,173
Clay and shale	123,279	133,984
Copper ore and copper precipitate	1,912	2,705
Fluorspar	28,691	33,833
Gypsum	243,811	238,494
Igneous rocks	61,117	57,921
Iron ore	1,675,868	1,881,853
Iron pyrites	2,080	2,463
Lead ore	25,383	24,265
Limestone *	343,560	356,316
Manganese ore	4,170	5,393
Ochre, umber, etc.	5,804	5,999
Rock salt	218,055	214,573
Sandstone	98,022	89,718
Slate	101,648	95,271
Tin ore, dressed †	6,822	6,942
Zinc ore	17,704	17,294

* Including 1,432 tons of calc spar in 1912 and 1,267 tons in 1913.

‡ In addition, 408 tons of undressed tin ore were obtained in 1912 and 1,042 tons in 1913.

The above figures do not in all cases represent the total production of the minerals for the year. Large quantities of several important minerals, such as iron ore, limestone, sandstone, slate, clay, etc. are obtained from quarries under the Quarries Act and from other open workings, the returns from which are not yet available. The totals for coal and for the ores of copper, lead, and zinc are, however, substantially complete.

Copper solutions; Action of iron sulphides on ——. S. Croasdale. Eng. and Min. J., 1914, **97**, 745—748.

METALLIC copper, not copper sulphide, is precipitated from solution by ferrous sulphide or iron matte:

$$4FeS + CuSO_4 = Cu + FeSO_4 + Fe_3S_4.$$

When the solution contains more than 3 per cent. of free (sulphuric) acid, the precipitated metal is masked by the presence of a small quantity of copper sulphide, but the amount of copper in the precipitate ($Cu + Fe_3S_4$) remains practically constant irrespective of the time of contact and the temperature of the solution. Artificial sulphides of iron and copper, containing more than 5 per cent. of the latter, have only a slight precipitating effect upon copper solutions. There is apparently no rule governing the action of the natural sulphides of iron, some of which, both simple and complex, precipitate copper rapidly from its solutions under favourable conditions, whereas others have practically no precipitating effect.—W. E. F. P

PATENTS.

Iron ore and the like; Process for briquetting ——. G. Crusius, Kreis Peine, Germany. Eng. Pat. 27,536, Nov. 29, 1913. Under Int. Conv., Nov. 30, 1912.

TAR from which the middle oils, water and light oils, have been removed, is used as a binding material for iron ore, Thomas slag, etc.—T. ST.

Iron ores, etc.; Treatment of fine —— by agglomeration in a rotary furnace and smelting in the blast furnace. G. Polysius. Ger. Pat. 271,367, March 2, 1912.

THE fine ore, with the necessary additions, is agglomerated in one or more rotary furnaces disposed above the blast-furnace into which the hot agglomerated material is charged directly.—A. S.

Iron and other metals; Process and apparatus for recovering —— from blast-furnace dust and the like. J. B. E. Billard. Fr. Pat. 464,623, Nov. 6, 1913.

A MIXTURE of the dust with bituminous coal and lime is agglomerated by "coking" and then smelted, the coking being effected in a series of parallel channels communicating with the smelting chamber and heated by the gases from the latter.—W. E. F. P.

Iron oxide ores; Process and rotary kiln for the preparation of —— for magnetic concentration. E. Schröder. Ger. Pat. 271,695, July 21, 1911.

THE ore is heated under reducing conditions by a flame from a burner, the latter being introduced, at the lower end of the rotary kiln, and so near to the wall of the kiln, that the ore comes in contact with the inner portion of the flame.—A. S.

Iron; Process of treating molten ——. J. E. Johnson, jun. Fr. Pat. 464,208, Oct. 29, 1913. Under Int. Conv., Aug. 13, 1913.

To improve resistance, fineness of grain and "whiteness" of the lower grades of cast iron, a portion of the molten metal is "blown" until practically all the silicon is oxidised, and then at a lower temperature (to prevent oxidation of carbon) until saturated with oxygen. Silicon and the remainder of the original metal are then added.
—W. E. F. P.

[Steel.] Refining metals; Process of ——. A. Patton, McKeesport, Pa. U.S. Pat. 1,091,588, March 31, 1914.

MOLTEN steel from a Bessemer or an acid open-hearth furnace is poured into an acid-lined vessel, and thence, without the acid slag, into a basic-lined receptacle in which it is treated, first with materials to form a basic slag and then with a recarburiser and manganese.—A. S.

Iron and nickel; Separation of —— from cupriferous sulphide ores and metallurgical products (mattes). W. Borchers and E. Thilges. Ger. Pat. 271,595, Aug. 1, 1913.

THE material is melted with lime or limestone and a carbonaceous reducing agent, the latter being introduced gradually, so that at first mainly iron, and then iron and nickel are separated, whilst, simultaneously, the basic slag becomes richer in sulphides (calcium sulphide), which retard the separation of the copper. The lining of the hearth may serve as source of carbonaceous reducing agent, the carbon dissolving in and diffusing through the iron or ferro-nickel first separated, and only then coming in contact with the charge above.—A. S.

Copper; The recovery of —— from its ores and solutions. H. L. Sulman, H. F. K. Picard, and Minerals Separation Limited, London. Eng. Pats. 1152, Jan. 15, 9171, April 18, and 16,017, July 11, 1913.

PYRITES or copper pyrites is heated with lime, or with lime and carbon, and the product, containing ferrous sulphide and calcium sulphide, is used to precipitate copper as sulphide from copper-bearing solutions, preferably acidified. The copper sulphide is added to ore pulp which is to be treated by the agitation-froth method of concentration, to increase the volume and coherence of the froth. Pulp containing copper in solution, may be treated directly with the sulphide precipitant.—T. ST.

Boron-copper; Manufacture of ——. E. D. Gleason, Brooklyn, N.Y., U.S.A. Eng. Pat. 8790, April 14, 1913.

A FUSED mixture of calcium fluoride, 3, and vitrified boric acid, 1 part, is heated until dense fumes of boron fluoride are evolved, and molten copper at about 2500° F. (1371° C.), or higher, is then added. Copper having boron in the graphitoidal state uniformly distributed throughout it is thus obtained, and is used for preparing alloys of copper and lead, and of copper, lead and tin, in which the copper is comminuted to the greatest possible extent, and uniformly distributed.—T. ST.

[Copper] Alloy. T. Westley, Dudley. Eng. Pat. 15,982 July 11, 1913.

DIFFERENT grades of the alloy have the following composition:—

	Cu	Sn	Zn	Pb	Mn	Al	P
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
"Hard"	81⅜	10½	2⅛	3⅜	2½	1/16	1/16
"Tough"	88½	5⅝	1 15/16	1⅞	1⅞	⅛	1/16
"Medium" ..	86	7½	2	2	2 5/16	⅛	1/16

—W. E. F P.

Metal founding. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 6286, March 13, 1913.

COPPER, silver, or other metal which absorbs gas when melted, is melted and superheated above a layer of a mixture of boric anhydride (2 or more parts per 100 parts of metal) and an inert material such as charcoal or coarse sand. Copper is preferably heated to about 1300° C. The boric anhydride, which remains melted below the metal, is then gradually stirred into the melt to effect purification, and when finally, with the inert material, it floats on the metal, the latter is cast as quickly as possible. Copper thus treated has a high electrical conductivity.
—T. ST.

Metalliferous ores; Concentrating apparatus for cleaning separating and classifying ——. G. H. Harris, Wadebridge, Cornwall. Eng. Pat. 7233, Mar. 26, 1913.

To shake or bump washing or jigging tables, a shaking mechanism of the type having a driven member (pulley crank or eccentric), attached to the upper end of the shaf about which the table rotates, adjustable out of balance
—W. E. F. P.

Sodium; Manufacture of —— and apparatus for use therewith. J. W. Swan, Warlingham, Surrey, and J. A. Kendall, London. Eng. Pat. 7987, April 4, 1913.

THE mixture of sodium vapour and carbon monoxide produced by distilling sodium carbonate and carbon, is passed through fused sodium cyanide to retain any carbon and sodium carbonate produced by a reversal of the original action. The cyanide may be introduced into the retort with the soda, or may be formed there by passing a current of nitrogen into the retort. The condenser is provided with suitable outlets for cyanide, sodium, and carbon monoxide.—T. ST.

Alkali metals; Process for preparing —— by reaction between their haloid salts and certain compounds of alkaline-earth metals. L. Hackspill and C. Staehling. Fr. Pat. 464,469, Nov. 5, 1913.

AN alkali halide is heated, preferably in a vacuum, with a carbide, hydride or silicide of an alkaline-earth metal. —W. E. F. P.

Alkali metals; Production of alloys of —— by electrolysis of fused alkali hydroxides, and the production from these alloys of alkali metals or their compounds. E. A. Ashcroft. Fr. Pat. 464,951, Nov. 14, 1913.

A THIN layer of melted caustic alkali is electrolysed at about 400° C., using a molten heavy metal as the cathode, and a current density as high as possible at the anode, the electrolyte and cathode being kept in movement. The alloy may be further treated in a second cell, working separately or in combination with the first and with or without the use of electrolysis, for the production of alkali metals, alkali amides, cyanamides, cyanides, etc.—B. N.

Galvanising wire, sheets and other products; Bath for ——. N. K. Turnbull, Manchester. Eng. Pat. 9815, Apr. 26, 1913.

THE molten zinc is floated upon molten lead, and contamination of the zinc by the steel container is prevented by confining the external heating of the latter to the bottom and lower portion of the sides, and by providing the upper, unheated portion with a lining of refractory material or solidified zinc, an external, annular cooling chamber being disposed around the top of the container in the latter case.—W. E. F. P.

Screw or worm conveyers for use in charging rotary reduction furnaces. A. E. Bourcoud, London. Eng. Pat. 10.207, Apr. 30, 1913.

THE distance between the discharge end of the conveyor and the end of its casing is lengthened, either by means of a telescopic fitting, or by altering the position of the worm or screw. A mass of material sufficient to prevent leakage of gas is thus maintained in the discharge end of the conveyor casing.—W. E. F. P.

Tin ores or concentrates; Treatment of ——. E. V. Pearce, Penzance. Eng. Pat. 11,612, July 22, 1913.

THE ore (cassiterite), alone or mixed with sulphur or pyrites, is heated out of contact with air. The sulphides or other compounds formed from metallic impurities are then removed by treatment with mineral acids, the hydrogen sulphide evolved being employed for the separation of commercial products from the acid solution. The residue from the acid treatment is smelted for tin as usual. —W. E. F. P.

Nickel; Recovery of —— from its ores. H. L. Sulman, H. F. K. Picard, and A. E. Roberts, London. Eng. Pats. 17,131, March 18, and 18,769, Aug. 18, 1913. Additions to Eng. Pat. 27,626, Nov. 30, 1912 (this J., 1914, 30).

MAGNESIUM silicate ores (garnierite) containing nickel are treated with a limited quantity of sulphuric acid, which has a selective action on the nickel. The latter is finally precipitated by a soluble sulphide. Magnesium sulphate is crystallised from the filtrate, mixed with two equivalents of common salt, and the mixture, after heating to drive off steam and hydrochloric acid, is roasted in a reverberatory furnace with coal to produce sodium sulphide, which is used for the precipitation of nickel in succeeding operations.—T. ST.

Metals; Process of treating ——. [Rendering iron and copper non-oxidisable.] E. G. Gilson, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,091,057, March 24, 1914.

METALS such as iron or copper are rendered non-oxidisable by heating them in a non-oxidising atmosphere to 600°—900° C. in contact with a powdered mixture of pure aluminium and aluminium oxide, and a small percentage of a chloride.—T. ST.

Aluminium alloy. W. A. McAdams, Bay Shore, N.Y. U.S. Pat. 1,092,500, April 7, 1914.

AN alloy of Al, 70; Zn, 26; Cu, 3, and Ag, 1 parts by weight. —T. ST.

Aluminium and its alloys; "Flux" for —— and process of making the same. J. C. Gelly. Fr. Pat. 464,505, Nov. 6, 1913. Under Int. Conv., Nov. 15, 1912.

THE material (deoxidant, etc.) is composed of Ni, 1; Mn, 1; Cr, 1 and "infusible aluminium" 9—12, parts by weight, and prepared by adding the last-named ingredient (obtained by reaction between anhydrous aluminium chloride and potassium) to the molten mixture of the other three, and finally pulverising the product.—W. E. F. P.

[Aluminium] Metals; Process for producing colourations and black tints upon ——. L'Aluminium Français. Fr. Pat. 464,722, Jan. 20, 1913.

A NEUTRAL or alkaline solution of ammonium molybdate is electrolysed in a cell of which the metal (aluminium) forms the cathode.—W. E. F. P.

Electric furnace for metallurgical purposes. H. H. Buckman, jun., Indianapolis, Ind. U.S. Pat. 1,092,764, April 7, 1914.

THE electrodes of the furnace extend downwards from a support capable of rotating horizontally. One electrode is near the axis of rotation, and is of different polarity from the others, which are equidistant from it.—T. ST.

Metals; Precipitation of —— from cyanide solutions. C. Butters, Oakland, Cal. U.S. Pat. 1,092,765, April 7, 1914.

CYANIDE solutions containing dissolved precious metals are passed through a rotating mill containing commercial aluminium as a lining and in the form of granular pieces. —T. ST.

Annealing furnace. H. Hillebrand, jun. Ger. Pat. 271,438, Nov. 19, 1912. Addition to Ger. Pat. 257,716 (this J., 1913, 540).

THE cooling chamber may be mounted, independently of the furnace, on a movable support, and between it and the furnace are two concentric annular sealing troughs, the inner one filled with granular material, such as sand, and the outer one with a heavy oil. Both the cooling chamber and the furnace are thus effectively sealed, and the inner sand seal serves to prevent the transference of heat to the oil seal and the entry of oil vapours into the furnace. —A. S.

Iron; Method of precipitating —— from solutions containing zinc and iron. A. Ramén, Helsingborg, Sweden. Eng. Pat. 9064, April 17, 1913.

SEE Ger. Pat. 266,349 of 1912; this J., 1913, 1156.—T. F. B.

Pig-iron; Manufacture of ——. F. Prudhomme, Vienne, France. U.S. Pat. 1,092,168, April 7, 1914.

SEE Fr. Pat. 434,014 of 1911; this J., 1912, 236.—T. F. B.

Sulphide ores ; Process for the treatment and separation of complex ——. T. R. Forland, Broken Hill, N.S.W. Eng. Pat. 7107, March 25, 1913. Under Int. Conv., March 29, 1912.

See Fr. Pat. 456,063 of 1913 ; this J., 1913, 949.—T. F. B.

Metals ; Processes of treating —— [*to prevent oxidation*]. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 9097, April 17, 1913.

See U.S. Pat. 1,091,057 of 1914 ; preceding.—T. F. B.

Chromium ; Process for increasing the yield of —— *in the aluminothermic production of carbon-free ferro-chromium alloys from chrome-iron ores.* T. Goldschmidt, A.-G., Essen on Ruhr, Germany. Eng. Pat. 10,879, May 8, 1913. Under Int. Conv., Feb. 18, 1913. Addition to Eng. Pat. 18,671, July 5, 1912.

See Addition of April 26, 1913, to Fr. Pat. 453,205 of 1913 ; this J., 1913, 1072.—T. F. B.

Cupolas. A. Tropenas and E. Tournier, Paris. Eng. Pat. 20,924, Sept. 16, 1913. Under Int. Conv., Oct. 21, 1912.

See Fr. Pat. 449,663 of 1912 ; this J., 1913, 493.—T. F. B.

Blast furnaces ; Apparatus for charging —— *with incandescent coke.* C. Semmler, Wiesbaden, Germany. Eng. Pat. 22,873, Oct. 10, 1913.

See Fr. Pat. 463,524 of 1913 ; this J., 1914, 424.—T. F. B.

Waste heat ; Utilisation of —— *more especially that of iron works and the like.* C. Semmler, Wiesbaden, Germany. Eng. Pat. 22,875, Oct. 10, 1913.

See Fr. Pat. 463,300 of 1913 ; this J., 1914, 426.—T. F. B.

Smelting metal, metal ores, and the like ; Apparatus for electrically ——. S. Guggenheim, Berlin. Eng. Pat. 23,004, Oct. 11, 1913.

See Fr. Pat. 463,233 of 1913 ; this J., 1914, 426.—T. F. B.

Metal-founding. C. L. Spinney, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,091,542, March 31, 1914.

See Eng. Pat. 6286 of 1913 ; preceding.—T. F. B.

Nickel ; Recovery of —— *from its ores.* H. L. Sulman and H. F. K. Picard, Assignors to The Madagascar Mineral Synd., Ltd., London. U.S. Pat. 1,091,545, March 31, 1914.

See Eng. Pats. 27,626 of 1912 and 3814 and 6703 of 1913 ; this J., 1914, 30.—T. F. B.

Furnace ; Electric —— *for use in metallurgy.* E. Stassano. First Addition, dated Sept. 11, 1913, to Fr. Pat. 434,803, July 28, 1911. Under Int. Conv., Sept. 18, 1912.

See Eng. Pat. 21,281 of 1912 ; this J., 1913, 95.—T. F. B.

Furnace : Electric resistance —— *and its application to the treatment of zinc ores.* Comp. pour le Traitement des Métaux et des Minerais par l'Electricité. Fr. Pat. 464,347, Jan. 10, 1913.

See Eng. Pat. 12,444 of 1913 ; this J., 1913, 1159.—T. F. B.

Alloy ; Non-oxidisable ——. J. Coup and E. Allbaugh. Fr. Pat. 464,556, Sept. 9, 1913. Under Int. Conv., April 1, 1913.

See U.S. Pat. 1,069,113 of 1913 ; this J., 1913, 870.—T.F.B.

Alkali metals and their alloys ; Process for making —— *by electrolysis of molten alkali carbonates.* Chem. Fabr. von Heyden A.-G. Fr. Pat. 464,661, Nov. 8, 1913. Under Int. Conv., Nov. 18, 1912.

See Ger. Pat. 269,712 of 1912 ; this J., 1914, 321.—T. F. B.

Magnesium ; Process for producing metallic ——. R. W. Wallace and E. Wassmer. Fr. Pat. 464,691, Nov. 10, 1913.

See Eng. Pat. 18,449 of 1912 ; this J., 1913, 1159.—T. F. B.

Organic and inorganic substances [*metals, etc.*] *; Process for treating* ——. J. A. McLarty. Fr. Pat. 465,134, Nov. 14, 1913. Under Int. Conv., Nov. 20, 1912.
See U.S. Pat. 1,073,076 of 1913 ; this J., 1913, 980.—T.F.B.

Separating different kinds of minerals, such as coal, ores, etc. Eng. Pat. 26,418. *See* I.

Purification of blast-furnace gases. Ger. Pat. 271,303. *See* 11A.

XI.—ELECTRO-CHEMISTRY.

Preparation and testing of silver nitrate for use in the silver voltameter. Rosa and others. *See* VII.

Electrolysis in concrete. Rosa and others. *See* IX.

Patents.

Accumulators ; Lead ——. G. C. Dymond, Liverpool. From Marquise des Ligneris née Tailhandier du Plaix. Paris Eng. Pat. 15,327, July 3, 1913.

A plate for lead accumulators comprises a thin body portion with horizontal strips inclined upwards at an angle to it, thus forming grooves for the reception of the active material. The strips may be arranged on both sides of the plate, either opposite to one another, or with the strips on one side opposite to the grooves on the other, and the body portion may be cut away to make the plate lighter, preferably leaving supporting bands. A well-ground mixture of litharge and glycerin is used as the paste. (Reference is directed to Eng. Pats. 11,923 of 1887, 8904 and 18,034 of 1895, 780 of 1896, 23,243 of 1898, 11,349 and 16,636 of 1899, 6454 and 10,191 of 1901, 4520 and 12,857 of 1902, and 24,224 of 1908 ; this J., 1888, 218 ; 1896, 277, 361 ; 1903, 216.)—B. N.

Electrodes applicable to primary and secondary batteries and to electrolysis. R. P. Barbier. Fr. Pat. 465,011, Nov. 18, 1913.

A porous mass of carbon is formed round a central carbon rod, by heating organic or mineral material in a closed vessel, and manganese or lead peroxide, or other active material is then fixed in the pores by chemical means or by the electrolysis of suitable solutions. In the latter case the electrolyte may be regenerated by the use of similar exhausted electrodes, either by an independent operation, or by connecting these with the negative pole during electrolysis.—B. N.

Insulating composition. Insulator. F. M. Locke, Victor, N.Y. U.S. Pats. 1,091,678 and 1,091,679, March 31, 1914.

(1) Aluminium silicate and a boron compound are fused together to form a homogeneous body. (2) A "vitrifiable base," such as silica, is fused with boron to form a homogeneous body.—B. N.

[*Electrical*] *Insulating composition.* L. E. Barringer, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,091,725, March 31, 1914.

The composition is used as a filler for oil-immersed electrical coils, and comprises, by weight, 82 parts of copal gum, 10 of castor oil, and 8 parts of resin extracted from crude rubber, to which colophony may be added. It possesses high insulating properties, remains liquid when heated, and is insoluble in mineral oil.—B. N.

Furnace: Electric crucible ——. D. F. Calhane, Worcester, Mass. U.S. Pat. 1,091,808, March 31, 1914.

An external wall of cement is provided with an inner one of asbestos filling, the latter having a partition of asbestos board between its inner and outer surfaces, and within the whole is an inner wall of solid insulating material with a cement bottom and an electrode on the base. Several removable and replaceable solid insulating blocks of alundum are placed one upon the other at the bottom of the furnace for supporting the crucible at different heights, and a continuous granular packing of carbon, acting as a resister, is placed around the blocks and crucible, a second upper electrode being in contact with the carbon packing. Several removable insulating rings of alundum are located one upon the other within the packing around the crucible for directing the current, and by varying the number of rings the heat may be concentrated along any desired portion of the walls of the crucible.—B. N.

Furnaces; Electric ——. F. T. Snyder. Fr. Pat. 465.188, Nov. 21, 1913.

The furnace, with heat-insulating refractory walls, is supplied with alternating current through a resister having a negative temperature coefficient, and the temperature is regulated by submitting the current to the influence of a "reactance," so that the energy which is developed diminishes with an increase of flux of the current through the resister. The "reactance" may consist of thin steel plates or rings enveloping the furnace, or be entirely at the exterior of the furnace in series with the resister, or a combination of the two methods may be used.—B. N.

Electrode-holder for electric furnaces. Ges. für Elektrostahlanlagen m.b.H. Fr. Pat. 464,396, Nov. 4, 1913.

The electrode is surrounded by two tubes; at the upper end the inner tube has a screw thread on its outer surface and the outer one a thread on its inner surface, whilst at the lower end the outer surface of the inner and the inner surface of the outer tube taper in opposite directions, so that by turning the outer tube the conical surfaces are forced together for maintaining a tight joint. A collar, also threaded, is screwed on to the top of the inner tube, and, by means of packing, maintains a tight joint between this tube and the electrode.—B. N.

Purification of gas by high-tension electric currents. Purifying gas by electricity; Process and apparatus for —— *by charging and depositing the particles in suspension.* G. A. Krause. Fr. Pats. 465,276 and 465,277, Nov. 24, 1913. Under Int. Conv., Nov. 25, 1912.

(1) The curves of the current are utilised to a greater extent by a division of the current, this being produced by an arrangement of several points and plates, fixed or movable, in contact with each other in the circuit. (2) Electrodes of the same polarity are employed at the places of charging and deposition, and the speed of the gas in the channel connecting the chambers containing the electrodes is greater than in the chambers themselves. Groups of electrodes, pivoted around an axis, may be employed as the collecting electrodes.—B. N.

Insulator. Insulating material. L. E. Barringer, Schenectady, Assignor to General Electric Co., New York. U.S. Pats. 1,091,620 and 1,091,621, March 31, 1914.

See Eng. Pats. 2128 of 1909 and 5156 of 1911; this J., 1910, 164; 1911, 1320.—T. F. B.

Electrical-insulating composition and method of preparing the same. J. W. Aylsworth, Assignor to Condensite Co. of America, East Orange, N.J. U.S. Pat. 1,092,511, April 7, 1914.

See Fr. Pat. 435,944 of 1911; this J., 1912, 446.—T. F. B.

Electro-osmotic operations; Process and apparatus for carrying out ——. Ges. f. Elektro-Osmose m. b. H. Fr. Pat. 464,714, Nov. 10, 1913. Under Int. Conv., July 21, 1913.

See Eng. Pat. 26,061 of 1913; this J., 1914, 206.—T. F. B.

Electrolysis of aqueous solutions; Process and apparatus for the ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 465,128, Jan. 29, 1913.

See Eng. Pat. 11,872 of 1913; this J., 1913, 981.—T. F. B.

Incandescence bodies [of boron] for electric lamps, furnaces, etc. Fr. Pat. 464,552. *See* IIb.

[Electrolytic] Preparation of persulphates from sulphates or bisulphates, without the use of a diaphragm. Ger. Pat. 271,642. *See* VII.

XII.—FATS; OILS; WAXES.

Oil resources of the Empire. F. Mollwo Perkin. J. Roy. Soc. Arts, 1914, 62, 471—488.

Report, largely statistical and commercial of the oils, mineral, animal and vegetable, obtained within the Imperial area, and arranged both geographically and according to class or nature.

Fish oil from India. Bull. Imp. Inst., 1914, 12, 50—53.

As a result of experiments carried out by the Madras Government Fishery Department a local fish-oil industry has been established. In 1909 there was only one factory, but at the commencement of the 1911—1912 season between forty and fifty small factories were producing oil and guano from fish—principally sardines—in Malabar and South Canara. The fish is boiled in open pans holding ½ to ⅔ of a ton and is then pressed in coarse coir bags in simple screw presses; the guano is broken up and sun dried (see this J., 1914, 270). The crude oil fetches about £10 10s. per ton of about 250 galls. at the factory. A better market exists for finer grades of oil, and machinery has been installed at Tanur for producing pale-coloured oil, for separating the "stearine" and refining the oil. The analytical characters of a number of samples of the oil and one of the "stearine" are tabulated: they show that these oils would be suitable for the usual purposes to which fish oils are applied, such as leather dressing, etc.—R. G. P.

Natural and hardened [hydrogenated] fats; Unsaponifiable constituents of ——. J. Marcusson and G. Meyerheim. Z. angew. Chem., 1914, 27, 201—203.

Various natural fats, including tallow, whale oil, and vegetable oils, contained from 0·03 to 0·38 of cholesterol or phytosterol (determined by the digitonin method), the highest proportion being found in linseed oil and the lowest in tallow. The phytosterol constituted from 33 to 55 per cent. of the unsaponifiable matter of the vegetable oils, and the cholesterol from 8 to 14 per cent. of the unsaponifiable matter of the animal fats. The other constituents consisted in the main of dextrorotatory alcohols which neutralised, wholly or in part, the optical lævorotation of the cholesterol or phytosterol. For example, the sesamin in sesamé oil caused the unsaponifiable matter to have $[a]_D = +52°$. This characteristic may be used as a test of sesamé oil in cases where the colour reactions give negative results through previous treatment of the oil. The unsaponifiable matter, after removal of the cholesterol or phytosterol as digitonides, was a thick oily substance, containing dextrorotatory alcohols, with the exception of that from tallow which contained lævorotatory alcohols. Only in the case of dark marine animal oils (*Tranen*) were there more than traces of hydrocarbons. The unsaponifiable matter of sesamé oil freed from cholesterol showed $[a]_D = 102°$. The iodine value of the unprecipitated unsaponifiable matter of the fats examined ranged from 56 to 78, or about the same as that of the cholesterol or phytosterol (68). Small quantities of hydrocarbons may be detected by this test. As a rule hydrogenated fats contained less cholesterol or phytosterol than the original fats, the proportion decreasing with the degree of hardening. The other constituents of the unsaponifiable matter were yellow and semi-solid. From "talgol" and "candelite" a saturated alcohol was extracted with petroleum spirit. It melted at 59·3° to 59·8° C., and had the refraction at 100° C. of octodecyl alcohol (1·4268). On hydrogenation cholesterol was resinified to the extent of about 75 per cent. at 200° C., whilst phytosterol was not appreciably affected. At 250° C. cholesterol no longer yielded crystalline derivatives, though these could still be obtained from phytosterol. This explains why cholesterol cannot be precipitated with digitonin from "talgol" and similar products from animal fats.—C. A. M.

Rubber substitutes. Ditmar. *See* XIV.

Detection of cocoanut oil in butter fat by means of Polenske's distillation method and Bömer's phytosteryl acetate method. Barthel and Sondén. *See* XIXA.

Preparation of new cheap feeding stuffs and food products. Nagel. *See* XIXA.

PATENTS.

Animal matter containing moisture, oil, or grease; Apparatus for treating ——. G. F. Metzger, Lakewood, Ohio. U.S. Pat. 1,091,524, March 31, 1914.

THE material is heated, by means of steam pipes in a perforated casing which can be separated into sections, means being provided for draining off liquid from the space between the casing and the outer wall of the tank, which is connected at the top with an exhaust fan. —C. A. M.

Oleic and other fatty acids derived from train or fish oils; Process for deodorising ——. W. H. Hofmann, Hamburg, Germany. Eng. Pat. 21,478, Sept. 23, 1913. Under Int. Conv., Sept. 28, 1912.

SEE Fr. Pat. 462,763 of 1913; this J., 1914, 324.—T. F. B.

Sterilisation of liquids [*and bleaching oils, by ultra-violet rays*]. Addition to Fr. Pat. 403,945. *See* XIXB.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Chemical utilisation of Southern pine waste. Whitaker and Bates. *See* V.

PATENTS.

Lakes; New colour ——. P. A. Newton, London. From Farbenfabriken vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,557, July 5, 1913.

PIGMENTS of bluish red shade and fast to light are produced from the aluminium compounds of sulphonic acids of purpurin or purpurin-amide. The substratum may be the excess of aluminium hydroxide from the preparation of the lake, or any other substance, *e.g.*, barium sulphate. —J. B.

Turpentine; Separating apparatus for ——. *Turpentine-condenser.* H. L. Hough, Redlevel, Fla. U.S. Pats. 1,092,051 and 1,092,052, March 31, 1914.

(1). THE material is introduced into a perforated separating receptacle disposed at the top of a tank and above the first of a series of settling compartments in the bottom of the tank; and is there subjected to the action of a steam spray. (2). The vapours are condensed in a chamber surrounded by water or other medium and having a hopper-shaped bottom in which is an opening through which the condensed liquids fall into a lower chamber provided with means for separating the turpentine from the condensed water.—C. A. M.

White lead; Process of producing ——. E. Euston, St. Louis, U.S.A. Eng. Pat. 21,848, Sept. 27, 1913.

SEE U.S. Pat. 1,075,143 of 1913; this J., 1913, 1077.—T. F. B.

Alumina colour-lake; Red ——. *Red alumina colour-lakes obtained from aminoxanthopurpurinsulphonic acids.* C. Thun, Elberfeld, P. Tust and P. Thomaschewski, Vohwinkel, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pats. 1,090,352 and 1,090,353, March 24, 1914.

SEE Eng. Pat. 15,557 of 1913; preceding.—T. F. B.

Shellac and its allied lacs; Process of refining ——. H. Cassard, Baltimore, U.S.A. Eng. Pat. 13,309, June 9, 1913.

SEE U.S. Pat. 1,066,794 of 1913; this J., 1913, 835.—T. F. B.

Resinous composition. Resinous condensation product. M. J. Callahan, Pittsfield, Mass., Assignor to General Electric Co., New York. U.S. Pats. 1,091,627 and 1,091,628, March 31, 1914.

SEE Eng. Pats. 24,060 and 24,059 of 1912; this J., 1913, 951.—T. F. B.

Resinous composition and process of making the same. M. Callahan, Pittsfield, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,091,732, March 31, 1914.

SEE Eng. Pat. 24,254 of 1912; this J., 1914, 92.—T. F. B.

Flexible composition, electrically insulating and unaffected by water and by heat. T. D. Kelly. Fr. Pat. 464,579 Oct. 17, 1913. Under Int. Conv., Oct. 18, 1912.

SEE Eng. Pat. 23,846 of 1912; this J., 1913, 1120.—T. F. B.

Production of a high-grade, pale coumarone-resin from heavy benzol of b. pt. 160°—180° *C.* Ger Pat. 270,993. *See* III.

Manufacturing a binding or covering medium from waste sulphite lyes. Eng. Pat. 7324. *See* V.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber substitutes. R. Ditmar. Gummi-Zeit., 1914, 28, 998—1000, 1032—1034, 1070—1077.

THE author suggests that the elasticity of rubber substitutes may be measured by placing the powdered substance in a cylindrical vessel, and allowing it to be compressed by a loaded piston, noting the depression and the recovery on subsequently removing the load. Details are given of a large number of experiments in preparing substitute from rape oil. 50 grms. oil were mixed with sulphur and with different additions (paraffin, mineral oil), with stirring, in a flat porcelain dish, and heated on an air bath till the reaction began, when the mixture foamed: the temperature was then usually about 195°—200° C. The reaction usually lasted for at least 3 mins., the temperature rising to about 220°—230° C. The hot mass was poured on a glass plate, and the product tested after 24 hours. It was then stored for about 80 days and again tested for appearance, elasticity, etc. With unoxidised rape oil the best result was obtained by adding 32 per cent. of sulphur (calculated on the amount of oil). The product was not so good if less than 28 per cent. of sulphur was used. Using rape oil which had been oxidised by blowing in air for 5 hrs. at 250° C., good results were obtained with 18 per cent. of sulphur; one of the best products was made with 22 per cent. of sulphur. A considerable number of experiments were made with both oxidised and unoxidised rape oil with the addition of varying quantities of mineral oil. Analyses were made of the products usually more sulphur was lost by volatilisation, and the acetone extract (8 hrs.) and free sulphur were higher in the case of the unoxidised oil.—H. E. P.

Some Barbier-Grignard reactions. Preparation of unsaturated hydrocarbons with conjugated double linkages [*isoprene*]. Kyriakides. *See* XX.

Patents.

Rubber; Treatment of ——. F. Ripeau, Paris. Eng. Pat. 21,771, Sept. 26, 1913.

See Fr. Pat. 460,689 of 1913; this J., 1914, 93.—T. F. B.

Vulcanisation of natural or artificial rubber; Process for accelerating the ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 464,533, Nov. 7, 1913. Under Int. Conv., Nov. 15 and Dec. 24, 1912.

See Eng. Pat. 11,530 of 1913 and Ger. Pat. 268,387; this J., 1913, 1078; 1914, 269.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin; Colloid-chemical studies on ——. M. Navassart. Kolloidchem. Beihefte, 1914, 5, 299—374.

Experiments with a number of samples of the purest commercial tannin, of different origin, showed that tannin has no definite solubility in water, alcohol, acetone, commercial glacial acetic acid, and formol, but is miscible therewith in all proportions, forming gelatinous masses at high concentrations: in this respect tannin resembles colloids of the emulsoid type, such as gelatin. It is practically insoluble in ether, chloroform, benzene, petroleum ether, carbon tetrachloride, carbon bisulphide, and xylene. The density of aqueous solutions of tannin of all concentrations, and of solutions in organic solvents for concentrations up to 20 per cent., is a linear function of the concentration: in this respect tannin behaves more like a suspension-colloid. The specific optical rotation of tannin increases considerably in aqueous solutions as the solution is diluted; in organic solvents the rotatory power is lower and does not vary much at different concentrations. The viscosity of aqueous solutions containing 10—12 per cent. of tannin is only slightly higher than that of pure water; above 18 per cent. it rises rapidly, and at 30 per cent. is 9—10 times greater than that of water, whilst at 60 per cent. a jelly is formed. Solutions in organic solvents are more viscous than aqueous solutions at the ordinary temperature. The results of experiments on the dialysis, ultramicroscopic examination, etc., of tannin solutions are also described, and it is concluded that aqueous tannin solutions exhibit properties intermediate between those of a true solution and a colloidal solution, and between those of suspensoid and emulsoid sols.—A. S

Tans (*phlobaphenes*). *Powdered* —— *and different reactions of hydrolysis* (*photolysis*). E. O. Sommerhoff. Collegium, 1914, 81—84. (See also this J., 1914, 152.)

Sparingly soluble tannins (*e.g.* gambier and quebracho) are best dissolved by moistening first with a little cold water and then making into a paste with warm water. Sudden treatment with much hot water has the effect of essening their solubidity. Tannins have an opposite lectric charge to that of animal blood and the author has hown that a third substance such as alcohol has a favourble influence on the oxidation process of two colloids f opposite electric charges such as albumin and tannin. 0 per cent. of pure finely divided sulphur added to the nsulphited quebracho extract in a large tumbler in hich 100 kilos. of calf skins were being tanned caused he whole of the interior of the drum to be filled with sulphur dioxide and the goods, even after lying for a day, had still a distinct odour of sulphur dioxide. The sulphur may have derived its oxygen either from the air or from the hydrated tannins. In the latter case the tannins as they penetrated the hide not only electrically neutralised the hide albumin but also yielded up oxygen, becoming reduced. By lying in damp air secondary photochemical oxidation takes place by which the hide albumin and also the quebracho tannin are further oxidised and become completely insoluble. The time of hanging and the intensity of the light is therefore of great importance as regards the resistance of the leather to hot and cold water. The long boiling of gambier as usually practised in tanning and silk-dyeing causes a hydrolytic decomposition of the phlobaphenes. The hydrolysis is greatly accelerated by light and air as the hydrogen ions of the water are activated by the oxygen of the air in the presence of the light energy. The action of soap solutions on linen is also greatly intensified by sunlight. Water in the presence of air and direct sunlight acts upon colloids forming hydrogen peroxide.—D. J. L.

Tanning materials; Colour valuation of ——. H. C. Reed. J. Amer. Leather Chem. Assoc., 1914, 9. 170—174.

In making colour valuations of tanning materials, using pelt, the latter is always tanned completely, excess of colouring matter thus being present. As skin absorbs colouring matters selectively this gives fallacious results. It is impossible to obtain pelt of sufficient uniformity to give concordant results. The use of hide powder is again advocated. The squeezed hide powder after use in the official method of tannin analysis is broken up and allowed to dry in the dark and the colour of the powder taken as an indication of the colour value of the material. The chroming of the hide powder has little influence on the colour.—T. C.

Picric acid and quinone; Tanning with ——. E. O. Sommerhoff. Collegium, 1914, 225—229.

Picric acid is rapidly absorbed by hide, colouring it yellow and some tanning action takes place. Quinone colours hide very slowly violet (better in presence of light) and this changes gradually to brown with accompanying tanning action. Picric acid tans without being constitutionally changed, whilst with quinone the reverse is the case. Laboratory tanning experiments are considered to correspond with picric acid tanning, *i.e.* tanning action without constitutional change in the tanning material, whilst in actual practice the tanning process proceeds, as with quinone, with simultaneous constitutional change in the tanning material. In picric acid tanning the oxidation of hide albumin takes place on drying the leather, whilst with quinone, oxidation takes place in the tan bath. In quinone tanning it is very probable that water chemically combined with hide albumin is decomposed with formation of quinol (hydroquinone) and oxidised albumin: the quinol is subsequently re-oxidised at the expense of the oxidised albumin or of the air, the process being considerably affected by light.—T. C.

Harness leather; Growth of mould on ——. A. Seymour-Jones. Leather Trades Rev., Feb., 1914. J. Amer. Leather Chem. Assoc., 1914, 9. 180—186.

A piece of harness leather on keeping developed raised nodules although the grain was not damaged. These were due to the growth of roots of *Penicillium glaucum* on the sebaceous gland layer (*stratum sebaceum*), the spores having entered through the hair holes. It is recommended that mouldy leather should be scoured with hot water containing 0·5 to 1 per cent. of formic acid or sponged with 1 per cent. formic acid.—T. C.

Patents.

Conversion of animal substances [*waste leather*] *into ammonia and combustible gases.* Eng. Pat. 5348. *See* IIa.

Treating wool or other fibrous substances, skins, hides or textile fibres to destroy anthrax and other disease germs. Eng. Pat. 5924. *See* V.

Treatment of leather waste for obtaining soluble nitrogenous and phosphatic fertilisers. Fr. Pat. 464,077. *See* XVI.

XVI.—SOILS ; FERTILISERS.

Fish guano from India. Bull. Imp. Inst., 1914, **12**, 53—55.

Three samples of fish guano prepared at the Madras Government Fisheries Station were examined. They contained about the same percentage of nitrogen and an average amount of phosphoric anhydride when compared with commercial fish manures ; and average amounts of fat and phosphoric anhydride, but a somewhat smaller amount of protein when compared with commercial fish meals used for cattle and pig feeding.—R. G. P.

Fertilisers ; Experiments with ——. C. E. Thorne and E. Mohn. Ohio Stat. Bull. No. 260. 405—448. Expt. Stat. Record, U.S. Dept. Agric., 1914, **30**, 25.

The experiments, begun in 1895 and still in progress, were made on a cold heavy, clay soil lying over compact argillaceous shales. Phosphate fertilisers proved more valuable than nitrogenous or potash fertilisers, especially in the earlier years: acid phosphate (superphosphate) and steamed bone-meal were about equally effective. Mixtures prepared as required from tankage, superphosphate, and muriate of potash were more effective and much cheaper than commercial mixed fertilisers. In the earlier years the yield of clover was increased by application of phosphate, but more recently good results could only be obtained after application of limestone.—A. S.

Explosion of acetylene [*from calcium cyanamide*]. Morpurgo. *See* VII.

Patents.

Fertilisers ; Treatment of leather waste for obtaining soluble nitrogenous and phosphatic ——. V. L. Leblanc, R. Ledoyen et Cie. Fr. Pat. 464,077, Oct. 9, 1913.

To obtain a fertiliser containing 2 per cent. of organic nitrogen and about 10 per cent. of phosphoric acid, 100 kilos. of leather waste are dissolved by treatment with 90 kilos. of sulphuric acid of 52° B. (sp. gr. 1·563) for about one hour under a steam pressure of 5 kilos. per sq. cm., and 60 kilos. of phosphate, containing 26—27 per cent. of phosphoric acid, are impregnated with 100 kilos. of the solution.—O. R.

Manure from tanned-leather shavings or cuttings ; Process of making ——. A. Moise, Barr, Germany. U.S. Pat. 1,092,074, March 31. 1914.

See Fr. Pat. 458,674 of 1913 ; this J., 1913, 1079.—T. F. B.

Superphosphates ; Process for making double ——. T. L. Willson. Fr. Pat. 464,992, Nov. 17, 1913.

See U.S. Pat. 1,078,887 of 1913 ; this J., 1914, 35.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar cane ; Natural colouring matters of the ——, and their influence in the manufacture of white sugar. C. Muller. Bull. Assoc. Chim. Sucr., 1914, **31**, 647—652.

Chlorophyll, anthocyan (the red colouring matter present in dark canes), and the yellow pigment or chromogen of the bagasse do not appear to interfere much with the production of white sugar ; the colouration of syrups is mainly due to other causes, probably to unknown colouring matters. Chlorophyll is insoluble in water. Anthocyan though very soluble and possessing considerable tinctorial power (red in acid and green in alkaline solutions), is decomposed very rapidly after the crushing of the cane, and very small quantities only are present in the juice ; none remains in the bagasse. The yellow colouring matter of the bagasse is much more stable than anthocyan but only slightly soluble in water. It is yellow in presence of alkalis but decolourised by acids. The greater part of that present in the juice passes into the scum and the defecation mud. Sulphitation appears to have little effect on these colouring matters, but carbonatation and phosphatation suffice to remove all that may have passed into the juice.—J. H. L.

Heat balance of a cane sugar factory. N. Deerr. Hawaiian Sugar Planters' Assoc, Expt. Stat., Bull. No. 43, Agric. Chem. Series, 1914.

The amounts of steam required for power and for heating purposes in an Hawaiian cane sugar factory of high efficiency were determined, using the following data: 100 short tons of cane produced 50,000 lb. of bagasse and 110 tons of juice, and the combustion of the bagasse gave 130,000 lb. of steam, the ratio of steam formed to fuel burnt being 2·6. *Power.*—The following values for the I.H.P. per 100 tons of cane per hour were obtained : Mill engines, 1112 ; quadruple evaporator pump, 43 ; vacuum pump, 66 ; crystallisers, 24 ; centrifugals, 111 ; juice-heater pump, 8 ; and other motors, 46 ; a total of 1410 I.H.P., which corresponded with 7330 lb. of steam or 5·6 per cent. of that from the boilers. *Juice-heaters.*—Before entering the evaporators, the juice was heated from 82° to 212° F. (from 27·8°—100° C.), cooled to 202° F. (94·4° C.), and reheated to 212° F. (100° C.). Taking the specific heat of the juice to be 0·9, the amount of steam required was 30,590 lb., or 23·4 per cent. of that from the boilers. *Quadruple evaporator.*—Juice at 13° Brix was concentrated to 65° Brix. Assuming that 1 lb. of steam evaporated 4·2 lb. of water in the effect apparatus used, the steam required to remove 176,000 lb. of water was 41,859 lb., or 32·5 per cent. of that from the boilers. *Vacuum pans.*—If 1 lb. of steam evaporated 1 lb. of water in the pans, to eliminate the remaining water, namely, 15,000 lb., the steam required was 15,182 lb. or 11·6 per cent. of that coming from the boilers. The total amount of steam required was thus 94,952 lb., or only 73·1 per cent. of that from the boilers. In a factory in which the working was inefficient, though not extremely so, the bagasse only produced 110,000 lb. of steam, and the steam used at the different stations was :—*Power.*—7330 lb., or 6·7 per cent. *Juice-heaters.*—37,145 lb., or 33·7 per cent. *Quadruple evaporators.*—45,350 lb., or 41·2 per cent. *Vacuum pans.*—19,470 lb., or 17·7 per cent. The total was thus 109,295 lb. of steam, or 99·3 per cent. of that coming from the boilers, under which circumstances the factory would barely be able to work without extra fuel. The factors for ensuring efficiency in heat economy in the sugar factory are as follows : ample heating surface in boilers ; control of the bagasse fuel combustion ; insulation of hot surfaces ; the use of evaporators of sufficient heating surface readily to obtain a syrup of a density not less than 65° Brix ; and the application of the "extra steam" and multiple heating systems.—J. P. O.

Sugars ; Determination of reducing —— in sugar fo melting ("*sucres de fonte*"). C. Muller. Bull. Assoc Chim. Sucr., 1914, **31**, 646—647

From 10 to 20 grms. of the sample, dissolved in 20 c.c. o hot water, are heated with 50 c.c. of Fehling's solutio for 10 mins. at 63°—65° C., then mixed with 50 c.c. o cold water and filtered. The filter (diam. 10 cm.) is washe and introduced into 5 c.c. of hydrochloric acid and afte the precipitate has dissolved, the liquid is treated wit 10 c.c. of aqueous ammonia (sp. gr. 0·925) and titrated t a pale lilac tint with potassium cyanide solution (45 grms. per litre). The cyanide solution is standardised by diluting 24 c.c. of Fehling's copper sulphate solution (69·28 grms. $CuSO_4,5H_2O$ per litre) to 100 c.c., and titrating 10 c.c., which correspond to 0·025 grm. of reducing sugar, after addition of 5 c.c. of hydrochloric acid and 10 c.c. of ammonia. The filter paper retains a small quantity of copper solution, usually corresponding to 0·3—0·4 c.c. of the cyanide solution; this can be determined once for all and a correction made. When only small quantities of reducing sugars are being determined, it is unnecessary to re-oxidise the precipitated cuprous oxide with potassium chlorate before addition of ammonia. —J. H. L.

Reducing sugars contained in cane molasses; Origin of the ——. H. Pellet. Intern. Sugar J., 1914, **16**, 172—176.

Ripe and uncut sugar cane always contains a very variable amount of reducing sugars, which may increase during the treatment of the juice by the defecation-sulphitation process of clarification, especially during the concentration of the juice and the working-up of the after-products. The amount of the increase is usually 0·1—0·3 per cent. of the cane. There can be no decrease in the quantity of reducing sugars during manufacture, using the defecation process, and any such differences must be attributed to errors in nalysis and sampling.—J P. O.

Maple products; Analysis of ——. *IV. Composition of maple sugar sand.* J. F. Snell and A. G. Lochhead. J. Ind. Eng. Chem., 1914, **6**, 301—302.

Six samples (from Quebec) of washed, air-dried maple ugar sand contained from 65—80 per cent. of normal alcium malate, 6—18·5 per cent. of silica, minor quantities f manganese, magnesium, and phosphorus, traces of iron, nd 10—17 per cent. of undetermined matter. (See also Varren, this J., 1911, 980.)—A. S.

Gums from Northern Nigeria; "Golawai," "Katalabu," and "Kol-kol" ——. Bull. Imp. Inst., 1914, **12**, 27—31.

The results of the examination of 3 samples of "Golawai" um from *Acacia camphylacantha*, Hochst., 2 of "Katalabu" um from *A. Sieberiana*, D.C., and 3 grades of "Kol-kol" um from *A. Senegal*, Willd., are shown in the following able :—

	Golawai.	Katalabu.	Kol-kol.
	per cent.	per cent.	per cent.
oisture, per cent. ..	10·6—10·7	10·2—10·3	13·1—13·5
h, per cent.	3·4— 3·6	2·1— 2·3	3·3— 3·5
atter insol. in water, per cent.	1·1— 2·2	1·3— 1·8	0·1— 0·4
id number	1·9— 2·5	3·9— 4·4	3·2— 3·3
lative viscosity of a 10 per cent. solution at 22° C. (water at 22° C.=1)	8·8—13·1	4·7— 5·7	6·2— 6·4

e "golawai" gum was valued at 15s.—17s. 6d. per cwt. a "semi-insoluble" gum. "Katalabu," a glassy gum the "soluble" type, gave a yellowish brown mucilage h good adhesive properties, and was valued at 22s. 6d. 24s. per cwt., with "glassy Khartum" gum at 31s. cwt. (April 1913). "Kol-kol" gum closely resembled rdofan gum but gave rather darker solutions: the ole consignment was sold at 30s. per cwt. (Dec. 1913). —R. G. P.

trin; Solubility of ——. W. K. Lewis. J. Ind. Eng. Chem., 1914, **6**, 308—309.

Weighed quantities of dextrin were agitated with asured quantities of water, and the insoluble residue separated by centrifuging. The results showed that with increasing quantities of water, the amount of dextrin dissolved increased continuously, although in no case was the whole of the dextrin dissolved, and the concentration of the solution did not remain constant no matter how small a quantity of water was used. It is suggested that this behaviour may be due to adsorption of a soluble by an insoluble constituent, in which case the equation: $\log(A-x)=\log k+\frac{1}{n}\log c$ should hold, A representing the total soluble portion, x the soluble portion actually dissolved, c the concentration of the solution, and k and n constants, characteristic of the dextrin employed, and offering, in the author's opinion, a better means of distinguishing between different samples of dextrin than any other method hitherto suggested. In applying the method, values of x and c are determined experimentally, and a value for A chosen such that a straight line is obtained when values of $\log(A-x)$ are plotted against values of log c: the slope of the line gives the value of $\frac{1}{n}$ and the intercept of the line, the logarithm of k.—A. S.

An experimental study in multiple effect evaporation. Deerr. *See* I.

Determination of sucrose in presence of lactose and in milk preparations. Rakshit. *See* XIXa.

Patents.

Sugar juices; Process and apparatus for freeing —— *from fibrous and suspended matters.* Maschinenfabrik Grevenbroich. Fr. Pat. 464,897, Nov. 13, 1913. Under Int. Conv., Dec. 9, 1912.

Raw sugar juices obtained by maceration or pressing are passed in a wide shallow layer across the surface of a large volume of resting liquid into which the suspended matters sink. The height of the moving layer may be regulated by a series of transverse adjustable baffle-plates, which, sloping downwards in the direction of flow of the liquid, serve to confer a downward motion on the particles. The lower part of the reservoir is divided into several funnel-shaped chambers, each with an outlet at the bottom for drawing off the matters which have subsided.—J. H. L.

[*Sugar*]. *Extraction of certain soluble substances contained in the cells of certain plants.* M. Paquier, C. Théry and E. Gallois. Fr. Pat. 464,947, Jan. 25, 1913.

The vegetable material is partially or completely desiccated by the action of heat and reduced pressure, so as to effect the coagulation of substances coagulable by heat but not to render soluble those which become soluble at high temperatures. The material is subsequently extracted, at the ordinary temperature, with water or other solvents. The process is specially applicable to the extraction of sugar from beetroots.—J. H. L.

Sugar juices; Catalytic process effecting a purification of —— *at least equal to that produced by ordinary double carbonatation, and at the same time reducing by more than* 50 *per cent. the weight of lime employed.* H. Manoury. Fr. Pat. 465,270, Nov. 24, 1913.

The greater part of the lime used for defecation is replaced by relatively small quantities of other oxides such as those of iron, manganese or aluminium. Salts of these metals (sulphates, sulphites, chlorides) may be added to the juices, and the corresponding oxides precipitated by lime; when sulphates are employed sufficient baryta to precipitate the sulphuric acid is also added. For example, fresh juices may be treated with 1 grm. of ferrous sulphate crystals per litre, heated to 80° C., agitated with 3 grms. of lime per litre and a quantity of barium carbonate equivalent to the sulphate added, heated to 100° C. and filtered, and the lime remaining in the juice saturated by carbonatation (more lime being added if necessary) or sulphitation.—J. H. L.

Sugar factories and refineries ; Apparatus for the crystallisation and stationary draining of massecuites of ——. M. E. R. J. M. Lambert. Fr. Pat. 465,348, Nov. 26, 1913.

A number of fixed troughs are disposed parallel to each other at short distances apart, so that cold air can circulate freely around them during the crystallisation of the massecuite. Hinged to the back of each trough is a shutter which, when swung back horizontally, engages the front of the next trough. The space below and between the troughs then constitutes a closed chamber which can be heated by admission of steam in order to diminish the viscosity of the molasses during the draining of the crystals.—J. H. L.

[Sugar.] Evaporators [e.g., of the Kestner type] ; Device for preventing the juice from rising above a definite level in film ——. Sudenburger Maschinenfabrik und Eisengiesserei A.-G. zu Magdeburg. Ger. Pat. 270,876, Dec. 24, 1912.

A double-seated valve is inserted in the inlet pipe for the juice and is connected by a rod with a float placed at the maximum height for the juice level : the entering juice forces the valve downwards off its seating, flows into the evaporator and rises in the tube connecting the float-chamber with the inlet-pipe. If the juice rises above a definite height, the float rises and closes the double-seated valve, thus shutting off the supply of juice. If the level of juice in the evaporator falls too low, the pressure rises owing to stronger evaporation, and a steam-pressure regulator shuts off the supply of steam.—A. S.

Cane juices ; Treatment of ——. W. Guerrero, Madrid. Eng. Pat. 6785, March 19, 1913. Under Int. Conv., April 9, 1912.

See Fr. Pat. 445,830 of 1912 ; this J., 1912, 1195.—T. F. B.

Dissolving sugar or other substances ; Continuously working apparatus for ——. Maschinenfabrik Grevenbroich. Fr. Pat. 464,671, Nov. 8, 1913. Under Int. Conv., Dec. 28, 1912.

See Ger. Pat. 266,335 of 1912 ; this J., 1914, 14.—T. F. B.

Apparatus for drying, revivifying, and decarbonising boneblack. Eng. Pat. 6347. *See* I.

Production of glucose and ethyl alcohol from sawdust or other cellulosic material. Fr. Pat. 464,502. *See* XVIII.

Sugars [from cellulosic material] ; Process of producing fermentable ——. U.S. Pat. 1,091,327. *See* XVIII.

Clarifying effluents and waste waters from sugar factories and the like. Fr. Pat. 464,964. *See* XIXb.

XVIII.—FERMENTATION INDUSTRIES.

Yeast fermentation without sugar. XIV. Further investigation of carboxylase. C. Neuberg and P. Rosenthal. Biochem. Zeits., 1914, 61, 171—183.

Further evidence is adduced for the existence of carboxylase as an enzyme distinct from zymase (cp. this J., 1911, 1179 ; 1913, 620). The nitrogenous precipitate produced by addition of acetone or alcohol and ether to yeast maceration juice contains not only zymase, but carboxylase which exhibits great activity even after the precipitate has been dried and redissolved in water. Carboxylase ferments oxalacetic acid and its salts under conditions which completely arrest the fermentation of sugar. It is the first enzyme known to liberate carbon dioxide from carboxylic acids.—J. H. L.

Tricresol as a substitute for toluene in enzyme work. S. S. Graves and P. A. Kober. J. Amer. Chem. Soc., 1914, **36**, 751—758.

Tricresol, neutralised if necessary by sodium hydroxide, is considered to be superior to toluene on account of its solubility in water, lower volatility, and more powerful germicidal action. For trypsin, pepsin, urease, and diastase, concentrations up to 0·5 per cent. are recommended ; for erepsin and invertase, 0·2 per cent.—F. Sodn.

[Beer] Original gravity ; The ebullioscope in the determination of ——. T. H. Pope. Brewers' J., 1914, **50**, 239—242 (cp. Cain, this J., 1914, 156.)

The thermometer scale of the ebullioscope or alcoholmeter employed, is calibrated to show the change in gravity of the beer due to fermentation, so that the sum of the value thus obtained and the gravity of the beer itself, represents the original gravity. In use, the mercury thread of the instrument first rises to a maximum and then falls slightly to a point at which it remains constant for some time ; this point should be taken as the reading. The unfermented matter in the beer vitiates the reading appreciably only in the neighbourhood of the zero point, the error disappearing at those parts of the scale where the readings with beers are taken. The method is accurate and much more expeditious than the ordinary distillation method.—L. E.

Tartar ; Crystallisation of cream of —— *in the fruit of grapes.* W. B. Alwood. J. Agric. Res., 1914, **1**, 513—514.

The soft cells lying immediately beneath the skin of the grape contain a higher proportion of tartaric acid and potassium bitartrate than the interior pulp ; potassium bitartrate occurs in these cells in the form of minute crystals.—L. E.

Unfermented grape juice in California ; Manufacture o ——. W. V. Cruess and C. J. Hintze. J. Ind. Eng Chem., 1914, **6**, 302—304.

As a result of an experimental investigation some modifications of the method of manufacture of unfermented grap juice as practised in California are suggested. A mixtur of ripe grapes, to give flavour, with grapes of high acidit should be used and potassium metabisulphite (8—12 o. per ton of grapes) added at the crusher to prevent fermen ation. After defecation (settling) for 24—48 hours, t juice should be racked off, clarified by means of casei (4—6 oz. per 100 galls.) dissolved in sodium carbonate ammonia, treated with a small quantity of tartaric ac (0·1—0·2 per cent.) to facilitate separation of cream tartar, heated to 165° F. (74° C.) and stored in barre When most of the excess cream of tartar has separated, t juice should be racked off, filtered if necessary, treat with a small quantity of citric acid (0·05—0·1 per cen to prevent further separation of cream of tartar, a pasteurised in bottles at 160° F. (71° C.).—A. S.

Cider ; Disease of —— *known as green-sickness* [" *verdis ment* "]. Warcollier. Comptes rend., 1914, **158**, 97 976.

This disease generally appears at the beginning of mentation in ciders characterised by low contents of m acid, tannin and nitrogenous bodies, and a rather h content of mineral matter, especially lime. The affected ciders contain nitrites formed either from nitrates in the water used for extracting the pressed pulp, or by exposure of the pulp to air; the fresh pulp contains no nitrite. The nitrites oxidise the tannin, and the olive-green colour characteristic of the disease is due to combination of the oxidised tannin with a ferrous salt. The disease arrests fermentation although an abundant deposit of yeast is obtained. To prevent the disease, water of high nitrate-content should not be used, fruit soiled with earth or organic matter should be washed, the pulp should not be exposed too long to the air, and prolonged contact of the pulp, marc, or juice with iron utensils should be avoided. —L. E.

Methyl alcohol; Colour reaction for the detection of ——. C. D. Manzoff. Z. Unters. Nahr. Genussm., 1914, 27, 469—470.

When a mixture of nitromethane, ammonia, and vanillin is heated, a red colouration is produced which disappears on cooling; under similar conditions, nitroethane yields only a faint yellow colouration. The test will detect the presence of 1 part of nitromethane in 100,000 parts of nitroethane. The intensity of the colouration obtained depends, to a certain degree, on the quantity of vanillin employed. Other aliphatic and aromatic aldehydes and ketones do not give a colouration with nitromethane, with the exception of *p*-hydroxybenzaldehyde, which yields an orange-red colour. To detect methyl alcohol in ethyl alcohol, 200 c.c. of the spirit are mixed with 5 c.c. of phosphoric acid, distilled, and the first 5 c.c. of distillate heated with 5 grms. of red phosphorus and 20 grms. of iodine for 20 minutes under a reflux condenser, and distilled. The distillate is treated with 3 grms. of silver nitrite, again distilled, the first 5 drops of distillate mixed with 5 drops of ammonia and 0·01 grm. of vanillin, and the mixture heated. A red colouration indicates the presence of methyl alcohol in the spirit.—W. P. S.

Freezing of wine, milk, and other alimentary fluids. Parenty. *See* XIXa.

Patents.

Pasteuriser for malt beverages, wines, aerated waters and other liquids. H. Erikson, Askersrend, Sweden. Eng. Pat. 20,016, Sept. 4, 1913.

The pasteurising vessel is jacketed and contains a coil. Heating and cooling media are supplied and discharged hrough single pipes branched near the apparatus, one ranch being connected with the coil and the other with he jacketed space. The apparatus is supported by runnions on trestles and can be rocked in a vertical lane.—L. E.

Beer; Manufacture of non-alcoholic ——. K. Kroupa, Rannersdorf, Austria. Eng. Pat. 29,314, Dec. 19, 1913. Under Int. Conv., Dec. 19, 1912.

Mixture of beer and hopped beer wort is heated to xpel alcohol and then carbonated.—L. E.

ugars [from cellulosic material]; Process of producing fermentable ——. F. E. Gallagher, Newton, Mass., Assignor to Standard Alcohol Co., New York. U.S. Pat. 1,091,327, March 24, 1914.

the production of fermentable sugars from cellulosic aterial, the spent wort is mixed with the soluble products hydrolysis of the cellulosic material, and the whole is rther hydrolysed.—L. E.

ucose and ethyl alcohol from sawdust or other cellulosic materials; Production of —— A. de Posnansky. Fr. Pat. 464,502, Jan. 14, 1913.

HE material is heated in an autoclave, first with free lphurous acid and then with the acid in presence of an excess of alkali, in particular ammonia. After washing, saccharification is effected by heating under pressure with an acid, preferably sulphuric acid, and the saccharine liquid is purified by addition of aluminium compounds and tannin, and removal of the latter by means of albumin or gelatin; by addition of alkaline-earth carbonates, sodium phosphate and alum; by treatment with reducing substances, *e.g.*, sulphites, thiosulphates, zinc or zinc hydrosulphite, and in the last two cases subsequent addition of carbonates and sodium phosphate; by addition of litharge in slight excess, afterwards removed; by separation of the sugar and salts from the resinous and empyreumatic substances by dialysis; or by filtration. The purified juice is concentrated by evaporation, distillation under a layer of vaseline, paraffin, etc., or freezing, and afterwards either fermented, or worked up for glucose by evaporating to dryness at a low temperature, extracting with hot alcohol and collecting the glucose which separates on cooling.—J. H. L.

Saccharification of starch; New organism and its application to the —— *and the manufacture of alcohol, vinegar, wines and other products derived from the saccharification of starch.* Société d'Exploit. des Procédés H. Boulard. Fr. Pat. 464,601, Oct. 29, 1913.

Starch is saccharified by means of a mould, *Mucor Boulard No.* 5, which occurs in large quantities on plants in the Far East. The mycelial threads exhibit transverse membranes, and pear-shaped enlargements at their ends which become detached in old cultures. Potato starch and cereal starch, after a suitable treatment (heating under pressure), are saccharified with equal ease by this organism, which is so robust that bacterial infection is not to be feared, and saccharification can be carried out in open vats at temperatures as high as 45° or as low as 20° C.—J. H. L.

Fusel oil; Process of producing ——. J. Scheckenbach, Munich, Germany. Eng. Pat. 20,942, Sept. 16, 1913. Under Int. Conv., Sept. 21, 1912.

See Fr. Pat. 462,472 of 1913; this J., 1914, 329.—T. F. B.

Distillery-vinasses; Extraction of glycerin and fatty matters contained in ——. G. P. Guignard, Melun, and H. L. A. M. Watrigant, Lille, France. U.S. Pat. 1,092,791, April 7, 1914.

See Fr. Pat. 427,560 of 1910; this J., 1911, 1134.—T. F. B.

Mannite from natural musts; Process for making ——. G. P. Guignard. Fr. Pat. 464,644, Jan. 17, 1913.

See Eng. Pat. 3261 of 1913; this J., 1913, 879.—T. F. B.

Manufacture of metallic vessels for alcoholic fermentation, and for the treatment and storage of liquids. Fr. Pat. 464,337. *See* I.

Carburetting alcohols for industrial use during manufacture. Fr. Pat. 465,243. *See* IIa.

Separation and recovery of volatile acids, methyl compounds, and furfuran bodies from hydrolysed lignocelluloses. Fr. Pat. 464,608. *See* V.

XIXa.—FOODS.

Sucrose in presence of lactose and in milk preparations; Determination of ——. J. N. Rakshit. J. Ind. Eng. Chem., 1914, 6, 307—308.

The lactose is first determined by titration with Fehling's solution, then a measured quantity of Fehling's solution is boiled with the calculated quantity of the sugar solution so as to precipitate the copper and decompose the lactose, the mixture is filtered, and the sucrose in the filtrate determined as usual after inversion and neutralisation. Milk and solutions of milk preparations are first coagulated by addition of dilute citric acid, drop by drop, shaking well between successive additions. Results are given showing the accuracy of the method.—A. S

Alimentary liquids ; Freezing of wine, milk and other ——. H. Parenty. Comptes rend., 1914, **158**, 921—922.

Liquids may be concentrated by freezing and centrifuging more economically than by evaporation, provided that, corresponding to the multiple effects in the latter process, the frozen residues are utilised for further refrigeration. The process, which has been used for the concentration of wine and milk, insures the retention of volatile constituents in the liquid, aids clarification, and does not alter the flavour, aroma, or colour.—L. E.

Butter fat ; Detection of cocoanut oil in —— *by means of Polenske's distillation method and Bömer's phytosteryl acetate method.* C. Barthel and K. Sondén. Z. Unters. Nahr. Genussm., 1914, **27**, 439—453.

Numerous samples of Swedish butter examined during the years 1904—1912 never gave a Polenske value exceeding that fixed by Polenske as the maximum value for genuine butter, *i.e.*, 3·5 when the Reichert-Meissl value was 30. This method was capable of detecting 10 per cent., and in some cases 5 per cent., of cocoanut oil in butter-fat, but could not be relied upon in all cases, since butter obtained from cows fed on beetroot leaves or cocoanut oil cake (not more than 2 kilos. per animal per day) gave a Polenske value which exceeded the limit. Bömer's phytosteryl acetate method yielded reliable results even in the case of butter from cows fed on beetroot leaves, cocoanut oil cake, etc.—W. P. S.

Fat ; Rapid determination of —— *in cheese, butter and cream.* K. Kropat. Arch. Pharm., 1914, **252**, 76—82.

Cheese.—From 2 to 3 grms. are heated with 5 c.c. of 25 per cent. hydrochloric acid until a brown solution is obtained, 3 to 5 c.c. of alcohol are added, the mixture cooled, and shaken with 25 c.c. of ether until the layers separate, when 25 c.c. of petroleum spirit are added and the extraction completed. After standing 10 to 15 mins., from 1 to 1·5 grms. of gum tragacanth and 3 to 5 c.c. of water are introduced into the separating funnel, which is rotated until the gum swells up, and then vigorously shaken until coagulation of the gum takes place. The clear ethereal layer is drawn off, the residue washed with petroleum spirit (15 c.c.), the extract and washings evaporated, and the residue dried for 2 hours and weighed. *Butter.*—1 grm. is gently warmed with 3 to 5 c.c. of water, 3 to 5 c.c. of alcohol added, and, after cooling, the fat is extracted with 20 c.c. each of ether and petroleum spirit, the casein coagulated by shaking with 1 grm. of gum tragacanth and 1 to 3 c.c. of water as described, the extract evaporated, and the residue of fat weighed. *Cream.*—From 2 to 5 grms. are treated with about 3 c.c. of ammonia solution and 3 to 5 c.c. of alcohol and shaken with 20 c.c. each of ether and petroleum spirit (with the subsequent addition of 3 to 4 c.c. of water in the case of sour cream). After 10 to 15 mins. 1 to 1·5 grms. of gum tragacanth are added, with 3 to 4 c.c. of water (if not already added) and the fat separated as described.
—C. A. M.

Malt coffee. F. Doepmann. Z. Unters. Nahr. Genussm., 1914, **27**, 453—466.

Malt coffee should be prepared from roasted malt: commercial products sometimes consist of roasted barley. For distinguishing between the two, the examination of the grains as regards their degree of germination is recommended. In the case of roasted malt, the length of the germ may equal or exceed the length of the grain, and from 70 to 90 per cent. of the grains exhibit some signs of germination. In two samples of roasted barley only 8 per cent. of the grains showed signs of germination.
—W. P. S.

Feeding-stuffs and food products ; Preparation of new cheap ——. O. Nagel. Z. angew. Chem., 1914, **27**, 208.

Castor oil-cake may be completely freed from the poisonous ricinin by repeated washing with 5 to 10 per cent. sodium chloride solution, until the washings no longer show any precipitate on heating. The mass is then centrifuged and dried for use as a feeding-stuff. Many oil-cakes, and especially that from rape seed, may be used as a cheap source of albumin. The fresh fat-free cake is extracted with water, the solution of albumin evaporated, and the residue dried at a low temperature. A product of finer quality is obtained in this way from sesamé oil-cake, while cocoanut and arachis oil-cakes yield readily digestible and very soluble albumins. Cottonseed oil-cake gives an albumin of dark colour and unpleasant odour, to remove which filtration through animal charcoal is required. The vegetable casein in soya bean oil-cake may be separated by treatment with dilute alkali solution, and precipitation with rennet or an acid. The cost of 100 kilos. of albumin in oil-cakes is estimated at less than M. 50 (£2 9s.).—C. A. M.

Patents.

Butter ; Purification of ——. E. B. Higgins, Liverpool. Eng. Pat. 15,221, July 2, 1913.

Rancid butter or butter contaminated with mechanical impurities is agitated at a low temperature, *e.g.*, 9° C., with an equal weight of a 2·5 per cent. solution of sodium carbonate. The mixture is allowed to settle, the deposited impurities drawn off, the butter strained from the liquid and washed 4 or 5 times with a 0·5 per cent. solution of common salt. The sodium carbonate may be replaced by other suitable alkalis, and the wash water may be slightly acidified, *e.g.*, with hydrochloric acid.—L. E.

Flour ; Process of bleaching ——. J. A. Wesener. Fr. Pat. 465,300, Nov. 25, 1913.

The flour is treated with a mixture of nitrosyl chloride and chlorine obtained from a liquefied mixture of the gases stored under pressure.—W. P. S.

Cotton seed ; Manufacture of food from cakes made from ——. Molassine Co., Ltd., East Greenwich, and J. J. A. de Whalley, Lee, Kent. Eng. Pat. 7687, April 1, 1913.

Press-cakes of undecorticated cotton seed, are ground and then separated into meal, husks, and cotton fibre, *e.g.*, by a blast of air. The meal is used as a food either alone or mixed with other foodstuff. The husks may be ground and added to other foods such as a mixture of molasses and peat: or the husks and cotton fibre, mixed, if desired, with sphagnum, are digested unde pressure, with or without addition of a small quantity a suitable acid, the sugar and easily digestible fibre thu obtained serving as a food or food ingredient fo animals.—L. E.

Milk ; Sterilisation of ——. A. Helbronner, M. vo Recklinghausen, and V. Henri, Paris. Eng. Pat. 742 March 28, 1913. Under Int. Conv., March 30, 1912.

See Addition of March 30, 1912, to Fr. Pat. 442,807 1911 ; this J., 1913, 764.—T. F. B.

Cereal coffee or coffee substitutes and method of makin J. H. Kellogg, Battle Creek, Mich., U.S.A. Eng. Pa 17,387, July 29, 1913.

See U.S. Pats. 1,069,265 to 1,069,268 of 1913 : this 1913, 880.—T. F. B.

Unctuous or gelatinous masses for alimentary purposes, perfumery, etc. A. Eichengrün. Fr. Pat. 464,283, Oct. 6, 1913.

See Ger. Pat. 268,189 of 1911; this J., 1914, 221.—T. F. B.

Baking salt. Eng. Pat. 17,941. *See* VII.

Preparing an acid calcium lactate. Ger. Pat. 271,643. *See* XX.

XIXb.—WATER PURIFICATION; SANITATION.

[*Water.*] *Storage; Advantages and disadvantages of reservoir* ——. W. P. Mason. J. Franklin Inst., 1914, **177**, 369—384.

The main disadvantages of the storage of drinking water before distribution are the increase in colour of the lower layers of the water if the bottom of the reservoir is not clean, the growth of small organisms producing taste and smell due to an abundance of food-material extracted from the ground forming the bottom, and the deficiency in dissolved oxygen in the lower layers. An important point is the protection of the reservoir and watershed from accidental contamination by fæcal matter. The seasonal growth of algæ is easily dealt with by treatment with copper sulphate, one part of copper sulphate to 3½ million parts of water being effective, at a total cost of 14·9 cents (7½d.) per million parts of water. There is also an occasional growth of various forms of *Crenothrix*, of which *C. kuhniana* grows in water containing a large amount of organic matter, little dissolved oxygen, and about 0·3 part Fe per million. The great advantage of storage is the destruction of pathogenic and other bacteria, but care must be taken that the whole of the water undergoes the stated period of storage. A case is cited of a narrow lake 10 miles long, in which the prevailing wind blew in the direction of the flow of water down the lake; sewage matter entering on the surface at the head of the lake was carried to the lower end, where the water intake was situated, in as little as three days. Emergency water intakes, which are frequently in inferior positions, should not be used unless the water can be properly stored. —J. H. J.

Radio-activity; The measurement of the —— *of springs.* C. Engler, H. Sieveking, and A. Koenig. Chem.-Zeit., 1914, **38**, 425—427 and 446—450.

An improved form of the Engler and Sieveking fontactoscope is described, by means of which more exact measurements of the radio-activity of natural waters may be made. It consists of a vessel of ten litres capacity on the neck of which fits a hollow conical stopper, supporting a Wulf quartz-fibre electrometer. Through a hole in the stopper, which can be closed at will by a rubber plug, passes a conducting wire connecting the electroscope with a rod suspended within the large vessel. Before use the normal rate of discharge is determined by shaking in the vessel, for half a minute, one litre of inactive distilled water, charging the electroscope, and observing the fall of potential, which under normal conditions should be between 15 and 30 volts per hour. One litre of the active water is then shaken in the vessel for half a minute, whereby all but about 2 per cent. of the radium emanation is transferred to the air. The fall of potential per hour is again determined, the normal loss deducted, and a correction applied for the solubility of the emanation in the water, and for the Duane effect (size and form of the apparatus). From the fall of potential per litre per hour thus calculated, the activity of the water is given by $A=\frac{v}{300}\times\frac{c}{3600}\times 1000$ Mache units (v=fall of potential, c=capacity of system). The results to be of comparative value must be referred to some definite time from the commencement of the shaking out of the emanation, as the activity, due to the pure emanation, rapidly increases owing to the production of RaA and RaC. In making rapid measurements the readings should be taken 2 mins. from the commencement of the shaking out, and tables are given to enable such figures to be referred to the zero time, *i.e.* activity of the pure emanation.—G. F. M.

Carbon monoxide in air; Determination of ——. F. S. Sinnatt and B. J. Cramer. Analyst, 1914, **39**, 163—170.

The air, freed from carbon dioxide, unsaturated hydrocarbons and moisture, was passed through two vertical tubes packed with alternate layers of iodine pentoxide and glass wool and heated in a paraffin bath to 140°—160° C., and then bubbled through mercury and collected in a special apparatus, consisting essentially of a dry gas vessel connected with a long vertical tube dipping into mercury. The gas vessel was exhausted, connected with the vertical tube, and the gas allowed to flow in at the rate of 1 litre per hour, the volume being calculated from the fall of the mercury. The carbon dioxide formed from the carbon monoxide by the oxidising action of the iodine pentoxide could be accurately titrated in the gas vessel by Pettenkofer's process. The analyses were checked by using red-hot copper oxide in place of iodine pentoxide. —F. Shdn.

Sulphur dioxide in air; Determination of minute amounts of ——. A. Seidell and P. W. Meserve. J. Ind. Eng. Chem., 1914, **6**, 298—301.

To determine quantities of sulphur dioxide ranging from 0·0025 to 0·05 c.c. in 2½ litre samples of air (*e.g.*, from railway tunnels), 5 c.c. of a 0·1 per cent. aqueous starch paste was introduced into and distributed over the inner surface of the bottle containing the sample, and $N/1000$ iodine run in until a blue colour appears, a correction of 0·3 c.c. being made to allow for the quantity required to produce the colour in absence of sulphur dioxide. The results by this method are concordant but low, and should be multiplied by 1·3. To avoid errors due to oxidation of the sulphur dioxide by atmospheric oxygen, perfectly dry bottles should be used for collecting the samples, and except on very dry days, titration should be performed within less than half an hour.—A. S.

Soot-fall study of Pittsburgh. J. O'Connor, jun. Met. and Chem. Eng., 1914, **12**, 247.

Soot was collected in twelve different parts of Pittsburgh during one year (April, 1912, to April, 1913), the jars being changed each month. After drying in a steam oven, tar was determined by extraction with ether, the ash as usual, and the fixed carbon taken by difference: the ferric oxide in the ash was also determined. The composition of the soot at each station, and the calculated total fall, in tons per sq. mile per year, are shown in the following table:—

Composition of soot.

Station.	Tar.	Fixed carbon.	Ash.	Fe_2O_3. in ash.	Total fall.
	per cent.	per cent.	per cent.	per cent.	tons.
1	2·19	21·97	75·84	32·08	595
2	0·82	36·58	62·60	33·73	1950
3	1·56	30·14	68·30	58·78	670
4	1·12	25·11	73·77	30·98	1660
5	1·26	21·92	76·82	43·66	1630
6	0·36	32·96	66·68	47·44	978
7	1·00	37·06	61·94	38·44	812
8	0·74	31·06	68·20	33·38	922
9	0·62	28·22	71·16	35·42	748
10	0·42	38·16	61·42	24·05	721
11	0·76	39·28	59·96	36·52	995
12	1·04	28·82	70·14	31·47	693

—A. S.

Reduction of arsenic acid to arsenious acid by thiosulphuric acid. Chapin. *See* VII.

Determination of small quantities of lead. Siegfried and Pozzi. *See* XXIII.

Patents.

Water softening; Process for the preparation of complex silica combinations with metallic or other oxides with a view to ——. P. de Brünn. Fr. Pat. 464,018, Aug. 23, 1913. Under Int. Conv., Aug. 26, 1912.

The aluminium of the aluminate-silicate compounds used for softening water by filtration, is replaced by other metals, such as tin, zinc, lead, zirconium, or the like. Examples: (1). 120 parts of zirconium oxide, 300 parts of sodium carbonate, and 500 parts of powdered silica are fused at 1400° C. and the resulting vitreous mass treated with water whilst cooling. (2). 3000 grms. of caustic soda are added to 900 grms. of a stannous chloride solution containing 21 per cent. Sn, and 500 litres of a 5—10 per cent. solution of sodium sulphate, phosphate, or chloride are added to the mixture to assist precipitation, which is effected by addition of 1500 grms. of sodium silicate. The mixture is heated, filter-pressed, dried, and hydrated, preferably with warm water.—O. R.

Water: Process and apparatus for the purification of ——. Maschinen- und Waggonbau-Fabriks Akt. Ges. vorm. H. D. Schmid and F. von Suess. Fr. Pat. 464,670, Nov. 8, 1913. Under Int. Conv., Nov. 11, 1912.

The water, before it is sterilised by the action of ultraviolet rays, is passed through a filter composed of fibrous material and then through a sand filter.—W. P. S.

Waters; Process for precipitating substances from feed —— for the prevention of incrustation in boilers. I. Belorussoff. Fr. Pat. 465,239, Jan. 31, 1913.

The feed-water is heated in a closed tank by steam from a boiler, whereby bicarbonates are decomposed and carbonates precipitated. The tank is provided with a sludge-cock and the steam pressure may be utilised for introducing further quantities of water into the tank through an injector. The treated water is conducted from the upper part of the tank to the boiler.—W. P. S.

Effluents and waste-waters from sugar factories and the like; Process of clarifying ——. T. Steen. Fr. Pat. 464,964, Nov. 15, 1913.

A series of settling tanks is employed, but instead of the effluent passing successively from one tank to the next, the tanks are filled and emptied independently. Means are provided for removing the sediment deposited in the tanks from successive charges of effluent.—W. P. S.

Wood; Sterilising ——. O. Toepfer, Magdeburg, Germany. Eng. Pat. 22,825, Oct. 9, 1913.

The wood, especially the wood of containers of butter, cakes, etc., is treated in a tightly-closed vessel having a space below for collecting condensed water, and above this space a grate, with a lower and an upper grid, for supporting the pieces of wood in a vertical position. Above the upper grid is a distributing tubular ring, provided with separate connections and valves for steam, cold water and a drying medium such as hot air, and the wood may thus be exposed in rapid succession to the action of saturated steam, cold water, a partial vacuum and a drying medium.—B. N.

Ozonising liquids; System for ——. G. F. Butler, Niagara Falls, N.Y., Assignor to American Ozone Co. U.S. Pat. 1,089,108, March 3, 1914.

The supply column of the liquid to be ozonised contains a cut-off valve and is provided with means for injecting ozone at a point between the cut-off valve and the reservoir for the ozonised liquid; a second valve, situated between the reservoir and the point of injection of ozone, and controlled by the pressure in the column, is adapted to deflect the liquid from the reservoir.—O. R.

Sterilisation of liquids [and bleaching oils, by ultra-violet rays]. V. Henri, A. Helbronner and M. von Recklinghausen. Second Addition, dated Jan. 10, 1913, to Fr. Pat. 403,945, June 11, 1909 (this J., 1910, 107).

The liquid is introduced into a rotating drum which may be slightly conical, or cylindrical and inclined. The lamp emitting the rays is mounted inside the drum and the latter may be cooled externally by a water spray and filled with an inert gas or the air may be exhausted from it. The apparatus may also be used for bleaching oils.—W. P. S.

Liquids; Centrifugal apparatus for clarifying ——. R. A. Sloan and J. E. L. Barnes. Fr. Pat. 464,525, Nov. 7, 1913. Under Int. Conv., Nov. 11, 1912.

See Eng. Pat. 25,817 of 1912; this J., 1913, 1148.—T. F. B.

Purification of gases [from suspended particles] by formation of mist by supersaturation. Ger. Pat. 270,757. *See* I.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Nux vomica; Assay of ——. W. B. Cowie. Pharm. J., 1914, 38, 545.

Uniform results for the assay of *Nux vomica* can be obtained by the following method: 10 c.c. of the liquid extract are mixed with 10 c.c. of 5 per cent. acetic acid, evaporated till free from alcohol and cooled to 15° C. The liquid is mixed with 5—10 c.c. of *liquor ferri chloroxidi* and made up to 50 c.c. After shaking well, 25 c.c. are filtered off, mixed with a solution of 2·5 grms. of sodium carbonate crystals in 12·5 c.c. of water, extracted three times with 10 c.c. of chloroform, which is distilled off and the residue weighed after drying at 100° C., the weight being taken as total alkaloids. The residue is dissolved in excess of $N/10$ sulphuric acid and titrated with $N/10$ sodium hydroxide, using cochineal as indicator. The solution is evaporated, mixed with 4 c.c. of dilute sulphuric acid and made up to 12·5 c.c. This is heated to 25° C. for 20 minutes with 1·5 c.c. of nitric acid of sp. gr. 1·375. The liquid is then made alkaline with 10 per cent. sodium hydroxide solution, shaken out three times with 10 c.c. of chloroform, which is evaporated and the residue dried at 100° C. before weighing.—F. Shdn.

Carica Papaya juice; Standardisation of dried ——. F. F. Shelley. Analyst, 1914, 39, 170.

The following is a modification of Sörensen's test (compare this J., 1908, 135): 4·0 grms. of casein are dissolved in 100 c.c. of an alkaline solution containing 4 c.c. of $N/1$ soda. 25 c.c. of water containing 0·1 grm. of dried *Papaya* juice are added to 25 c.c. of the casein solution and the whole kept at 37° C. for 4 hours. 10 c.c. of a neutralised 40 per cent. formaldehyde solution are added to 20 c.c. of the liquid, and the mixture, equivalent to 0·04 grm. of the dried juice, is titrated with $N/5$ soda, using phenolphthalein as indicator. A similar mixture is made without the *Papaya* juice and titrated. The difference, which should be at least 1 c.c., gives the amount of acid required to neutralise the amino-acids formed by the hydrolysis of the casein. Pure dried *Carica Papaya* juice should give no reaction for starch with iodine, nor reduce Fehling's solution before or after hydrolysis.—F. Shdn.

Liquorice powder; Composition and analysis of compound ——. A. E. Parkes and F. Major. Analyst, 1914, 39, 160—162.

Moisture and ash are estimated by the usual methods. The carbon bisulphide extract is obtained by exhausting 5 grms. with the dry solvent for 12 hours in a Soxhlet apparatus, and after weighing, the extract is oxidised with fuming nitric acid preparatory to precipitation with barium chloride for determining the sulphur. The difference between the sulphur and total extract is principally oil from the fennel. The dry extracted powder is mixed with water, made up to 250 c.c. and allowed to digest with occasional shaking for 12 hours. After settling, 50 c.c. of the filtered liquid are evaporated to obtain the aqueous extract. Sugar can be determined in another 50 c.c. of the filtrate by the usual methods after treatment with lead acetate solution. The amount of crude glycyrrhizin is determined by acidifying 50 or 100 c.c. of the aqueous filtrate with dilute sulphuric acid, filtering off the precipitate and washing with a little cold water. The precipitate is dissolved in dilute ammonia, the solution filtered, evaporated to dryness and weighed. When senna is present, the ammoniacal solution has a fine cherry-red colour. The total sulphur is determined by oxidising about 1 grm. of the powder with fuming nitric acid and a little potassium nitrate or chlorate. This should be determined, as the sublimed sulphur used in making up the powder may not be completely soluble in carbon bisulphide. A microscopical examination should also be made. The extreme figures for 13 samples obtained on the market were: loss at 100° C. 7·9 to 3·0; ash 6·2 to 4·6; carbon bisulphide extract 10·7 to 9·2; sulphur in extract 7·9 to 6·3; total sulphur 9·2 to 7·8; cold water extract 63·9 to 61·1; ash of extract 2·4 to 1·8; sucrose 50·3 to 48·3; crude glycyrrhizin 2·9 to 1·2 per cent.

—F. Shdn.

Saffron; Examination of ——. R. Krzizan. Z. öffentl. Chem., 1914, 20, 109—114, 121—124.

Low results are obtained in the determination of invert sugar in saffron when sodium sulphate is used to remove the excess of basic lead acetate used for clarification; from 3 to 4 per cent. more invert sugar is obtained when the excess of lead is precipitated by sodium phosphate. Experiments with pure sucrose and with honey showed that correct results are obtained with sodium phosphate. Certain genuine samples of saffron contained as much as 21·75 per cent. of invert sugar and, after inversion, 23·53 per cent., calculated on the dry substance. The accepted maximum of 20 per cent. of invert sugar for pure saffron is, therefore, somewhat too low. Genuine saffron frequently contains up to 1 per cent. of sand, and usually yields not more than 6 per cent. of ash; about 70 per cent. of the ash is soluble in water and the alkalinity of the soluble ash corresponds with 6·9 c.c. of $N/1$ acid per grm. of total ash.—W. P. S.

Saffron; Detection of magnesium sulphate in ——. A. Nestler. Z. Unters. Nahr. Genussm., 1914, 27, 388—391.

The addition of glycerol to a saturated solution of magnesium sulphate prevents the latter from crystallising, but if a drop of chloral hydrate solution (5 : 2) be added, crystals of magnesium sulphate form almost immediately. To detect magnesium sulphate in saffron, the filtered aqueous solution is allowed to evaporate at the ordinary temperature to a syrup, and a drop of this is mixed on a microscope slide with a drop of chloral hydrate solution. In the presence of magnesium sulphate, crystals are obtained either at once or after the lapse of a few minutes. The crystals may be washed with alcohol and then identified by means of microchemical tests.—W. P. S.

Extraction by means of immiscible solvents; A study of the methods for —— *from the point of view of the distribution coefficients. I.* J. W. Marden. J. Ind. Eng. Chem., 1914, 6, 315—320.

The distribution ratio (d=concentration in water: concentration in immiscible solvent) was determined for a number of cases met with in analytical practice, and from the values obtained the efficiency of extraction was calculated by the formula: $x_n = x_0 \left(\frac{da}{e+da} \right)^n$, where a=volume of aqueous solution, e=volume of immiscible solvent, x_0=initial concentration of aqueous solution, and x_n= concentration after n extractions; the calculated results were checked by experiments. From the results obtained improvements in certain analytical methods are suggested. *Acetanilide in hydrogen peroxide.* Washing 50 c.c. of the sample twice with 20 c.c. of ether and once with 20 c.c. of chloroform (Bull. 150, U.S. Bureau of Chemistry) extracts only 95 per cent. of the acetanilide. Using chloroform only, in 10 c.c. portions, five washings (2 mins. each) will extract 99 per cent. and 8 washings 99·9 per cent. of the acetanilide. *Acetanilide, vanillin, and coumarin in vanilla extracts* (Hess and Prescott, this J., 1899, 397, 525; Winton and Silverman, this J., 1902, 1300). Extraction of 50 c.c. of the extract, freed from alcohol, once with 20 c.c. and 3 times with 15 c.c. of ether extracts 99·5—99·6 per cent. of the vanillin and practically all of the coumarin, but only 93 per cent. of the acetanilide. For removing the vanillin from the ether solution, the original proposal of Hess and Prescott appears to be the best: shaking 50 c.c. of the ether solution once with 10 c.c. of 5 per cent. ammonia removes practically all the vanillin and only about 5 per cent. of the acetanilide and 3 per cent. of the coumarin. *Salicylic acid, benzoic acid, and β-naphthol.* Salicylic and benzoic acids are removed practically completely from aqueous solution by a few extractions with ether, and β-naphthol in like manner from a slightly acid solution by a few extractions with chloroform. *Saccharin.* Chloroform is not so good and amyl acetate is slightly better than ether for extracting saccharin from aqueous solutions. The results are influenced considerably by the concentration of hydrochloric acid in the aqueous layer. It is recommended that 50 c.c. of the aqueous solution be treated with 2·5 c.c. of 38 per cent. hydrochloric acid and shaken four times with 10 c.c. of ether (2 mins. each time), whereby 99 per cent. of the saccharin is extracted; six washings give an extraction of 99·9 per cent. *Caffeine and tannin.* In the separation of caffeine from tannin in the analysis of tea, less chloroform may be used than recommended by Smith (this J., 1913, 804). Four washings of 50 c.c. of the solution with 10 c.c. portions of chloroform will extract 99·7 per cent. and five washings 99·95 per cent. of the caffeine.

—A. S.

Chrysophanic acid; Some reactions of —— *with reference to its detection in complex medicinal preparations.* E. M. Bailey. J. Ind. Eng. Chem., 1914, 6, 320—321.

Chrysophanic acid, a dihydroxymethylanthraquinone, $C_{15}H_{10}O_4$, is a yellow colouring principle present in certain medicinal plants, notably senna and rhubarb. For its detection in complex medicinal preparations an alcoholic extract of the sample is freed from alcohol or diluted with water, then acidified with a few drops of hydrochloric acid, and extracted with ether (if an emulsion forms it is easily destroyed by adding acetone). The ethereal solution is shaken with 2½ per cent. ammonia solution: chrysophanic acid, phenolphthalein, curcumin, and hæmatoxylin all impart a red colour to the alkaline solution. The solution is acidified and shaken with ether, which extracts only the chrysophanic acid and phenolphthalein. A portion of the ethereal solution is boiled with 4—5 c.c. of 25 per cent. sodium hydroxide solution and a little zinc dust: chrysophanic acid and phenolphthalein are both reduced, but on diluting the alkaline solution and treating with a few drops of hydrogen peroxide, only the chrysophanic acid is re-formed by oxidation, and its presence is indicated by a characteristic cherry-red colouration.—A. S.

Manganous oxide; Use of —— *for the catalysis of acids. Preparation of aldehydes and pentamethylenic ketones. Formation of cyclopentylamines.* P. Sabatier and A. Mailhe. Comptes rend., 1914, 158, 985—991.

Manganous oxide, prepared by heating the carbonate, when heated to 350° C., is an excellent catalyst for the reduction of organic acids by formic acid. If the vapour of the acid together with excess of formic acid vapour is passed over the heated oxide, a good yield of the corresponding aldehyde is obtained. *e.g.* isovaleric acid gives a 50 per cent. yield of isovaleraldehyde. If adipic acid or its β-methyl derivative is used in the absence of formic acid, the vapours being carried over the catalyst by a current of carbon dioxide, cyclopentanone or β-methylcyclopentanone can easily be obtained with about 80 per cent. yields. The oximes of these ketones on being reduced by hydrogen in contact with metallic nickel at 180° C., are converted into the corresponding amines, primary, secondary, and tertiary amines being formed in each case. The secondary amine is obtained in greatest quantity (upwards of 50 per cent.), the remainder containing primary and tertiary in equal quantities.—W. H. P.

Barbier-Grignard reactions ; (1) *Some* ——. (2) *Processes for the preparation of unsaturated hydrocarbons with conjugated double linkages* [*isoprene*]. L. P. Kyriakides. J. Amer. Chem. Soc., 1914, **36**, 657—670.

(1) With aliphatic ketones and aldehydes, the best results were obtained by working at a low temperature and with vigorous shaking, especially in the case of substances containing mobile halogen atoms. In some cases, ethyl chloride was used with advantage, instead of the bromide, in preparing the Grignard reagent, the addition product with magnesium-ethyl chloride and chloroacetone, for example, in the preparation of chloromethylbutanol, being much more soluble in ether than the ethyl bromide addition product. (2) Oxides of the hydrocarbons were dehydrated to hydrocarbons of the butadiene series by heating at temperatures above 350° C., in the presence of catalysts (*e.g.*, kaolin) ; a reduced pressure was found necessary. Using a high vacuum, the hydrocarbons obtained could be polymerised directly after distillation. 1-Methylbutanal (methylethylacetaldehyde) was dehydrated in a similar manner to isoprene, but a purer product, readily polymerising to caoutchouc, was obtained by direct dehydration of 2-methyl-1.2-butylene oxide, prepared from chloromethylbutanol.—F. Sodn.

Saturated and unsaturated hydrocarbons ; Simultaneous oxidation of —— *by potassium permanganate.* N. Kishner. J. Russ. Phys. Chem. Ges., 1913, **45**, 1788—1792. Chem. Zentr., 1914, **1**, 1498.

In experiments on the separation of mixtures of saturated and unsaturated hydrocarbons by oxidising the latter with permanganate, it was observed that saturated hydrocarbons though quite resistant to the action of permanganate when pure, were oxidised to a considerable extent in presence of unsaturated hydrocarbons. 2.6-Dimethyloctane, for example, was not attacked when boiled with permanganate solution alone, but in presence of menthene, was oxidised to the extent of up to 50 per cent.—A. S.

Formaldehyde, its applications and analysis. G. Desmurs. Bull. Assoc. Chim. Sucr., 1914, **31**, 660—674.

An account is given of the properties, industrial applications, and methods of analysis of formaldehyde, and a short bibliography is appended (see Romijn, this J., 1897, 366 ; Nicloux, this J., 1897, 941 ; Blank and Finkenbeiner, this J., 1899, 79 ; Clowes and Tollens, this J., 1900, 77 ; Peska, this J., 1901, 1031 ; Vanino and others, this J., 1901, 1251 ; 1902, 193 ; 1913, 83 : Hartwagner, this J., 1913, 111). The following modification of Romijn's iodometric method, is recommended for the analysis of commercial formaldehyde :—The sample is diluted until it contains about 2 per cent. of formaldehyde, and 5 c.c. are mixed with 30 c.c. of $N/1$ sodium hydroxide, and treated with $N/5$ iodine, whilst agitating, until the liquid is bright yellow. The flask is then closed, and shaken for 1 min., 40 c.c. of $N/1$-hydrochloric acid are added, and the excess of iodine is titrated with sodium thiosulphate solution. One c.c. of $N/1$ iodine corresponds to 0·015 grm. of formaldehyde.—J. H. L.

Patents.

Organic solvents ; Production of ——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 29,963, Dec. 30, 1912.

A mixture containing halogen derivatives of more than one hydrocarbon of the paraffin series is acetylated. For example, the fraction of petroleum spirit of boiling point 28° to 69° C. is chlorinated, and the mixture of chloropentanes and chlorohexanes is acetylated ; the product consists of a mixture, in approximately the proportions given, of the following :—Olefines, 35 per cent. ; chloroolefines, 5 per cent. ; acetic esters of monohydric alcohols, 50 per cent. ; acetic esters of dihydric alcohols, 10 per cent. If desired the mixture may be separated by fractionation, and the various products used as solvents, or the undistilled mixture may be used as a solvent, particularly for nitrocellulose.—T. F. B.

Liquid [*methyl acetate*] *which is able to dissolve energetically various substances ; Process for making a* ——. A. Helbronner and G. E. Criquebeuf. Fr. Pat. 464,646, Jan. 18, 1913.

A liquid containing from 65 to 75 per cent. of methyl acetate, the remainder being chiefly acetone and methyl alcohol, is obtained by distilling crude or purified pyroligneous acid until about one-tenth of the volume has passed over, adding to the residue a suitable esterifying agent (*e.g.*, 2 to 3 per cent. of a mineral acid), and continuing the distillation until about one-third of the residue has distilled ; the combined distillates are finally rectified. The product may be used for dissolving resins, fatty compounds, cellulose nitrate or other cellulose esters, etc.—T. F. B.

Therapeutical agent suitable for the treatment of tuberculosis ; Manufacture of a ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 2610, Jan. 31, 1914.

A remedy for tuberculosis is obtained by cultivating tubercle bacilli on nutrient broth containing a small quantity of a gold salt, but insufficient to prevent entirely the development of the bacilli ; the culture is then transferred to a nutrient medium containing a larger quantity of gold, and the process is repeated several times, on media containing increasing quantities of gold salt. The final product consists of tubercle bacilli which contain a certain amount of gold, and which are not killed by gold salts ; it can be made into emulsions with glycerin water or converted into tuberculin by the usual methods.—T. F. B.

Arseno-metal preparations and process of making sam P. Ehrlich, Frankfort, B. Reuter, Höchst, and P Karrer, Frankfort, Assignors to Farbwerke vorm Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,091,881, March 31, 1914.

Arseno-compounds containing the radical, $C_6H_5.As : As$ are combined with salts of heavy metals in solution. I particular, the hydrochloride of 3.3′-diamino-4.4′-d hydroxyarsenobenzene is combined with cuprous chlorid —T. F. B.

Azo dyestuffs containing the arseno group ; Process f making ——. Farbwerke vorm. Meister, Lucius, un Brüning. Ger. Pat. 271,271, Feb. 19, 1913.

Azo dyestuffs which contain the arseno group, and a suitable for therapeutic purposes, are obtained by reduci with hypophosphorous acid azo dyestuffs containing arsinic acid or arsenoxide grouping. The azo group is n affected by the reducing agent.—T. F. B.

Fatty acids containing arsenic and phosphorus ; Process for preparing [iron] salts of ——. F. Heinemann. Ger. Pat. 271,158, Jan. 3, 1913. Addition to Ger. Pat. 257,641.

The higher unsaturated fatty acids containing arsenic and phosphorus described in the principal patent (see Eng. Pat. 18,732 of 1912 ; this J., 1913, 109) are converted into their iron salts. The products are suitable for use in medicine, especially for the treatment of chlorosis and anæmia. (See also Eng. Pat. 10,378 of 1913: this J., 1914, 218.)—T. F. B.

Cyclic chlora compounds ; Process for obtaining ——. Fabriques de Produits de Chimie Organique de Laire. Fr. Pat. 464,645, Jan. 17, 1913.

Benzyl chloride and its homologues are obtained by condensing aromatic hydrocarbons with monochloro-acetone in presence of stannic chloride or other suitable metallic chloride. When homologues of benzene are used, the chloromethyl group generally enters the benzene nucleus in the *p*-position to the alkyl group. The ethyl, propyl, butyl, amyl, cyclohexyl, methylethyl, methylpropyl, and methylbutyl derivatives of benzyl chloride have been prepared in this way. The following example illustrates the process :—Equimolecular proportions of toluene and chloro-acetone are dissolved in twice their weight of carbon bisulphide or carbon tetrachloride, the solution is cooled to about —10° C., and ¼ mol. of stannic chloride is added drop by drop. After the mixture has stood for half an hour the oily layer is separated, poured on ice, washed with water, and distilled ; the unchanged toluene passes over first and then, at 102°—110° C., under a pressure of 30 mm., the *p*-methylbenzyl chloride, the yield being about 60 per cent. of the toluene used.—T. F. B.

Phenyl αβ-dibromopropionic acid ethyl ester ; Process for preparing stable ——. E. Merck. Ger. Pat. 271,434, Dec. 8, 1912.

Ethyl cinnamate is brominated in presence of an indifferent solvent in which the dibromo ester is soluble with difficulty (*e.g.*, petroleum spirit, carbon tetrachloride, and chloro derivatives of ethane), and the product is treated with water. The resulting phenyl-αβ-dibromopropionic acid ethyl ester (ethyl αβ-dibromohydrocinnamate) is stable, especially if the presence of iron or its compounds, or other substance which favour its decomposition, is avoided during its preparation.—T. F. B.

Calcium lactate ; Process for preparing an acid ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 271,643, Sept. 6, 1912.

The acid calcium lactate containing four mols. of lactic acid is treated with a solvent for lactic acid ; or calcium oxide, hydroxide, carbonate, or lactate, is evaporated with a solution containing a quantity of lactic acid corresponding to about three mols. for each atom of calcium, any excess of lactic acid being removed by a solvent. The resulting acid lactate forms stable mixtures with carbonates and bicarbonates, and so can be used in the preparation of baking powders.—T. F. B.

Hydrastinine ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Germany. Eng. Pat. 14,120, June 18, 1913.

See Ger. Pat. 267,272 of 1913 ; this J., 1914, 220.—T. F. B.

Per-acids from aldehydes ; Process for the manufacture of ——. Consortium f. Elektrochem. Industrie G. m. b. H. Nuremberg, Germany. Eng. Pats. 16,849 and 17,018, July 22 and 24, 1913. Under Int. Conv., Sept. 6, 1912, and April 11, 1913.

See Fr. Pat. 460,972 of 1913 ; this J., 1914, 42.—T. F. B.

Azo dyestuffs containing the arseno-group ; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 2090, Jan. 26, 1914.

See Ger. Pat. 271,271 of 1913 ; preceding.—T. F. B.

Quinoline-4-carboxylic acids arylated in the 2-position ; Sulpho compounds of ——. A. Thiele, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,091,870, March 31, 1914.

See Eng. Pat. 16,482 of 1913 ; this J., 1914, 42.—T. F. B.

Formaldehyde ; Process for making crystalline polymerisation products from ——. F. Pollak. Fr. Pat. 461,731, Nov. 10, 1913. Under Int. Conv., Dec. 13, 1912.

See Eng. Pat. 25,830 of 1913 ; this J., 1914, 218.—T. F. B

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Colour photography and colour cinematography. F. W. Donisthorpe, Barnes. Eng Pat. 7368, March 28, 1913.

A negative taken through a light filter of one colour is superimposed on a positive transparency made through a filter of another colour, and a print is made through both, so that only the coloured portions of the image appear in the resulting print ; this is then coloured with a suitable toning bath and superimposed with a black and white print. The silver image may be toned with a bath which so affects the gelatin combined with the silver that the subsequent staining baths have no effect on that part of the gelatin For example, baths containing iron and vanadium or uranium may be used to produce red or yellow images, and the toned prints may be stained with green or violet dyes.—T. F. B.

Photography in colours on fabrics ; Process of ——. T. Valette and R. Feret. First Addition, dated Oct. 4, 1913, to Fr. Pat. 457,446, May 3, 1913.

An apparatus is described for holding the support to ensure perfect register of the monochrome images, for use in the process of the principal patent (see this J., 1913, 1033).—T. F. B.

Toning bath containing tellurium for photographic silver images. Chem. Fabr. auf Actien vorm. E. Schering. Ger. Pat. 271,041, Dec. 17, 1912.

A solution of tellurium in an alkali sulphide is used for toning photographic silver images. The tones obtained are somewhat bluer than those produced by selenium (see U.S. Pat. 1,064,379 ; this J., 1913, 712), and resemble those obtained with gold toning baths.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Viscosity of solutions of nitrocellulose in alcoholic camphor solutions. Nishida. See V.

Patents.

Cordite mill. A. A. Schaschke, Aberdeen. Eng. Pat. 15,605, July 7, 1913.

The teeth of a row of discs, spaced upon a rotating or rocking shaft, pass between the teeth of a fixed comb.

The cordite is carried forward by the moving teeth, and sheared between them and the fixed teeth.—O. E. M.

Matches; Process of making a composition for use in ——. H. Staier, New York. U.S. Pat. 1,092,408, April 7, 1914.

A SUBSTITUTE for yellow phosphorus is produced by heating a mixture of six parts by weight of red phosphorus, two of metallic sulphide, and three of sulphur to about 500° F. (260° C.) washing, and drying.—O. E. M.

Explosive. O. Silberrad, Buckhurst Hill. U.S. Pat. 1,092,758, April 7, 1914.

SEE Eng. Pats. 13,861 of 1911 and 712 of 1912; this J., 1912, 978.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Lead; Determination of small quantities of ——. M. Siegfried and W. Pozzi. Biochem. Zeits., 1914, **61**, 149—156.

MINUTE quantities (less than 1 mgrm.) of lead can be rapidly determined, in tap water, for example, by the following modification of the colorimetric method. 100 c.c. of the liquid are mixed with 9 c.c. of *N*/100 hydrochloric acid, 1 c.c. of a 1 per cent. solution of the purest gum arabic, and 10 c.c. of a saturated solution of hydrogen sulphide. From the tint of the liquid the quantity of lead present is estimated approximately, and a standard solution for colorimetric compari on is made by diluting the requisite volume of lead nitrate solution (0·1599 grm. per litre) to 100 c.c., and mixing this with acid, gum arabic and hydrogen sulphide, as before. Details of procedure are given from the comparison of the liquids in a Duboscq colorimeter. Small quantities of iron and manganese do not affect the results. The concentration of acid employed prevents the precipitation of iron sulphide but does not interfere with the complete conversion of the lead into sulphide. The gum arabic is employed to prevent flocculation of the lead sulphide. When lead compounds are evaporated with nitric acid, *e.g.*, in the investigation of organic material for lead, a small quantity of the latter is converted into an insoluble form (possibly silicate). —J. H. L.

Arsenic; Quantitative separation of —— from metals by means of hypophosphorous acid. L. Brandt. Chem.-Zeit., 1914, **38**, 461—463, 474.

FROM almost all the common metals, even when associated with a relatively large excess, arsenic can be quantitatively separated by precipitation with hypophosphorous acid, and determined iodometrically in the precipitate by the method already described (this J., 1914, 28). Iron, manganese, nickel, cobalt, zinc, chromium, aluminium, tin, sodium, potassium, and the alkaline-earth metals have no influence on the accuracy of the arsenic determination, and the metals themselves can be subsequently determined by the usual methods. Lead and silver should be removed as sulphate and chloride respectively before addition of hypophosphorous acid. Copper, if only present in small amount, does not interfere, but if present in large proportion, the arsenic should be precipitated first as ferric arsenate, the precipitate dissolved in hydrochloric acid and the solution then treated with hypophosphorous acid in the usual way. Mercury must likewise be previously removed as mercurous chloride, by reduction with cold formic and phosphorous acids or with a boiling ammoniacal solution of hydrazine sulphate. Bismuth, though sometimes precipitated with the arsenic, can be readily redissolved in the excess of concentrated hydrochloric acid present. Antimony cannot be separated from arsenic by this method.—G. F. M.

Differentiation of natural and oil asphaltums. Pailler. *See* IIA.

Determination of the melting point of asphaltum. Schanin. *See* IIA.

"Free carbon"; its nature and determination in tar products. Weiss. *See* III.

Process of oxidation of indigo [by permanganate]. Wagner. *See* IV.

Analysis of cellulose compounds. Hottenroth. *See* V.

Reduction of arsenic acid to arsenious acid by thiosulphuric acid. Chapin. *See* VII.

Precipitation of alumina in presence of fluorides. Cavaignac. *See* VII.

Determination of cobalt in steel. Slawik. *See* X.

Assaying concentrates and battery chips for gold and platinum metals. Crosse. *See* X.

Colour valuation of tanning materials. Reed. *See* XV.

Determination of reducing sugars in sugar for melting ("sucres de fonte"). Muller. *See* XVII.

The ebullioscope in the determination of original gravity. Pope. *See* XVIII.

Colour reaction for the detection of methyl alcohol. Manzoff. *See* XVIII.

Determination of sucrose in presence of lactose and in milk preparations. Rakshit. *See* XIXA.

Detection of cocoanut oil in butter fat by means of Polenske's distillation method and Bömer's phytosteryl acetate method. Barthel and Sondén. *See* XIXA.

Rapid determination of fat in cheese, butter and cream. Kropat. *See* XIXA.

Measurement of the radioactivity of springs. Engler and others. *See* XIXB.

Determination of carbon monoxide in air. Sinnatt and Cramer. *See* XIXB.

Determination of minute amounts of sulphur dioxide in air. Seidell and Meserve. *See* XIXB.

Assay of Nux vomica. Cowie. *See* XX.

Standardisation of dried Carica Papaya juice. Shelley *See* XX.

Composition and analysis of compound liquorice powder. Parkes and Major. *See* XX.

Detection of magnesium sulphate in saffron. Nestler. *See* XX.

Some reactions of chrysophanic acid, with reference to its detection in complex medicinal preparations. Bailey. *See* XX.

A study of the methods for extraction by means of immiscible solvents from the point of view of the distribution coefficients. Marden. *See* XX.

Formaldehyde, its applications and analysis. Desmurs. *See* XX

Patents.

Methane or other inflammable gases in the air; Device for measuring the amount of ——. Accumulatoren-Fabrik Akt.-Ges., Berlin. Eng. Pat. 1283, Jan. 16, 1914. Under Int. Conv., April 15, 1913.

See Ger. Pat. 268,844 of 1913; this J., 1914, 190.—T. F. B.

Organic analysis; Apparatus for use in elementary ——. H. Brach, Vienna. Eng. Pat. 4826, Feb. 24, 1914. Under Int. Conv., March 5, 1913.

See Ger. Pat. 263,680 of 1913; this J., 1913, 1035.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

"*Negative*" *adsorption.* A. M. Williams Faraday Soc., April 22, 1914. [Advance proof.]

An experimental examination of the adsorptive action of purified blood charcoal on aqueous solutions of various electrolytes. With very dilute solutions of potassium chloride or magnesium sulphate the adsorption was positive; on increasing the concentration the adsorption rose to a maximum, then declined, and finally attained a negative value. A similar maximum was observed for ammonium chloride, but in this case no negative value was reached. Barium chloride solution showed an uninterrupted increase over the range of concentrations investigated.—J. R.

Book Received.

E. Merck's Annual Report (of Recent Advances in Pharmaceutical Chemistry and Therapeutics). 1912. Volume XXVI. E. Merck, Darmstadt. London: 66, Crutched Friars, E.C. 1913. Price 1s. 6d.

Volume (8¾ by 5¾ ins.) containing 473 pages of subject-matter, and alphabetical indexes of subjects, of diseases, etc., of authors, and an alphabetical bibliographic index. There is at the commencement a monograph on lecithin (50 pages), with an index to the literature of lecithin (22 pages), and at the end an article on the "Assay and Standardisation of Digitalis preparations," by Prof. H. Heintz of Erlangen.

*New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Ferretti*, U.: L'industria del freddo e le sue applicazioni. 2a ediz., con prefazione di C. Tellier. Arpino, 8° fig., p. xvi, 1118, con 1 ritr. e 1 tav. 1914 Lire 20.

Haeder, H.: Pumpen u. Kompressoren. Handbuch f. Berechng., Entwurf, Bau, Betrieb, Untersuchg. u Verbesserg. v. Pumpen- u. Kompressoranlagen. 3., neubearb. Aufl. Fur Studium u. Praxis bearb. 1. Bd. Kolbenpumpen u. sonst. Wasserhebevorrichtgn., Kolbenkompressoren u. Vakuumpumpen (1050 Abbildgn., 175 Tab., viele Beispiele). (VIII, 421 S.) 8°. Wiesbaden, O. Haeder. 1914. Cloth M. 8.

Kreglewski, A.: Die Spül- u. Auspuffvorgänge bei Zweitakt-Verbrennungs-Kraftmaschinen m. besond. Berücksicht. der schnellaufenden Oelmotoren. (29 S. m. 39 Fig.) Lex 80. Berlin, Verlag f. Fachliteratur. 1913. M. 1.50.

Neumann, H.: Die Verbrennungskraftmaschinen in der Praxis. Handbuch. f. die Anlage, Wartg., Betrieb u. Konstruktion der modernen Verbrennungskraftmaschinen. 2. Aufl. (3. Taus.) (XI, 368 S. m. 236 Abbildgn.) 8°. Leipzig, Dr. M. Jänecke. 1914. Cloth M. 6.80.

IIa. *Brame*, J. S. S.: Fuel; solid, liquid and gaseous. 15+372 p. il. diagrs. tabs. Arnold, London. 1914. Net 12s. 6d.

Braunkohlenindustrie, Die deut. I. Bd. 14. Lfg. Halle, Knapp. 1914. M. 2.

IIb. *Siller*, Dr. W.: Versuche über gelöstes Acetylen unter besond. Berücksicht. seiner Verwendung f. die Beleuchtg. v. Eisenbahnwagen. (VII, 72 S. m. 63 Abbildgn.). Gr. 8° Oldenburg, G. Stalling's Verlag. 1914. M. 4.50.

V. *Pannain*, E.: Filati e tessuti. Milano, 16° fig., p. viii 288. 1914. Lire 3.50.

VI. *Chaplet*, A.: Les apprêts textiles, 68 fig., in-8°. Paris. 1914. Gauthier-Villars. 10 fr.

VII. *Escard*, J.: Les phosphates, in-8°. Dunod et Pinat. Paris. 1914. 1 fr. 50.

Jahrbuch der deutschen Kaliwerke. 5. Ausg. Jahrg. 1914. Mit den Beteiligungsziffern, Lieferungsbedinggn. usw. des Kalisyndikates u. den Bekanntmachgn. zum Reichskaligesetz u. zu den Ausführungsbestimmgn. (85 S.) 8°. Leipzig, Dr. M. Jänecke. 1914. M. 1.20.

Le Chatelier, H.: La silice et les silicates. 60 fig., in-8°. Herman et fils, Paris. 1914. 15 fr.

Wolf, Dr. P. M.: Ueber die Synthese v. 100 prozentigen Wasserstoffperoxid m. Hilfe der stillen elektrischen Entladung. (V. 35 S.) Gr. 8°. Oldenburg. G. Stalling's Verlag. 1914. M. 2.50.

VIII. *Brown*, W. N.: The Art of Enamelling on Metal. 2nd edition, revised. Cr. pp. 58. Scott Greenwood. London. 1914. Net 3s. 6d.

Ure, P. N.: Black glaze pottery from Rhitsona in Bœotia. N.Y., Oxford Univ. 1913. 2+64 p. il. pls. O. Bds. 1914. $2.50.

IX. *Barth*, J.: Zementröhren, ihre Herstellung, Prüfung u. Verwendung zu Kanalisationsanlagen. Auf Grund langjähr. Erfahrgn. bearb. (223 S. m. Abbildgn.) Lex 8° Berlin, Tonindustrie-Zeitung. 1914. Cloth M. 10.

Benner, R. C.: Papers on the effect of smoke on building materials. Pittsburgh, Pa., Univ. of Pittsburgh. 1913. 58 p. il. tabs. D. (Mellon Inst. of Industrial Research and Sch. of Specific Industries, smoke investigation bull.), pap. 1914. 25 c.

Bericht üb. die 16. Haupt-Versammlung des deutschen Beton-Vereins (E. V.) am 13., 14. u 15. 2. 1913. (363 S. m. Abbildgn. u. Taf.) 8°. Berlin, Tonindustrie-Zeitg. 1914. M. 5.

Ruff. Prof. O.: Ueber die Herstellung feuerfester Gegenstände üb. 2000° in Oefen m. reduzierender Atmo-

sphäre. (31 S. m. 8 Abbildgn.) Lex 8°. Berlin, J. Springer. 1914. M. 1. Forschungsarbeiten auf dem Gebiete des Ingenieurwesens.

Kosmann, Dr. H. B.: Die Verbreitung der nutzbaren Kalksteine im nördlichen Deutschland. (363 S. m. 1 eingedr. Kartenskizze u. 1 Bildnis.) 8°. Berlin, Tonindustrie-Zeitung. 1913. Cloth M. 10.

Naske, C.: Die Portland-Zement Fabrikation. Ein Handbuch f. Ingenieure u. Zementfabrikanten. 3. vollständig umgearb. u. verm. Aufl. (496 S. m. 408 Abbildgn.) Lex 8°. Leipzig, Th. Thomas Verl. 1914. Cloth M. 24.

Röll, W.: Der Asbest u. seine Bedeutung bezw. Verwendung zu Bau- u. Industriezwecken. 3., neubearb. Aufl. (18 S. m. 2 Abbildgn.) 8°. Breslau, Preuss und Jünger. 1914. Pf. 75.

Searle, A. B.: Cement, concrete and bricks. N.Y., Van Nostrand. 11+412 p. il. diagrs tabs. O. 1914. $3.

Weigert, A.: Beton im Hausbau. (VI, 165 S. m. Abbildgn.) gr. 8°. Berlin, Tonindustrie-Zeitung. 1914. Cloth M. 7.50.

X. *Jahrbuch* f. Mineralogie. 37. Beilagebd. 1. Heft. Stuttg., Schweizerbart. 1914 M. 11.

Kershaw, J. B. C.: Electrothermal methods of iron and steel production; with an introd. by J. A. Fleming; il. by 50 tables and 92 diagrs. and photographs. N.Y., Van Nostrand. 23+233 p. O. 1914. $32.

Froehlich, D. W.: Ueber den Einfluss v. Gasen auf hochprozentigen Nickelstahl. (III 30 S. m. 19 Abbildgn. im Text u. auf 5 Taf .gr. 8°. Oldenburg. G. Stalling's Verlag. 1914. M. 3.

Mazzotto, D.: Le leghe metalliche ed i principî scientifici della metallografia moderna. Modena, 16° fig., p. xii, 421. 1914 Lire 6.

XI. *Benischke*, Prof. G.: Die wissenschaftlichen Grundlagen der Elektrotechnik. 3., teilweise umgearb. u. verm. Aufl. (XVI, 605 S. m. 551 Abbildgn.) gr. 8°. Berlin, J. Springer. 1914. Cloth M. 15.

Dany-Henault, O., H. *Gall* et P., A. *Guye*: Principes et applications de l'électrochimie. T. IV. Lois fondamentales de l'électrochimie. Les applications de l'électrochimie. L'acide nitrique synthétique par combustion électrique de l'azote, 183 fig., in-8°. Paris, 1914. Ch. Béranger. 30 fr.

XII. *Soap Makers' Directory* (The), 1914. 8vo, bds. Simpkin. London. 1914. Net 2s. 6d.

XVII. *Möller*, H.: Der theoretische Wärmeverbrauch e. Rohrzuckerfabrik f. Verdampfen, Erwärmen, Verkochen u. Krafterzeugung. Eine Studie. (VII, 138 S. m. 34 Fig.) 8°. Berlin, J. Springer. 1914. M. 5.

Ranc, A.: Contribution à l'étude des actions physiologiques de la lumière. Action des rayons ultra-violets sur les hydrates de carbone, in-8°. Paris, 1914. A. Leclerc. 10 fr.

XVIII. *Brauereien*, Malz-Fabriken, Brennereien, Sprit- u. Presshefen-Fabriken, Die deutschen, im Besitze v. Aktien-Gesellschaften. Jahres-Bericht der finanziellen Verhältnisse u. Betriebs-Ergebnisse im Geschäftsj. 1912/13 (Einbd.: 1914). 17. vollständig umgearb. u. verm. Aufl. (XII, 422 S.) gr. 8°. Berlin, Verlag f. Börsen- u. Finanzliteratur. 1914. Cloth M. 6.

Daum, Dr. W.: Ueber die Phosphorsäure in der Bierwürze, ihre Beziehung zur Acidität u. zum Brauwasser. (92 S.) gr. 8°. Berlin, H. Lonys. 1914. M. 3.

XIXA. *Beythien*, A., C. *Hartwich*, M. *Klimmer*: Handb. d. Nahrungsmitteluntersuchg. 19—22. Lfg. Lpzg., Ch. H. Tauchnitz. 1914. M. 10.

XIXB. *Hazen*, A.: Clean Water and how to get it. 2nd edition, revised and enlarged. Cr. 8vo. Chapman and Hall. London. 1914. Net 6s. 6d.

Lueger, Prof. O.: Die Wasserversorgung der Städte. In 1. Aufl. v. L. 2. Aufl. v. Prof. R. Weyrauch. 1. Bd.: Vorkenntnisse u. Hilfswissenschaften. Die Hydrologie. Die Wassergewinnung. (XIV, 828 S. m. 380 Abbildgn.) 1914. Lex 8°. Leipzig, A. Kröner. Half-mor. M. 40.

XX. *Freundlich*, Prof. H.: Kapillarchemie u. Physiologie. 2. erweit. Aufl. (48 S. m. 5 Fig.) 8°. Dresden, Th. Steinkopff. 1914. M. 1.50.

Halliburton, W. D.: The essentials of chemical physiology; for the use of students. 8th ed. N.Y., Longmans. 11+324 p. il. col. pl. diagrs. tabs. O. 1914. $1.50.

Tschirch, A.: Pharmakognosie. 36. Lfg. Lpzg., Ch. H. Tauchnitz. 1914. M. 2.

XXIII. *Estreicher*, Prof. T.: Ueber die Kalorimetrie der niedrigen Temperaturen. (66 S.) Lex 8°. Stuttgart, F. Enke. 1914. M. 1.50.

Stieglitz, J.: The Elements of Qualitative Chemical Analysis. 2 vols. 8vo. Bell. London. 1914. Net 12s.

Wölbling, Prof. H.: Die Bestimmungsmethoden des Arsens, Antimons u. Zinns u. ihre Trennung v. anderen Elementen. (377 S. m. 39 Abbildgn.) 1914. Lex 8°. Stuttgart, F. Enke. Cloth M. 13.80.

XXIV. *Centnerszwer*, Dr. M.: Die chemische Verwandtschaft u. ihre Bedeutung f. die Technik. Auf Grund der neuesten Untersuchgn. dargestellt. (III 84 S.) 8° Riga, Jonck and Poliewsky 1914 M. 1.20,

Gmelin u. Kraut's anorgan. Chemie. 7. Aufl. v. Friedheim u. Peters. 172. u. 173. Lfg. Hdlhg., Carl Winter. 1914. M. 3.60.

Handwörterbuch d. Chemie. 117. Lfg. Brnschwg., Vieweg and S. 1914. M. 2.40.

Schüle, Prof. W.: Technische Thermodynamik. 2., erweit. Aufl. der "Techn. Wärmemechanik." 2. (Schluss-) Bd.: Höhere Thermodynamik m. Einschluss der chem. Zustandsändergn., nebst ausgewählten Abschnitten aus dem Gesamtgebiet der techn. Anwendgn. (XVI, 350 S. m. 155 Fig. u. 3 Taf.) Gr. 8°. Berlin, J. Springer. 1914. Cloth M. 10.

Smith, E. F.: Chemistry in America; chapters from the history of science in the United States. N.Y., Appleton. c. 8+356 p. il. pors. O. 1914. $2.50.

Van Nostrand's chemical annual, 1913; a handbook of useful data for analytical, manufacturing and investigating chemists and chemical students. 3d issue, rev. with addition of new tables and a section on stoichiometry; ed. by J. C. Olsen and Alb. Melhado. N.Y., Van Nostrand. c. '09. 14+669 p. tabs. D. limp. leath. 1914. $2.50

Weinberg, Dr. A. v.: Kinetische Stereochemie der Kohlenstoffverbindungen. (VIII, 107 S. m. 25 Abbildgn.) Lex 8°. Braunschweig, F. Vieweg and Sohn. 1914. Cloth M. 4.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

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Canadian Section.

Meeting held at Montreal, on Thursday, 29th January, 1914.

PROF. R. F. RUTTAN IN THE CHAIR.

MAPLE SAP PRODUCTS AND THE CANADIAN STANDARDS.

BY PROF. J. F. SNELL.

Introduction.

The making of maple syrup and sugar is an industry confined to the area of about one-eighth of the continent of North America. Only in the eastern provinces of Canada and the north-eastern quarter of the United States does the sugar maple occur in sufficient abundance to render the industry possible.

Manitoba, Minnesota, Iowa, and Missouri mark the western limits, and Tennessee, Kentucky, and Virginia the southern limits of the productive territory. Ontario and Quebec, the northern New England States, New York, Pennsylvania, Ohio, Indiana, Michigan, Wisconsin, and West Virginia are the only communities in which the industry is carried on upon a considerable scale. The maple sugar industry is thus a much more localized one than either the cane-sugar or the beet sugar industry. It makes no attempt to compete with these latter in the production of white sugar. From the standpoint of these larger sugar industries maple products are crude, but their value as luxuries depends upon this very fact, the characteristic maple flavour enhancing their price, wherever that flavour is in demand.

In the regions where the sugar maple flourishes the industry is an old-established branch of farming. In spite of claims to the contrary there appears to be good evidence that the aborigines made sugar before the coming of the white man. Some historians have been disposed to credit Michel Sarrazin, a Quebec physician who lived from 1659 to 1734, with the discovery of the art of making syrup and sugar from maple sap, the alleged discovery being dated about 1695. Sarrazin enjoyed the distinction of correspondent of the Académie Royale des Sciences and in 1730 communicated to that body a memoir containing some accurate references to the sugar maple and its products.

But Père Lafitau, writing just five years after the reputed discovery, describes and gives a picture of an Indian sugaring and explicitly states that the French work it better than the Indians, "*from whom the former have learned to make it.*" There are also earlier references to the making of maple syrup and sugar. One of the earliest and most interesting, though not the most definite, is that of Robert Boyle in 1663, which is worth quoting for its quaint language:

"There is in some parts of New England a kind of tree, whose juice that weeps out of its incisions, if it be permitted to exhale away the excess moisture, congeals into a sweet substance."

In 1675 the missionary Le Clerq writes concerning maple sap: "What seemed to me so remarkable in this maple water is that if by boiling one reduces it to one-third its volume (one-thirtieth would be more accurate) it becomes a real syrup, which hardens much like sugar and takes a reddish colour. Little loaves of it are made and sent to France and it is often used when French sugar is not to be had."

Joutel in 1684, La Hontan in the same year, and Père Rasles in 1689 also describe the making of syrup and sugar.

What is, if correct, a most convincing piece of evidence in favour of the Indian as the original sugar maker, is presented by Sy in his discussion of the question.[*] He states that although there are in the Indian languages many names for maple tree and maple sugar, only a single one has been found that shows any likeness to any European word for sugar, namely the Cree word *so-kaw*, which is believed to be a corruption of the French *sucre*. That this word was applied only to the white sugar introduced by the French serves to add force to the argument that if the Indians had learned the art of making maple sugar from the white men, they would inevitably have adopted some of the European words relating to it. Sy also states that some tribes designated a certain month of the year the "sugar moon," and held a sugar festival or "maple dance" in the spring, when old and new sugar were mingled by the medicine man, as he invoked the aid of the Great Spirit.

The Maple Tree.

Syrup and sugar are made from several species of maple. The hard, rock or sugar maple—*Acer saccharum*—occupies the first place. A variety of this species, known as the black maple—*Acer saccharum nigrum*—is equally good but is rare in Canada. The soft or silver maple—*Acer saccharinum*—and the red maple—*Acer rubrum*—are also tapped, especially in districts where the sugar maple is not abundant. The sap of the latter two varieties contains less sugar than that of *Acer saccharum* and their barks contain pigments which discolour the sap.

The usefulness of the sugar maple tree is by no means confined to its annual production of sugar. Its wood is one of the most valuable of our hardwoods. Tough, heavy, strong, and very hard, it is capable of taking a high polish and wears very evenly. Hard maple is widely used as frame-wood in agricultural machinery, as axles of waggons and as keel wood for ships. It makes excellent flooring and is considered the best wood in the market for the manufacture of wooden bowls and shoe-lasts. The "curly" and "bird's-eye" modifications and the rarer "blister" or "landscape" wood, are among the most beautiful of veneer woods used in the manufacture of household furniture and the panelling of railway carriages. Other uses of hard maple are for waggon spokes, saddle-trees, shoe-pegs and tooth-picks. The wood that is not suitable for these higher applications can be used for fuel—hard maple being the very best of our Canadian stove woods—or for the manufacture of charcoal, wood alcohol, and acetic acid. Mr. R. H. Campbell, Director of Forestry for the Dominion Government, has given it as his opinion that it would, in the end, prove a more profitable investment to plant sugar maples than white pines, though the maple seedlings are dearer and the rate of growth much less than that of the pines. The advantage of the maple over the pine would be found more particularly in the case of the small woodlot owner or farmer, who has many uses for the wood, as well as for the sap, and especially in those regions where the sugar maple already exists in the stand.[†] It must be admitted, however, that the conditions of growth favourable to maximum lumber production are not those most favourable to maximum sap production. The former demands a long, unbranching stem; the latter a spreading crown with an extensive leaf area. The moist, humus-rich soil of the forest is favourable to both sap and wood production. The maple, therefore, thrives best in groves, rather than in the open.

The sap.

The primitive method of tapping was to gash the tree with an axe. The modern method is to bore one or more holes one or two inches deep, with a $\frac{3}{8}$ to $\frac{1}{2}$ in. bit. Into the hole is driven a metal spout, which usually carried a hook upon which a bucket is hung to catch the dropping sap. That the flow of the sap is caused by an internal pressure has been established, but the nature of this pressure has not been made clear. Experience shows that the best runs of sap are obtained on moderately warm calm days, following frosty nights. Sap will flow in such weather at any time of the winter, but it is only in the early spring that such weather is at all frequent.

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[*] Journal of the Franklin Inst., Oct. 1908.

[†] Spencer, The Maple Sugar Industry in Canada. Dominion of Canada Department of Agriculture, Bulletin No. 2b, 1913, pp. 19—20.

The Indian drew his maple sap through wooden spouts, collected it in wooden troughs and probably boiled it in wooden or earthen vessels by throwing in heated stones. Wooden spouts, buckets and gathering and storage tanks are not yet entirely discarded, but the up-to-date sugar maker uses no vessels but those of heavily tinned iron. Experience has shown that the sap keeps better in metal vessels of this kind and the bacteriological investigations of the Vermont Experiment Station have made clear the reason.

Maple sap is a dilute aqueous solution of sucrose, salts and albumin. Such a solution constitutes an ideal culture solution for micro-organisms and the sap is subject to nearly as many and as diverse diseases as is milk. Drawn from the tree and stored under aseptic conditions maple sap will keep perfectly for years, even with free access of air. But in practice it becomes more or less infected with bacteria and moulds and deteriorates rapidly, in such a manner that the best grade of syrup can only be made by boiling the sap the day it is drawn from the tree or at latest the following morning. The most common forms of organisms present in maple sap, it appears, are the fluorescent bacteria and these affect the colour rather than the flavour of the sap. The non-fluorescent spore-bearing bacteria and the moulds do not seriously darken the colour but injure the flavour and in many instances render the sap turbid. Certain specific organisms, believed to be new species, render sap stringy and affect the flavour and clearness like the moulds and non-fluorescent bacteria. Sap affected by any of these diseases is popularly termed "sour," although its acidity is, as a rule, not more than normal.

It has long been realised that high-grade syrup cannot be made from the sap obtained towards the end of the sugar season. "Last run" goods are often very dark in colour and usually lack the delicate flavour possessed by the best syrups. Green sap is almost always secured just before the close of the season when the leaf buds are ready to open. The term "buddy" is commonly applied to the flavour of this late run sap. The work of the bacteriologists has shown that, while there is undoubtedly a deterioration in the flavour of sap due to physiological changes occurring in the tree towards the end of the season, much of the trouble which has been designated "buddiness" is really due to the growth of micro-organisms, which naturally becomes more rapid towards the end of the season, when the weather is warmer. The advantage of metal vessels over wooden is, therefore, due to the superior cleanliness of the former. Covers on the buckets also make for cleanliness.

Modern "gathering tanks" for conveying the sap to the sugar-house are of galvanised or tinned iron, as are also the storage tanks from which the sap is run into the evaporators. In the best practice these storage tanks are in a covered shed on the north side of the sugar-house, so that the sap is kept cold while in storage. In warm weather ice is kept in the sap in the storage tank.

The evaporation.

An argument much relied upon by those who maintain that the Indians did not boil sap is that they could not do so for want of metal vessels. Though it is, as we have seen, probably not true that the Indians were daunted by so small a difficulty, it is certain that the advent of the iron kettle marked the first great advance in the art of sugar making. The "potash" kettle, slung over an open fire, is still in use, on not a few farms in Canada, but this primitive method of evaporation is scorned by all who aspire to make goods of any but the lowest quality.

About half a century ago it began to be realised that a wider, shallower vessel would not only be more economical of fuel but would produce a better coloured syrup. The rectangular pans then adopted have since developed into the modern evaporators of heavy tinned plate, having corrugated bottoms to increase the heating surface and divided into compartments, from one of which to another the evaporating sap flows until it finally reaches the finishing compartments, which are placed in some types at the front and in others at the back of the fire. The evaporator stands upon an iron or brick "arch," in which the fire is built. Wood fuel is almost universally employed. Rapid shallow boiling prevents caramelisation and yields a syrup of light colour and of a milder flavour than that of deep-boiled syrup.

Maple sap contains from less than two to over six per cent. of sucrose. The average is about 3 per cent. Reducing sugars are absent or present in very small quantity in fresh sap, but are developed in the yeast and mould fermentation, as well as in those produced by certain of the bacteria, through the most abundant class of bacteria, the fluorescent group, appear to have but little effect on the sucrose. In addition to sucrose, the sap contains albumin and salts, the latter apparently chiefly malates.

Maple sugar sand.

As the sap boils, the albumin coagulates and forms a surface scum, which the sugar-maker skims off. As the consistency of the liquid approaches that of a syrup a

TABLE I.

Results of analysis of washed sugar sand.

Constituents determined.	Samples.						
	1.	2.	3.	4.	5.	6.	
H_2O	0·21	0·69	0·69	0·57	0·17	0·11	
CaO	25·74	22·63	24·27	24·07	25·33	23·06	
MnO	1·87	1·38	1·80	1·63	1·49	—	
MgO	—	—	0·27	0·84	0·45	0·88	
$C_4H_4O_4$*	53·73	46·49	47·14	44·32	50·73	44·88	
SiO_2	6·16	18·55	13·74	15·03	10·65	13·82	
P_2O_5	—	0·99	0·70	0·82	0·33	0·29	
Total	87·71	90·73	88·61	87·28	89·15	83·04	
							Average.
Ca	17·76	15·62	16·75	16·61	17·44	15·91	16·68
$C_4H_4O_5$†	61·17	52·90	53·64	50·44	57·73	51·06	54·49
Ratio, 1 :	3·44	3·38	3·20	3·04	3·31	3·21	3·26
$CaC_4H_4O_5$, calculated : (a) from Ca	76·22	67·03	71·88	71·28	74·83	68·28	71·59
(b) from $C_4H_6O_5$	79·67	68·91	69·87	65·73	75·25	66·56	70·98

*. Malic acid anhydride. †. Malate radicle.

precipitate forms known as "sugar sand" or "niter"—the latter being from the chemical standpoint a peculiarly inappropriate term, as the substance contains not more than a trace of nitrogen. A little of the precipitate settles on the bottom of the evaporator but larger quantities are obtained from the finished syrup by straining or settling.

Table I. gives the result of the analysis of six samples of sugar sand, which had been washed until the washings no longer tasted of sugar. These were all Province of Quebec samples of the season of 1911 and were analysed by Mr. Grant Lochhead in the Chemical Laboratory of Macdonald College. An analysis of Vermont sugar sand published by Warren in 1911* gives essentially the same results. The chief constituent of sugar sand is evidently calcium malate, this salt constituting from 65 to 80 per cent. of the washed material. The only other constituent of prominence is silica which in the samples analysed varied from about 6 to about 18 per cent. There is in all of these analyses a considerable proportion of undetermined matter. I understand Prof. Warren is investigating the nature of this undetermined residue.

Both Prof. Warren and Mr. Lochhead found it easy to prepare calcium bimalate from sugar sand, and malic acid can also be obtained with little difficulty. The present demand for malic acid is so small that I have found it impossible to interest Canadian manufacturers in its preparation. Through Prof. Warren's efforts, however, a German manufacturer has become interested and is now experimenting with the process on a manufacturing scale. Calcium bimalate makes an ideal acid constituent for baking powders, but it seems scarcely probable that it can be manufactured at a cost low enough to enable it to compete with cream of tartar—much less with alum and acid phosphate of lime, the acid constituents of perhaps three-fourths of the baking powder on sale in Canada at the present time.

From the results of ash determinations upon 21 samples of sugar sand received from Quebec farmers in the season of 1912, together with their reports of the amounts of sugar made by them that year, I have estimated that the sugar sand produced annually in Canada is sufficient to make 18 tons of malic acid and that produced in the United States sufficient to make 42 tons of malic acid. This would make a total possible production of 60 tons of malic acid annually. Prof. Warren has made an estimate based upon an average yield of 3000 pounds maple sugar and 20 pounds sugar sand per 1000 trees. His estimate is 175 tons of sugar sand, containing 50 per cent. of malic acid. Allowing for manufacturing losses, this would yield a quantity of malic acid not far in excess of my estimate of 60 tons. The difficulty of collecting the raw material from so large a number of producers would diminish the actually possible production of acid. On the other hand it is certain that in Canada at least, not half the maple trees are tapped each year. I have been told that many trees, growing on low ground, are left untapped because they yield so large a quantity of sugar sand that it is difficult to make syrup of good colour from their sap. If the production of sugar sand were an object, it is likely that these trees of more than average yield would be tapped and would add not a little to the quantity of material available.

Finishing syrup and sugar.

Maple syrup is not always finished in the evaporator. Many makers finish in separate finishing pans. Some finish on the cook-stove, adding milk, eggs, or soda, or combinations of these to clarify the syrup. These clarifying agents are, however, unnecessary and their use is becoming obsolete. Straining through felt gives a satisfactorily clear syrup.

There are various methods of testing the syrup to determine when the evaporation has been carried far enough. Some makers cool a sample and note its consistency. This, however, takes time, and the syrup may become over-concentrated while the test is in progress. Many take up a dipperful of the hot syrup and allow it to flow from the dipper. If it "sheets" or "forms an apron" on the dipper it is ready to draw off. Still others use a thermometer, drawing off the syrup when its boiling temperature has reached 219°—220° F. A fourth method is to use a hydrometer or saccharometer. This is graduated on the Baumé system. The hydrometer is used in a metal cylinder suspended inside the evaporator. The boiling syrup is dipped into this cylinder and gives a reading of 30·5 degrees when ready to draw off. At room temperature the density of finished syrup is 1·320 or 35·6° B.

Which of these tests gives the best results is doubtful. We are this year asking for samples of syrup finished in various ways in order to test the matter. The syrup put upon the market varies greatly in water content, much being so thin as to ferment readily and much so thick as to deposit sucrose crystals in the container. In the syrup my assistant, Mr. Scott, has examined during the past year the water-content has varied from 30 to 45 per cent. The standard of 35 per cent. water set by the Dominion Government is, I think, just right. The United States standard of 32 per cent. water is decidedly below the average actually found in syrups, and syrup with so low a water-content is unquestionably liable to crystallise in cold storage.

Maple sugar is made by evaporation of the sap beyond the syrup stage. The cooling test is much used in finishing sugar. Some makers depend upon the volume of foam produced in the boiling. Still others use the thermometer, a boiling temperature of 238°—240° F yielding a soft and one of 242°—245° F. a hard sugar. The standard of moisture content set by the Canadian Government, viz., 10 per cent., is, I think, never exceeded in hard sugar: 6·44 per cent. was the highest quantity found in a sugar by the Laboratory of the Inland Revenue Departments in its inspection of a year ago and no other sample contained over 6 per cent. of moisture.

Adulteration.

With the exception of spices there is probably no class of food materials that has been so much subjected to adulteration in Canada as maple syrup and sugar. Tables II. and III. give the results of the inspections which have been made by the Inland Revenue Department. They show in all instances a large proportion of samples adjudged adulterated or doubtful, the proportion being naturally greater in inspections made just before, than in those made immediately after, the sugaring season. Small as is the proportion of samples adjudged genuine it is by no means improbable that some of those which have met the criteria of purity applied by the Laboratory of the Inland Revenue Department were really adulterated goods. The detection of adulteration in maple products is rendered difficult by the circumstance that the adulterant commonly used is the chief constituent of maple sugar itself, viz., sucrose. Methods of analysis must, accordingly, be directed towards the determination of the minor constituents, viz., the salts and the colouring and flavouring matters.

TABLE II.

Inspection of maple syrup—Inland Revenue Department.

Date.	Per cent. of samples found		
	Genuine.	Adulterated.	Doubtful.
July, 1896	85	8	7
March, 1905	18	78	4
May, 1905	59	38	3
March, 1906	26	62	12
May, 1906	51	33	16
May, 1907	77	8	15
February, 1908	78	17	5
May, 1908	87	13	—
May, 1910	85	12	3
November, 1911....	Standards	adopted.	
December, 1912, to April, 1913	69	29	2

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* Warren, Journ. Amer. Chem. Soc., **33**, 1205 (1911).

TABLE III.

Inspection of maple sugar—Inland Revenue Department.

Date.	Per cent. of samples found		
	Genuine.	Adulterated.	Doubtful.
March, 1905	55	36	9
May, 1905	83	17	—
March, 1906	42	46	12
May, 1906	85	15	—
May, 1907	72	22	6
May, 1908	87	11	2
September, 1910 ..	74	16	10
November, 1911....	Standards	adopted.	
December. 1912., to January, 1913 ..	56	41	3

The determination that has been most relied upon by the Laboratory of the Inland Revenue Department is one that originated in that Laboratory. If I do not mistake, it was devised by the late chief analyst, Thomas Macfarlane. It consists in adding a definite quantity of lead subacetate to the suitably diluted syrup or dissolved sugar and weighing the precipitate formed. The method was probably suggested by those previously described by Hortvet[*] and by Jones[†] in which the volume of the precipitate produced by lead subacetate was observed after sedimentation in a centrifugal machine. These methods in turn were suggested by the observation that very heavy precipitates are obtained in clarifying maple sugar solutions with lead subacetate, preliminary to polariscopic examination. The weight of the precipitate obtainable from 100 grams of the dry matter of sugar or syrup under the conditions prescribed is called the *Canadian lead number*. In addition to the Canadian lead number the Laboratory of the Inland Revenue Department has from time to time made determinations of total ash and of malic acid value. The malic acid value is determined by a method adapted by Hortvet[‡] from Leach and Lythgoe's method of determining malic acid in cider vinegar.[§] This consists in precipitating with a calcium salt and alcohol in slightly ammoniacal solution, igniting the precipitate (assumed to be calcium malate) and determining the alkalinity of the ash obtained, the results being calculated over to per cent. of malic acid in the original material.

History of the standards.

In 1911, the chief analyst and his advisory board were confronted with the task of recommending a standard of purity for maple products. Looking over the results obtained in his laboratory upon syrups collected upon the market, Dr. McGill found that only 59 samples out of 1200 had Canadian lead numbers below 2·50. His first thought was to set the standard at that figure. But after corresponding with dealers in maple products, among others with Mr. John H. Grimm, of Montreal, who advanced the objection that modern methods of evaporation tended to give syrups with lower lead values than those made in the older ways, the board settled upon a standard of 2·2 for lead value, 0·5 for total ash, and 0·4 for malic acid value. This standard was adopted by order-in-council, March 22nd, 1911, to come into effect on April 25th. The dealers continuing to raise objections to the standard, Dr. McGill invited a large number of maple syrup makers to send in samples of their products for analysis. About 450 samples were received and analysed.[||] Canadian lead value and malic acid value were determined in all of these samples. In 115 total ash was determined and also the quantity of ash insoluble in water. In 47 samples the *Winton lead number* was determined, this being a method of precipitation with lead subacetate in which the relative proportions of sugar, water and reagent are different from those used in the Canadian method, and instead of weighing the precipitate one determines the quantity of lead precipitated by analysing an aliquot of the filtrate and comparing with a blank.[*] Cognizance was also taken of the extensive work of Bryan[†] upon some 480 syrups, of which 86 were of Quebec origin. As a result of this work, the standards were altered in November, 1911, to the following, which are still in effect :—

THE PRESENT STANDARDS.

Maple sugar.

Maple sugar is the solid product resulting from the evaporation of maple sap, or of maple syrup, and contains not more than ten (10) per cent. of water. It yields not less than six-tenths (0·6) of one per cent. of ash, reckoned on the dry matter of the sugar when incinerated in such a way as to assure the earths being present as salts and not as oxides, and not less than twelve one-hundredths (0·12) of one per cent. of ash, insoluble in water, employed as described below. It yields not less than three-tenths (0·3) per cent. of malic acid, reckoned on the dry matter, when worked as described below. It yields a lead number not less than one and seven-tenths when worked by the Canadian method, nor less than one and two-tenths (1·2) when worked by the Winton method, as described below.

Maple syrup.

Maple syrup is syrup made by the evaporation of maple sap, or by the solution of maple concrete in water, and contains not more than thirty-five (35) per cent. of water. The dry substance of maple syrup shall meet all the above standards for maple sugar.

Methods of Working.

Water in maple sugar shall be determined by heating to 100° C. five (5) grammes of the finely powdered sugar, spread upon a watch glass, to constant weight. The loss of weight shall be reckoned as water.

Water in maple syrup shall be determined by drying (5) five grammes of the syrup, on asbestos fibre or in admixture with sand, to constant weight, at a temperature not exceeding 100° C. The loss of weight shall be reckoned as water.

Total ash in both maple sugar and maple syrup shall be determined by gentle ignition of five (5) grammes in platinum, to the point of incipient charring, after which, ignition to constant weight shall be completed in a muffle, at as low a temperature as possible. The resultant ash is then treated with ammonium carbonate in solution, dried and gently ignited, when the weight should remain unchanged.

Insoluble ash is determined by treating the total ash with 40 c.c. of hot water, and gently boiling for two minutes. The contents of the dish are then thrown upon a small, ashless filter, and washed with hot water till the total filtrate amounts to 100 c.c.

Malic acid.—Six and seven-tenths (6·7) grammes of the dry sugar, or its equivalent amount in syrup, is weighed into a 200 c.c. beaker and water added to make a volume of 20 c.c. The solution is made slightly alkaline with ammonia, 1 c.c. of a ten per cent. solution of calcium chloride is added, then 60 c.c. of 95 per cent. alcohol. The beaker is covered with a watch glass and heated for one half-hour on a water bath, when the flame is turned off and the beaker left to stand over night. The material in the beaker is then filtered through a good quality filter paper, the precipitate washed with hot 75 per cent. alcohol to freedom from soluble calcium salt, dried and ignited. From 15 to 20 c.c. of tenth-normal hydrochloric acid is added to the ignited residue, the lime thoroughly dissolved by careful boiling, and the excess of acid titrated with tenth-normal sodium hydroxide, using methyl orange as an indicator. One-tenth of the number of cubic centimeters of acid neutralized express the result, which for the present will be called "Malic Acid Value."

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[*] Hortvet, J. Amer. Chem. Soc. (1904) **26,** 1543.

[†] Jones, Vermont Agr. Expt. Sta. 18th Annual Report, 1904-5, 322.

[‡] Hortvet, J. Amer. Chem. Soc. (1904) **26,** 1536.

[§] Leach and Lythgoe, J. Amer. Chem. Soc. (1904) **26,** 380.

[||] McGill, Laboratory Inland Revenue Dept. Ottawa, Bul. **228** (1911).

[*] Winton and Kieider, Journ. Amer. Chem. Soc., **28,** 1204 (1903

[†] Bryan, Bureau of Chemistry, U.S. Dept. Agr., Bulletin 13- (1910).

Lead Number—Canadian Method. Five (5) grammes of the dry sugar, or its equivalent in syrup, is dissolved in water, to a volume of 20 c.c. Two (2) c.c.'s of a solution of sub-acetate of lead is added, and the solutions thoroughly mixed. After standing for two hours, the precipitate is filtered off, using a Gooch crucible or a sugar tube packed with asbestos, and washed four or five times with hot water, using the suction pump, dried and weighed. The weight of the dry precipitate in grammes is multiplied by 20. The product is the Lead Subacetate Number.

Mode of preparation of solution of subacetate of lead as follows :—

Boil for half an hour 430 grammes of normal lead acetate and 130 grammes of litharge with 1,000 c.c. water. Cool the mixture, allow to settle, and dilute the supernatant liquid to 1·26 specific gravity.

Winton Method.—Twenty-five (25) grammes of dry sugar, or its equivalent in syrup, is transferred to a 100 c.c. flask with water. Add 25 c.c. of the standard lead acetate solution and shake ; fill to the mark, shake and allow to stand at least three hours before filtering. From the clear filtrate, pipette off 10 c.c. to a 250 c.c. beaker, add 40 c.c. of water and 1 c.c. of concentrated sulphuric acid ; shake and add 100 c.c. of 95 per cent. alcohol. Let stand over night, filter on a tared Gooch crucible, wash with 95 per cent. alcohol, dry in a water oven and ignite over a Bunsen burner, applying the heat gradually at first. Cool and weigh. Subtract the increase in weight of lead sulphate from the weight of the blank. Multiply the difference by the factor 27·325. The determination of the blank is made as follows :—

Transfer 25 c.c. of the standard lead acetate solution to a 100 c.c. flask, add a few drops of acetic acid and make up the whole to the mark with water. Shake and use 10 c.c. for the determination of lead, as directed in the preceding section.

Note 1.—If the maple syrup samples have undergone fermentation in any degree, the carbonic acid must be boiled off before adding the lead acetate solution. This with either of the above methods.

2. If crystallisation of sugar has taken place in maple syrup samples, this must be redissolved by gently warming the sample before proceeding with the analysis.

3. The standard lead acetate solution for Winton method is made by diluting one volume of the solution of sub-acetate of lead with four (4) volumes of water and filtering.

Criticism of the standards.

Some of the differences between these standards and those they displaced are obvious. The Canadian lead number has been lowered from 2·2 to 1·7 and the malic acid value from 0·4 to 0·3 ; and the total ash requirement has been raised from 0·5 to 0·6 per cent. The new values introduced into the standard are the Winton lead number and the insoluble ash.

The introduction of a requirement for insoluble ash was probably suggested by the work of Prof. C. H. Jones of the Vermont Agricultural Experiment station or by the Vermont State standards based upon that work.[*] It is worth noting that these latter standards are higher than the Canadian in respect to all the values common to the two. Prof. Jones's most recent statement about these standards is that they are "none too low," which seems to imply a doubt whether they are not too high.

Their requirements are : Total ash 0·77 per cent., insoluble ash 0·23 per cent., malic acid value 0·60 per cent., all, as in the Canadian standard, on the moisture-free basis. It is also worth noting that in the extensive work of Bryan the lowest percentage of insoluble ash found coincides with the figure adopted in the Vermont standard, viz. 0·23 per cent. ; but the lowest malic acid value is 0·29 per cent., thus coinciding with the Canadian standard and falling to half the value adopted in the Vermont standard.

Comparing the Canadian standard with the results obtained in the investigation upon which it was based, we find that the figure adopted for total ash is distinctly below the minimum found, viz. 0·69 per cent. The figures adopted for insoluble ash and malic acid value are identical with the minima found ; although in the former only two samples in 450 fell below 0.19, and in the latter only two samples in 450 fell below the older standard of 0·40 per cent. In setting the standards for lead value, however, the same rigid adherence to the results of the investigation was not observed. The tabulated results of the investigation show no less than twelve instances in 450 in which the Canadian lead number calculated to dry substance is below the standard adopted, and eight instances in 47 in which the Winton lead number is below the standard adopted. Why this favour to the lead number ? Is it merely an instance of parental solicitude, or are there substantial reasons for treating this value differently from the others ?

In the bulletin reporting the investigation, it is pointed out that a possible error of 0·2 in the Canadian lead value inheres in the method.[*] Thinking this might furnish an explanation of the action of the advisory board, I wrote the Chief Analyst upon this point and received from him the following reply, based upon a memorandum furnished by Mr. A. Valin :

"The reason for taking 1·7 instead of 1·2 for the minimum lead number is not due to any of the above irregularities in the technique, but to the fact that exceptional samples that gave the low lead values *could not be accepted as genuine.*"

In view of the confidence expressed in genuineness of the samples in the bulletin itself, this struck me as a remarkable admission.

Another point to be noted in reference to the relation of the standards to the investigation underlying them is that the methods prescribed for the determination of Canadian and Winton lead numbers and of malic acid value differ from those used in the investigation itself. In the latter, fixed quantities of syrup were used and the results calculated over to the dry basis. The standards, however, prescribe the use of a quantity of syrup or sugar containing a fixed quantity of dry matter. At first sight it may appear that calculation to a basis of 100 grams dry matter must yield results identical with determination upon the quantity of material containing 100 grams dry matter. In the case of the lead values, however, this certainly does not hold true, and the same is probably true of the malic acid value.

Ross[†] has shown that the lead subacetate precipitate is soluble both in excess of the reagent and in sucrose solution. In view of this fact it is clear that the quantities of reagent, precipitable matter, sucrose and water present in a given experiment may all influence the results obtained. Mr. Scott and I[‡] have shown that results obtained in the Canadian method, using the quantity of syrup containing 5 grams of dry matter, are higher than those obtained with the use of 5 grams. of syrup and calculated to the dry basis. We found in four syrups an average difference of 0·36 in the lead numbers obtained by the two modes of working (see Table IV.). In the letter from the Chief Analyst already referred to as based on Mr. Valin's memorandum, there is a sentence which appears to mean that the Inland Revenue chemists have also found that higher results are obtained by the methods of the standards than by the use of the uniform quantity of 5 grams syrup, but that they find a difference of only 0·2 between the results obtained in the two ways. They also claim that results are more concordant when obtained on dry substance, and our experience confirms this conclusion, if thereby is meant that the range of variation in genuine syrups is narrower (see Table V.). Herein there would be a legitimate argument for setting the standard above the minimum found by calculation to dry basis. But as already noted, their letter disclaims all arguments based on technique and confesses a doubt as to the genuineness of some of the samples used in their work. Moreover, there is no reference in the bulletin itself to any difference between results obtained in the two modes.

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[*] Jones, Vermont Agr. Expt. Sta. Bulletin 167, p. 473 (1912).

[*] Laboratory Inland Revenue Dept. Bulletin **228**, p. 13.

[†] Ross, Bureau of Chemistry, U.S. Depart. Agr. Circ. **53** (1910).

[‡] Snell and Scott, J. Ind. and Eng. Chem., 1913, **5**, 993.

TABLE IV.

Comparison of lead numbers on dry basis, actual and calculated.

Syrup number.	Canadian lead method.			Winton lead method.		
	Actual lead No.	Calculated lead No.	Difference.	Actual lead No.	Calculated lead No.	Difference.
1	1·80	1·36	0·44	1·35	1·53	0·18
2	3·20	2·95	0·25	1·96	2·11	0·15
3	3·02	2·63	0·39	1·98	2·20	0·22
4	2·86	2·51	0·35	2·01	2·16	0·15
		Average	0·36			0·18

TABLE V.

Canadian lead number on wet and on dry basis.

	Wet basis.	Dry basis.
Average	1·91	2·83
Maximum	4·68	6·56
Minimum	0·89	1·37
	3·79	5·19
Range per cent. average	198	183
Range per cent. minimum ..	426	379

A further criticism that may fairly be urged against the standards is that they give to the terms "Winton lead number" and "malic acid value" significations different from those which they have hitherto held and which they still hold in the United States. The malic acid value has always been determined upon 6·7 grams of the sample, whether syrup or sugar. The results are sometimes calculated over to the dry basis, but this is a different matter from using the quantity of sample containing 6·7 grams dry matter, since the latter procedure alters the relative quantities of calcium chloride, water, alcohol, sugar and malic acid present. The Winton lead number has, likewise, always been determined with the use of 25 grams of syrup, and the procedure of the Canadian standards gives a result different from that obtained by calculating the true Winton number to the dry basis. Curiously enough, the difference is in this instance in the opposite direction from that found in the Canadian lead number. The Canadian standards method for Winton lead number gives lower results than the true Winton lead number calculated to the dry basis, the difference averaging 0·18 in the four syrups examined by us. (See Table IV.) And what is still more remarkable, an examination of McGill's and Bryan's results shows that the range of variation of the Winton lead number is less when the numbers are given on the wet basis than when they are calculated to the dry basis. This is true both of the results as a whole and of the results of each investigator considered separately. (See Table VI.) To reduce Winton lead numbers to a dry matter basis is, therefore, in my opinion, labour wasted.

TABLE VI.

Winton lead number on wet and on dry basis.

Bryan's samples.	Wet basis.	Dry basis.
Average of 481 samples ..	1·78	2·70
Maximum	2·70	4·41
Minimum	1·15	1·76
Difference	1·55	2·65
Range per cent. of average ..	87	98

McGill's samples.	Wet basis.	Dry basis.
Average of 47 samples....	1·17	1·75
Maximum	1·53	2·38
Minimum	0·70	1·05
Difference	0·83	1·33
Range per cent. of average ..	71	76

Finally, there is a general objection to be urged against the prescription of methods requiring the use of quantities of sample containing a fixed quantity of dry matter. This objection refers to the inconvenience of weighing out varying quantities of sample as compared with weighing out fixed quantities. The inconvenience is aggravated by the prescription of a direct drying method for moisture. One must defer commencing the other determinations until the moisture results are available. This means a delay of half-a-day in reaching conclusions. A refractometric determination of moisture would obviate the delay, and I think I am correct in saying that sugar chemists in general have rather more confidence in moisture determinations obtained with the use of a refractometer than in those made directly. But the use of a fixed quantity of sample would be the most convenient arrangement, would put the Winton lead number and malic acid value on the same basis as in the United States, and would, so far as I can see, have no material disadvantage in any respect.[*] The Canadian lead number and the malic acid value could be calculated to the dry basis. The Winton lead number, as we have seen, ought not to be calculated to the dry basis.

A word more as to the method in which the standards have been applied in the single inspection that has been made since their adoption.[†] Canadian lead numbers are given for all the samples examined, but (with two exceptions) it is only where the Canadian lead number falls below the standard that any of the other analytical results are given. This appears to afford the adulterator an opportunity to obtain a clear field for his product by compounding it so as to escape condemnation by this single test. If he can only make it give a Canadian lead number above 1·7 he need pay no attention to the other requirements of the standard.

The Conductivity Test.

At a meeting of the American Chemical Society held in Washington in December, 1911, I described a method of detecting adulteration of maple syrup by measuring the electrical conductivity of a mixture of the syrup with twice its volume of water. This dilution of the syrup was selected because it represents approximately the maximum conductivity obtainable in diluting maple syrup with water. (See Diagrams I. and II.) Results obtained with 68 syrups showed a range of conductivity value (specific conductivity at 25° C. × 105) from 110

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[*] Jones' method of preparing the sample by reboiling and filtering ought to be adopted.

[†] McGill. Lab. Inland Revenue Dept., Ottawa, Bulletins 258 & 259 (1913).

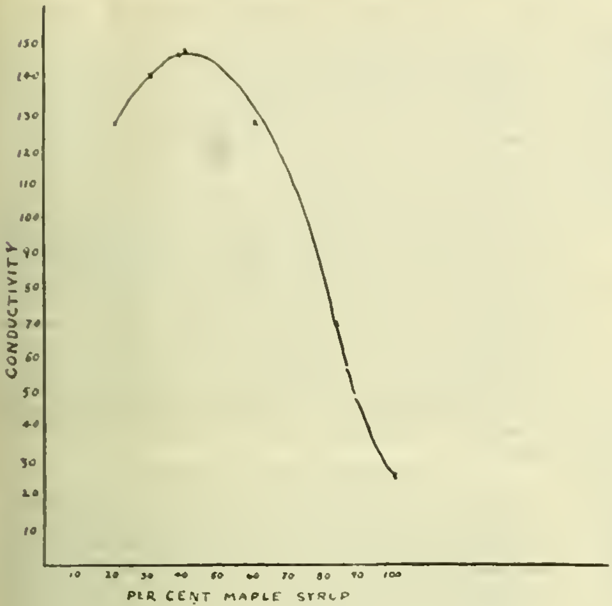


FIG. 1.

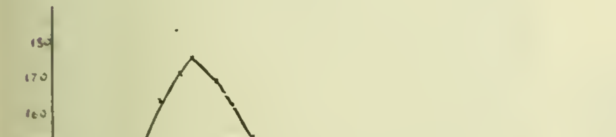


FIG. 2.

to 203. In the discussion of my contribution some one remarked that a syrup of maximum conductivity value could be diluted with nearly an equal volume of pure sucrose syrup and yet come within the range of genuine syrups. This criticism led me to examine the effect which adulteration of genuine maple syrup with syrup of equal density made from granulated sugar has, not only upon the conductivity value, but also upon the other analytical values. The average results of experiments upon three samples of maple syrup are shown in Table VII. They show that the total ash and the Winton lead number fall off proportionally to the content of genuine maple syrup The conductivity value lags behind to some extent, and so, for some undetermined reason, does the alkalinity of the soluble ash. The Canadian lead number is unique in that it falls off more rapidly than the actual maple content. This is a point of distinct advantage for the Canadian lead method.

The value of a method, however, depends not alone upon how much its figure is affected by adulteration but also upon the range which the figure shows in genuine syrups. To get more light upon the range of variation of the conductivity value and at the same time to check the results of the investigation of the Inland Revenue Department, we collected 126 genuine syrups last spring direct from the sugar bushes of Quebec and Ontario. The samples were obtained, some of them by myself, the others by graduates of Macdonald College and the Ontario Agricultural College, occupying positions of responsibility as local agricultural demonstrators. These men were instructed to take no samples about which there could be the least doubt and to take them in the sugar house, whenever practicable A detailed report of our work will appear in the "Journal of Industrial and Engineering Chemistry" at an early date. Its general outcome is to corroborate in the main the evidence of the Inland Revenue investigation as to the composition of genuine Canadian maple syrup. Among our 126 samples representing a variety of conditions of locality, soil and method of manufacture, we find no less than 18 having percentages of total ash below the Vermont standard of 0·77 per cent. We have five below the minimum of 0·69 per cent. found by the Inland Revenue Department, and three of these are just above the limit of the Canadian standard, being 0·61, 0·62 and 0·64, respectively. None of these three syrups contained as much as 35 per cent. of water. It is evident, then, that the Vermont standard on total ash is too high for Canadian syrups. If the principle of adopting the absolute minimum is to prevail, the standard for total ash must remain where it now stands. I think, however, that injustice would be rare under a standard of 0·65 per cent.

In insoluble ash we have not found a sample as low as 0·12, but we have found one at 0·16, one at 0·18, one at 0·21, and one at 0·22—four in all below the Vermont standard. Inasmuch as in the work of Jones, Bryan, McGill and ourselves this determination has been made upon 770 genuine syrups and only one has given a value below 0·16 and only four have given values below 0·19, it appears to me absurd to adopt so low a standard as 0·12. If an insoluble ash requirement is worth introducing into the standard at all, it ought certainly to be set higher. A standard of 0·19 would condemn only one-half of 1 per cent. of the samples which have been investigated.

Our "malic acid values" were determined according to the Canadian standards method. They, therefore, cannot fairly be compared with the Vermont standard, since this refers to true malic acid value. We have three samples among our 126 below the discarded Canadian standard of March, 1911, viz., 0·40 per cent. Two of these are at 0·38, the third at 0·34. If malic acid value is a useful criterion of purity, the requirement of 0·40 per cent. might surely have been retained with but little risk of injustice.

In Canadian lead number, determined according to the standards, we have found no sample as low as the standard. Indeed, we have found but three having values below 2·00. One of these is practically 2·00, viz. 1·98. The others are 1·82 and 1·74 respectively. The latter is the only one approaching the limit of the standard. It would seem that if this determination is to be made as prescribed in the standards, the question of raising the minimum ought to receive further consideration.

In the modified Winton number of the Canadian standar our minimum is 1·41. This minimum is 0·21 above the standard. My objections to the inclusion of this modified Winton lead number in the standard have been stated above, but if it is to be retained, it appears to me that our results on 126 samples, *determined according to the prescribed method*, offer a more secure basis for the selection of a limiting value than do McGill's results on 47 samples, determined on 25 grams syrup and calculated to the dry basis, particularly as his minimum (1·05) is so far below that of Bryan (1·76), obtained by the same procedure upon 481 samples.

TABLE VII.

Effect of adulteration with sucrose syrup on the analytical values.

Average of results on three syrups.

Per cent. of maple syrup in the mixtures.					
Actual	Estimated from				
	Total ash.	Alkalinity sol. ash.	Conductivity.	Winton Pb No.	Canadian Pb No.
90	90·8	99·3	90·2	93·6	82·9
80	76·6	85·2	84·3	81·8	68·3
70	64·7	75·7	74·5	71·8	57·3
60	59·3	65·2	65·6	58·1	43·6
50	53·8	56·4	56·0	50·0	27·5
40	37·9	48·4	46·4	39·4	17·0
30	28·4	37·4	35·9	29·4	7·9
20	20·5	28·9	25·8	22·1	—
10	8·4	13·6	14·3	10·4	—

The minimum conductivity value found in our 126 samples was 112. The lower limit of 110 originally set is thus confirmed. Five samples gave values exceeding the proposed maximum of 200. The highest was 230, the next 219, the others 205, 204 and 202. Four of these five samples were kettle boiled and treated with eggs and milk; and four of the five contained excess of water—though the sample with *highest* conductivity value was of exactly correct density. I conclude that a conductivity value of over 200 is rare and one of over 205 *extremely* rare. No syrup made on a modern evaporator has given a conductivity value of over 200.

Comparison of Ranges of Variation of Analytical Values.

We come now to a very important question, which ought to receive the attention of the Advisory Board on Food Standards, viz.: "Have the most useful analytical values been selected for inclusion in the standard?" I have already referred to the work which Mr. Scott and I have published in reference to the rate of falling-off of values as syrup is adulterated with more and more cane-sugar, and have pointed out the advantage which, in this respect, the Canadian lead method has over all others. But another criterion has also to be applied in the comparison of analytical values to determine their usefulness, viz.: "What range of variation does each analytical value show in genuine maple products?" The four large investigations of genuine syrup (those of Jones, Bryan, McGill and ourselves) furnish data for the answer to this question. Table VIII. shows the number of analyses of genuine syrup in which each of these values has been determined, the maximum, minimum, and average results which have been obtained, and the range of variation of each analytical value, expressed first in per cent. of the average, and secondly in per cent. of the minimum. It will be observed that the conductivity value makes the best showing of all in this comparison, the total ash and the alkalinity of the soluble ash come next, then the weight of the soluble ash and the Winton lead number, this being the true Winton number calculated to a dry-matter basis. On the wet basis, as we have seen, the Winton number makes a better showing, and it comes out still better if either Bryan's results or McGill's results are considered alone. The malic acid value and the insoluble ash, to which Prof. Jones has attached so much importance, make the poorest showing of all the values, and the ash-ratios are equally poor.

A Scheme of Rapid Analysis.

It is a point of much practical importance to the analyst that the values showing the narrowest range of variation in genuine syrups are also values which can be quickly and easily determined. In our contribution to the Journal of Industrial and Engineering Chemistry Mr. Scott and I are proposing a scheme of rapid analysis embracing six determinations involving less than an hour's actual attention, which we hope will prove adequate to detect adulteration in the great majority of instances. The scheme is outlined in Table IX. The figures for total ash, alkalinity of soluble ash, and Canadian lead number are to be *calculated* to dry basis, but the Winton lead number and the conductivity value are not. It should be noted that the insoluble ash is left upon the filter, so that if the results of the rapid scheme leave room for doubt, one can ignite, weigh and titrate the insoluble ash, and thus get all the usual analytical data with the exception of the malic acid value. It is our hope that this latter troublesome determination, in which apparently no two analysts can get accordant results, may always be found to be quite superfluous.

We have placed the conductivity method first, not because it is our own, but because we believe that it, by itself, is capable of settling the question in many instances. In other words, we believe that no syrup which does not show a normal conductivity value can be genuine. We have not a great deal of data upon this point. But in 1911 and 1912 we examined 34 samples of syrup which were on sale in the Western Provinces. Fifteen of these gave conductivity values below the minimum found in genuine syrups and all fifteen were shown to be adulterated by other tests. These fifteen, we maintain, might have been condemned on the strength of the conductivity test alone. The other tests which we made upon the 34 syrups revealed

TABLE VIII.

Analytical values in genuine maple syrups.

Value.	No. of analyses.	Maximum.	Minimum.	Average.	Range.	
					Per cent. of average.	Per cent. of minimum.
Total ash	770	1·68	0·61	0·96	111	175
Soluble ash	770	1·23	0·30	0·59	158	310
Insoluble ash	770	1·01	0·12	0·37	241	742
Ratio $\frac{\text{Sol. ash}}{\text{Insol. ash}}$	655	3·86	0·53	1·74	191	628
Alkalinity sol. ash	655	1·22	0·41	0·74	109	198
Alkalinity insol. ash	655	2·08	0·41	1·00	167	407
Ratio $\frac{\text{Alk. sol.}}{\text{Alk. insol.}}$	655	1·83	0·21	0·80	203	771
Canadian Pb No.	456	6·56	1·37	2·83	183	379
Winton Pb No.	528	4·41	1·05	2·62	128	320
Malic acid value	1094	1·60	0·29	0·80	164	452
Conductivity value	174	230	110	148	81	109

TABLE IX.

Scheme for rapid analysis of maple syrup.

Determination.	Time required.		Limits of value.	
	Actual attention.	To reach result.	Extreme.	Ordinary.
Conductivity value 25° C.	5 min.	5 min.	110 to 230	113 to 205
Refractometer reading	5 ,,	5 ,,	—	—
Total ash, dry basis	7 ,,	1½ hrs.	0·61 ,, 1·68	0·69 ,, 1·47
Alkalinity of soluble ash, dry basis	5 ,,	½ hr.	41 ,, 122	48 ,, 109
Canadian lead number, 5 g. syrup, dry basis	12 ,,	5 hrs.	1·37 ,, 6·56	1·51 ,, 4·55
Winton lead number, 25 g. syrup, wet basis	17 ,,	9 ,,	0·70 ,, 2·70	0·76 ,, 2·47
Total time required	51 min.	9 hrs.		

adulteration in only two others, neither of which, however, professed to be pure. One of these two was low in all the other values determined, the other in total, ash only.

Maple Sugar-making as an Agricultural Industry.

Maple sugar-making has been from the first, and, so far as one can see, must continue to be, an agricultural industry. The fact that it is only for a few weeks in the spring that sap can be obtained in quantity and of quality suitable for sugar-making and that during those weeks the melting of the snow renders the roads nearly impassable, prevents the organisation of the industry in a manner that would render it possible to use the highly economical evaporating apparatus which is employed in the beet and cane sugar industries. Multiple effect vacuum pans are out of the question for a single farmer or even for the number of farmers that could deliver sap at a central station. The enormous amount of fuel consumed in evaporation at atmospheric pressure is apt to shock the sugar refinery man. With the most modern apparatus from seven to twelve cords of wood are used in the manufacture of a ton of maple sugar. But it must be remembered that the wood is close at hand and can be collected and prepared at very little cost. Two dollars a cord is perhaps a fair estimate of its value. Coal is but little used, and if wood is eventually to be displaced as a fuel it is not unlikely that it will be liquid fuel, rather than coal, which will take its place.

According to the census of 1911, the total production in the Dominion of Canada in 1910 was 12,178,216 pounds of sugar and 1,066,971 gallons of syrup (see Table X.). The combined value was $2,569,233, of which Quebec contributed nearly two-thirds and Ontario nearly one-third, the other provinces contributing only 3 per cent. altogether. The production of sugar in the United States in 1909 was not two million pounds greater than that in Canada in 1910, but the syrup produced in the States was nearly four times he Canadian output. The total value of the maple products n the United States in 1909 was almost exactly twice that of Canada in 1910.

TABLE X.

Canadian Census returns on maple sap products in 1910.

	Sugar lb.	Syrup gallons.	Value $	Per cent. of total value.
Quebec	9,427,694	984,282	1,680,393	65
Ontario	2,510,207	58,018	831,483	32
New Brunswick	143,779	18,211	37,337	3
Nova Scotia	96,315	6,424	19,785	
Prince Edward Island	206	16	82	
Manitoba	15	20	153	
Dominion of Canada	12,178,216	1,066,971	$2,569,233	100

The production of sugar in the United States in 1909 was 18 per cent. greater and the production of syrup early 50 per cent. greater than in 1899. The production of syrup and sugar in Quebec in 1910 was 35 per cent. greater than in 1900, but the value of the product had increased by only 24 per cent. In Ontario there was a falling-off of 22·5 per cent. in production in 1910 as compared with 1900. It ought to be noted, however, that the annual production in any locality varies considerably from year to year on account of variations in weather and other conditions.

The relative importance of the maple crop in the Province of Quebec as compared with some other farm products is shown in Table XI.

TABLE XI.

Maple compared with other farm products.

Province of Quebec Census of 1911.

Maple sugar and syrup	$1,680,000
Poultry sold and slaughtered	1,708,000
Sheep, sold and slaughtered	1,583,000
Cream	1,567,000
Fruits, orchard and small	1,470,000
Honey and wax	280,000

Macdonald College, Quebec.

London Section.

Meeting held at Burlington House, on Monday, May 4th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

APPARATUS FOR THE AUTOMATIC MEASURING AND INJECTION OF CHEMICALS.

BY THE HON. R. C. PARSONS, M.A., M.INST.C.E.

Having devoted much attention to the filtration of water on an extensive scale, both by means of the ordinary sand filter, and more recently by the mechanical filter, it was found to be necessary in some instances to add a chemical to the water, previous to its passing through a filter, so as to obtain a clear effluent.

The methods for adding the requisite quantity of chemical in a constant proportion to the water to be treated, although the flow of the latter may vary considerably, form the subject to be discussed in this paper.

In connection with the water supplies of the populous cities of the Argentine Republic, South America, where the water is frequently obtained from the River Plate, extensive filtration plants have been installed. The water of this river is charged with very finely divided alluvial matter, and as is the case with the water of the River Nile, requires special appliances to ensure its being thoroughly cleansed by filtration. In the case of the City of Buenos Ayres, with the Water Works of which the author was connected as Consulting Engineer some years ago, the consumption of water was 60,000,000 gallons per day, drawn from the River Plate; the filtration was effected entirely by means of gravitation sand filters, and it was found impossible to ensure a clear filtrate without the employment of some form of coagulent.

The chemical experimented with in that case was aluminium sulphate, which when added to the water, previous to its entering the settling pools, was found to yield a clear effluent when passed through sand filters. The use of this chemical has since been constantly continued, and the method of adding it to the water to be treated is by tipping definite quantities of the salt into tanks of known capacity, and from these the solution is pumped into the settling pools with a rapidity regulated arbitrarily by the superintendent in charge.

It will be realised that with this rough and ready method of control there is at times too much chemical added which leads to the corrosion of the water mains throughout the city, and is also deleterious to the health of the population, but at others too little, in which case there is not sufficient to clarify the water.

An equally unsatisfactory method was in operation at the water works of the city of Rosario de Santa Fe, where the consumption of water, derived from the Rio Paraná, now amounts to 12,000,000 gallons per day, but in this case the chemical employed is alumino-ferric salt.

It was realised by the Directors of the Water Works Company that as the consumption of chemical was considerable, and consequently an important item in the working expenses, it would be advisable to adopt some more scientific method for adding the chemical to the water to be treated. The author was instructed to consider the question, and advise as to what course should be adopted.

In the first instance the various methods then in use for adding chemicals to water, previous to its passing on to filters were examined, and as none appeared to fulfil the necessary requirements, the author devised the apparatus known as the "Tiltometer," a detailed description of which was read before the Society of Dyers and Colourists in March 1912.

An elevation of this instrument is shown in Figure 1, and it may be described as essentially a low pressure injector, or one which is only capable of injecting the chemical into a main having a head not greater than the elevation of the point, L.

The water flows from the crude liquid tank to that for the treated liquid through a main in which is a Venturi tube, A, of the ordinary type, and as is well known, when a current is flowing through the main a reduction of pressure is produced at any point where the main is contracted in sectional area. This difference of pressure is termed the Venturi head. Thus at the point A the pressure is less than that existing in the main on either side of it. B and C are two vertical cylinders, and these are connected at their lower ends by pipes, one to the contracted main at the point, A, and the other to the main at its normal section.

Within the cylinders, B and C, are plungers, whose weight is greater than that of the water they displace, and of such diameter that they can rise and fall without touching the sides of the cylinders. These plungers are attached to either end of a lever pivotted at its central point on knife edges E. A means of adjustment is provided in the rod connecting one of the plungers to the end of the lever. Attached to this lever, and concentric with its axis, is a cylindrical tank having an opening at the top through which the chemical reagent enters. The height of the solution in it is maintained accurately constant by means of a ball valve. From the circumference of the cylindrical tank extends a projection containing an adjustable orifice which allows the chemical reagent to flow out of the tank and fall into the cup L, from which it enters the water to be treated, flowing along the main. This orifice being in the form of a diamond or one with parallel sides, preserves the same shape for all degrees of opening, and is found to possess a practically constant coefficient of discharge.

It is well known that the difference of pressure recorded in a Venturi tube varies as the square of the velocity of the water flowing along the main in which it is placed, therefore the difference of level in the two cylinders, B and C, varies in the same ratio. The plungers, F and G, rise and fall with these changes of level, and they in their turn rotate the cylindrical tank, the orifice of which thus becomes immersed at a depth below the surface of the solution in the cylindrical tank, depending upon the angle of rotation. Further, the flow of solution through this orifice varies as the square root of the depth of its submersion, consequently for any variation of flow in the water main a similar variation takes place in the flow of the reagent into the mains, and the percentage of chemical added continues constant.

Theoretically, therefore, the action of the apparatus would be perfect if it were possible to avoid certain errors connected with the Venturi effect, and also with the passage of the chemical through the orifice; yet these are so nearly eliminated that the practical error under extreme conditions of working, does not exceed $1\frac{2}{3}$ per cent.

The following are the results o tests made upon a large apparatus constructed substantially as show in Figure 1, and which has been i constant service for a considerabl period :—

TABLE 1.
Gallons per hour.

Water.	Chemical.	Per cent.
640	19·8	3·09
1820	52·2	3·04
1820	57·2	3·14
2390	73·7	3·08

The first column indicates the flo of water in the main. The second t chemical added. The third the rat of columns one and two

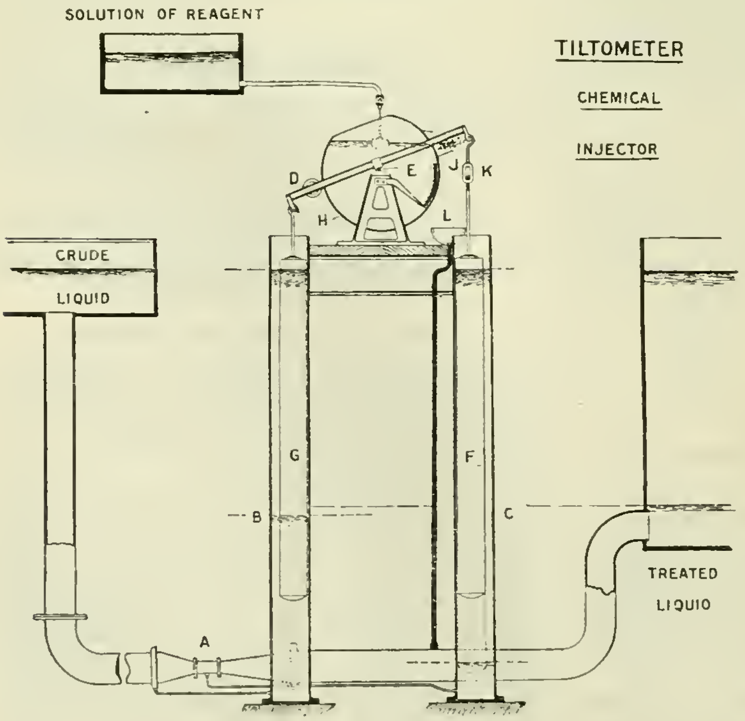


FIG. 1.

As a rule it is advisable to use a standard solution of reagent, and to give a practical example of the working of the apparatus just described, a case may be cited where the flow in the main varies from nothing up to 1,000 gallons per hour, and requires to have 7 grains of alumino ferric salt added to each gallon. In this case the Venturi tube will be 4 inches diameter, narrowing to 2 inches in the throat. The difference of level in the two cylinders B and C, when 1,000 gallons per hour is passing, will be about 2 feet, which will impose a head of about 12 inches upon the orifice J in the cylindrical tank.

The strength of the solution might for simplicity be 1 of alumino-ferric salt to 70 of water, or 1,000 grains to the gallon. If therefore 7 gallons of the solution is added to each 1,000 gallons passing through the mains, the required treatment is effected.

The diameter of the orifice J in this case will be about 3/32nds of an inch in diameter.

At the Water Works of Rosario above mentioned where two Tiltometers are being installed, the method employed for determining the percentage of chemical to be added to a water, such as that of the River Plate, is by ascertaining the degree of turbidity by the usual method of viewing an object through a column of water, and measuring the length of the column when it becomes invisible. A scale is then prepared which enables the attendant to set the orifice, after which the variation of the flow is taken charge of by the apparatus, automatically. Should the river water become more or less turbid, then the orifice is again adjusted in a similar manner. The volume of chemical passing through the Tiltometer is indicated by the pointer on the side of the cylindrical tank.

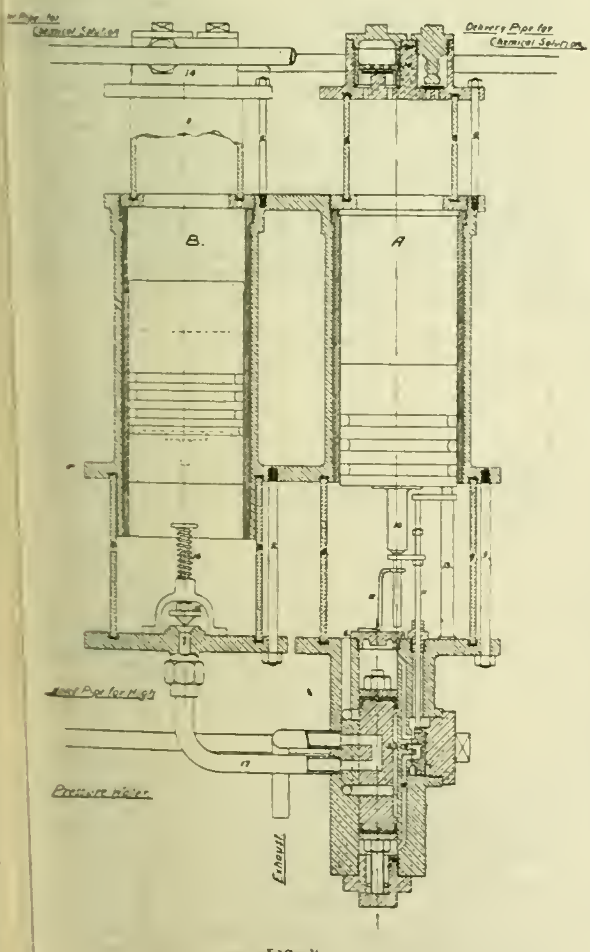

Pipe for Chemical Solution
Delivery Pipe for Chemical Solution
14
B.
A
Inlet Pipe for High
Pressure Water
17
Exhaust

FIG. 2.

Having described the principle and the operation of the "Tiltometer," several of which are in operation and working entirely satisfactorily, the "High Pressure Chemical Injector" will now be explained.

In view of mechanical filtration now being adopted very largely, and with it the chemical treatment of the crude water being found advisable, the injection of the chemical into the water mains under pressure has been found necessary. As the result of numerous investigations and experiments the apparatus which will now be described has been found to yield satisfactory results.

Figure 2 shows a sectional elevation of this apparatus. The motive power of the "High Pressure Chemical Injector" is, as in the "Tiltometer," derived from the difference between the actual pressure in the water main and that in the throat of a Venturi tube inserted therein. This is the best method of obtaining the required difference of pressure, as it involves the least possible loss of head in the mains.

The injecting apparatus consists of two cylinders of equal diameter, in which solid pistons slightly heavier than the fluid they displace, and having wide circumferential grooves, move quite freely; that marked A being termed the working cylinder, whilst that marked B the secondary cylinder. Below the working cylinder are situated the controlling valve gear and valves for the admission and release of the actuating fluid, to and from both cylinders. These consist of a telescopic rod 10 attached to the lower end of the piston in the working cylinder. The lower extremity of this rod is attached to a fork which engages the valve spindle 11, and by means of adjustable tappets on it moves the slide valve (1) each time the piston completes its stroke in either direction. This valve then admits the pressure of the mains alternately to either end of the cylindrical valve (2, 2) and also simultaneously exhausts it from the opposite end. At both ends of this cylindrical valve are cup leathers for preventing leakage occurring past the ends of the valve. In the cylindrical valve, between the cup leathers, are the necessary ports for admitting the working fluid to both cylinders A and B alternately and releasing it from them. Below the secondary cylinder B is an inlet valve kept open by means of a spiral spring 16 until forcibly closed by contact with a projection on the lower end of the piston, on the completion of its downward stroke. Above each cylinder is an upper valve box, each containing an inlet and outlet valve which consist of thin flat discs of pure soft rubber. Between the upper valve boxes and also the lower valve boxes and the two cylinders are provided glass cylinders (8, 8) which are useful for enabling the attendant to observe the important working parts of the apparatus.

The standard solution of chemical to be injected is stored in a tank situated some ten feet above the apparatus, and a pipe connects it with the inlet valves of the upper valve boxes. The inlet pipe for the high pressure water connects the main with the back of the cylindrical valve and the delivery pipe connects the outlet valves of the upper valve boxes with the throat of the Venturi tube. Upon this last-mentioned pipe is the valve (18) of special construction, the orifice of which is diamond shaped, which, as already stated, ensures its preserving the same form at all stages of opening, so as to maintain a practically constant coefficient of flow for all openings.

It should be explained that it is obviously impossible to exhibit in this room the injector forcing chemical into a water main. In order, however, to produce a similar effect, an additional valve is fixed on the outlet pipe beyond the regulating valve. By more or less closing this valve the throat pressure of the main is imitated. The chemical after it passes through the small Venturi is then returned to the chemical tank, and for exhibition the action of the injector is therefore continuous.

In order to prevent any deposit occurring in the passages and chambers, care is taken that still liquid shall not exist at any point. A vortex action is therefore maintained in the chambers by the in and out flow of the chemical, which has proved to be quite effectual.

Action of the apparatus.

The action of the apparatus is as follows :—The pistons A and B being at the lower end of their respective strokes, and the upper valve boxes full of chemical, the working fluid is admitted to the apparatus, and the cylindrical valve then allows it to flow to the under side of piston A. This piston immediately commences to rise, injecting the chemical above, and continuing to do so until it reaches the end of its upward stroke. At this point the rod (10) moves the valve (1) which admits the high pressure water to the lower end of the cylindrical valve, which on rising opens the release port and allows the piston A to descend. The same movement of the cylindrical valve admits the working fluid to the lower end of cylinder B, the piston in which immediately commences to rise, injecting the chemical at the same rate as was previously done by piston A, and continues the process of injection.

The upward movement of piston B only continues until piston A has completed its downward stroke, and is ready to recommence the operation of injection. The cylindrical valve is then moved downwards and piston A again rises, while piston B moves downwards to the end of its stroke so as to be ready to take its place again when piston A has reached the top of its stroke.

With this cycle of operations the injection of the chemical, except during the momentary shifting of the valves, is constant. The stroke of piston A is thus always of constant length, but this is not the case with piston B, the stroke of which is of a variable length, depending upon the rapidity with which the Injector is working.

An injector capable of injecting 40 gallons of chemical per hour against any pressure was exhibited at the meeting. Both cylinders were 3 inches diameter, and the stroke of piston A was 4 inches, whilst that of B varied considerably, depending upon the time occupied by the return stroke of piston A.

TABLE 2.

Opening of regulator.	Venturi head ft.	Quantity of Water g.p.m. 3in. main 4 to 1 ratio.	Quantity of chemical g.p.m. weighed.	Per centage.
in.	per cent.		per cent.	
¼	31·8	210	0·633	0·299
	25·7	189	0·533	0·282
	21·3	172	0·500	0·290
	17·9	157	0·450	0·286
	15·2	145	0·419	0·289
	7·88	104	0·300	0·289
	5·38	86	0·250	0·291
	3·68	72	0·209	0·291
	1·18	40	0·110	0·275
	0·656	30	0·087	0·289
3/16	32·0	211	0·600	0·284
	23·4	180	0·533	0·296
	18·8	160	0·450	0·279
	11·5	127	0·363	0·286
	5·64	89	0·250	0·281
	2·23	56	0·155	0·277
	0·58	29	0·075	0·269
⅛	33·1	215	0·463	0·215
	25·7	189	0·380	0·201
	15·1	145	0·300	0·207
	10·8	122	0·243	0·198
	5·78	90	0·170	0·189
	1·05	38	0·150	0·196
1/16	32·0	211	0·266	0·126
	22·1	178	0·225	0·128
	11·8	136	0·163	0·119
	4·46	79	0·100	0·127
	0·92	36	0·045	0·125
1/32	30·7	206	0·125	0·061
	19·4	164	0·100	0·061
	9·45	115	0·063	0·055
	3·15	66	0·040	0·061

Careful tests were made with this injector, some of which are given in the above table. The first column indicates the amount that the regulating valve is open. The second is the Venturi pressure actuating the Injector. The third is the calculated flow of water through a main to produce this Venturi pressure. The fourth is the quantity of chemical passed by the Injector in gallons per minute as weighed. The fifth is the percentage ratio of the third and fourth columns. These figures indicate that the apparatus gives very accurate results over a tolerably wide range of flow through the main, which in the case in question amounted to a ratio of 1 to 7.

In order to adapt the High Pressure Chemical Injector to practical requirements, it was necessary to provide an easy method for indicating at any moment the quantity of chemical being injected in a given time.

It was found advisable to make use of a small Venturi tube for this purpose, and in Plate III., which is an illustration of the apparatus exhibited, a Venturi tube is attached on the right hand side, with the requisite manometer above it. It will be observed that there is a difference in the height of the columns, indicating that a current of the chemical is passing through the tube, and by reference to the discharge diagram of this Venturi tube, the flow at any time can be ascertained.

On the opposite side of the Injector is another manometer, the columns of which are attached, one to the water main, and the other to the throat, of the Venturi tube inserted in it. The difference of the height of these columns when referred to the discharge diagram of this Venturi tube, gives the flow through the main. By comparing the readings from these two manometers the percentage of chemical introduced into the water to be treated is at once ascertained. Should the required percentage not be correct, then by a slight adjustment of the regulating valve on the outlet from the injector, the necessary alteration may be made, which then continues constant, although the flow in the main varies.

The following diagrams A, B, C, D, E, indicate the relative movements of the water in the main and the chemical discharged by the Injector. The parabolic curve in each is that universally used for ascertaining the flow through a main in which a Venturi tube is inserted, when the Venturi head is observed on the Manometer on the left hand side of the Injector. The tube selected for consideration is one of 3 inches diameter with a throat ratio of 4 to 1. The small circles which form a curve, which practically coincides with this curve, are those of the flow of the chemical as indicated by the Venturi head in the manometer, on the right hand side ; the observations on both manometers being taken simultaneously. Both curves practically coincide, showing that the apparatus works with great accuracy.

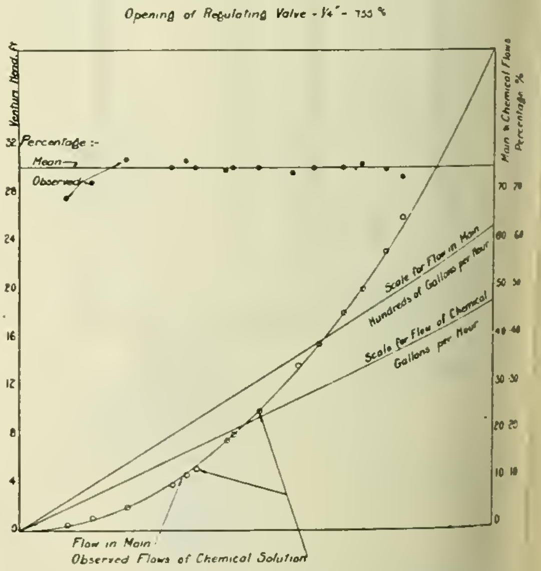


DIAGRAM A.

On these diagrams are also drawn two straight lin starting from the origin, the upper one showing the di charge through the 3 inch main above mentioned when t

Venturi tube in it produces the respective heads on the manometer. The lower line in the same manner indicates the flow of chemical through the small Venturi tube at the various heads shown on its manometer. The horizontal straight line shows the mean percentage of chemical it is desired to inject into the main, and the circles along it indicate the actual observed results, which very nearly coincide with it.

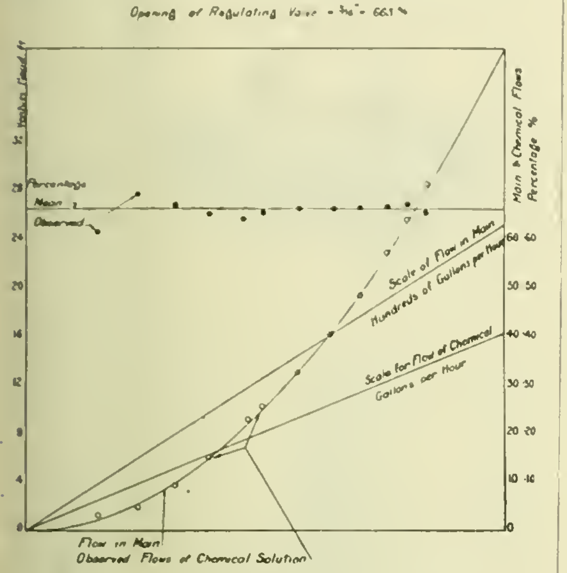


DIAGRAM B.

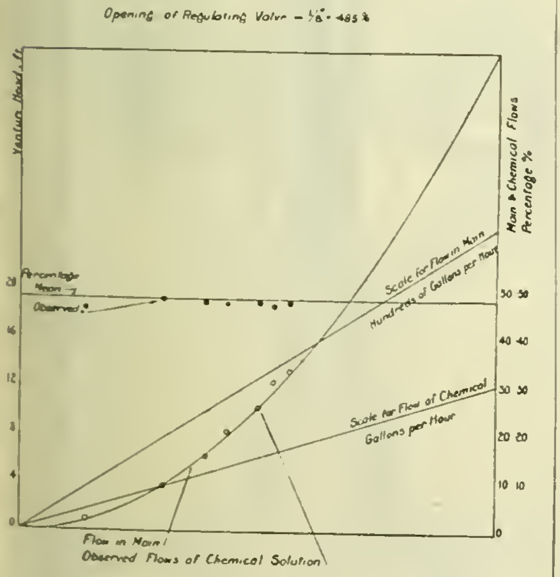


DIAGRAM C.

The results of the tests given in the table, and also those indicated in the diagrams, prove that the apparatus gives very accurate results when working with a range of flow in the main of 1—7, and a variation of percentage of chemical of 1—5, but should greater ranges be required, special arrangements can be made.

The reason for the accuracy of these results being obtained can be easily explained. The Venturi head in the water main varies as the square of the flow, further the fluid friction through the passages of the injector and the regulating valve also vary as the square of the flow. Further the measurement of the discharge of chemicals is by a Venturi tube, the head of which varies as the square of the flow. Consequently if there was no mechanical friction in the apparatus, it should give practically perfect results, as was the case with the "Tiltometer." The only disturbing influence is any mechanical friction, which, owing to the special construction of the apparatus, is reduced to almost nothing, which is proved by the fact that the Injector will work with a water pressure of less than $\frac{1}{2}$ an inch of mercury.

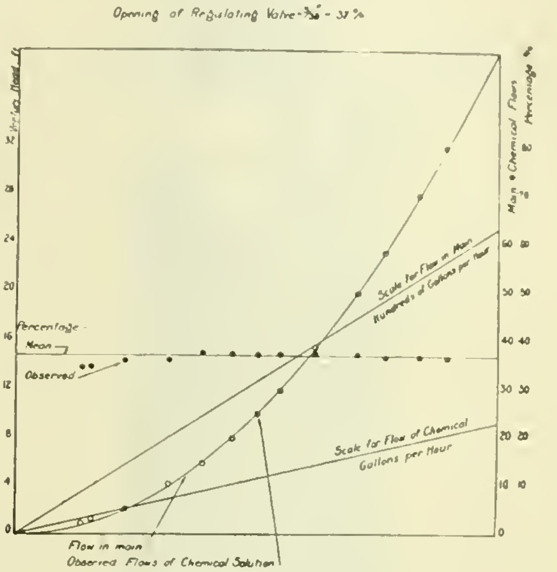


DIAGRAM D.

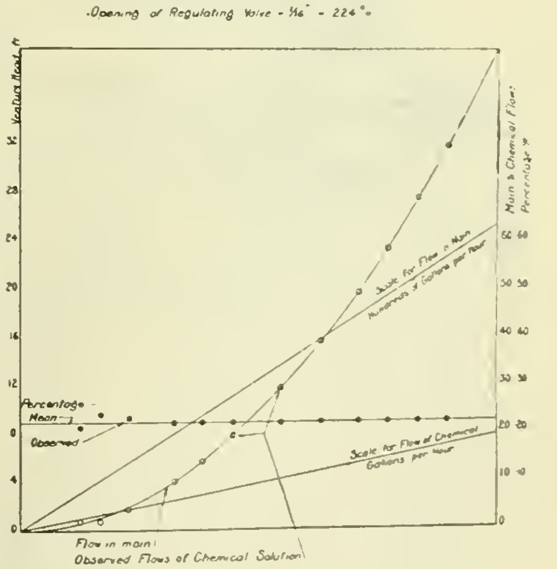
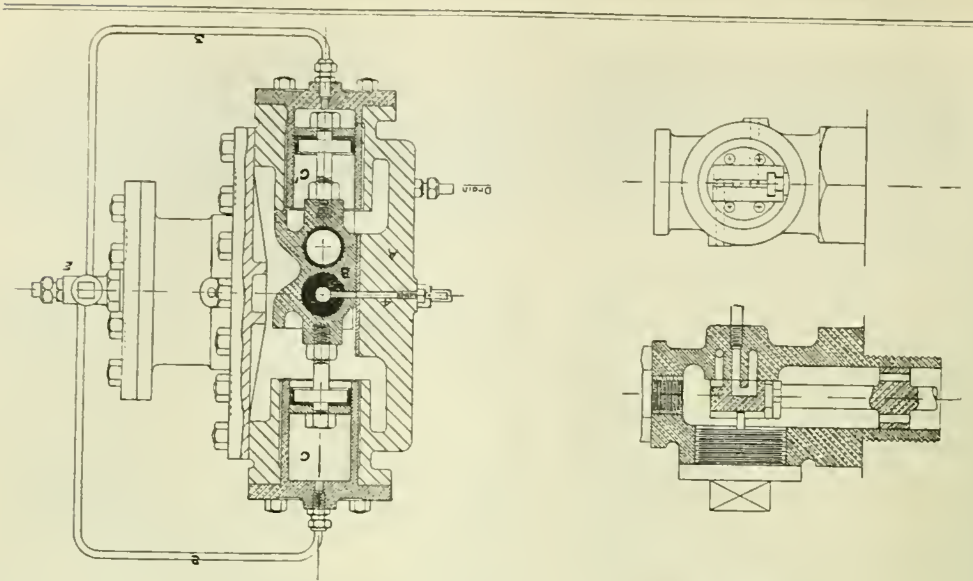


DIAGRAM E.

The pistons are quite loose fits in the cylinders, and are slightly heavier than the fluid they displace. There is, therefore, a small leak of water past them, which is in an upward direction, except at the conclusion of the downward stroke, when at the moment of reversing the valves, it is a leak of chemical in a downward direction. To prevent any passage of the upper liquid into the lower due to these leaks the piston is provided with deep circumferential grooves in which the fluid due to leakage in



Automatic Shifting Valve.

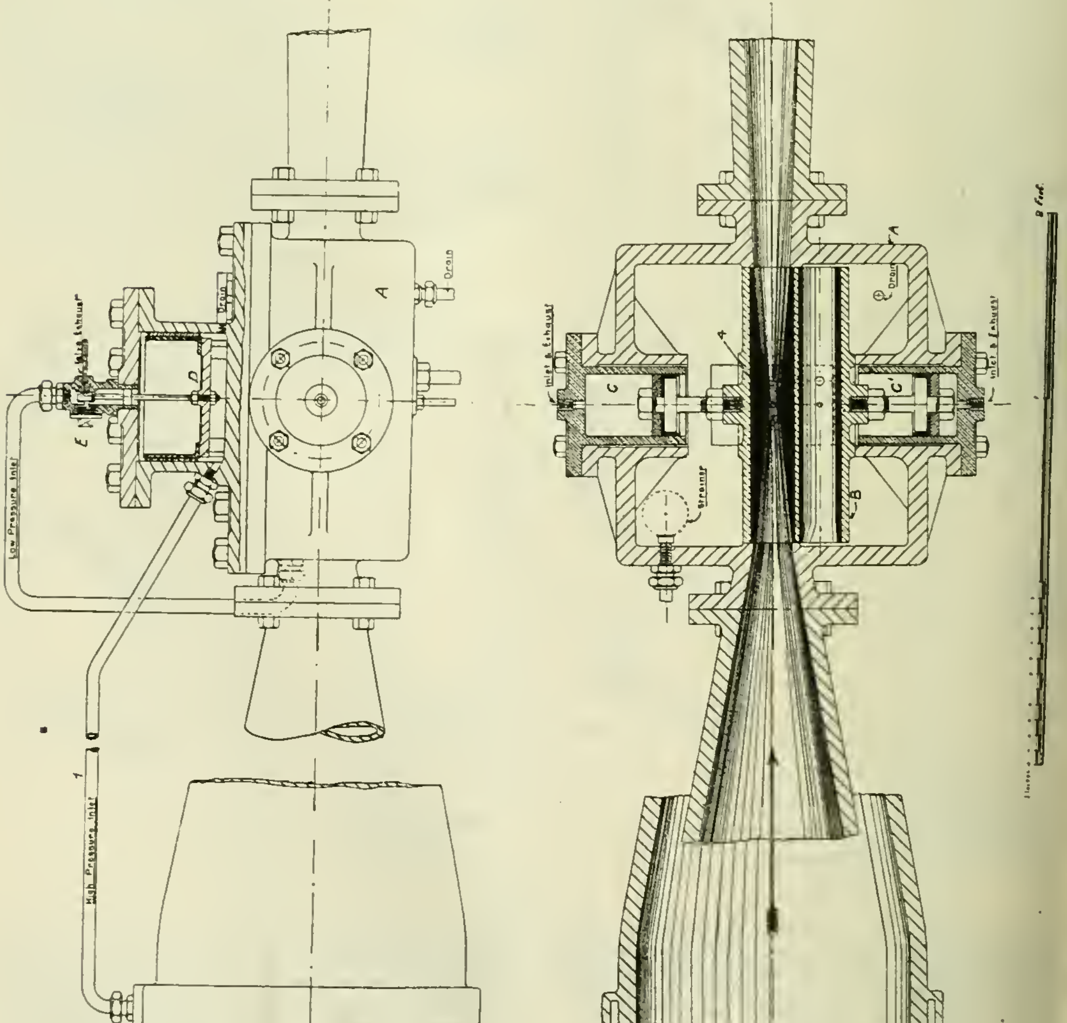


FIG. 3.

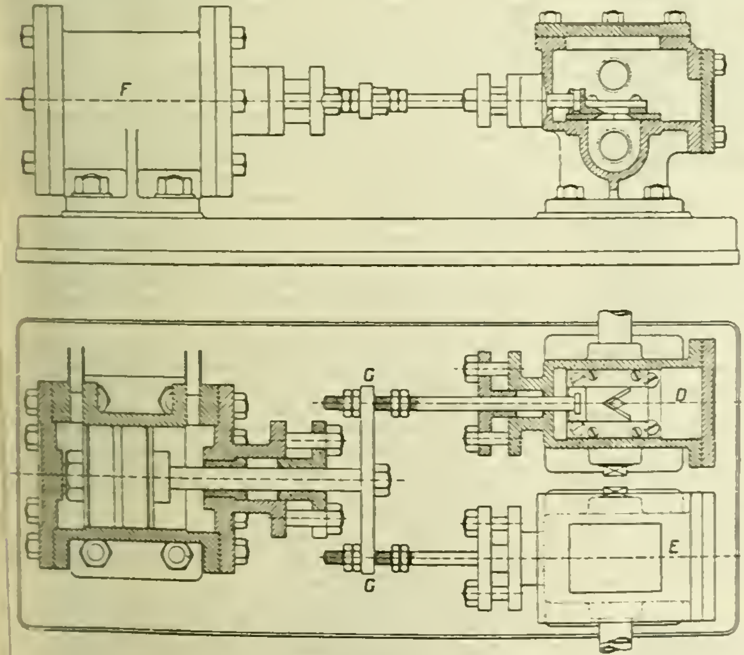
a downward direction is stored and is returned by the similar leakage in the upward direction, consequently there is no loss of chemical.

Tho movement of the cylindrical valve which controls the movement of the pistons is worked entirely by the pressure of the mains, and not by the Venturi head. Consequently it does not interfere with the accurate working of the apparatus.

The apparatus exhibited gave accurate results with a variation of flow in the main up to 1 to 7. There are instances, however, in water supplies where the variation reaches 1 to 30, and the following device can be adopted to meet this requirement.

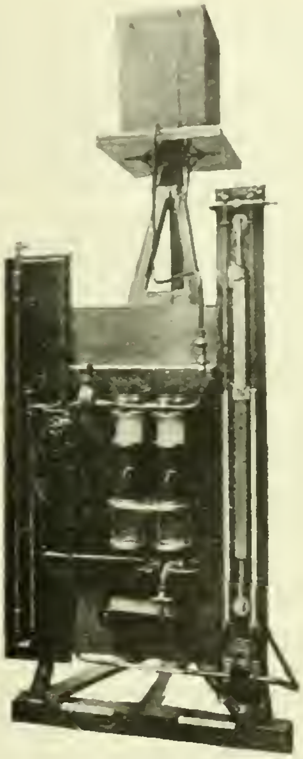
Figure 3 shows a Venturi tube specially constructed, having a rectangular metal box A, termed the Shuttle Box inserted where the throat is usually situated. Within this box is fitted a moveable sliding piece termed the Shuttle (B), in which there are two cylindrical passages or throats, the ends of both of which are of the same diameter as the Venturi tubes leading away from it on either side. One of these throats is of the same diameter throughout, and the second is contracted in the middle.

If the flow of the water through the main is small then the small throat is used, while when it increases to a definite amount the larger throat is called into operation. This is effected by releasing the water pressure from the outer end of one cylinder (C), or the other (C_1), the internal pressure against both pistons being equal. Assuming that the smaller throat is in operation, and the flow in the main increases, which in turn produces a Venturi head as between the main and the shuttle box, the pressure flows along pipe I under piston D, which is quite a loose fit, and is weighted to any desired amount, preferably equivalent to a Venturi head of 30 feet of water. When this pressure is reached the piston rises and moves the slide valve E, releasing the high pressure water from the end of the cylinder by means of the pipe 2. As soon as the flow in the mains falls to the same above mentioned limit, the piston D falls, and the small throat is again brought into service. The shuttle as it moves to and fro slides upon the flat surface of the box in which there is a port connecting either with the wide or narrow throats, whichever is in operation at the time. This port is connected by a pipe with the outlet ports of the Injector.



Regulating Valve.

Fig. 4.



As the admission of chemical to the main is much larger when the large throat is in use than when the small one is in service, it is necessary that the operation of changing the throats shall also simultaneously change the regulating valve (Fig. 4). This is done by means of cylinder, F, into either end of which the high pressure water is admitted at the same time as to C or C_1. The tappets, G, give the necessary adjustments to regulate the percentage of chemical, and when these are set for any given percentage the remainder of the operations are effected entirely automatically, following the variations in the flow through the main.

In the apparatus exhibited the chemical is milk of lime, composed of whiting 1, water 20, and this has no corrosive action on the brass of which the injector is made. If, however, the chemical be of a corrosive nature then the parts exposed to it are made of vulcanite or one of the non-corrosive alloys.

Special attention has been devoted to producing an injector which, whilst possessing extreme accuracy, is reliable in its action, is not subject to wear and tear, and above all is not costly to manufacture. It is believed that the apparatus exhibited possesses all these qualifications, and can be employed for all purposes where it is required to mix one fluid with another in definite and constant proportions.

Note.—Should any further information be required beyond that contained in the paper, it can be obtained by application to The Stereophagus Pump and Engineering Co., Ltd., 39, Victoria Street, London, S.W.

THE APPLICATION OF JETS FOR MIXING PURPOSES.

BY OSKAR NAGEL, PH.D.

Jet appliances consist principally of two or more nozzles of increasing diameter and so connected with each other that the jet of gas or liquid passes from a narrow to a wider nozzle, whereby a vacuum is created, and the material that is to be moved, is transported by the jet, which acts as motor. Such apparatus is easily handled, has no moving parts, and requires little repair, so that its low efficiency as a motor is not a drawback when used only for intermittent work. The injector, however, occupies an exceptional position, since the heat energy of the steam is recovered by being returned to the boiler.

The low efficiency of jet apparatus as "transporters" is caused by the fact that about 75 per cent. of the energy of the jet is consumed in the whirl, which is formed at the transit of the jet from one nozzle to the other. This whirl effects so intimate a mixture of the motor jet with the medium to be moved, that it is a matter of surprise that jet appliances have not been used as "mixers," rather than "transporters."

The chemical industry rather lacks mixing appliances for gases and liquids, and the jet apparatus is wel worth consideration for certain operations. One of these is the chamber process of manufacturing sulphuric acid, which requires chambers of very large dimensions in order to mix the gases thoroughly during their passage. Were it possible to introduce the gases as a perfect mixture into the chamber, its dimensions could be much reduced.

While this apparatus has been recommended for moving the gases through the chamber system, its effect as a mixing machine has been entirely overlooked.

In order to use the jet blower as a mixer it must be connected with the system in a different way from what it would be if used for the transportation of gases. It is not enough to lead steam jets through the wall of the chamber, nor to install a steam jet blower without housing into the pipe coming from the Glover. With such an installation only a part of the gases would get incorporated into the whirl and a partial mixture only would take place. In order to effect a perfect mixture, the whole of the gas must be forced through the nozzles. This is accomplished by tightly connecting the gas pipe of the system, preferably that part which leads from the Glover to the first chamber, with the inlet opening of the steam jet blower.

In order to prevent the gases from entering the chamber at too high a temperature it is advisable to enlarge the lower part of the casing of the steam jet blower. In the space so gained a tubular cooler is provided (for either air or water) in order to cool the gases to 65° C. The gases travel from the Glover through the jet blower to a small chamber and from here through two reaction towers to the Gay Lussac.

In order to increase the mixing effect of the apparatus as much as possible and to reduce the "motor-effect" of the jet it is best to have the gas delivered at the inlet opening of the apparatus at atmospheric pressure, so that the function of the jet blower is exclusively to mix the gases, the latter being delivered at the outlet of the apparatus at atmospheric pressure. By this mode of working the efficiency of the jet as a mixing machine reaches a maximum, at which 20 cb.m. of air is drawn through the nozzle by means of 1 kilo. of steam of 2 atmospheres.

It is clear from these figures that in the chamber process less steam is needed for effecting the mixture of the gases than is required for the reaction leading to the formation of sulphuric acid. The plus of steam necessary for the formation of the acid can either also be sent through the jet apparatus (in which case the apparatus would need to be correspondingly larger), the energy of the plus steam being utilised for the increase of the draught in the chambers, or it may be injected directly into the chamber by means of spray nozzles.

Preliminary experiments show that for a plant in which 3150 kilos. of sulphur are burnt per day, a chamber of a capacity of 850 cubic meters may be sufficient, if after the chamber two reaction towers are provided. The first tower should contain about 20 layers of 20 plates, the second about 30 layers of 12 plates each.

While we are able to utilize the steam jet as a mixer in the chamber process, we can with the same convenience apply the liquid jet in the contact process. In this case sulphuric acid is used as "motor" liquid, while trioxide is the material to be drawn into the whirl. By using a water jet condenser very satisfactory results are obtained in this process of absorption and also in other processes of similar nature.

An effect in many respects similar to that of jet apparatus is obtained by spray nozzles, since the spray, in forming a hollow cone, creates a vacuum in the direction of its motion. On the other hand the spray is also a mixing machine and adapted to effect absorption of large volumes of gases with small volumes of liquids. For this purpose the spray nozzle must be enclosed in a suitable cover in order to force every particle of the gas through the hollow cone of the sprayed liquid.

Meeting held at Burlington House, on Monday, May 4th 1914.

MR. W. F. REID IN THE CHAIR.

A REACTION OF TETRANITROMETHANE.

BY PROF. W. R. HODGKINSON AND CAPT. F. R. J. HOARE.

Some time ago (Chem. Soc. Trans., 1910, 2099) an easy method of formation of tetranitromethane from acetic anhydride was described by F. D. Chattaway.

A small quantity was given to me by the author for trial if if could be employed for a particular technical purpose. Incidentally it was found that in alcoholic-ammoniacal solution certain metals—as copper and nickel—caused a somewhat vigorous action with subsequent separation of a crystalline substance, whilst other metals, as iron and aluminium, were under the same conditions quite inert. After a number of experiments it was observed that only those metals were active which form amides or amino-like compounds, as copper, zinc, cadmium and nickel, directly on contact with air, ammonia and water.

Tetranitromethane is freely soluble in alcohol and acetone. These solutions do not act upon metals until ammonia is added. A yellow colouration then develops, the temperature rises, and there is a slight evolution of gas (nitrogen, carbon dioxide).

As the action on copper was observed only to becom vigorous after a small quantity of the blue cupramin compound had formed, a cupramine solution was adde to an alcoholic solution of tetranitromethane. Crystal formed almost immediately. Analysis of these showe them to be identical in composition with those forme from the metal in an ammoniacal-alcoholic solution o tetranitromethane.

Similar results were obtained with nickel, zinc an cadmium-amine-solutions, and later it was found tha the same compounds were also produced by adding a ammonuim (double) salt, such as nickel-ammonium nitrat to the tetranitromethane solution.

These compounds crystallised well from hot absolu alcohol or acetone but hydrolysed somewhat rapidly heating with water. The result of the hydrolysis of t nickel compound led to the observation that when tetr nitromethane is dissolved in alcoholic ammonia some nit formamine, $C(NO_2)_3NH_2$, results, alcohol at the same ti becoming oxidised. Analysis for nitrogen by combusti in vacuum tube gave N_2 33·7 and 33·5; calculated $C(NO_2)_3NH_2$, 33·7 per cent.

Crystallised from ammoniacal alcoholic soluti the nickel salt appears to have the compositi $[C(NO_2)_3NH]_2Ni.3NH_3.H_2O$.

Analysis: Nickel—mean of 3 analyses, 12 7; nitrog 34·4 and 34·8. Calculated, Ni 12·9; N_2 34·5 per ce

Copper salt $[C(NO_2)_3NH]_2Cu.3NH_3.H_2O$. Found, Cu 1 per cent.; N_2 31·03 per cent. Calculated, Cu 13·07 cent.; N_2 30·94 per cent. The silver salt prepared f ammonio silver nitrate in a similar manner to the others gave on analysis :—silver, 36·18 and 36·35; nitrogen, 25·65 and 25·63 per cent. Calculated for

$((C(NO_2)_2NHAg)3NH_3$, Ag 35·9, N_2 25·7 per cent.

Molecular weight determination (boiling point) in acetone gave results distinctly confirmatory of the above formula, but ammonia seems to be split off from these compounds by long heating in acetone or alcohol. All these substances explode or burn rapidly when heated and are also sensitive when dry to percussion or friction.

Beyond the analyses and ebullioscopic molecular weight determination, no proof of the above formula is at present put forward.

Manchester Section.

Meeting held at the Grand Hotel on Friday, April 3rd, 1914.

MR. J. H. HOSEASON IN THE CHAIR.

EXPERIMENTS ON THE OXIDATION OF SEWAGE WITHOUT THE AID OF FILTERS.

BY EDWARD ARDERN, M.SC., AND WILLIAM T. LOCKETT, M.SC.

It has long been known that if sewage be exposed to the air for a sufficient period of time, the organic contents are gradually oxidised, with the formation of a deposit of so-called "humus" and the final production of nitrate from the ammonium salts and the nitrogenous organic matter.

This purification change of which the course of the reaction has been so carefully studied and thoroughly worked out by Adeney in his researches on behalf of the Royal Commission on Sewage Disposal, takes place, however, comparatively slowly, and even if aided by direct aeration, by no means becomes a practical method of sewage purification.

Numerous investigators have from time to time endeavoured to utilise aeration methods in the practical solution of the sewage problem, but until quite recently without any reasonable amount of success.

Among the earlier investigations may be mentioned those of Dupré and Dibdin[1] on the aeration of London Sewage, and those of the Massachusetts State Board of Health relating to the use of aeration in the filtration of sewage through gravel and sand filters. Dr. Drown,[2] chemist to this Board, concluded from the results of a series of experiments, that the oxidation of organic matter in water was not hastened by vigorous agitation with air.

Waring[3] of the United States was one of the first to apply aeration methods in the purification of sewage on a working scale.

In 1886 Hartland patented an aeration chamber for the purification of sewage or tank effluent, which Kaye Parry[4] employed in experiments undertaken in 1887, while in 1892 Lowcock conducted experiments on the aeration of filter beds by a forced air supply.

In the latter year Mason and Hine[5] published the results of a research on the aeration of mixture of sewage and water in which they concluded that aeration had but little oxidation effect on the sewage.

In 1897 Fowler[6] investigated the effect of aeration on the effluent resulting from the chemical precipitation of Manchester sewage, without any very tangible results being obtained, at any rate so far as the total amount of oxidation was concerned.

It would thus appear that the results of the earlier investigations on the subject of aeration of sewage, indicated that aeration *per se* could not be considered as a practicable adjunct in the process of sewage purification.

Recently, however, the subject has been reopened by the work of Black and Phelps, Clark, Gage and Adams, and Fowler and Mumford.

In dealing with the question of the pollution of the New York Harbour, Black and Phelps[7] studied the possibilities of the application of aeration to the treatment of sewage.

Their experiments dealt with the aeration of both fresh and partially septicised sewage, in various types of tanks and it was shown that under certain conditions it was possible by means of a reasonable amount of aeration to remove the more readily putrescible matters from the sewage and thereby to a certain extent increase its stability.

Black and Phelps were so far convinced of the practicability of such methods of treatment of sewage, as to recommend that the sewage from a certain section of the New York area should be dealt with on these lines, prior to discharge into the waters of the harbour.

In the Annual Report of the Massachusetts State Board of Health for the year 1912, published at the end of 1913, is described an investigation by Clark and De M. Gage on the possibilities of the use of aeration for preliminary treatment of sewage prior to filtration. They found that simple aeration of sewage for 24 hours reduced the free and albuminoid ammonia to some extent and that with sewage which was both aerated and seeded with green growths—*Protococcus* and *Scenedesmus*—the albuminoid ammonia was even more noticeably reduced. Later it was found that appreciable nitrification was obtained within 24 hours in the aerated sewage containing the green growths.

Subsequently Clark and Gage found that aeration for a much shorter period, in a tank containing slabs of slate about one inch apart, covered with a compact brown growth of sewage matters, was sufficient to coagulate the sewage colloids, and thus to produce a well clarified non-nitrified effluent capable of satisfactory filtration at several times the normal rate.

Later Fowler and Mumford[8] carried out experiments on the action in the presence of air, of an organism designated "M7" (isolated by Mumford from ponds receiving water discharged from a colliery) on sewage containing a certain proportion of iron salts.

This organism has the property of precipitating the iron as ferric hydroxide from solutions of iron salts.

In the paper referred to, it is stated that sewage (in presence of a certain quantity of iron salts) inoculated with this organism, can be thoroughly clarified by six hours aeration. The resultant effluent after settlement of the separated organic colloids, was quite clear and practically free from colloids. It is further stated that although the ordinary methods of analysis failed to reveal the extent of the change effected by the above treatment, the effluent after aeration was always non-putrefactive on incubation, and could be readily oxidised and nitrified by filtration at a high rate.

In quite a recent publication Clark and Adams[9] give the results obtained during 12 months operation of the specially constructed tank used in their earlier experiments previously referred to.

It is shown that a rather better coagulation of the organic colloids and purification of the sewage generally, can be obtained by means of aeration for a period of five hours, under the conditions of experiment, than is obtained by efficient chemical precipitation, and at a considerably reduced cost.

The effluent resulting from the aeration treatment was applied to trickling filters 10 feet deep, at rates varying from 8 to 10 million gallons per acre per day, with the production of a well-nitrified and thoroughly stable filtrate.

In connection with the experiments carried out by Clark and his colleagues, it should be mentioned that the sewage treated was considerably more dilute than the majority of English sewages, as will be seen from the following average analytical returns taken from the paper quoted.

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[1] Report to Royal Commission on the Metropolitan Sewage Disposal, 1884, Vol. 2.

[2] Clark and Adams, Engineering Record, February 7th, 1914, p. 158.

[3] Rafter and Baker, 1894, Sewage Disposal in the United States, p. 535.

[4] Trans. Inst. C.E. Ireland, Vol. XX., 1888.

[5] Journ. Amer. Chem. Soc., Vol. 14, p. 7.

[6] Annual Report, 1897, Rivers Dept., Manchester Corporation.

[7] Mass Inst. of Technology. Contributions from the Sanitary Research Laboratory, Vol. VII., Boston, Massachusetts, 1911.

[8] Journal of Roy. San. Inst., November, 1913.

[9] Engineering Record, February 7th, 1914, p. 158.

	Parts per 100,000.
Oxygen consumed	3·52
Free and saline ammonia	3·62
Abuminoid ammonia	0·57

The researches of Clark, Gage, and Adams, and of Fowler and Mumford, show a marked advance on previous work, but it will be seen that in the case of the former investigators the idea of surface contact is retained, as evidenced by the construction of the aeration tank, and that in order to produce a nitrified and stable effluent, further treatment in filters is still required.

With regard to the method of treatment suggested by Fowler and Mumford, while the clarification is effected in the absence of surface contacts, the questions of inoculation and the addition of iron salts are introduced and the provision of filters for the rapid treatment of the clarified effluent remains.

In a previous communication to this section of the Society[10] in regard to the effect of the waste liquor from sulphate of ammonia plants on the oxidation of sewage, the present authors, in conjunction with Dr. Fowler, gave some results of the direct aeration of sewage.

It was noted that while some coagulation of the colloid matter took place in the course of twenty-four hours aeration, a period of several weeks elapsed before nitrification was complete.

In November, 1912, Dr. Fowler visited the States in connection with the question of the pollution of the New York Harbour. Shortly after his return he described to the authors a laboratory experiment which he had seen in progress at the Lawrence Experiment Station, Massachusetts, which evidently referred to the earlier work of Clark and his colleagues on the aeration of sewage in the presence of green organisms, as the bottle in which the sewage was aerated was coated inside with strands of algal growth. Dr. Fowler suggested that new work might with advantage be carried out on somewhat similar lines.

Acting on this suggestion, further investigations with regard to the subject of aeration of sewage, were undertaken by the authors.

An account of the results which have so far accumulated is given in the following paragraphs.

Preliminary experiments.

In a series of preliminary experiments, samples of Manchester raw sewage, contained in bottles of 80 oz. capacity, were aerated until complete nitrification ensued; the aeration being effected by drawing air through the sewage by means of an ordinary filter pump.

In the case of the first experiment, about five weeks' continuous aeration was required in order to obtain complete nitrification, as had been previously observed. At the end of this period the clear oxidised liquid was removed by decantation, and a further sample of raw sewage aerated in contact with the original deposited matter, until the sewage was again completely nitrified.

This method of treatment was repeated a number of times with the retention in each case of the deposited solids.

It was found that as the amount of the deposited matter increased, the time required for each succeeding oxidation gradually diminished until eventually it was possible to completely oxidise a fresh sample of crude sewage within twenty-four hours.

For reference purposes and failing a better term, the deposited solids resulting from the complete oxidation of sewage have been designated "activated sludge." Reference to its general characteristics, chemical composition and biological contents will be made later.

As a result of these preliminary experiments the following observations may be made:—

(*a*) In order that the final nitrification change may proceed without hindrance, it is necessary that the alkalinity or basicity of the sewage should be rather more

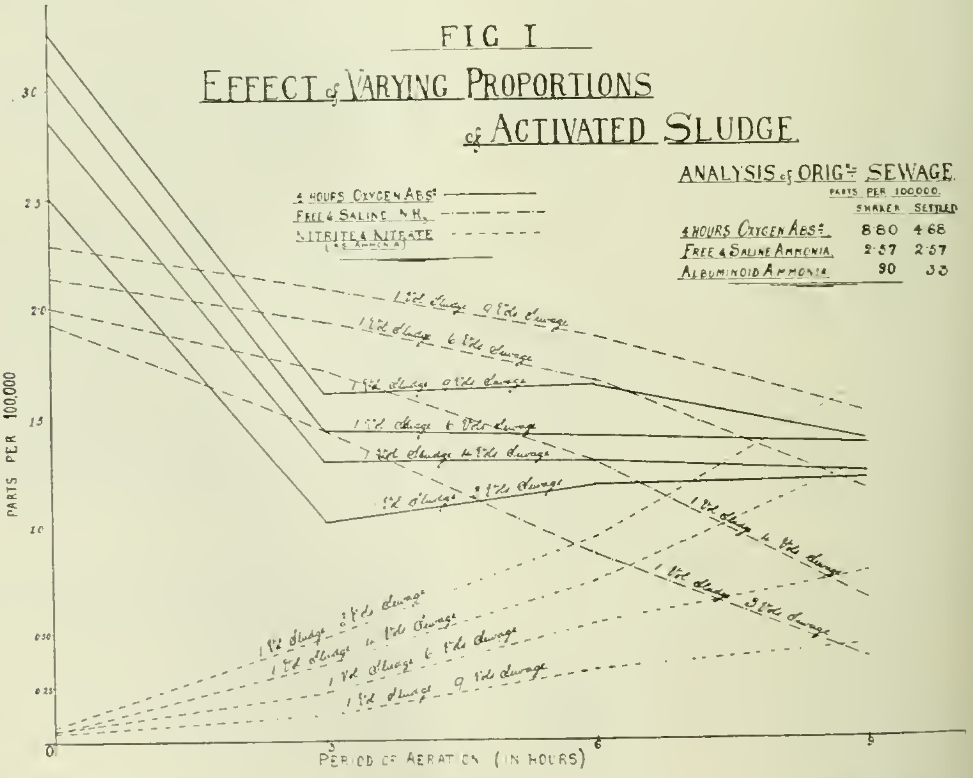

FIG I

EFFECT of VARYING PROPORTIONS of ACTIVATED SLUDGE

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[10] This Journal, No. 10, Vol. XXXI., 1912.

than equal to the nitric acid resulting from nitrification of the ammonium salts. In some cases it has consequently been found necessary to add a small quantity of alkali prior to complete nitrification.

(*b*) It is essential that the activated sludge should be kept in intimate contact with the sewage during aeration.

This point is illustrated by an experiment, the results of which are given in Table I from which it will be seen that while the initial effect on the oxidisable matters as measured by the oxygen absorption test, is not materially affected, on further aeration a marked improvement is shown in the case where the activated sludge is kept in intimate contact with the sewage, than where such conditions do not obtain. Further, in regard to the amount of nitrification very much greater differences are to be observed. This is of considerable importance, as it will be seen from later experiments that the maintenance of the activity of the sludge is considerably influenced by the extent to which the oxidation is carried.

(*c*) That the relation of the volume of the activated sludge to the volume of sewage treated is of importance, more especially in regard to the rate of nitrification.

This latter point is clearly shown by the results of an experiment which was actually carried out much later on in the course of this investigation and which are given on Table Ia (p. 526) and plotted in Figure 1.

It will be seen from this table and diagram that while apart from the dilution effect, the reduction in the amount of oxidisable matter is not seriously affected by the varying proportions of activated sludge, the amount and rate of nitrification are influenced in a marked degree.

Oxidation of Manchester sewage.

Once having accumulated a sufficient volume of activated sludge in the manner previously described, a series of determinations were made of the effect of aeration in contact with the sludge, of various samples of the Manchester sewage received at Davyhulme.

In general a proportion of one volume of activated sludge to four volumes of sewage was taken, although in the earlier experiments a much smaller proportion of sludge was employed.

A number of typical results are recorded in Table 2. In each of the experiments quoted the samples of sewage taken are twenty-four hours average samples.

Reference to this table will show that an extraordinarily high degree of purification can be obtained within a reasonable period of time by aeration in contact with the activated sludge.

On the average, aeration under the conditions of experiment for a period of six hours, with subsequent settlement, is sufficient to obtain a percentage purification as measured by the four hours Oxygen Absorption and Albuminoid Ammonia Tests, quite equal to that yielded by efficient bacterial filters. In all cases the resultant effluent is non-putrefactive on incubation.

The amount of nitrification obtained during this period depends to a certain extent on the concentration or strength of the sewage dealt with. In several instances, when treating wet weather sewage, six hours' aeration has been found sufficient to completely oxidise the ammonia present (see Table 2, Expt. No. 30). With average strength Manchester sewage the free and saline ammonia content is entirely removed in from 10 to 18 hours' aeration.

It should be mentioned that all the experiments have been worked on the fill and draw method, and it may be reasonably anticipated that equally good results would be obtained with a less aeration period, when working on a continuous flow system.

Outdoor experiments are being commenced in which a continuous flow of a mixture of sewage and activated sludge will be passed through an aeration chamber.

Course of reaction.

In all cases it has been noted that there is a rapid initial effect on the oxidisable matters both colloidal, etc., and crystalloidal, with the production in a period of about three hours of a well-clarified effluent.

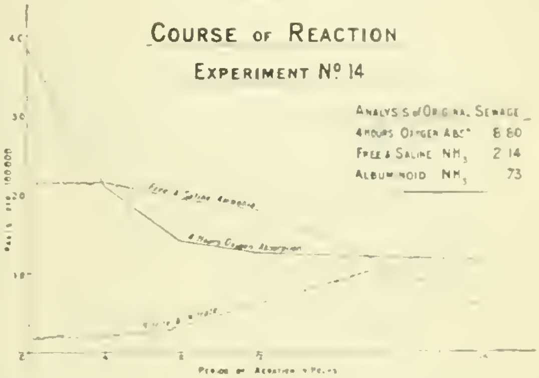
The later stages of the aeration are largely confined to the nitrification of the ammonium compounds.

In order to clearly illustrate this course of the reaction the results of an early experiment (see Table 2, p. 527, Exp. 14) are quoted, in which a small proportion only of activated sludge was employed, as in the later experiments with an increased proportion of sludge the first change occurs rapidly and consequently nitrification is established so early as to partially mask the course of the reaction.

The results of this experiment are plotted in Fig. 2 from which it will be seen that the purification change follows on the lines demonstrated by Adeney.

In view of this fact it was thought of interest to endeavour to sectionise the purification process into (*a*) a carbonaceous fermentation and (*b*) a nitrification process, with the idea of comparing the results with those obtained by the orginal method of working.

FIG II



Attempt to sectionise the oxidation process.

For the purpose of this experiment a partially activated sludge was taken, which while it was capable of effecting the first change, *i.e.*, the removal of the oxidisable matter did not actively promote nitrification.

Three large bottles were used.

(1) Containing a certain volume of this partially activated sludge (α sludge).

(2) (β sludge) and (3) ($\alpha\beta$ sludge) Containing a similar volume of thoroughly activated sludge which had been proved capable of vigorously promoting nitrification.

The experiment was carried out in the following manner. Equal volumes of the same sample of sewage were introduced into bottles Nos. 1 and 3 and aeration commenced. At the end of two hours' aeration the contents of bottle No. 1 were allowed to settle for two hours and the supernatant liquor was decanted into bottle No. 2. Another sample of sewage was then added to bottle No. 1 and aeration resumed. After a further two hours' aeration the contents of each of the bottles were allowed to settle for two hours.

In this manner an effluent was obtained from bottle No. 2 which had received two hours' aeration in contact with the partially activated (α) sludge and a further two hours' aeration in contact with actively nitrifying (β) sludge, and from bottle No. 3 an effluent which had been aerated for six hours in contact with thoroughly activated ($\alpha\beta$) sludge.

This method of operation was repeated as often as was reasonably practicable within the twenty-four hours, with the result that the partially activated sludge and nitrifying sludge (bottles Nos. 1 and 2) dealt with three volumes of sewage each working day, as compared with the two volumes treated by the thoroughly activated sludge.

The results obtained during the course of this experiment are given in Table 3 (p. 528).

Reference to this table will show that there was no very material difference in the effluents yielded by the two methods of working.

At the same time it will be seen that the results with the ordinary activated sludge show a marked deterioration as compared with those previously obtained, particularly in regard to the amount of nitrification.

Table I.

Effect of "Intimate" Contact.

Results in parts per 100,000.	Experiment 7(a)								Experiment 8(a).								
	4 Hours oxygen absorption.		Free and saline ammonia.		Albuminoid ammonia.		Nitrite and nitrate.		4 Hours oxygen absorption.		Free and saline ammonia.		Albuminoid ammonia.		Nitrite and nitrate.		
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	
Original..........	3·88	4·06	2·71	2·71	·33	·33			5·20	5·31	2·43	2·36	·47	·485	·07	·07	A = sludge in contact with sewage without intimate mixture B = intimate mixture of sewage and sludge. In each case the samples were settled for 2 hours prior to analysis.
After 4 hours aeration	2·46	1·77	2·71	2·50	·215	·145			2·90	2·90	2·36	2·28	·30	·29	·17	·15	
After 24 hours aeration	1·26	·60	2·57	·15	·105	·05	nil	1·72	2·00	1·28	2·28	1·22	·215	·10	·07	·86	

In this experiment a proportion of 1 vol. activated sludge to 25 vols. sewage was employed.

Table Ia.

Ratio of Sludge to Sewage.

Results in parts of 100,000.	Experiment 9la.																	
	Raw sewage.		1 vol. sludge to 9 vols. sewage.				1 vol. sludge to 6 vols. sewage				1 vol. sludge to 4 vols. sewage.				1 vol. sludge to 3 vols. sewage.			
	Shaken.	Settled.	Original.	3 Hrs.	6 Hrs.	9 Hrs.	Original.	3 Hrs.	6 Hrs.	9 Hrs.	Original.	3 Hrs.	6 Hrs.	9 Hrs.	Original.	3 Hrs.	6 Hrs.	9 Hrs.
4 Hours oxygen absorption (total)	8·80	4·68	3·26	1·60	1·63	1·40	3·08	1·43	1·40	1·32	2·80	1·28	1·28	1·22	2·51	1·00	1·17	1·20
Crystalloids ..		2·57	1·72	·91	·80	·80	1·63	·80	·76	·76	1·37	·68	·68	·68	1·31	·63	·68	·66
Colloids, etc.		2·11	1·54	·69	·83	·60	1·46	·63	·64	·51	1·43	·60	·60	·51	1·20	·37	·49	·54
Oxidisable matter removed Total				1·66	1·63	1·86		1·65	1·68	1·76		1·52	1·52	1·58		1·51	1·34	1·31
Crystalloids..				·81	·92	·92		·83	·87	·87		·69	·69	·69		·68	·63	·65
Colloids, etc.				·85	·71	·94		·83	·82	·92		·83	·83	·89		·83	·71	·66
Per cent. reduction on raw sewage	—	47	63	82	81	84	65	84	84	85	68	85	85	86	72	89	87	86
Per cent. reduction on settled sewage	—	—	30	66	65	70	34	69	70	72	40	73	73	74	46	79	75	74
Free and saline ammonia	2·57	2·57	2·28	2·07	1·86	1·50	2·14	1·93	1·64	1·14	2·00	1·71	1·28	·64	1·93	1·43	·86	·37
Reduction in free NH_3	—	—	—	·21	·42	·78	—	·21	·50	1·00	—	·29	·72	1·36	—	·50	1·07	1·56
Per cent. reduction on raw sewage	—	—	11	19	28	42	17	25	36	56	22	33	50	75	25	44	67	86
Albuminoid ammonia ..	·90	·33	·315	·16	·15	·12	·315	·15	·12	·10	·30	·13	·10	·08	·26	·10	·08	·065
Reduction in albd. NH_3				·155	·165	·195		·165	·195	·215		·17	·20	·22		·16	·18	·195
Per cent. reduction on raw sewage	—	63	65	82	83	87	65	83	87	89	67	86	89	91	74	89	91	93
Per cent. reduction on settled sewage	—	—	5	52	55	64	5	55	64	70	9	61	70	76	21	70	76	80
Nitrite and nitrate (in terms of NH_3)			·06	·12	·32	·43	·04	·23	·54	·77	·04	·36	·74	1·28	·07	·47	·93	1·64
Amount of NH_3 oxidised			—	·06	·26	·37	—	·19	·50	·73	—	·32	·70	1·21	—	·40	·86	1·57
Per cent. of NH_3 oxidised			2	5	12	17	2	9	21	30	2	14	29	50	2	18	36	64

Except in the case of the original shaken sample, two hours settlement was allowed prior to analysis.

TABLE II.

Oxidation of Manchester sewage.

Results in parts per 100,000.	Experiment 14.					
	Raw sewage.	R.S. + sludge.	After aeration in contact with sludge for :—			
	Shaken.	Settled.	4 hrs.	8 hrs.	12 hrs.	24 hrs.
4 hours oxygen absorption	8·80	3·83	2·09	1·40	1·26	1·17
Per cent. reduction on raw sewage	—	56	76	84	86	87
Free and saline ammonia	2·14	2·14	2·14	1·93	1·80	·96
Per cent. reduction on raw sewage	—	nil	nil	10	16	55
Albuminoid ammonia ..	·73	·345	·265	—	·12	·105
Per cent. reduction on raw sewage	—	53	64	—	81	86
Nitrite and nitrate (in terms of NH_3)	—	·20	·20	·32	·60	1·46
Per cent. oxidised	—	9	9	15	28	68

1 vol. sludge to 12 vols. sewage.

Results in parts per 100,000.	Experiment 22.							
	Raw sewage.	R.S.•	Original settled.		After aeration for			
					6 hours		12 hours.	
	Shaken.	Shaken.	R.S.• alone.	R.S.+ sludge	R.S.• alone.	R.S.+ sludge.	R.S.• alone.	R.S.+ sludge.
4 hours oxygen absorption	14·90	10·63	7·46	6·09	6·57	1·83	5·20	1·31
Per cent. reduction on raw sewage	—	29	50	59	56	88	65	91
Free and saline ammonia	3·43	3·00	3·00	3·00	2·57	1·31	2·14	nil
Per cent. reduction on raw sewage	—	13	13	13	25	62	38	100
Albuminoid ammonia ..	1·10	·82	·53	·54	·415	·16	·365	·135
Per cent. reduction on raw sewage	—	25	52	51	62	85	67	88
Nitrite and nitrate (in terms of NH_3)	—	—	nil	·51	nil	1·80	nil	2·58
Per cent. oxidised			nil	15	nil	52	nil	75

1 vol. sludge to 4 vols. sewage.

Results in parts per 100,000.	Experiment 25.							
	Raw sewage.	R.S.•	Original settled.		After aeration for			
					6 hours.		12 hours.	
	Shaken.	Shaken.	R.S.• alone.	R.S.+ sludge.	R.S.• alone.	R.S.+ sludge.	R.S.• alone.	R.S.+ sludge.
4 hours oxygen absorption	15·32	10·06	6·07	5·91	5·26	2·20	4·91	1·29
Per cent. reduction on raw sewage	—	34	55	61	66	86	68	92
Free and saline ammonia	2·43	2·29	2·29	2·29	2·29	1·14	2·14	nil
Per cent. reduction on raw sewage	—	6	6	6	6	53	12	100
Albuminoid ammonia ..	1·07	·67	·36	·36	·44	·165	·305	·105
Per cent. reduction on raw sewage	—	37	66	66	59	85	72	90
Nitrite and nitrate (in terms of NH_3)	—	—	—	—	nil	1·50	nil	2·30
Per cent. oxidised	—	—	—	—	nil	62	nil	95

1 vol. sludge to 4 vols. sewage.

• = Original sewage with 20 per cent. water added, to obviate dilution effect of sludge.

	Experiment 30.				
	Raw sewage.	Original settled.		After 6 hrs. aeration.	
	Shaken.	Alone.	+ sludge.	Alone.	+ sludge.
4 hours oxygen absorption (total)	11·20	7·29	4·57	6·63	2·09
Crystalloids					
Colloids, etc.					
Per cent. reduction on raw sewage	—	35	59	41	81
Per cent. reduction on settled sewage	—	—	—	—	—
Free and saline ammonia	1·57	1·57	1·29	1·57	nil
Per cent. reduction on raw sewage		nil	18	nil	100
Albuminoid ammonia ..	·50	·385	·385	·385	·15
Per cent. reduction on raw sewage		23	23	23	70
Per cent. reduction on settled sewage		—	—	—	—
Nitrite and nitrate (in terms of NH_3)		nil	·07	nil	1·70
Per cent. oxidised		nil	4	nil	100+

1 vol. sludge to 3 vols. sewage.

	Experiment 81.				
	Raw sewage.		After aeration for		
	Shaken.	Settled.	3 hrs.	6 hrs.	9 hrs.
4 hours oxygen absorption (total)	13·37	9·40	2·00	1·37	1·20
Crystalloids					
Colloids, etc.					
Per cent. reduction on raw sewage	—	30	85	90	91
Per cent. reduction on settled sewage	—	—	79	85	87
Free and saline ammonia	3·71	3·71	2·80	2·00	1·14
Per cent. reduction on raw sewage	—	—	25	46	72
Albuminoid ammonia ..	1·36	·70	·18	·105	·08
Per cent. reduction on raw sewage	—	49	87	92	94
Per cent. reduction on settled sewage	—	—	74	85	89
Nitrite and nitrate (in terms of NH_3)	—	—	·10	·52	·92
Per cent. oxidised	—	—	3	14	25

1 vol. sludge to 4 vols. sewage.

	Experiment 86.				
	Raw sewage.		After aeration for		
	Shaken.	Settled.	3 hrs.	6 hrs.	9 hrs.
4 hours oxygen absorption (total)	14·27	9·30	2·97	1·34	1·12
Crystalloids					·78
Colloids, etc.					·34
Per cent. reduction on raw sewage	—	—	79	91	92
Per cent. reduction on settled sewage	—	—	68	86	88
Free and saline ammonia	3·30	3·30	2·86	2·14	1·36
Per cent. reduction on raw sewage	—	—	13	35	59
Albuminoid ammonia ..	1·19	·62	·205	·10	·08
Per cent. reduction on raw sewage	—	48	83	92	93
Per cent. reduction on settled sewage	—	—	69	84	87
Nitrite and nitrate (in terms of NH_3)	—	—	·04	·34	·80
Per cent. oxidised	—	—	1	10	24

1 vol. sludge to 4 vols. sewage.

	Experiment 89.				
	Raw sewage.		After aeration for		
	Shaken.	Settled.	3 hrs.	6 hrs.	9 hrs.
4 hours oxygen absorption (total)	14·63	10·10	2·17	1·50	1·29
Crystalloids			1·14	81	·80
Colloids, etc.			1·03	·69	·49
Per cent. reduction on raw sewage	—	31	85	90	91
Per cent. reduction on settled sewage	—	—	79	85	87
Free and saline ammonia	4·14	4·14	3·43	2·00	1·43
Per cent. reduction on raw sewage	—	—	17	52	65
Albuminoid ammonia ..	1·43	1·04	·22	·115	·105
Per cent. reduction on raw sewage	—	27	85	92	93
Per cent. reduction on settled sewage	—	—	79	89	90
Nitrite and nitrate (in terms of NH_3)	—	—	·04	·80	1·14
Per cent. oxidised	—	—	1	19	28

1 vol. sludge to 4 vols. sewage.

TABLE III.

Results of sectionised experiments.

Results in parts per 100,000.	Experiment 40.					Experiment 41.					Experiment 45.					Experiment 47.				
	Raw sewage.		Effluent after aeration in contact with			Raw sewage.		Effluent after aeration in contact with			Raw sewage.		Effluent after aeration in contact with			Raw sewage.		Effluent after aeration in contact with		
	Shaken.	Settled.	α sludge.	β sludge.	αβ sludge.	Shaken.	Settled.	α sludge.	β sludge.	αβ sludge.	Shaken.	Settled.	α sludge	β sludge.	αβ sludge.	Shaken.	Settled.	α sludge.	β sludge.	αβ sludge.
4 hours oxygen absorption	12·68	8·92	3·26	2·28	2·34	9·70	6·63	2·80	2·06	2·00	10·06	7·90	3·48	2·70	2·09	17·14	13·00	6·00	3·28	2·94
Per cent. reduction calculated on Raw sewage			74	82	81			71	80	80			65	75	80			65	81	83
Per cent. reduction calculated on Settled sewage			63	74	73			57	69	70			50	66	74			54	75	77
Free and saline ammonia........	3·86			3·86	3·86	3·00			3·28	3·28	3·70			3·28	2·86	4·28			4·14	3·43
Per cent. reduction calculated on raw sewage				nil	nil				nil	nil				11	23				3	20
Albuminoid ammonia	1·70	1·04		·36	·36	1·10	·50		·25	·245	1.10	·70		·405	·35	1·61	1·02		·405	·45
Per cent. reduction calculated on Raw sewage..				79	79				77	78				63	68				75	72
Per cent. reduction calculated on Settled sewage				65	65				50	51				42	50				60	56
Nitrite and nitrate (in terms of NH_3)				·12	.36				·11	·17				·12	·16				·04	·06
Per cent. of ammonia oxidised ..				3	9				4	6				3	4				1	1
Temperature								6·2°C.			5·5° C.			7·5°C.	7·5°C	9·0° C.				

α Sludge = Partially activated sludge—non-nitrifying.
β and αβ Sludge = Thoroughly activated sludge—capable of vigorously promoting nitrification.

TABLE IV.

Oxidation of Manchester Sewage under Various Conditions.

A = 1 Filling with 20 hours aeration.
B = 2 Fillings with 10 hours aeration each
C = 1 Filling with 6 hours aeration with subsequent aeration of sludge alone
D = 3 Fillings with 6 hours aeration each.

FIRST WEEK.

Results in parts per 100,000	Experiment 54.						Experiment 55.						Experiment 56.						Experiment 57.					
	Original.		After 6 hours aeration.				Original.		After 6 hours aeration.				Original.		After 6 hours aeration.				Original.		After 6 hours aeration.			
	Shkn.	Sttld.	A.	B.	C.	D.	Shkn.	Sttld.	A.	B.	C.	D.	Shkn.	Sttld.	A.	B.	C.	D.	Shkn.	Sttld.	A.	B.	C.	D.
4 Hours oxygen absorption	15·90	9 30	1·71	1·77	1·91	1·69	14·71	9 60	1·86	2·09	2·57	2·00	13·60	10·50	1·66	1·83	2·28	2·09	16·80	9·90	1·48	1·52	1·86	2·00
Per cent. reduction calculated on Raw sewage..			89	89	88	89			87	86	83	86			88	87	83	85			91	91	89	88
Per cent. reduction calculated on Settled sewage			82	81	79	82			81	78	73	79			84	82	78	80			85	85	81	80
Free and saline ammonia........	4·60	—	2·86	2·86	2·86	2·70	3 60	—	2·57	3·43	3·30	3·15	3·50	—	1·30	2·30	2·36	2·30	3·30	- -	1·57	2·43	2·00	2·57
Per cent. reduction calculated on raw sewage			38	38	38	41			29	5	8	12			65	37	36	37			52	26	39	22
Albuminoid ammonia	1·19	·73	·25	·26	·265	·25	1·04	·73	·22	·22	·305	·205	·84	·50	·28	·205	205	·35	·87	·47	·135	·135	·15	·18
Per cent. reduction Calculated on Raw sewage..			79	78	78	79			79	79	71	80			67	76	76	58			84	84	83	79
Per cent. reduction Calculated on Settled sewage			66	64	64	66			70	70	58	72			44	59	59	30			71	71	68	62
Nitrite and nitrate (in terms of NH_3)	—	—	·91	·91	·86	1·00	—	—	·80	·06	·14	·06	—	—	1·02	12	·12	nil	—	—	·71	·17	·20	·07
Per cent. of ammonia oxidised ..			20	20	19	22			24	2	4	2			29	3	3	nil			22	3	6	2

	Second Week.												Third Week.											
	Experiment 59.						Experiment 62.						Experiment 65.						Experiment 66.					
	Shkn.	Sttld.	A.	B.	C.	D.	Shkn.	Sttld.	A.	B.	C.	D.	Shkn.	Sttld.	A.	B.	C.	D.	Shkn.	Sttld.	A.	B.	C.	D.
4 Hours oxygen absorption total	15·20	10·50	2·09	1·92	2·03	2·26	16·68	11·00	1·46	2·20	1·52	3·37	14·86	10·00	1·74	2·03	1·71	2·57	15 66	11·20	1·46	1·74	1·51	2·74
Crystalloids		6·57	1·00	1·06	·94	1·34		6·63	—	—	—	—		5·37	1·09	1·12	1·11	1·31		6·52	1·06	1 03	·97	1·71
Colloids, &c.		3·93	1·09	·86	1·09	·92		4·37	—	—	—	—		4·63	·66	·91	·60	1·26		4 68	·40	·71	·54	1·03
Per cent. reduction calculated on Raw sewage ..			86	87	87	85			91	87	91	80			88	86	89	83			91	89	90	83
Settled sewage			80	82	81	79			87	80	86	69			83	80	83	74			87	84	87	76
Free and saline ammonia	3·57		2·14	2·72	2·14	2·86	3·86		2·14	3·70	2·28	4·14	3·93		2·43	3·14	2·00	3·43	3·60		1·70	2·30	1·70	3·15
Per cent. reduction calculated on raw sewage			40	24	40	20			45	4	41	—			38	20	49	13			53	36	53	13
Albuminoid ammonia	1·16	·62	·18	·18	·18	·205	1·27	·79	·205	·265	·18	·39	1·10	·53	·165	·22	·15	·28	1·58	·62	·105	·165	·105	·25
Per cent. reduction calculated on Raw sewage ..			84	84	84	82			84	79	86	69			85	80	86	75			93	90	93	84
Settled sewage			71	71	71	68			74	67	77	57			69	58	72	47			83	73	83	60
Nitrite and nitrate (in terms of NH_3)			·96	·38	·60	·09			·17	·03	·22	·04			·20	nil	·19	nil			·36	·03	·33	nil
Per cent. of ammonia oxidised ..			27	11	17	3			4	1	6	1			5	nil	5	nil			10	1	9	nil

TABLE V.

Effect of Temperature.

Results in parts per 100,000.		Temp.	Experiment 93.					Experiment 94.					Experiment 95.					Experiment 96.				
			Raw sewage.		After aeration for			Raw sewage.		After aeration for			Raw sewage.		After aeration for			Raw sewage.		After aeration for		
			Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs	9 Hrs.
4 Hours oxygen absorption	Total	5° C.	10 63	7·70	2·23	1·88	1·60	15·31	9·00	3 03	2·74	2·69	13·94	7 80	3·09	2 72	2·83	11 80	8 50	2 80	2 63	2·28
	Crystalloids	5° C.		5 26	1·16	·91	·88		5·09	1·14	1·26	1·17		4·34	1·32	1·06	1·04		4 80	1·23	1·09	1·00
	Colloids, etc.	5° C.		2 44	1 07	·97	·72		3·91	1·59	1·48	1·52		3 46	1·77	1·66	1·79		3 70	1·57	1·54	1·28
	Total	15° C.			1·57	1·37	1·29			2·29	1·48	1·49			1·97	1 40	1·17			1·77	1·37	1·17
	Crystalloids	15° C.			·88	·83	·83			1·26	·94	·96			1·16	·83	·77			1·16	·81	·71
	Colloids, etc.	15° C.			69	·54	·46			1 03	·54	·53			·81	·57	·40			·61	·56	·46
Per cent. reduction calculated on	Raw sewage	5° C.			79	82	85			80	82	82			78	81	80			76	78	81
	Do.	15° C.			85	87	88			85	90	90			86	90	92			85	88	90
	Settled sewage	5° C.			71	76	79			66	70	70			60	65	64			67	69	73
	Do.	15° C.			80	82	83			75	84	84			75	82	85			79	84	86
Colloids, etc., removed ..		5° C.			1·37	1·47	1·72			2·32	2·43	2·39			1·69	1·80	1·67			2·13	2·16	2·42
		15° C.			1·75	1·90	1·98			2·88	3·37	3·38			2·65	2·89	3·06			3·09	3·14	3·24
Free and Saline ammonia		5° C.	4·43	4·43	4 43	4·00	3·71	3·86	3·86	3·57	3·36	3·29	2·50	2·50	2·64	2·36	2·21	3·28	3·28	2·64	2·64	2·43
		15° C.			3·80	3·07	2·43			3·07	2·28	1·36			1·93	1·12	·23			2·43	2 07	1·14
Per cent. reduction		5° C.			nil	10	16			7	13	15			nil	5	12			20	20	26
		15° C.			14	30	45			20	41	65			23	55	91			26	37	65
Albuminoid ammonia ..		5° C.	·98	·54	·27	215	·165	1·16	·62	·335	·37	·42	1·30	·56	·40	·35	·35	·98	·46	·28	·305	·27
		15° C.			·165	·13	·065			·23	·205	·165			·215	·15	·08			·15	·17	·115
Per cent. reduction calculated on	Raw sewage	5° C.			72	78	83			71	68	64			69	73	73			71	69	72
	Do.	15° C.			83	87	93			80	82	86			83	88	94			85	83	88
	Settled sewage	5° C.			50	60	69			46	40	32			28	37	37			39	34	41
	Do.	15° C.			69	76	88			63	67	73			62	73	86			67	63	75
Nitrite and nitrate (in terms of NH_3)		5° C.			·07	·17	·26			·04	·06	·06			·03	·04	·14			·14	·07	·12
		15° C.			·07	·54	·97			·04	·40	·86			·10	·60	1·14			·04	·27	·54
Per cent. of ammonia Oxidised		5° C.			2	4	6			1	2	2			1	2	6			4	2	4
		15° C.			2	12	22			1	10	22			4	24	46			1	8	16

TABLE VI.

Effect of Temperature.

Results in parts per 100,000	Temp.	Experiment 73.					Experiment 74.					Experiment 75.					Experiment 76.				
		Raw sewage.		After aeration for			Raw sewage.		After aeration for			Raw sewage.		After aeration for			Raw sewage.		After aeration for		
		Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.
4 Hours oxygen absorption	13° C.	12·11	8·30		1·46		10·50	6·40	1·26	1·26	·91	10·30	7·40	1·51	1·31	1·09	12·10	8·80	1·66	1·37	1·37
	29° C.				1·49				1·23	1·29	·91			1·63	1·31	1·03			1·63	1·31	1·40
	30° C.				2·20				2·03	1·97	1·51			1·91	1·40	1·89			2·11	1·71	—
Per cent. reduction calculated on Raw sewage	13° C.				88				88	88	91			85	87	89			86	89	89
Do.	20° C.				88				88	88	91			84	87	90			87	89	88
Do.	30° C.				82				81	81	86			81	86	82			83	86	80
Settled sewage	13° C.				82				80	80	86			80	82	85			81	84	84
Do.	20° C.				82				81	80	86			78	82	86			82	85	84
Do.	30° C				74				68	60	76			74	80	75			76	81	..
Free and saline ammonia	13° C.	3·80			2·14		2·14		1·43	·71	nil	2·56		2·14	1·43	·54	2·56		2·14	1·64	·79
	20° C.				2·43				1·29	·23	nil			2·14	1·29	·20			2·21	1·57	·36
	30° C.				2·57				1·57	·57	nil			2·36	1·71	·29			2·29	1·03	·60
Per cent. reduction calculated on raw sewage	13° C.				41				33	67	100			16	44	79			16	36	69
	20° C.				36				40	89	100			16	50	92			14	39	86
	30° C.				32				27	73	100			8	33	89			11	25	77
Albuminoid ammonia	13° C.	·96	·61		·105		·84	·36	·13	·10	·08	·70	·44	·165	·13	·095	·96	·64	·16	·105	·08
	20° C.				·105				·10	·10	·08			·18	·115	·095			·15	·105	·08
	30° C.				·265				·22	·165	·11			·20	·165	·105			·20	·15	·12
Per cent. reduction calculated on Raw sewage	13° C.				89				85	88	90			76	81	86			83	89	92
Do.	20° C.				89				88	88	90			74	84	86			84	89	92
Do.	30° C.				72				74	80	87			71	76	85			79	84	88
Settled sewage	13° C.				83				64	72	78			63	70	78			75	84	88
Do.	20° C.				83				72	72	78			59	74	78			77	84	88
Do.	30° C.				57				39	54	69			55	63	76			69	77	81
Nitrite and nitrate (in terms of NH_3,)	13° C.				·63				·10	·44	1·34			·11	·81	1·19			·10	·50	1·21
	20° C.				·21				·17	·76	1·31			·09	56	1·43			nil	·57	1·64
	30° C.				·06				·09	·60	1·17			·03	·31	1·24			·03	·21	1·00
Per cent. of ammonia oxidised	13° C.				17				5	21	63			4	32	40			4	19	47
	20° C.				6				8	32	61			3	20	56			nil	20	64
	30° C.				2				4	28	55			1	12	48			1	8	39

TABLE VII.

Effect of Temperature.

Results in parts per 100,000.	Temp.	Experiment 79.					Experiment 80.					Experiment 81.					Experiment 82.				
		Raw sewage.		After aeration for			Raw sewage.		After aeration for			Raw sewage.		After aeration for			Raw sewage.		After aeration for		
		Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.	Shaken.	Settled.	3 Hrs.	6 Hrs.	9 Hrs.
4 Hours oxygen absorption	13° C.	11·66	8·30	1·80	1·09	1·03	11·77	8·40	2·20	1·43	1·20	13·37	9·40	2·00	1·37	1·20	13·60	8·80	1·77	1·31	1·29
	20° C.			2·17	1·28	1·11			1·97	1·54	1·26			2·37	1·57	1·34			2·06	1·43	1·12
	30° C.			3·26	2·06	1·43			2·60	1·77	1·40			3·26	2·06	1·71			2·51	1·69	1·66
Per cent. reduction calculated on Raw sewage	13° C.			85	91	91			81	88	90			85	90	91			87	90	90
Do.	20° C.			81	89	90			84	87	89			82	88	90			85	89	92
Do.	30° C.			72	82	88			78	85	88			76	85	87			82	88	88
Settled sewage	13° C.			78	87	88			74	83	86			79	85	87			80	85	85
Do.	20° C.			74	85	87			77	82	85			75	83	86			77	84	87
Do.	30° C.			61	75	83			69	79	83			65	78	82			72	81	81
Free and saline ammonia	13° C.	2·86	2·86	1·93	1·14	·39	3·20	3·20	2·57	1·93	1·57	3·70	3·70	2·80	2·00	1·13	3·70	3·70	2·57	1·71	1·14
	20° C.			2·00	·03	nil			2·36	1·29	nil			2·93	2·21	1·00			2·64	1·64	·64
	30° C.			2·43	1·64	·53			2·57	1·93	·80			3·07	2·86	1·50			2·80	2·22	60
Per cent. reduction calculated on raw sewage	13° C.			33	60	86			20	40	51			24	46	69			31	54	69
	20° C.			30	67	100			26	60	100			21	40	73			29	56	83
	30° C.			15	42	82			20	40	75			17	23	59			24	40	84
Albuminoid ammonia ..	13° C.	·84	·50	·205	·095	·065	·08	·50	·215	·12	·10	1·36	·70	·18	·105	·08	·98	·62	·165	·105	·085
	20° C.			·23	·105	·07			·205	·13	·10			·22	·13	·08			·195	·105	·085
	30° C.			·45	·22	·12			·23	·165	·12			·405	·25	·18			·23	·12	·085
Per cent. reduction calculated on Raw sewage	13° C.			76	89	92			78	88	90			87	92	94			73	89	91
Do.	20° C.			73	87	92			79	87	90			84	91	94			80	89	91
Do.	30° C.			46	74	86			77	73	88			70	82	87			77	88	91
Settled sewage	13° C.			59	81	87			57	76	80			74	85	89			73	83	86
Do.	20° C.			54	79	86			59	74	80			69	81	89			69	83	86
Do.	30° C.			10	56	76			54	67	76			42	64	74			63	81	86
Nitrite and nitrate (in terms of NH_3)	13° C.			·06	1·14	1·79			·06	·43	·69			·10	·51	·92			·10	·31	1·20
	20° C.			·03	1·14	1·83			·04	·69	1·83			nil	·28	1·06			nil	·46	1·48
	30° C.			nil	·57	1·14			·03	·31	·83			nil	·20	·52			nil	·20	1·20
Per cent. of ammonia oxidised	13° C.			2	40	63			2	14	22			3	14	25			3	8	32
	20° C.			1	40	64			1	22	57			nil	8	29			nil	12	40
	30° C.			0	20	40			1	10	26			nil	5	14			nil	5	32

TABLE VIII.

Oxidation of Various Sewages.
Moss Side Sewage.

Results in parts per 100,000.		Sample A.											Sample B.										
		Original.			After aeration for								Original.			After aeration for							
		Shaken.	After 2 hrs. settlement.		3 Hours.		6 Hours.		12 Hours.		24 Hours.		Shaken.	After 2 hrs. settlement.		3 Hours.		6 Hours.		12 Hours.		24 Hours.	
			Alone.	+ sludge.	Sewage.	Sewage + sludge.	Sewage.	Sewage + sludge.	Sewage.	Sewage + sludge.	Sewage.	Sewage + sludge.		Alone.	+ sludge.	Sewage.	Sewage + sludge.	Sewage.	Sewage + sludge.	Sewage.	Sewage + sludge.	Sewage.	Sewage + sludge.
4 Hours oxygen absorption (total) ..		9·83	8·57	10·88	8·71	5·55	8·88	4·00	5·76	2·16	3·60	1·49	11·66	9·00	8·10	8·50	2·74	7·60	2·34	4·16	1·54	3·43	1·51
Crystalloids			4·06	3·88	3·68	1·62	3·54	1·26	2·00	·96	—	—		4·23	3·89	2·86	1·57	2·97	1·41	—	—	—	—
Colloids, &c.			4·51	7·00	5·03	3·93	5·34	2·74	3·76	1·20	—	—		4·77	4·21	5·61	1·17	4·63	1·23	—	—	—	—
Per cent reduction calculated on	Shaken sample		13	nil	10	43	8	59	41	78	63	85		23	30	27	77	35	80	64	87	71	87
	Settled sample			nil	nil	35	nil	53	33	75	58	83			10	6	70	16	74	54	83	62	83
Free and saline ammonia............		6·00	6·00	6·11	6·07	5·43	5·71	4·43	5·14	3·28	3·57	1·14	6·00	6·00	6·00	5·57	4·29	5·14	3·29	3·43	1·21	2·86	nil
Per cent. reduction				nil	nil	10	5	26	11	45	40	81			nil	7	29	14	45	43	80	52	100
Albuminoid ammonia		1·19	·96	1·36	·90	·67	·83	·33	·71	·29	·585	·15	2·20	1·27	1·26	1·09	·40	·83	·22	·79	·16	·63	·10
Per cent. reduction calculated on	Shaken sample		19	nil	24	44	30	72	38	76	51	87		42	43	50	82	62	90	64	93	71	95
	Settled sample		—	nil	6	30	13	66	23	70	39	84		—	1	14	69	35	83	38	89	50	92
Nitrite and nitrate (in terms of NH_3)			nil	·12	nil	·42	nil	·98	nil	1·43	nil	3·92		nil	·07	nil	·50	nil	1·14	nil	2·57	nil	3·50
Per cent. of ammonia oxidised			nil	2	nil	7	nil	16	nil	24	nil	65		nil	1	nil	8	nil	19	nil	43	nil	58

Withington Sewage.

		Original.		After aeration for								Original.		After aeration for					
		Raw sewage.		2 Hours.		4 Hours.		6 Hours.		9 Hours.		Raw sewage.		3 Hours.		6 Hours.		7 Hours.	
		Shaken.	Settled.	Alone.	+ sludge.	Alone.	+ sludge	Alone.	+ sludge.	Alone.	+ sludge.	Shaken.	Settled.	Alone.	+ sludge.	Alone.	+ sludge.	Alone.	+ sludge.
4 Hours oxygen absorption	Total	5·12	3·77	2·86	1·28	2·17	1·03	2·06	1·00	1·71	1·00	5·60	2·92	2·29	1·53	1·88	1·20	1·88	1·26
	Crystalloids		1·49	1·17	·54	·88	·56	·94	·51					—	—	—	—	·91	·69
	Colloids, &c. ..		2·28	1·69	·74	1·29	·47	1·12	·49					—	—	—	—	·97	·57
Per cent. reduction calculated on	Shaken sample		26	44	75	58	80	60	80	67	80	—	48	59	73	67	79	67	78
	Settled sample		—	24	66	42	73	45	74	55	74	—	—	22	48	36	59	36	57
Free and saline ammonia............		2·78	2·78	2·28	1·80	2·14	1·07	2·14	·64	2·21	·09	2·29	1·86	1·36	1·29	1·40	·26	1·36	nil
Per cent. reduction		—	—	18	35	23	62	23	77	21	97	—	19	41	44	39	89	41	100
Albuminoid ammonia		·815	·50	·405	·15	·405	·08	·38	·08	·42	·07	·70	·30	·285	·15	·23	·06	·15	·05
Per cent. reduction calculated on	Shaken sample	—	39	50	82	50	90	53	90	48	91	—	57	59	79	67	91	79	93
	Settled sample	—	—	19	70	19	84	24	84	16	86	—	—	5	50	23	80	50	83
Nitrite and nitrate (in terms of NH_3)				·23	·50	·215	1·31	·06	1·50	·09	1·72			nil	·46	nil	1·09	nil	1·37
Per cent. of ammonia oxidised				8	18	8	47	2	54	3	62			nil	20	nil	48	nil	60

Table IX.

Oxidation of Various Sewages.

Results in parts per 100,000	*Gorton.*						*Macclesfield.*							
	Raw sewage.		After aeration for				Raw sewage.		After aeration for					
			3 Hours.		9 Hours.				3 Hours.		6 Hours.		9 Hours.	
	Shaken.	Settled.	Alone.	+ sludge.	Alone.	+ sludge.	Shaken.	Settled.	Alone.	+ sludge.	Alone.	+ sludge.	Alone.	+ sludge.
4 Hours Oxygen absorption — Total	15·13	11·70	9·49	2·57	6·86	1·28	12·57	9·10	8·50	2·72	7·30	1·66	6·50	1·37
Crystalloids		6·28	4·57	1·54	2·52	·80		4·06	3·66	1·12	2·51	·80	2·46	·74
Colloids, etc.		5·42	4·92	1·03	4·34	·48		5·04	4·84	1·60	4·79	·86	4·04	·63
Per cent. reduction calculated on — Raw sewage		24	38	83	55	92		27	32	78	42	87	48	89
Settled sewage			19	78	41	89			7	70	20	82	29	85
Colloids, etc., removed			·50	4·39	1·08	4·94			·20	3·44	·25	4·18	1·00	4·41
Free and saline ammonia	5·72	5·72	5·72	4·26	4·57	1·43	3·80	3·80	3·71	3·00	3·71	2·21	3·71	1·00
Per cent. reduction			0	25	20	75			2	21	2	42	2	74
Albuminoid ammonia	2·01	1·50	1·37	·42	1·03	·15	1·62	1·16	—	·50	—	·265	—	·18
Per cent. reduction calculated on — Raw sewage		25	31	79	48	92		28		69		84		89
Settled sewage			9	72	31	90				57		77		85
Nitrite and nitrate (in terms of NH_3)			·03	·04	·06	1·22			nil	·10	nil	·50	nil	1·14
Per cent. of ammonia oxidised			1	1	1	21			0	3	0	13	0	30

Table X.

Effect of Sterilisation of Sludge.

	Raw sewage		Diluted* raw sewage	Sewage (diluted)* alone.				Sewage + sterile sludge.				Sewage + active sludge.			
				Original.	After aeration for			Original.	After aeration for			Original.	After aeration for		
	Shaken.	Settled.	Shaken.	Settled.	3 Hrs.	9 Hrs.	18 Hrs.	Settled.	3 Hrs.	9 Hrs.	18 Hrs.	Settled.	3 Hrs.	9 Hrs.	18 Hrs.
4 Hours oxygen absorption — Total	11·77	8·10	8·20	6·12	5·92	5·43	3·77	10·00	10·52	10·17	7·20	4·12	1·63	1·20	1·14
Crystalloids				3·88	4·00	3·54	2·86	5·63	5·76	5·26	3·40	2·50	·94	·77	·77
Colloids, etc.				2·24	1·92	1·89	·91	4·37	4·76	4·91	3·80	1·62	·69	·43	·37
Free and saline ammonia	3·30	3·30	2·95	2·86	2·86	2·36	2·07	2·95	2·86	2·64	2·50	2·95	2·71	1·72	·57
Albuminoid ammonia	·87	·42	·61	·315	·305	·33	·26	2·50	2·23	2·04	1·81	·215	·105	·12	·105.
Nitrite and nitrate (in terms of NH_3)				·06	·06	nil	·03	·12	nil	nil	nil	·09	·12	·58	1·14

* Original sewage diluted with a volume of water equivalent to the volume of sludge employed in the experiment.]

In the absence of any other altered factor this decreased efficiency might reasonably have been ascribed to the fact that while in the previous experiments any particular sample of sewage was always aerated in contact with the activated sludge for from 20 to 24 hours to ensure complete nitrification, in the present case, at the end of first six hours' aeration the purified liquor was replaced with a further sample of sewage.

Unfortunately, however, during the course of this series of experiments, low temperatures were experienced, not only with the sewage dealt with, but also in the laboratory, owing to trouble with the heating apparatus.

It was thus impossible to say to what extent, if any, either of these two factors influenced the results obtained, and instead of continuing sectionised experiments on these lines, attention was diverted to the study of the questions involved.

Before leaving this part of the subject it may be stated that while the above experiment failed to determine the possibilities of sectionising the oxidation process the matter has not been lost sight of, and it is the intention of the authors to return to this question at an early date.

Maintenance of Sludge Activity.

In order to determine how far the purification effect of the activated sludge was influenced by not carrying the oxidation process to complete nitrification the following experiment was carried out.

Activated sludge of known efficiency was divided into four equal volumes and placed into separate bottles, viz., A. B. C. and D. each of four litres capacity and containing a sample of the same sewage.

The following procedure was then adopted :—

Bottle A.—Sewage aerated for six hours in contact with activated sludge, followed by two hours' settlement, sample of purified effluent taken, remaining contents of bottle aerated for 14 to 16 hours longer.

Bottle B.—Sewage aerated in contact with activated sludge for ten hours, sample taken at end of six hours.

This operation was repeated twice during the twenty-four hours.

Bottle C.—Sewage aerated in contact with activated sludge for six hours, sample taken and purified effluent removed as in A. Sludge was then aerated for the remainder of the day.

Bottle D.—Sewage aerated for six hours in contact with activated sludge, followed by two hours' settlement and subsequent removal of purified effluent by decantation.

This operation was repeated three times during the twenty-four hours.

It will be seen that with similar aeration the sludge in bottle D. dealt with three volumes of sewage to two volumes in case of bottle B. and one volume in the case of bottle A., while the sludge in bottle C. also only dealt with one volume of sewage, but the amount of air required for aeration was reduced by the fact that for from 14 to 16 hours the sludge alone was aerated.

A series of results obtained during the course of this experiment are given in Table 4 (p. 528).

The results of the first experiment of this series (Experiment 54) are given in order to show that the activity of the sludge in each case was identical. As the experiment proceeded, while the oxidation effect as measured by the oxygen absorption test differed only slightly according to the method of working, a marked difference was observed in the amount of nitrification. In the case of the sludge contained in Bottle A., which only dealt with one sample of sewage per day, the nitrification was maintained as in the first experiment, but in each of the other methods of working the nitrification was seriously impaired, in fact almost inhibited.

It was observed, however, that the sludge in Bottle C. after the removal of the oxidised effluent, had not been well aerated during the period of working. Accordingly means were adopted to improve this aeration. The results obtained during the second and third week's working, of which typical examples are given (Experiments 59—66) show that the effect of this improved aeration was to maintain the activity of the sludge and consequently to yield similar results to those obtained when the whole of the sewage and sludge was aerated for 22 hours.

It will be seen that the results obtained with the sludge contained in Bottle D. gradually deteriorate with the total inhibition of nitrification. In the case of the sludge in Bottle B. the falling off in its activity was not so marked, although the nitrification was considerably reduced.

It is evident from the results of this experiment that the activity of the sludge is gradually diminished, when working on the fill and draw method, if it is called upon to treat further samples of crude sewage, prior to the complete nitrification of the previous sample dealt with.

The results also show that this difficulty may be overcome by simple aeration of the sludge alone, until the free and saline ammonia content is removed.

Influence of Temperature.

In order to determine the influence of temperature on the oxidation process a series of experiments extending over several weeks were carried out on the aeration of Manchester sewage in contact with activated sludge at temperatures varying from 5°—30° C. A number of typical results are given in Tables 5, 6 and 7 (pp. 529—531).

It should be mentioned that in all the experiments quoted in this section of the work, the activated sludge dealt with one volume only of sewage per day. Samples were taken after three, six and nine hours' aeration respectively and then aeration was resumed until the next dose of sewage was treated.

It was found that the oxidation process could be maintained within a fairly wide range of temperature. At temperatures constantly below 10° C. a very marked deterioration in the results was observed, especially with regard to the removal of the colloidal matters. Also nitrification was practically inhibited within a period of nine hours' aeration. It is fairly evident that this effect would be accumulative over a prolonged period of working with the probable eventual production of inactive sludge.

At temperatures varying from 12—14° C., which is the usual air temperature of the laboratory, the activity of the sludge was well maintained with the production at all times of a satisfactory effluent.

It was further observed that with a temperature of 20° C. equally good results were obtained as regards the removal of the oxidisable matter and clarification effect, with an increase in nitrification during the later periods of aeration.

Working with temperatures as high as 30° C. it was found that the initial clarification effect was to some extent interfered with and that the effluent resulting from subsequent settlement showed a slight deterioration as compared with that obtained when working at tempera- tures from 12—20° C. This effect became less marked as the aeration continued and once nitrification was establishe it proceeded at a slightly increased rate as compared wit that obtained at temperatures below 20° C.

Oxidation of various sewages.

It was thought of interest to compare the results obtaine with Manchester sewage, which contains an undue pr portion of a variety of trade effluents, with those of mor purely domestic sewage.

Samples of sewage were therefore obtained from th following sewage works :—

(a) Moss Side Sewage Works	Urmston
(b) Withington Sewage Works	Chorlton
(c) Gorton Sewage Works	Gorton
(d) Macclesfield Sewage Works	Prestbury.

In view of the difficulty of obtaining average rep sentative samples of sewage from the above works, it w decided to work with samples of maximum strength, i. in each case the samples were taken in the afternoo and consequently this fact must be borne in mind considering the results which are given in Tables 8 and

In connection with these results attention should drawn to the following :—

(*a*) *Moss Side sewage.*

Experiments on this sewage were carried out in earlier part of the investigation and consequently proportion of activated sludge to the sewage treated was considerably less that in the later experiments. Further in order to more clearly demonstrate the actual oxidation effect of the activated sludge in the control experiment the sewage aerated alone was diluted with a volume of tap water equal to that of the sludge employed in the experiment. The analytical figures given for the shaken sample of sewage refer to the sample actually taken plus the diluting water.

Sample A.

This was a Monday afternoon sample, and obviously contained an excessive amount of soapy matter. It will be seen from the table that this soapy matter exerted a considerable emulsification or deflocculation effect as shown by the increase in the four hours' oxygen absorption and albuminoid ammonia of the "original" settled sample after mixing with the activated sludge, and in consequence of this effect the results obtained were not so striking as the previous ones, although considerable nitrification was obtained within six hours. It would appear that in the case of sewages containing undue proportion of soapy matter, preliminary treatment with lime might be advantageously employed.

Sample B.

It will be seen from the analytical returns that this was a stronger sewage than the preceding one, but contained less soap. In this case no preliminary emulsification was observed and a much greater purification was effected in the earlier stages of aeration.

(*b*) *Withington sewage.*

The sewage from the Withington works was considerably weaker than that received from the Moss Side works and consequently as would be anticipated, complete oxidation ensued within a greatly reduced period of aeration. It may be noted that two hours' aeration in contact with activated sludge, with subsequent settlement was sufficient to produce an effluent which was non-putrefactive on incubation.

(*c*) *Gorton sewage.*

It is evident from the analysis given in Table 9 that the sample dealt with was an exceedingly strong sewage. With three hours' aeration a remarkable change was effected as measured by the usual tests. After six hours' aeration an extremely well clarified effluent was obtained, but unfortunately owing to an accident it is not possible to give the chemical analysis.

Despite the highly concentrated nature of this sewage 9 hours' aeration was sufficient to yield an entirely satisfactory effluent showing a rather higher percentage purification on the raw sewage than that which is yielded by efficient bacterial filters. Within a period of 9—18 hours the whole of the free and saline ammonia was removed from the sewage.

(*d*) *Macclesfield sewage.*

The sample of Macclesfield sewage was very turbid and was said to contain waste refuse of a mucilaginous character derived from silk works. With this type of sewage the oxidation proceeds satisfactorily although the percentage purification effected is not quite so good as in the case of Gorton sewage. A well clarified effluent was obtained with six hours' aeration in contact with activated sludge and subsequent settlement. The whole of the free saline ammonia was removed within a period of sixteen hours.

Quality of effluents.

It has frequently been observed that effluents obtained from the oxidation process, while having a comparatively low oxygen absorption as measured by the permanganate test and a low albuminoid ammonia content, may absorb an undue proportion of dissolved oxygen on incubation for a number of days. When once the free and saline ammonia content of an effluent is very considerably lowered even without material alteration in the four hours' oxygen absorption and albuminoid ammonia figures, the amount of dissolved oxygen absorbed by the effluent is enormously reduced. It would thus appear that the stage to which nitrification has advanced is one of the factors governing the amount of dissolved oxygen absorbed by an effluent. Experiments are in progress with a view to throwing further light on this subject, but the data so far available is insufficient to allow of any definite conclusions. It is quite certain however, that in the effluents obtained, the amount of oxygen absorbed from permanganate bears no relation whatever to the amount of dissolved oxygen absorbed.

Activated sludge.

Activated sludge accumulated in the manner previously described is quite inoffensive, dark brown in colour and flocculent in character, and despite its low specific gravity separates from water or sewage at a rapid rate. After prolonged settlement the activated sludge however rarely contains less than 95 per cent. of water.

A remarkable separation of the water from the sludge can be readily obtained by treatment on fine grade strainers with the production of a sludge of the consistency of a stiff jelly.

Gelatine counts have shown a bacterial content of at least 30 million organisms per cubic centimetre. In addition, the sludge by reason of its nitrifying power must of necessity contain a large number of nitrifying organisms.

It should also be noted that a fairly large number of a variety of protozoa are to be found and we are indebted to Mr. James Crabtree for assistance in regard to the enumeration and identification of these higher forms of life. It does not however contain any algal growths.

The chemical analysis of an average sample of the activated sludge is as follows :—

	Percentage.
Organic matter	64·7
Mineral matter	35·3
Total nitrogen (N)	4·6
Phosphate (P_2O_5)	2·6
Matter extracted by CCl_4	5·8

Attention should be drawn to the abnormally high percentage of nitrogen as compared with ordinary unoxidised sewage sludge.

Nature of reaction.

Up to the present the authors have not seriously investigated the actual mechanism of the process and consequently no attempt has been made to differentiate between the part played by physical, chemical and biological agencies, all of which are doubtless, in varying degrees responsible for the total purification change. As to whether the protozoa content has any influence or not on the extent of the purification has yet to be determined, although it would appear that they rather indicate a particular condition of the activated sludge than play an important part in the changes effected.

While as previously stated no serious attempt has been made to determine to what extent bacterial agencies are concerned with the purification process, an experiment has been made on the effect produced by the aeration of sewage in contact with activated sludge both before and after steam sterilisation.

The results of this experiment are given in Table 10, from which it will be seen that activated sludge when sterilised under these conditions had no purification effect whatever (see p. 533).

It must be borne in mind, however, that the physical characteristics of the activated sludge may be seriously altered by the steaming process and consequently some other method of sterilisation, *e.g.*, by means of ultra-violet rays might yield somewhat different results.

Summary and Conclusions.

The foregoing investigations have established :

1. That the resultant solid matter obtained by prolonged aeration of sewage, which has been termed activated sludge, has the property of enormously increasing the purification effected by simple aeration of sewage, or in other words it greatly intensifies the oxidation process.

2. The extent of the accelerating effect depends upon the intimate manner in which the activated sludge is brought into contact with, and upon its proportion to, the sewage treated.

3. That in order to maintain the sludge at its highest efficiency it is necessary that there should not be at any time an accumulation of unoxidised sewage solids.

It is not necessary that the sewage should be kept in contact with the activated sludge until such conditions obtain, as its activity may be maintained by suitable aeration of the activated sludge alone.

4. That temperature exerts a considerable influence on the oxidation process. The purification effected is seriously diminished at temperatures constantly below 10° C. Up to 20—24° C. no material difference in the clarification effect and general purification has been observed although the nitrification change proceeds more rapidly as the temperature rises. At higher temperatures the clarification effect is somewhat interfered with during the earlier period of aeration, with a consequent delay in the establishment of nitrification. Subsequently the rate of nitrification somewhat increases.

5. That under the conditions of experiment a well oxidised effluent can be obtained by the aeration of average strength Manchester sewage in contact with activated sludge for a period of from six to nine hours. The percentage purification effected as measured by the usual tests is at least equal to that obtained by the treatment of sewage on efficient bacterial filters.

The period of aeration naturally depends upon the strength of the sewage treated and the degree of purification required.

6. That the activated sludge differs very considerably in character and composition from ordinary sewage sludge.

It is in a well oxidised condition and consequently entirely innocuous, can be readily drained on straining filters and possesses a high nitrogen content.

The scope of this inquiry has been up to the present largely confined to laboratory investigations and while the results obtained have shown conclusively that the purification process can be readily maintained, a large amount of further research is required in order to obtain a thorough knowledge of the character and mechanism of the changes taking place, which will be essential for the efficient control of the process.

The method employed in producing a satisfactory purification of sewage is however of so simple a nature, that there would not appear to be any insuperable difficulties in translating the experiments described, on to a working scale.

In view of the obviously great reduction in the area of works required and capital expenditure involved, the available data in regard to the probable cost of aeration is such as to lend encouragement to the idea that the adoption of aeration methods on the lines of these experiments would result in a considerable reduction in the total cost of sewage purification. In this connection it may be reasonably anticipated that the enhanced value of the resultant sludge should at least cover all costs incidental to its disposal.

In conclusion the authors wish to express their sincere thanks to Dr. Fowler for the suggestion which originated this inquiry, and for the keen interest with which he has followed the whole series of experiments.

They are indebted to the Rivers Committee of the Manchester Corporation for permission to publish the results of this investigation, which has been carried out in the laboratory at the Corporation Sewage Works, Davyhulme.

Discussion.

Dr. J. Grossman said that the sludge question had entered upon a phase in which, though it was not expected to produce a large profit, it was to a certain extent capable of commercial treatment. Where the present processes of purification might be barred by local circumstances the process described in the paper if successful would be greatly in advance of what was being done at present. No doubt, in some instances it would become a commercial question as to whether aeration by means of activated sludge would be more economical than any of the other processes of purification and the mechanical element would enter very largely into this question. He had been very much struck with the amount of nitrogen in the sludge. Was this partially due to the elimination to a greater extent of the detritus matter than was usual with ordinary sludge? Perhaps the authors could give them some information as to the average amount of nitrogen in ordinary Manchester sludge. Assuming even as much as two per cent. of nitrogen on the dry sludge then the 4 or 4½ per cent. of nitrogen shown could not be accounted for by a larger quantity of detritus having been taken out. Even if they took into consideration the ammonia being utilised by the bacteria, he could not understand how an increase of nitrogen could be obtained because the bacteria were supposed to oxidise the ammonia into nitrates which were soluble, unless the bacteria took up the nitrogen from the air and used it for building up their own bodies which afterwards remained in the sludge.

Mr. F. R. O'Shaughnessy regarded the paper as an epoch-making one, provided that the process experimentally established by the authors could ultimately be applied on the large scale at a reasonable cost. After all, from the point of view of the man-in-the-street—the man who paid the rates—the financial question was one of the first questions. The process suggested by the authors would greatly reduce the area of the works and would probably go far to eliminate nuisance, and these too were very important considerations from the public point of view. In Germany sewage was often merely precipitated or sedimented and the sewage liquor then pased through open channels for many miles to the nearest river. The Germans seemed to have no objection to this, but in England such a procedure would not be tolerated.

Apart, however, from such general and practical considerations, the scientific interest of the paper could not be over-estimated. So far as he could judge, the main principle at work did not differ substantially from that which obtained in an ordinary bacteria bed, viz., exposure to the necessary organisms in presence of an excess of oxygen. The experiments demonstrated that there must be considerable surface contact between the liquor to be purified and the "activated" sludge. The action was undoubtedly a very complex one. Merely physical effects in the way of flocculating the colloidal and finely divided suspended solids would be obtained which would help in clarifying the liquor. The destruction of the colloidal character of the sludge was no doubt brought about by biological agents and it was interesting to note that at a temperature of 30° C. a process of deflocculation went on

Recently he had read a paper before the Institute o Sanitary Engineers giving a number of observations bearin on these points. Many engineers apparently held th view that the so-called "colloiders" precipitated colloida matter by virtue of their physical action. This vie was erroneous, for these "colloiders" were efficient onl because they provided a habitat for the micro-organism which were the effective "colloiders." Not till th sewage liquor had an enormous surface presented to i as in a bacteria bed, did physical forces remove an appreciable quantity of impurities from the liquor. Th great advantage inherent in the process outlined by th authors of the present paper was that aerobic conditio prevailed and foul products were thereby eliminate

His observations on these phenomena extended ov many years and the following figures which were th averages of many analyses over a lengthy period made the Birmingham sewage under working conditions on th large scale were correspondingly very reliable. I had taken the "oxygen absorbed in four hours" figu on the liquor freed from visible suspended solids as index as to what happened This figure for the cru sewage liquor was 17·10 parts per 100,000, and aft passing through a plain rectangular sedimentation ta where the time of sojourn was four to five hours the liqu then gave the figure 13·71. A remarkable point w that 20 per cent. of the dissolved impurities were remov by this simple means. Further treatment of the liqu for six hours in a septic tank reduced the figure to 12· After that the liquor passed through a five-mile-long sew and the above figure was reduced by a six hours sojourn in this sewer to 9·11 parts per 100,000. The surface to which the liquor was exposed in this sewer was very considerable and the colloidal matter was precipitated to an appreciable extent on this journey, whilst the suspended matter was correspondingly increased. This suspended matter was arrested in upward flow conical tanks and the figure for the clear liquor issuing from these tanks fell from 9·11 (above) to 8·71 parts per 100,000. Passage through a percolation bed then reduced the figure to about two parts per 100,000 in ½ to 1 hour.

If the above observations were set out as rates per hour of elimination of impurities in solution the result became very striking. These rates were as follows :—

On the sedimentation tank	0·68	parts per hour.
,, ,, septic ,,	0·20	,, ,, ,,
,, ,, five-mile sewer	0·70	,, ,, ,,
,, ,, upward flow tank	0·28	,, ,, ,,
,, ,, percolation bed, about	10·00	,, ,, ,,

The total purification of dissolved oxidisable impurities by 22 hours tank treatment was about 50 per cent. and was greater under "septic" than under "non-septic" conditions.

In another set of experiments on the large scale the sewage was divided into two portions each portion passing through two separate sets of tanks. One portion was treated with two parts per 100,000 of bleaching powder and the other untreated. The chlorinated liquor was sterilised by the treatment, and no change took place in the figure for "oxygen absorbed" owing to passage through the tanks, whilst on the other hand an appreciable drop in the dissolved oxidisable impurities occurred in the liquor passing through the other set of tanks to which no bleaching powder had been added. These observations had a bearing on the process brought forward by Messrs. Ardern and Lockett, for they threw some light on the nature of the action. Broadly, his conclusions were that the grosser colloidal matters held by sewage iquors came down readily in ordinary continuous flow sedimentation tanks, that the great bulk of the colloidal matters—say 70—80 per cent—were held very tenaciously by the sewage liquor and were only removed by either biological agents, or physical forces suitably applied uch for instance as in a well constructed and properly worked bacteria bed. In ordinary modern works practice probably the biological factors were the most potent, and he experiments carried out by the Authors indicated that his held good with respect to the new process they desribed.

One other point he wished to refer to was the part played y the nitrogen in these phenomena. He agreed with he authors that this behaviour was rather puzzling, nd much work remained yet to be done on this most mportant aspect of the question.

Mr. S. E. Melling thought the process described was deal inasmuch as it resolved itself into a single-tank treatment. The greatest bugbear to the sewage problem had een the question of sludge disposal. By means of the w system the sludge, activated in the manner described, came the friend rather than the enemy of the sanitary ientist. Had there been any estimation of the perntage of nitrogen during the different stages of the velopment of activity of the sludge it would be teresting to learn by what stages the fixation of the trogen took place. He observed that the carbon tetraloride extract was put down as grease. Had any proximate examination been made of that extract, as would be distinctly against the value of the sludge a manure if the grease was left in ? The whole scheme peared to be one of great value for communities with ry small available spaces of land at their disposal. it was possible to have the carbonaceous fermentation ried out successfully in a preliminary tank, whether was in the nature of a "roughing" tank or filter, or ilar existing device, and so bringing the effluent to the ge where, by passing it through aerating-filters the essary nitrification could be attained, a great saving uld be effected. The filters could be fed four to six es their usual speed. An interesting point occurred connection with the disappearance of nitrogen, where in some cases the oxidised product did not at all correspond with the free ammonia. According to one of the tables shown it would seem that the best dilution for the oxidation-cycle to proceed, regularly and completely, was 1 : 12. Might there not be some feasible explanation of the loss of nitrogen when the ratio of activated sludge to sewage was much higher ?

Mr. Percy Gaunt said that the method of treatment suggested might offer advantages sufficient to compensate for any additional power required for the aeration process, in view of the reduced area required, and the possibility of reduction of the nuisance from smell and from flies. Under the present system, even when circumstances favoured a fairly compact scheme, an area of ten acres would usually be required for the disposal works of a town of about 40,000 inhabitants, when due allowance had been made for the selection of a site providing the fall of several feet, necessary for a filtration process. The experiments described suggested the possibility of reducing the area by about eighty per cent., and the necessary fall to a few inches. A suitable site under existing conditions might be two or three miles from the town, entailing an independent power installation, whereas with the reduced area and diminished fall requirements of the suggested method, full advantage might be taken of any cheap power (such as a town gas, or electricity supply) in choosing the position of the works. Interesting information as to the relative importance of the physical and biological factors in purification might be obtained from comparative aeration experiments conducted (a) under ordinary conditions ; (b) in the presence of ultra-violet rays.

Mr. Johnson inquired whether the sludge contained any ammonia, and also what quantity of air was required.

Mr. J. T. Thompson said that one striking feature of the new process was that it was aerobic from beginning to end, and it was probable that the amount of smell would be negligible. If these laboratory results could be economically obtained on a large scale the present elaborate system of dealing with sewage would be simplified ; the cost of pressing sludge, depositing it in the sea or in trenches on land would be avoided, for activated sludge evidently dries rapidly and would yield good manure. This process might also reduce the area of bacteria beds needed. What volume of air was it necessary to blow through the mixture, for this would be a costly item in practice ? He presumed there would be some limit below which the sludge would not be sufficiently mixed with the supernatant liquid to complete the oxidation in a reasonable time. With regard to the high nitrogen figure in the activated sludge, if possible, he would like to have an analysis of ordinary Manchester sludge to compare with the sample of activated sludge.

Mr. Hart (Leeds), speaking as an engineer, thought the process would resolve itself into a question of the relative cost of manipulation of the sludge either as liquid or solid matter. He admitted that the difficulty from the engineering side at the present time was to find a satisfactory method of manipulating the sludge for useful manurial purposes at a reasonable cost. At the moment he could not see that there was a probability of there being any great saving in costs of manipulation. The present experiments were, however, laboratory experiments, and it would be necessary to deal with sewage and sludge in bulk before any reliable data could be furnished as to cost.

Dr. G. J. Fowler said that a considerable time ago Mr. Ardern and himself read a paper before the Society on suspended matter in sewage and effluents, which raised in a simple way a question which had found its final expression in the paper they had heard that night, that was to say the flocculation of colloidal matter. The end had not been reached at once. There had been a number of stages, and a great many minds had been at work on the question. When he had the honour of delivering the Chairman's address before the Section he mentioned the idea of Dr. Maclean Wilson of an enzyme which might clot out sewage and produce the effect which now took place in a percolating filter, and ventured to suggest that it might be possible to find something of the kind. An experiment was tried with some of the deposit from a filter, blowing it up in sewage, with apparently little result. Other chemists had tried the same experiment. It was only right to admit that the illuminating idea which originated the work was really due to a visit he had paid while in the United States, to the Mecca of sewage purification, namely, the experimental station at Lawrence in the State of Massachusetts, where he saw the bottle, described in the paper, in which sewage had been completely purified by 24 hours' aeration. The idea at that time, and subsequently in the experiments which had been published from that laboratory, involved the principle of surface. He discussed some of the possibilities of the method with the President of the New York Sewerage Commission, and that gentleman was of the opinion that the idea of surface should be abandoned if possible if the matter was to be really advanced. They also discussed the question of the clarification of sewage. The problem at New York was to deal with some 1,000 million gallons of sewage per day and the idea of sprinkling such a large quantity about in the atmosphere in the hot American summer did not seem to be altogether practicable. In the intervening time other experiments had been made by Mr. Mumford and himself with regard to the clarification of sewage bacterially, and they had succeeded in clarifying altogether about 10,000 gallons by means of a process which had already been published. As Dr. Grossmann had observed, local conditions had to be taken into consideration. It was also necessary to consider the process of sewage purification on the one hand and the utilisation of the nitrogen and other constituents on the other. The process described in the paper aimed at purifying the sewage as rapidly and as simply as possible. He, for his own part, believed that the process was practicable on a large scale, and they would have some idea of what that meant when he mentioned that the settling tanks at Davyhulme were constructed to hold 21 millions gallons. The results indicated in the paper showed that some six hours' blowing would produce an effluent equal to the final effluent at present obtainable; that was to say, complete purification in six hours. Assuming that the operation was only carried out twice in the 24 hours, allowing six hours to blow and six hours for the manipulation Mr. Hart had spoken of, aerating the sludge and so forth, it meant that in the tanks available 42 million gallons per day could be purified. The consequent saving of space and expenditure on filters would be something enormous, and would allow for quite a large expenditure on power and otherwise for the provision of air. He would not commit himself to figures that evening. It would not be a wise proceeding at that stage. The question of cost had been very carefully considered, and the whole matter had been approached from a number of points of view. Estimates had been obtained for large scale-work in blowing and so forth. He had consulted Mr. S. L. Pearce, the Chief Engineer of the Manchester Corporation Electricity Department, with reference to the amount of power required for providing a certain amount of air, estimating for the greatest quantity of air conceivable for the purpose, and recent work which had been begun showed that there had been an over-estimation in that direction. Taking everything together he was convinced that the process was a practical proposition. In order to carry it out by the most economical method possible it was, of course, necessary to call in the aid of their friends the engineers. Figures as to cost had been published by experimenters in America. In a paper by Messrs. Clark and Adams, published in the "Engineering Record," the figure for electricity was placed at 2d. per unit, which was not very cheap, and on that basis the cost of air was given at 8s. 4d. per million gallons. The American sewage was rather dilute. There was also cost of the slate surfaces. Still, if it was possible to carry on the process at the cost of 8s. 4d. per million gallons the matter appeared to be quite practicable. It was necessary to get the principle right in the first place, and on that point he had no doubt. The idea was really nothing new in a way. All that was happening was that instead of running the stream of sewage over a filter bed with imperfectly oxidised sludge one took activated sludge and moved it about with complete aeration. In the same way that a percolating filter was a concentration of land treatment so the treatment described was a further concentration on the percolating filter. No really new principle was involved, and for that reason it appeared to him the thing was on right lines. Regarding the question of nitrogen which had been raised, his view was that the organisms collected a certain amount of nitrogen from the products present in solution and built up a certain amount of protoplasm thereby. He was confirmed in this opinion by experiments made at the Manchester University, where a deposit was obtained containing even more nitrogen than was indicated in the paper. The amount of mineral matter in activated sludge was not high. It would be necessary in order to secure success that very careful means be taken to remove the grit, and considerable engineering skill would be required to design really satisfactory grit chambers. There were no such things in existence in the world at the present time, but no doubt the problem was capable of solution. The complete removal of grit would materially assist the working of the process. The research work carried out by Messrs. Ardern and Lockett opened out possibilities which would re-awaken the public interest in the sewage problem, which, perhaps, to some of them had latterly become somewhat of a bore by being standardised to such an extent that the whole question had become one of routine. The Authors of the paper had now fired a bombshell into the camp, and perhaps they would all start on new ways in the future.

Mr. Ardern, in reply, said that no means had been taken to remove the detritus from the sewage which was generally the average 24 hours' sample. An inspection of the analysis would show that the percentage of organic matter in the resulting sludge was 65 per cent. or thereabouts, whereas the usual percentage of mineral matter in sedimented sludge in the case of Manchester would be about 50 per cent., so that there was a considerable increase in the organic content. With regard to the high percentage of nitrogen, the figure given was the mean of several determinations. It would appear that the high nitrogen content was due to a large extent to the flocculation of the fæcal emulsion. There had been no determinations of nitrogen at different stages of the accumulation of the sludge. There were still a number of points requiring elucidation, and it was not suggested that investigation had been made into every operation tha actually took place. What had been done was to endeavou to obtain results which could be readily maintained unde conditions in which apparently there should be no seriou difficulty in translating to a practical working scale. Th scientific side of the matter had only been dealt with in limited manner. The authors agreed with Dr. Fowle in regard to the principle of the process which he ha dealt with in the course of his remarks. As stated by M O'Shaughnessy, with a temperature of 30° Cent. there wa apparently a slight deflocculating action on the sludge, b it was not maintained, the effect being observable in t initial stages, flocculation subsequently occurring. N examination had been made of the grease extract, as at t time the determination was made the activated slud was rather a valuable product from the experiment point of view. He was of opinion, however, that t percentage of fatty matter present was not sufficient militate against the use of the sludge as a fertiliser. was a considerably lower percentage, as Dr. Grossma would be aware, than in the case of ordinary sewa tank sludge, even counting the whole carbon tetrachlori extract as grease. It was quite common for ordina tank sludge to contain 10 to 15 per cent. of grease extra and possibly in some cases a greater quantity. There no definite explanation to offer in connection with loss of the nitrogen, and there was no doubt that w regard to the conservation of that constituent furt information was required. In the earlier experime almost quantitative nitrification of ammonia was obtai This did not apply to the later experiments where t was a greater loss of nitrogen. It may be mentio that during the later experiments a greater volum sludge was employed, and nitrification proceeded more rapid rate which might possibly have some influ on the liability to losses of nitrogen. The question of effect of waste liquor from sulphate of ammonia pl had not been investigated. The Manchester se dealt with, however, contained from 0·5 to 1·0 per cent. of this trade effluent, and in this proportion no serious retarding effect on the oxidation process was apparent. If, as appeared probable, the process was essentially bacterial, there was no doubt that any serious amount of inhibiting matter, of whatever type, as long as it was bactericidal, would doubtless have to some extent a deterrent effect. The volume of air required was a point which obviously was connected with the cost of the aeration process. They had not gone very deeply into the matter. As a matter of fact the laboratory experiments had been aerated without consideration of the question of cost. They had determined the volume of air used in the experiments, which was evidently much in excess of that actually required; the quantity amounting to something about one-fifth of a cubic foot per square foot of tank area per minute. While Dr. Fowler naturally refrained from giving any figures, one could say without hesitation that the quantity of air required was very much less than that allowed in any calculations he had made. In the laboratory experiment the air was used not only for aeration but also as a means of agitation, and it was quite conceivable that a combination of mechanical agitation with the use of air for aeration purposes only would be more economical. That, of course, remained to be seen. A question had been raised as to the effect of grease, concerning which he could not give any information. Whatever grease there was in the average sample was in the sewage when they treated it, and there was no apparent hindrance to the oxidation process. At no time was there an excessive quantity of grease, but he was of opinion that some simple means would be adopted for removing any actual grease from the sewage before subjecting it to any such treatment.

The main feature of the experimental work was the satisfactory purification of sewage by tank treatment alone, with the production of a sludge which, owing to its oxidised and flocculent condition, could be readily dealt with and converted into a valuable fertilising agent.

A number of samples illustrating the experiments of the authors were exhibited.

Obituary.

HERMAN FRASCH.

Herman Frasch was born in Gaildorf, Würtemberg, in 1851. In 1868 he went to America and soon attained the foremost position in the Laboratory of Prof. Maisch of the Philadelphia College of Pharmacy. In a short time, however, he turned his attention to chemical industry, and acting quite independently, he commenced a series of investigations bearing upon the subject of petroleum and its products. In 1876, at the age of twenty-four, Frasch evolved a process for refining paraffin wax, which so pleased the directors of the Cleveland Petroleum Company, that they purchased it, and the young chemist was induced to leave Philadelphia and go to Cleveland, and make the petroleum industry his speciality. Numerous patents were now taken out by him. These were not all confined to petroleum and its products, for in 1882, he patented a process for making white lead directly from galena, and between 1882 and 1886 one for making sodium carbonate from salt by the ammonia process, besides others in connection with practical applications of thermo-electricity. In the works of the Empire Oil Company, Frasch solved the problem of purifying the offensive sulphurised petroleum oils of Canada and Ohio, thus raising them to a high degree of purity. In 1888, the Standard Oil Company bought his patents after exhaustively testing their value. One of Frasch's greatest achievements was his ingenious process for recovering the sulphur from a huge deposit in Louisiana, 1000 feet down in the earth and covered by dense layers of sand. Heat was applied to the sulphur *in situ* by means of superheated water forced down a boring, first fusing and then impelling the melted sulphur up an inner tube to the surface (see this J., 1912, 168—169). He applied for 10 patents for processes and apparatus in this connection. Now, thanks to Frasch's inventive genius, sulphur (formerly shipped from Sicily to America), is exported in large quantities from America to Europe. Frasch ultimately became President of the Union Sulphur Company of New York and Hamburg, and of the International Sulphur Refineries of Marseilles. Two years ago, at a Meeting of the New York Section of this Society, Prof. Chandler, in presenting to him the Perkin Gold Medal of the associated Chemical and Electrochemical Societies, said, the " Perkin Medal Committee felt fully justified in placing Mr. Frasch by the side of William H. Perkin, as one of our greatest industrial chemists and chemical engineers."

He died May 1st, 1914, in Paris, at the age of 63.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Taking samples of powdered or liquid substances; Apparatus for ——. T. Roberts, Bolton. Eng. Pat. 7354, March 28, 1913. Addition to Eng. Pat. 23,237 of 1911.

Various mechanical devices for controlling the sampling device of the apparatus described in the chief patent, and clockwork mechanism for operating the controlling device are claimed.—W. H. C.

Determining by weight quantities of gas, steam or other vapour or liquid; Process and apparatus for ——. G. A. H. Binz, Enfield. From C. A. Hartung, Berlin. Eng. Pat. 8042, April 5, 1913.

The resistance for varying the measuring current in proportion to the flow of the fluid in the measuring apparatus described in Eng. Pat. 27,357 of 1911 (this J., 1913, 74) is placed in the circuit before it branches to the resistance bridge, and the resistances which serve to correct for variations of pressure and temperature are placed in the branches of the bridge itself.—W. H. C.

Ovens [for ores, etc.]. C. Dressler, Marlow, Bucks. Eng. Pat. 8505, April 10, 1913.

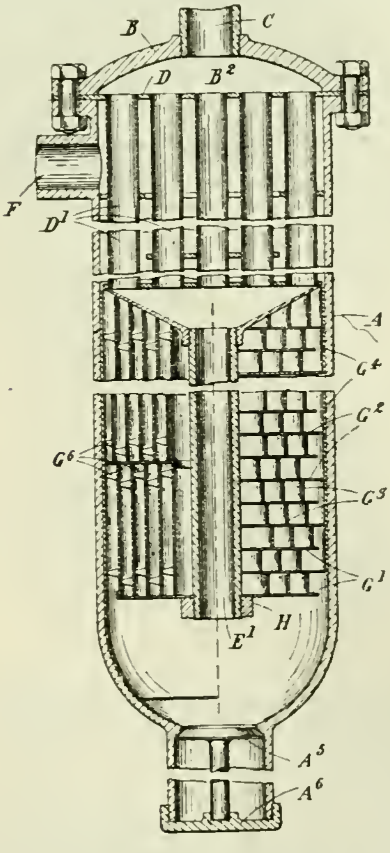
An oven of the type described in Eng. Pat. 8228 of 1912 (this J., 1913, 792) is so constructed that the interior of the combustion chamber (or chambers) is not in communication with the interior of the oven, and the cooling zone is provided with two or more conduits. Air or air and heating gases are passed through the conduits on their way to the combustion chamber, thereby serving as cooling media and, at the same time, being preheated. The conduits may be arranged one within another. The ends of the ovens may be normally closed, and the oven wall provided with inlets and outlets for the gases to be introduced.—F. Sodn.

Calcining and roasting furnaces. E. Cornet. Fr. Pat. 465,302, Nov. 25, 1913.

A column roaster or calciner provided with two grates, the lower to support the calcined or roasted product and the upper to support the charge. Air is admitted through a central conduit which extends upwards to about the middle of the charge and has a conical grid above and lateral openings as well. The kiln is also provided with a telescopic chimney the bottom portion of which can be lowered into the throat of the kiln. The grate bars are manipulated by levers.—W. H. C.

Retorts for treatment of fluids. C. V. Boys, London. Eng. Pat. 8803, April 15, 1913.

The retort, which is used for submitting liquids, gases or vapours to the action of heat, either alone or in the presence of a catalytic agent, is made in one piece and has a cover, B, at the upper end, and a valve, A^5, and cap, A^6, at the lower end for the removal of any deposit. The fluid to be treated enters the retort at C, passes downwards through a regenerative system of tubes, D^1, and a central conduit, E^1, and then upwards through a series of spiral passages and around the tubes, D^1, to the outlet, F. The spiral passages are formed by open scrolls of metal, G^3, arranged between the two series of alternate baffle-plates, G^1, G^2, as shown at the right-hand side of the figure, the fluid thus passing radially inwards and outwards in successive scrolls. When the plates, G^1, G^2, are wide apart as shown at the left-hand side of the figure, the scrolls are of corresponding depth and are spaced apart by tongues, G^6, stamped out from them. The plates G^1, G^2, and scrolls, G^3, may be made of a suitable metal to act as catalytic agent, the plates, G^2, then having flanges, G^4, which form a lining for the retort. The whole of the parts within the retort form an insertion which is supported from the tube-plate, D^1, and can be lifted out through the top of the retort. If the insertion becomes choked or jammed in the retort, the nut, H, is removed from below, the regenerator and pipe, E^1, lifted out and the scrolls and baffle-plates removed separately.—A. T. L.



Still or retort. S. E. Kelsey, Kansas City, Mo. U.S. Pat. 1,092,366, April 7, 1914.

The retort is fixed in a furnace and has an outlet port near the top. It is partly filled with molten material in which a number of baffles are floating. The material to be treated is delivered through a pipe into the lower part of the molten mass.—W. H. C.

Settling tanks. W. Loebel, Leipzig, Germany. Eng. Pat. 19,597, Aug. 29, 1913.

A settling tank is provided with curved baffles, guide plates, or deflectors extending from the inlet to near the outlet, to cause the liquid entering the tank to take a downward course before it rises to the outlet. Means are provided for removing sludge from the bottom of the tank. —W P. S.

Drying and mixing miscellaneous materials; Machine for ——. N. Ammann. First Addition, dated Nov. 3, 1913, to Fr. Pat. 453,614, Jan. 27, 1913 (this J., 1913, 780).

The closing device for the outlet end of the drying cylinder is formed of two concentric overlapping cones connected together by helical ribs. The interiors of the cones are also provided with helical blades. This device allows hot gases to enter the drying cylinder through the passage between the cones, whereas the dried material is prevented from escaping through this passage but is directed to the outlet end of the outer cone.—W. H. C.

Chemical reactions between solids and gases; Process for effecting ——. Soc. Générale des Nitrures. Fr. Pat. 465,242, Jan. 31, 1913.

In carrying out the process described in Fr. Pat. 462,464 (this J., 1914, 302), the gas is passed through the reaction chamber at a reduced speed, by causing it to leave or to enter and leave through the permeable walls of the chamber.—W. H. C.

Solids suspended in liquids; Process and apparatus for the extraction of —— in the form of mud. L. Hertenbein. Fr. Pat. 465,323, Nov. 26, 1913.

The mixture is fed into a tank in which a drum filter is rotated partially immersed. The periphery of the drum is formed of a number of separate arc-shaped filter chambers the outer surfaces being covered with filtering material and the interiors connected by two radial pipes and the hollow shaft with a vacuum pump and with a supply of compressed air, so that those filter chambers which are immersed in the liquid are under vacuum and those above the liquid under pressure. The filter-cake is loosened by the compressed air and removed by a roller working against the upper surface of the drum.—W. H. C

Absorption vessel with tangential gas-inlet tubes. H. Flasche. Ger. Pat. 271,786, March 21, 1913.

At the lower part of the vessel, just above the ends of the tangential gas-inlet tubes, is an annular hood provided with slots. The gas issuing from the tubes causes a vigorous circulation of the liquid below the hood, and the liquid above the hood is gradually drawn through the slots and intimately mixed with the incoming gas.—A. S.

Drying plastic materials; Method of —— and apparatus therefor. O. Eberhard, Heidenau, Germany. Eng. Pat. 8068, April 5, 1913.

See Fr. Pat. 455,959 of 1913; this J., 1913, 933.—T. F. B.

Drying machine; Centrifugal ——. A. Cassirer, München, Germany. Eng. Pat. 12,914, June 4, 1913.

See U.S. Pat. 1,087,528 of 1914; this J., 1914, 312.—T.F.B.

Drying-kiln; Continuous —— with vertical axis. J. Réol, Assignor to Soc. de Constructions Mécaniques d'Alais, Alais, France. U.S. Pat. 1,093,206, April 14, 1914.

See Eng. Pat. 16,262 of 1912; this J., 1913, 816.—T. F. B.

Gaseous mixtures; Process and apparatus for the separation of —— into their constituents. R. P. Pictet, Berlin-Wilmersdorf, Germany. Eng. Pat. 9357, April 21, 1913. Under Int. Conv., July 2, 1912.

See Fr. Pat. 457,031 of 1912; this J., 1913, 1108.—T. F. B.

Filter-press. C. W. Merrill, Berkeley, Cal. U.S. Pat. 1,093,345, April 14, 1914.

See Fr. Pat. 431,106 of 1911; this J., 1912, 16.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Methane; The lower limits of inflammation of —— with mixtures of oxygen and nitrogen. A. Parker. Chem. Soc. Trans., 1914, **105**, 1002—1007.

The lower limits of methane in mixtures of oxygen and nitrogen in various proportions in which self-propagation of the flame upwards took place indefinitely after the original source of ignition was removed, decreased from 5·99 per cent. of methane in oxygen to a minimum of 5·76 per cent. in a mixture of oxygen 25 and nitrogen 75 per cent. Further decrease of the oxygen content to 13·25 per cent. produced a marked rise in the lower limit. In air the smallest percentage of methane required to produce continuous propagation of the flame was 5·77, and a reduction of 4 per cent. in the oxygen content only raised the limit 0·2 per cent., so the reduction of the percentage of oxygen in the air of mines would hardly minimise the possibility of firedamp explosions.—G. F. M.

Gaseous mixtures; Ignition of —— by the electric discharge. H. F. Coward, C. Cooper and J. Jacobs. Chem. Soc. Trans., 1914, **105**, 1069—1093.

The inflammability of various gaseous mixtures was compared by determining the lowest pressures at which the mixtures could be ignited with a given sparking arrangement. Mixtures of oxygen and hydrogen were more inflammable as the proportion of oxygen was increased up to 70 per cent. Electrolytic gas at a pressure somewhat too low for ignition, became inflammable by adding, without change of volume, either oxygen, hydrogen, nitrogen, carbon dioxide or argon. Experiments were also made with mixtures of oxygen with carbon monoxide, cyanogen, methane and ethylene respectively, and with various diluents in each case. Two important factors governing the ignition were the thermal conductivity of the mixture and the energy degraded when the spark was passed; in the case of mixtures of carbon monoxide (moist) with oxygen and diluents, a third important factor was the "activation" of oxygen by the discharge. —A. T. L.

Oil gas; Manufacture of ——. A. E. Forstall. J. Gas Lighting, 1914, **125**, 511—512.

The improved Jones apparatus consists of a primary generator and a secondary generator communicating at their lower ends, each containing two superposed chambers partly filled with chequer-brickwork, through which the gases or vapours pass downwards. The gases or vapours from the lower end of the primary generator pass upwards through additional chequer-brickwork in the lower part of the secondary generator to the gas outlet which is common to both generators. In operation, the brickwork is heated first by blowing with air, which burns away the soot formed during the previous gas-making period, and then by admitting oil to burners placed in the lower of the two chambers of each generator. The temperature is raised to 1800°—2100° F. (982°—1149° C.) at the top of the primary generator and 1800° F. (982° C.) in the secondary generator. Gas making is then commenced and continued until the temperature falls to 1200° F. (649° C.). During gas making, oil-gas from the process is passed through the apparatus as well as steam, in order to dilute the oil vapours and reduce the amount of lampblack formed.—A. T. L.

Oil-gas produced in the Jones apparatus; Analyses of ——. L. B. Jones. J. Gas Lighting, 1914, **126**, 319. (See preceding abstract.)

The oil-gas contained CO_2, 3·6; C_6H_6, 0·9; C_nH_{2n}, 4·9; O_2, 0·2; CO, 9·4; H_2, 38·3; CH_4, 37·8; and N_2, 4·9 per cent., and had a calorific value of 686 B.Th.U. per cb. ft. The quantity of oil used was 7·2 galls. per 100 cb. ft. of gas, and 44 per cent. of the carbon contained in the oil passed into the gas.—A. T. L.

Nitrogen; Recovery of —— as ammonia, from coal. J. W. Cobb. J. Gas Lighting, 1914, **126**, 329—331.

The experiments of Burgess and Wheeler (this J., 1914, 191) on the slow distillation of bituminous coal in a vacuum showed that the greatest yield of ammonia per grm. of coal was obtained at about 550° C. Christie noticed that very little ammonia was produced below 500° C. or above 800° C. and that by slow distillation at 500°—700° C., about twice as much ammonia could be obtained as in the usual coke-oven or gas-retort practice. At 700° C., when equilibrium is attained, a mixture of nitrogen, hydrogen, and ammonia at atmospheric pressure contains only 0·022 per cent. NH_3, and a gas containing H_2 50, N_2 5, and NH_3 1·2 per cent., if left in contact with the charge in the retort at 800° C, would lose practically all of the ammonia by decomposition. Hence it is necessary to produce the ammonia at the lowest possible temperature and to remove it from the retort as soon as formed. In laboratory experiments at 800° C., when the gas was removed at once from the hot part of the tube, 22·5 per cent. of the nitrogen of the coal was obtained as ammonia; when the gas passed through a red-hot part of the tube before exit, 17·2 per cent.; and when the gas passed through red-hot coke, 9·4 per cent. When a current of carbon monoxide, carbon dioxide or nitrogen was passed over coke at 800° C., little or no ammonia was obtained from the nitrogen in the coke; with dry hydrogen, 10 per cent. of the nitrogen was liberated as ammonia; and when water vapour, alone or mixed with hydrogen, was used, nearly the whole of the nitrogen was obtained as ammonia. The conditions approximate to this in the Mond producer, in which 60—70 per cent. of the nitrogen is recovered. Producer gas or coke-oven gas which has been well scrubbed for the extraction of ammonia is specially suitable for regenerative working on a continuous system without reversals, because it is free from dust and does not choke the narrow conduits.—A. T. L.

By-product coking in Canada. Chem. Trade J., May 9, 1914. [T.R.]

According to the official figures for 1913, published by the Canadian Department of Mines, the total output of oven coke in the Dominion during the year was 1,517,133 tons of 2000 lb., made from 2,147,913 tons of coal, of which 1,598,912 tons were mined in Canada, and 549,001 tons imported. The total quantity of coke sold or used by the producers during the year was 1,530,499 tons, valued at 5,547,694 dols. In 1912 the total output was 1,406,028 tons, and the quantity sold or used by the producers, 1,411,229, valued at 5,164,331 dols. By-products from coke ovens recovered during the year included 10,608 tons ammonium sulphate. 8,371,600 gallons of tar, and 3,353,731 thousand cubic feet of gas, and the total value would approximate 866,150 dols. At the end of the year there were 1720 ovens in operation, and 1325 idle.

The exports of coke during 1913 were 68,235 tons, valued at 308,410 dols; and the imports 723,906 tons, valued at 2,180,830 dols. In 1912 the exports were 57,744 tons, valued at 252,763 dols.: and the imports 628,174 tons, valued at 1,702,856 dols.

Determination of sulphur in spent oxide by combustion. Somerville. *See* VII.

Development of dry cleaning in blast-furnace gas purification. Müller. *See* X.

An adiabatic calorimeter. Gray. *See* XXIII.

PATENTS.

Coal and like fuel; Compound for treating ——. J. H. Harris, London. Eng. Pat. 18,705, Aug. 18, 1913.

A MIXTURE of sodium chloride 53, sodium carbonate 33, and aluminium silicate 4 parts, and water is sprinkled over the coal. Chlorine is liberated when the coal is burned and assists the combustion.—W. H. C.

Vertical retorts; Method and apparatus for discharging carbonised products obtained in ——. J. G. Aarts, Dongen, Holland. Eng. Pat. 17,612, July 31, 1913. Under Int. Conv., Aug. 1, 1912.

THE descending mass of coke passes from the retort into an enlarged chamber below, and is divided vertically into two or more portions by a reciprocating saw. It then comes in contact with a set of spiral cams exerting an intermittent knocking off and picking action delivered from the centre outwards.—W. H. C.

Coal-gas and coke; Method of manufacturing ——. W. P. Parsons, Flushing, N.Y. U.S. Pat. 1,092,950, April 14, 1914.

COAL is distilled in retort chambers relatively long and high, the walls of which are inclined at an angle slightly greater than the angle of repose of the coal, so that the mass is subject to a nearly uniform pressure during distillation, due to its own weight. The chambers are heated uniformly by means of flues in the walls.—A. T. L.

Gas producers. W. Hart, Sydney, New South Wales. Eng. Pat. 8126, April 7, 1913.

To obtain tar-free power gas from wood and light waste fuel without the use of a wet scrubber, a producer is employed in which the air for combustion enters at both top and bottom of the fuel column, the gas outlet being midway. The fresh fuel is partially distilled in a large chamber above the upper air inlets, which are arranged around the throat connecting this chamber with the producer shaft and are inclined downwards. There are cooling and dust-collecting chambers at either side of the producer, the whole being enclosed in a rectangular casing. The gases from the producer pass through one set of cooling chambers, then through an annular re-heating chamber around the lower part of the producer shaft, and finally through the second set of cooling chambers and a chamber packed with cocoanut fibre.—A. T. L.

Gas producers, coal distillation retorts, etc. W. Anderson, Helensburgh, J. Meikle, Glasgow, and C. W. Fulton, Paisley. Eng. Pat. 11,712, May 20, 1913.

COAL is delivered continuously to the top of the fuel column by means of a screw conveyor arranged horizontally in a pocket in the vertical walls of the retort or producer, and coke or ash is removed continuously from the bottom of the retort or producer through a water-seal by means of an inclined screw conveyor. The conveyors are of the type described in Eng. Pats. 4446 of 1912 and 12,521 of 1913.—A. T. L.

Gas producer apparatus; Suction ——. P. T. Houston, London. Eng. Pat. 15,367, July 3, 1913.

THE producer is specially suitable for marine propulsion, and provides a supply of steam for auxiliary purposes during gas-making and also when gas is not required. A coking chamber for the fresh fuel is disposed above the producer chamber, the whole being enclosed in a water-jacket forming a steam-boiler provided with the usual fittings. The upper part of the coking chamber is provided with air inlet nozzles and forms a combustion chamber for burning the gases and vapours distilled from the fresh fuel. The crown of this chamber is connected with the top plate of the boiler by vertical tubes through which the combustion products pass. The coke formed in the coking chamber descends into the producer chamber, from which producer gas free from tar is drawn off for use in the main engines. When gas is not required, the level of the fuel may be near the producer grate, the apparatus then working simply as a boiler.—A. T. L.

Water-gas; Apparatus for generation of ——. J. Stephenson, Salisbury. Eng. Pat. 15,677, July 7, 1913.

To repeat automatically the desired cycle of operations, as described in Eng. Pats. 6849 of 1911 and 26,916 of 1912 (this J., 1912, 377; 1913, 971), the valves, etc., controlling the process are actuated by solenoids and electric motors controlled by contacts on a rotating drum. The operating circuits are closed by contacts on the drum and broken at some other point by the movements of the parts operated.—A. T. L.

Gas producers. W. Dodd, Oldham. Eng. Pat. 29,381, Dec. 20, 1913.

IN a producer in which steam is generated in a coil or chamber arranged in the upper part, and is led beneath the grate, water is fed through a trapped pipe to the steam pipe leading from the coil to the ash-pit.—A. T. L.

Coal gas; Process for the purification of —— *from hydrogen sulphide and cyanogen.* C. A. Bergh. Ger. Pat. 272,094, March 19, 1912.

A SOLUTION of a zinc salt, containing also ferrous chloride, is used as absorbent, and to neutralise the free acid formed, a quantity of an insoluble or sparingly soluble substance, preferably calcium carbonate, corresponding to the total quantity of hydrogen sulphide and cyanogen, is added, gradually or all at once, so that zinc sulphide and cyanide are precipitated either fractionally or together, whilst the iron remains in solution. By this method the waste lyes from copper extraction processes can be utilised, and in a single operation the separation of zinc from iron and of hydrogen sulphide from cyanogen effected.—A. S.

Hydrocarbons; Making lighter —— *from heavier ones.* Planes, Ltd., Birkenhead, and W. P. Thompson, Liverpool. Eng. Pats. 5245 and 21,273, March 1 and Sept. 20, 1913.

HYDROGEN or purified water-gas is passed through petroleum heated under a pressure of 5 to 100 lb. per sq. in. in the presence of finely-divided nickel, immersed in the liquid. The gases and vapours are separated from unchanged petroleum in the cooler parts of the still and then passed through a reducing valve to a purifier containing finely-divided nickel and finally to a condenser. The petroleum is freed from sulphur and asphaltum before use, on account of their harmful effect on the catalyser.
—A. T. L.

Mineral oil; Manufacture of products from ——. The New Oil Refining Process Ltd., London, and E. L. Lomax, Preston, Lancs. Eng. Pat. 10,040, April 29, 1913.

The gaseous products obtained in cracking hydrocarbon oils are passed through sulphuric, phosphoric, telluric, or selenic acid; from the floating mixture of oils obtained, the paraffins are recovered by distillation with steam in the presence of alkali. Unsaturated siccative oils are recovered from the residual alkaline solution by extraction with a solvent, and from the acid liquid by diluting it with water.—O. E. M.

Crude oil; Process for treating ——. W. S. Barnickel, St. Louis, Mo. U.S. Pat. 1,093,098, April 14, 1914.

Crude petroleum containing not less than 10 per cent. of water and slimy substances emulsified with the oil, is thoroughly mixed with iron sulphate solution, the quantity of sulphate not exceeding 1 per cent. of the impurities. On standing, the oil, slime, and water form separate layers, and the oil can be drawn off.—A. T. L.

Coke ovens; Regenerative ——. E. G. A. Lecocq, Brussels. Eng. Pat. 10,253, May 1, 1913. Under Int. Conv., May 13, 1912.

See Fr. Pat. 457,674 of 1913; this J., 1913, 1000.—T. F. B.

Coke ovens. Gebr. Hinselmann, Essen-Ruhr, Germany. Eng. Pat. 29,069, Dec. 16, 1913. Under Int. Conv., Jan. 13, 1913.

See Ger. Pat. 268,327 of 1913; this J., 1914, 411.—T. F. B.

Vertical retorts; Apparatus for discharging ——. H. Koppers, Essen on Ruhr, Germany. Assignor to H. Koppers Co., Chicago. U.S. Pat. 1,093,936, April 21, 1914.

See Eng. Pat. 29,371 of 1912; this J., 1913, 860.—T. F. B.

Illuminating and fuel gases from wood; Process of manufacturing ——. R. M. Poole, Mount Gambier, South Australia. U.S. Pat. 1,093,470, April 14, 1914.

See Eng. Pat. 13,929 of 1913; this J., 1914, 190.—T. F. B.

Asphalte-like masses and derivatives therefrom; Process for the manufacture of ——. L. Landsberg, Nuremberg, Germany. Eng. Pat. 8069, April 5, 1913.

See Fr. Pat. 457,054 of 1913; this J., 1913, 1000.—T. F. B.

Process of generating hydrogen. U.S. Pat. 1,092,903. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Peat, Treatment of —— by wet-carbonisation. N. Testrup and M. A. Atkinson, London, T. Rigby and G. W. Andrew, Dumfries, and Wetcarbonizing Ltd., London. Eng. Pat. 2283, Jan. 28, 1913.

Wet peat is subjected to wet-carbonisation, for example as described in Eng. Pats. 17,610 of 1911 or 25,146 of 1912 (this J., 1912, 1171; 1914, 346), the liquid matter is separated, neutralised with alkali, and concentrated in an evaporator, which may be of the type referred to in Eng. Pats. 12,462 and 22,670 of 1911 (this J., 1912, 971; 1913, 183). The vapours evolved during evaporation are washed with acid liquor to extract the ammonia, before they are returned to the heating surfaces of the evaporator. The concentrated liquor, or the solid evaporation residue, is mixed with peat fuel from the process and gasified in an ammonia-recovery gas producer. The proportion of the nitrogen in the wet peat passing into the liquor during wet-carbonisation may be increased by raising the temperature. In one case, the proportion was 19 per cent. at 180° C., but only 14 per cent. at 170° C.—A. T. L.

Ammonia contained in semi-solid materials [e.g. peat]; Process and apparatus for the recovery of ——. E. Stauber and W. Kochan. Fr. Pat. 464,227, Oct. 29, 1913.

An apparatus for the recovery, as ammonia, of the nitrogen contained in peat and similar substances by destructive distillation. Carbonisation is effected in a vertical retort into which the material is charged from a feed hopper, the latter having slots in its sides communicating with an annular flue surrounding the retort. In the lower part of the carbonising chamber is a system of tubes through which water is circulated; the steam developed serves to actuate an ejector in the gas-outlet main, whereby gases are exhausted from the retort and directed to a condenser where the ammonia is recovered, the uncondensable gases being returned and burned in the annular flue surrounding the retort and thus supplying some of the heat required for the carbonisation and for drying the raw material in the feed hopper. Steam from the water tubes may also be directed on to the incandescent charge in the carbonising chamber to increase the yield of ammonia. —A. S.

Wood distillation; Process and apparatus for ——. F. Woidich, Prague-Weinberge, Austria-Hungary. U.S. Pat. 1,092,620, April 7, 1914.

The gases from the retort pass through a collecting main in which they are brought into contact with tar and so become saturated with tar oil vapours. The saturated gases are then cooled to the dew point of the higher-boiling tar oils, and brought into intimate contact with the tar from which the oil has been removed; the oil vapours remaining in the gases are absorbed by the tar, which is then separated in a tar extractor.—W. H. C.

Arc light electrode. F. M. Lewis. Ger. Pat. 271,993, July 3, 1913.

A chromate is added to the known mixture consisting chiefly of tungstates and fluorides, which is applied to arc light carbons to improve their light-emitting and burning properties.—A. S.

Peat; Removal of water from wet carbonised ——. N. Testrup, London, and D. Söderlund, Clapham Park, Assignors to Wetcarbonizing, Ltd., London. U.S. Pat. 1,094,270, April 21, 1914.

See Eng. Pat. 4684 of 1911; this J., 1912, 323.—T. F. B.

Arc-electrode and process for making it. J. L. R. Hayden, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,093,182, April 14, 1914.

See Eng. Pat. 2027 of 1909; this J., 1910, 264.—T. F. B.

Electrode [for arc lamps]. E. Weintraub, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,093,957, April 21, 1914.

See Eng. Pat. 11,792 of 1912; this J., 1913, 415.—T. F. B.

Table photometers. Eng. Pat. 1239. *See* XXIII.

III.—TAR AND TAR PRODUCTS.

Patents.

Oils of the petroleum, tar and similar types; Apparatus for distilling ——. L. Steinschneider, Brünn, Austria. Eng. Pat. 8758, April 14, 1913.

The apparatus is for distilling oils under a high vacuum. The gases from the still are drawn through a tube condenser, and then through a liquid seal to the barometric condenser and vacuum pump. By varying the depth of the seal, the degree of vacuum in the still can be adjusted as desired. The oil condensed in the tube condenser passes through a cooling coil to a vessel connected with the vapour conduit leading to the barometric condenser, so that the vapours given off from this distillate are withdrawn. This vessel is connected with the distillate pump and has a branch-pipe through which the distillate can be passed directly to the receiving tank instead of through the pump.—A. T. L.

1-*Chloro-anthraquinone; Process for preparing nitro and chloro derivatives of* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,681, Aug. 12, 1911. Addition to Ger. Pat. 267,544 (see this J., 1914, 70).

NITRO-ANTHRAQUINONESULPHONIC acids or anthraquinonedisulphonic acids or their salts are heated with thionyl chloride. Sulphochlorides are obtained as intermediate products, from which sulphur dioxide is eliminated, with the formation of the corresponding nitrochloro or dichloro derivative.—T. F. B.

Sulphonaphthylated aromatic p-diamines; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,821, March 14, 1911.

AN aromatic *p*-diamine is condensed with an aminonaphthalenesulphonic acid, with or without addition of a solvent or suspending agent. The products appear to consist mainly of the monosubstituted compounds of the type, $NH_2.R.NH.C_{10}H_6.SO_3H$, which are valuable azo dyestuff components; the disulphonaphthyl derivatives are only produced in small quantity.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Sulphur; Action of —— *on amines. Part II. Aniline.* H. H. Hodgson and A. G. Dix. Chem. Soc. Trans., 1914, **105**, 952—956.

THE resinous mass which is the chief product of the action of sulphur (25 grms.) on aniline (50 grms.) and aniline hydrochloride (25 grms.) at 185°—190° C. for 3 to 4 hours, consists largely of trithioaniline $S_3(C_6H_4.NH_2)_2$. This was isolated as its sulphate by extraction of the mass with hydrochloric acid, addition of sulphuric acid, and precipitation by gradual addition of aqueous caustic soda solution (yield 71 grms.). On diazotisation and combining with the usual components it yielded dyestuffs possessing good fastness. The hydrochloride and a crystalline oxalate and benzoyl derivative are described. —G. H. F.

1.2.3.4.-*Tetrachloroquinizarin.* H. Hövermann. Ber., 1914, **47**, 1210—1213.

CONTRARY to the statement in Ger. Pat. 172,105, tetrachlorophthalic acid can be condensed with quinol under suitable conditions. When the constituents are heated to 195°—230° C. with boric acid, dihydroxybenzoyltetrachlorophthalic acid is first formed, and this is converted into 1.2.3.4.-tetrachloroquinizarin by heating the boric acid melt with concentrated sulphuric acid to 150°—165° C. The product dissolves in alkalis with a cornflower-blue colour and does not dye on the ordinary mordants. Heating to 250° C. with lime water and copper powder converts it into dichlorotetrahydroxyanthraquinone, in which the newly introduced hydroxyl groups probably occupy α-positions. This product dyes on mordants in shades similar to those of Brazil wood. Tetrachloroquinizarin reacts with *p*-toluidine to give 2.3.4-trichloro-1-*p*-toluidinoquinizarin, which is soluble in alkalis with a dark blue-violet colour.—J. B.

Carminic acid. C. and H. Liebermann. Ber. 1914, **47**, 1213—1219.

A CRITICISM of the recent work of Dimroth and his collaborators (Annalen, 1913, **399**, 1, 43, 62), arguments being deduced against the conclusion that carminic acid is an anthraquinone derivative, namely methylhydroxyanthraquinonecarboxylic acid. The solubility of carminic acid in water is without parallel amongst the hydroxyanthraquinones, except as glucosides or sulphonic acids. There is no parallel in the anthraquinone series for the peculiar behaviour of carminic acid in yielding water when heated above 145° C. with formation of a water-insoluble dyestuff, which cannot be reconverted into carminic acid. The yield of anthracene hydrocarbons obtained by the distillation with zinc dust is very small. A new derivative of carminic acid, the anhydride, $C_{22}H_{20}O_{12}$, has been obtained by the action of thionyl chloride. It is a red powder, insoluble in water and alcohol, and it can be reconverted into carminic acid by the action of alkali, differing in this from anhydrocarminic acid.—J. B.

Osage Orange; The value of —— *as a dyestuff.* F. W. Kressmann. Textile Colorist, 1914, **36**, 97—98.

THE dyestuff of the wood of the Osage Orange tree appears to be composed of morin and maclurin, as in the case of fustic. The extractive matter is almost identical with that of fustic in quality and quantity, and the 25,000 tons of mill waste produced annually in the United States might under certain conditions compete with fustic.—J. B.

Isocurcumin; Synthesis of an ——. G. Heller. Ber., 1914, **47**, 887—890.

VANILLIN was condensed with acetylacetone in presence of alcoholic hydrogen chloride, yielding a mixture of substances from which a product isomeric with curcumin was isolated. This so-called isocurcumin appears to consist of a mixture of stereoisomerides.—J. R.

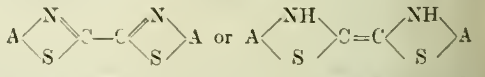
PATENTS.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin u. Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat 10,291, May 1, 1913.

THE products obtained by treating acetylamino-anthraquinones with acid chlorides (see Eng. Pats. 29,750 of 1906 and 9657 of 1907; this J., 1907, 1135; 1908, 556) are converted into deep red-brown to yellow-brown vat dyestuffs by treatment with dehydrating agents, for example sulphuric acid. The reaction may also be brought about by more energetic treatment with acid chlorides themselves, in which case it is possible to start directly from the acetylamino-anthraquinone or even from the aminoanthraquinone, the acetylation and the two steps of the reaction being performed in one operation. The reaction is complete when no further change takes place on heating the product with 97 per cent. sulphuric acid at 160° C. for two hours.—J. B.

Colouring matters of the anthraquinone series; Manufacture of compounds and ——. J. Y. Johnson, London. From Badische Anilin u. Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 21,027, Sept. 17, 1913.

VAT dyestuffs dyeing generally lemon-yellow shades and having the probable constitution



where A represents an anthraquinone residue, are produced by treating an *o*-halogen-acetylaminoanthraquinone with sulphur or a substance capable of yielding sulphur, or alternatively by treating an *o*-aminoanthraquinone mercaptan with a compound capable of introducing the oxalic acid residue, *e.g.*, oxalyl chloride.—J. B.

Acridones and thioxanthones of the anthraquinone series, Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 272,297, Feb. 7, 1913.

oa'-DIHALOGENANTHRAQUINONYLARYL ketones are treated with sulphamides, sulphides, or sulphydrates, or analogous

Compounds, preferably in presence of a diluent, a catalyst, and a substance which will combine with acid.—T. F. B.

Azo dyestuffs ; Production of new ——. P. A. Newton. From Farbenfabriken vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,380, May 2, 1913.

DISAZO dyestuffs dyeing cotton red to brown shades which become fast to washing and light by after-treatment with formaldehyde are formed by combining tetrazotised diaminodiphenylureas with one mol. of resorcinol and one mol. of an aminonaphtholsulphonic acid or a derivative thereof, *e.g.*, 2.8.6-, 2.5.7-, or 1.8.4-aminonaphtholsulphonic acids or their acetyl, benzoyl, or imidazole derivatives.—J. B.

Purpurincarboxylic acid ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 272,301, March 11, 1913. Addition to Ger. Pat. 260,765.

1.4-DIHYDROXYANTHRAQUINONE-3-CARBOXYLIC acid is used in place of 1.2-dihydroxyanthraquinone-3-carboxylic acid in the process described in the principal patent (see Eng. Pat. 29,506 of 1912 ; this J., 1913, 593). The first product of the oxidation appears to be 2-hydroxyanthradiquinone-3-carboxylic acid ; by prolonging the fusion, or by adding a reducing agent, or by pouring the melt into aqueous bisulphite solution, it is converted into the known 1.2.4-trihydroxyanthraquinone-3-carboxylic acid.—T. F. B.

Disazo dyestuffs ; Process for preparing mordant ——. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy. Ger. Pat. 271,445, Jan. 19, 1913.

THE disulphonic acids of thioaniline or of *p*-diaminophenyl ether are diazotised and combined with salicylic acid or *o*- or *m*-cresotinic acid. The products give yellow dyeings on wool, which are fast to potting and milling after chroming. They may also be used for printing cotton goods on account of their solubility and ease of fixation and the fastness of their chrome lakes.—T. F. B.

Anthraquinone derivatives containing sulphur ; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 271,947, June 5, 1913.

ANTHRAQUINONE-IMINES which do not contain substituents in the o-positions to the imino-group necessary for the formation of *p*-thiazines, are treated with sulphur chloride or solutions of sulphur in sulphur chloride. The products are *p*-thiazines of the anthraquinone series ; some of them are vat dyestuffs whilst others are easily converted into vat dyestuffs.—T. F. B.

Triphenylmethane dyes ; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,488, Aug. 28, 1913. Under Int. Conv., Aug. 30, 1912.

EE Fr. Pat. 461,810 of 1913 ; this J., 1914, 195.—T. F. B.

ulphur [sulphide] dye ; Green ——. J. Flachslaender and K. P. Grälert, Elberfeld, and M. Buff, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,093,259, April 14, 1914.

EE Ger. Pat. 254,304 of 1911 ; this J., 1913, 189.—T. F. B.

zo dyestuffs and their production. H. Levinstein and J. Baddiley, Assignors to Levinstein, Ltd., Blackley. U.S. Pat. 1,092,842, April 14, 1914.

EE Eng. Pat. 12,281 of 1911 ; this J., 1912, 634.—T. F. B.

nthraquinone dyes and process of making them. M. H. Isler and O. Bally, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 1,093,427, April 14, 1914.

E Ger. Pat. 259,370 of 1912 ; this J., 1913, 593.—T. F. B.

Nitrobenzene-diazonium derivatives ; Stable ——. O. N. Witt, Westend, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,093,567, April 14, 1914.

SEE Eng. Pat. 11,290 of 1913 ; this J., 1913, 821 —T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Pyrites ; Seleniferous —— *and its use in the manufacture of sulphite pulp.* J. C. Torgersen and C. Bay. Papierfab., 1914, 12, 483—484.

SELENIUM is always present in iron pyrites in proportions, relatively to the sulphur, ranging from 1 per 10,000 to 1 per 100,000. On roasting, the selenium is volatilised as selenium dioxide, but is finally found in the acid as elementary selenium. Under certain circumstances much harm may be done. Experiments in practice with two varieties of pyrites, both containing the same quantity of selenium, but one a dusty sort and the other free from dust, proved that it is not directly the presence of selenium which causes trouble but the simultaneous presence of dust. With very dusty sorts of pyrites it is impossible to eliminate all the flue dust by means of scrubbers, and this dust, consisting of iron oxide, may act as an energetic contact substance promoting the catalytic destruction of the sulphurous acid or calcium bisulphite by the selenium. This action is recognised by a sudden fall in the sulphurous acid and lime-contents of the digester liquor after the digestion has proceeded for some time. The sulphuric acid thus formed attacks the cellulose. Since the ill effects of the selenium are promoted both by a high temperature and long duration of digestion, the above defects are most noticeable in the manufacture of "high-boiled" bleaching pulp.—J. F. B.

Papers ; Durability of high-grade ——. W. Herzberg. Papierfab., 1914, 12, 478—479.

HJELMSÄTER (Papierfab., 1912, 10, 686, 1459) exposed a number of papers, both animal-sized and rosin-sized, to full sunlight from June to August, and then tested the deterioration produced. In all the papers, including even the tub-sized hand-made papers, the exposure to light and air produced a profound deterioration in the resistance to folding ; in many cases this had fallen to 5 per cent. of the original value. The sizing-resistance to ink had disappeared in all cases. The papers belonging to Normal class 1, both the animal-sized papers and those doubly sized (both animal and rosin sizes) showed only a slight darkening in colour ; the rosin-sized samples were much discoloured. It was concluded that the deterioration in resistance to folding produced by exposure was in some way connected with the destruction or decomposition of the sizing. From tests in which papers were steeped in solutions of aluminium sulphate, potassium sulphate and aluminium acetate and then exposed to light, the author concluded that the deterioration was brought about by the presence of aluminium sulphate ; aluminium acetate had no ill effect. Herzberg points out that in the tests recorded, those papers containing only very small quantities of aluminium salts proved no more resistant than those samples containing comparatively large proportions, so that a directly injurious influence of aluminium sulphate cannot be inferred. The fact that the introduction of a large excess of this salt into the paper was found to be injurious does not prove that papers containing normal quantities are similarly affected.—J. F. B.

Papers produced from different kinds of deciduous and coniferous woods by the soda and sulphite processes ; Comparison of ——. C. Beadle and H. P. Stevens. Paper-Maker, 1914, 47, 397—403.

COMPARATIVE tests were made with papers manufactured from bleached and unbleached pulps prepared from seven deciduous woods by the soda process and from fifteen coniferous woods by both the soda and the sulphite processes. The average results for the papers from the different classes of pulp are shown in the following table :—

Pulps.	Length of fibre in mm.	Thickness of paper in mm.	Substance in grms. per sq. m.	Breaking strain in lb. per inch width.	Breaking length in metres.	Total elongation at break.	Permanent elongation at break.	Bursting strain, corrected to uniform substance of 100 grms. per sq. m., in lb. per sq. in.
Broad-leaf, soda :								
Unbleached	1·27	0·17	103	4·5	727	2·5	1·9	9·6
Bleached	1·17	0·14	87	5·6	1178	2·9	2·0	12·8
Coniferous, soda :								
Unbleached	2·72	0·13	79	12·5	2785	3·4	2·1	32·2
Bleached	2·37	0·12	78	13·2	3026	3·5	1·7	27·4
Coniferous, sulphite :								
Unbleached	2·55	0·12	82	8·3	1928	2·9	1·9	22·9
Bleached	2·44	0·12	85	10·8	2384	3·0	1·8	23·0

(See also this J., 1913, 1103.)—A. S.

Patents.

Silk ; Treatment of waste —— or other fibres to increase their coefficient of friction on each other. W. E. Muntz, London. Eng. Pat. 8278, April 8, 1913.

Waste silk or other fibres which cannot be spun owing to lack of cohesion and shortness of staple, are treated with a solution capable on evaporation of leaving a deposit which will increase the coefficient of friction of the fibres on each other. A solution of rubber in pure carbon bisulphide may be used for this purpose, the material being treated in bulk before spinning, or the yarn itself treated after first spinning loosely.—J. B.

[Drying] Textile materials with elastic fluids ; Apparatus for treating ——. Pulsometer Engineering Co., Ltd., Reading, and T. G. Marlow, London. Eng. Pat. 8794, April 14, 1913.

An apparatus for drying rags or the like consisting of a revolving cylinder fitted inside with lifting plates which overlap and are of a yielding or springy nature. The cylinder is mounted on a set of supporting rollers near the centre and is capable of expansion in opposite directions. —J. B.

Fur ; Preparing —— for felting. E. Tweedy, Assignor to E. R. Tweedy and Matteawan Manufacturing Co., New York. U.S. Pat. 1,085,391, Jan. 27, 1914.

Fur, either on the skin or cut, is treated, preferably in a closed chamber, with ozone in order to render it capable of felting, this process replacing the usual "carroting" with mercury nitrate solution.—J. B.

Grease [from textiles] ; Process and apparatus for the continuous extraction of ——. H. Gohy. Fr. Pat. 465,097, Aug. 30, 1913. Under Int. Conv., Aug. 31, 1912.

The material (particularly textile fabric) is made to pass continuously through an apparatus with two communicating compartments. In the first the fat is extracted by a current of hot solvent circulating in the opposite direction, whilst in the second the material, after passing between rollers, is freed from solvent by a current of hot air or gas, the expelled solvent being led to a condenser. —C. A. M.

Paper ; A process for drying ——. E. P. Butts, Springfield, Mass. U.S. Pat. 1,094,195, April 21, 1914.

The air used in drying paper is first saturated with water at a definite temperature and then heated to a definite higher temperature after which it is brought into contact with the paper.—J. B.

Cellulose formates and process of making same. O. Bonhoeffer, Elberfeld, and H. Guntrum, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,093,247, April 14, 1914.

See Fr. Pat. 422,542 of 1910 ; this J., 1911, 532.—T. F. B.

Artificial horsehair ; Process of manufacturing ——. C. M. Sanlaville, Le Coteau, France. U.S. Pat. 1,093,295, April 14, 1914.

See Fr. Pat. 435,989 of 1911 ; this J., 1912, 381.—T. F. B.

Producing fermentable sugars [from sawdust]. Eng. Pat. 14,938. *See* XVII.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Aniline Black ; Thermal relationships in the formation of —— on the fibre. F. Erban. Oesterr. Chem.-Zeit., 1914, **17**, 83—87.

A description of some experiments on the dyeing of Aniline Black on tightly packed material (cops and stockings). The material was padded with a chlorate-vanadium black liquor and placed in a closed vessel in a room the temperature of which can be regulated. Observation of the temperature inside the material showed first a gradual and then a rapid rise until a maximum was reached, followed by a gradual falling off during some days. This spontaneous oxidation was dependent on the amount of vanadium present and was also influenced by the degree of dampness and the compression of the material. The rise in temperature was not harmful but on the contrary was necessary for the formation of a useful black. The conditions to be observed were a gradual approach to the critical temperature at which reaction sets in, by careful regulation of the heating of the oxidation chamber, and then, when spontaneous oxidation set in, an avoidance of drying by evaporation of the outer portions of the mass, whereby unevenness and tendering would be caused, also streakiness on the edges owing to moisture condensing on the walls of the vessel, causing local washing out of the base. When the material was loosely packed the temperature rose more quickly and the reaction was accelerated, but, owing to more rapid cooling, a lower maximum temperature was reached.—J. B.

Para-diamines ; The affinity of —— for fibres. I. Franêk. Rev. Gén. Mat. Col., 1914, **18**, 129—133.

When wool, oiled cotton or cotton mordanted wit antimony tannate is treated with a boiling solution o benzidine hydrochloride, the diamine is fixed on th fibre but unmordanted cotton and cotton mordante with aluminium oleate remain unaffected. The bas thus fixed, on diazotising and developing with β-naphtho gives a strong colouration, red-brown on the mordante cotton and red on the wool. The colour is quite differen from that obtained by combining tetrazotised benzidin with 2 mols. of β-naphthol, which is a deep brow It is concluded that one amino group only of th benzidine is diazotised and a mono-azo dyestu produced, the other amino group being attache to the fibre or to the mordant. Other shades can produced on wool by the use of various developers, *e.g.*, 2-amino-8-naphthol-7-sulphonic acid gives a brownish yellow shade of red, aminonaphthol ether a blue, *m*-toluylenediamine a fine red-brown and aminodiphenylamine an olive. Mono-amines (*e.g.*, aniline, amino-acetanilide) can be fixed on wool but cannot be diazotised on the fibre; *m*- and *p*-diamines behave similarly to benzidine on wool. An aminoazo compound (*e.g.*, Aniline Yellow) behaves like a simple mono-amine and cannot be diazotised on wool, while diamino-dibenzeneazodiphenyl develops like other diamines. In the author's opinion a diamine is fixed on wool in a manner analogous to the dyeing of basic dyestuffs, *i.e.*, viewing wool as an amino acid, the acid part of the radical combines with one of the amino groups of the diamine. This explains why one amino group only of the diamine is diazotisable.—J. B.

PATENTS.

Dyeing and drying wool, hair, rags, cotton and other fibres; Apparatus for washing, sterilising, and drying wool, hair, or rags, or for ——. W. Crowther, Bradford. Eng. Pat. 7648, April 1, 1913.

AGITATION of the material is caused by means of compressed air, forced in below the perforated false bottom of an ordinary dye-tub. An upright pipe reaching below the false bottom and delivering above the surface of the material causes an additional circulation of the liquor. Hot or cold air is used as required. After running off the liquor the material is dried and sterilised by compressed air at 230° F. (110° C.).—J. B.

Dye-vats; Method of supplying dye-compounds to ——. T. Southwell, Halifax. Eng. Pat. 7711, April 2, 1913.

THE colour, etc., is admitted to the steam pipe from which it is ejected by the steam into the dye-vat in a uniform manner. (Reference is directed to Eng. Pat. 11,402 of 1899; this J., 1899, 913.)—J. B.

Dyeing machine. W. J. Mellersh-Jackson, London. From F. J. Muir, Winchester, Mass., U.S.A. Eng. Pat. 8971, April 16, 1913.

A PRESSURE dyeing apparatus in which a basket having perforated bottom, periphery and central pipe rests on the conical bottom of the closed outer casing in such a way as to leave separate spaces between the bottom and periphery respectively of the basket and the outer casing. The circulating pump is connected independently with the bottom chamber, the peripheral chamber and the central pipe so that the circulation can be directed at will into that part of the basket where it is most required. The perforations are of gradually decreasing size towards the top of the apparatus, the central and peripheral portions of the cover of the basket are non-perforated and detachable perforated horizontal pipes are fitted between the central pipe and the peripheral wall of the basket, in order to promote uniform dyeing.—J. B.

Dyeing and otherwise treating textiles; Rotary apparatus for ——. R. P. Smith and G. E. Drum, Philadelphia, Pa., U.S.A. Eng. Pat. 9576, April 23, 1913.

THE material is carried in a rotary drum having non-perforated ends and radial partitions and perforated inner and outer walls. The drum is mounted to revolve within the dye vat, and the dye-liquor is circulated through the material in each radial compartment first in one direction and then in the reverse direction during a single rotation of the drum, the circulation being effected by blades mounted radially on an axle which revolves inside the inner wall of the drum and in a direction opposite to that of the drum.—J. B.

Aniline Black; Process and apparatus for continuous chroming in dyeing ——. J. P. Bemberg, Akt. Ges., Barmen-Ritterhausen, Germany. Eng. Pat. 21,930, Sept. 29, 1913. Under Int. Conv., Oct. 30, 1912.

INSTEAD of the usual chroming on the jigger, the cloth, after padding and oxidation, is successively saturated with a chroming liquor, squeezed, and passed through an air way, this sequence of operations being repeated as often as is necessary. The apparatus consists of a succession of chroming troughs arranged in steps, fresh liquor being supplied to the first trough according to the rate at which it is removed from the last one. After the material has passed through the first trough, it is squeezed, passed through the ager, and then into the second trough, and so on.—J. B.

Pictures; Process of transferring —— *to bases of linen, wood, and the like.* A. Christiansen, Lübeck, Germany. Eng. Pat. 29,026, Dec. 16, 1913.

PICTURES are transferred to a new base by first applying a mixture of collodion (47), celluloid varnish (47) and oil of juniper (6 per cent.), which stiffens the film of colouring matter, then immersing in a solution (*e.g.* soda) which softens its existing base, transferring the colour film to a temporary carrier, removing the original backing and finally securing the picture to the new base by an adhesive. —J. B.

Printing on fabrics; Process for ——. K. Gross. Ger. Pats. 272,526 and 272,527, Feb. 28 and Sept. 3, 1913.

(1) THE goods are treated with an alkali and a reducing agent and then printed with a "reduction dyestuff" in the form of a lithographic ink or printing ink, or they are first printed and then treated with an alkali and a reducing agent; in either case the colour is fixed by steaming. The resulting prints are fast to washing and rubbing. (2) The goods are treated with alkali and then printed with a lithographic or printing ink containing the dyestuff or its leuco-compound and a reducing agent, and finally steamed. The sparingly soluble, stable hydrosulphite compounds may be used as the reducing agent.—T. F. B.

Coloured reserve-effects under vat dyestuffs; Process for producing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 272,685, May 8, 1913.

VAT dyestuffs can be divided into two groups according to their behaviour in presence of a mixture of dextrose and an easily reducible organic substance (nitro compounds or anthraquinone derivatives); one group is fixed on the fibre under these conditions whilst the other group is reserved. This process for producing coloured reserve effects consists in applying to the fibre one dyestuff from each of the above groups in presence of a mixture of dextrose and a reducible organic compound.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Iodides; Direct iodometric determination of soluble ——. W. Stüwe. Apoth.-Zeit., 1914, 29, 382.

THE iodide is decomposed by adding an excess of potassium iodate and acidifying with dilute nitric acid. The free acid is then neutralised by barium carbonate, the previous addition of a small quantity of alcohol being recommended to prevent foaming and consequent loss of iodine. To the neutral solution potassium iodide is added to bring the precipitated iodine into solution, the excess of barium carbonate is allowed to settle, and the iodine determined by titration of an aliquot portion of the clear solution with standard thiosulphate. Five-sixths of the iodine indicated represents that present originally as iodide. The method is applicable in the presence of chlorides, but not of bromides.—G. F. M

Pyrites and sulphuric acid in the United States; Production of —— *in* 1913. W. C. Phalen. Oil, Paint, and Drug Rep., April 27, 1914. [T.R.]

THE production of pyrites in the United States in 1913 was 341,338 long tons, valued at $1,286,084. In 1912, the output amounted to 350,928 tons, valued at $1,334,259. The output of by-product pyrites, obtained in connection with coal mining, fell off materially. The imports of pyrites during 1913 were 850,592 tons, and in 1912 970,785 tons.

According to returns for the year 1913 the production of sulphuric acid in the United States was 3,538,980 short tons of 50° acid, valued at $22,366,482. This does not include a small amount of fuming acid but includes by-product acid obtained in the smelter industry. The acid produced at copper and zinc smelters in 1913 amounted to 790,296 short tons of 50° acid, valued at $4,346,272. The production of acid by grades is tabulated in detail below :—

Grade.	Quantity. tons.	Value.
50° B.	1,643,318	$9,212,917
60° B.	509,929	3,202,528
66° B.	797,104	9,282,422
Other grades	63,158	986,659
Total	3,013,509	$22,684,526
Total reduced to 50° B. acid.*	3,538,980	$22,366,482

*Exclusive of a small amount of fuming acid.

Rare earths ; Some errors in the determination of the —— as hydroxides. T. O. Smith and C. James. Chem. News, 1914, **109**, 219—220.

The determination of the rare earths by precipitation with ammonia or sodium hydroxide, and weighing as oxide, gave higher results than those obtained by precipitating as oxalate. The amount of hydroxide added in excess also influenced the result, and the higher values given by this method are ascribed to the carrying down of sodium by the precipitate and to the formation of basic salts. By the oxalate method perfectly concordant results were obtained.—G. F. M.

Sulphur in spent oxide ; Determination of —— by combustion. C. W. Somerville. J. Gas Lighting, 1914, **126**, 241—242.

The sulphur is burnt in a stream of oxygen, the sulphur dioxide absorbed in alkali, and the alkaline sulphite solution oxidised with hydrogen peroxide, the sulphate being then determined either by titrating the excess of alkali with acid, or as barium sulphate. A simple apparatus is described. The combustion vessel is a vertical glass cylinder, in which is placed a crucible containing the spent oxide. The oxygen is led through a vertical tube to the interior of the crucible, in which the oxide is ignited. The determination can be completed in 20 to 25 minutes, the results agree within 0·5 per cent. and show a yield of sulphur 0·3 to 1 per cent. higher than by extraction with carbon bisulphide.—A. T. L.

China clay : Adsorptive power of ——. P. Rohland. Kolloid-Zeits., 1914, **14**, 193—195.

According to Carli (Z. physik. Chem., 1913, **85**, 2). colloidal ferric hydroxide is not appreciably adsorbed by kaolin. The author points out that some kaolins become plastic and acquire adsorptive power only after prolonged contact with water, whereby colloids, principally hydroxides of aluminium and silicon, are formed. A kaolin from Hohburg, Saxony, adsorbed colloidal ferric hydroxide almost completely. This kaolin consisted of : clay substance 96, felspar 1, and quartz 3 per cent., and yielded the following results on analysis ; loss on ignition, 12·67 ; SiO_2, 49·96 ; Al_2O_3, 36·33 ; Fe_2O_3, 0·72 ; CaO, traces ; K_2O, Na_2O, 0·34 per cent.—A. S.

Reactions in reversed flames. II. Reduction of liquid anhydrous chlorides of groups 3—5 of the periodic system in the reversed chlorine-hydrogen flame. F. Meyer and H. Kerstein. Ber., 1914, **47**, 1036—1049.

Experiments of a similar character to those described previously (this J., 1912, 1030) with an improved apparatus have been made. The previous results were confirmed and the yield of titanium trichloride from the tetrachloride was increased to 70 per cent. by using a very rapid current of hydrogen. Boron chloride and silicon tetrachloride were not reduced. Carbon tetrachloride gave a deposit of finely divided, very voluminous carbon (C 94·6 per cent.) containing small proportions of chlorine and hydrogen which could not be removed by heating in a vacuum at 600° C. ; the carbon readily yielded mellitic acid when oxidised with fuming nitric acid. Phosphorus pentachloride gave a red product (P 92—94 per cent.) very similar to Schenck's scarlet phosphorus. Antimony pentachloride gave a greyish black powder consisting of about 93 per cent. of black antimony and 7 per cent. of the trichloride. Vanadium tetrachloride gave a very voluminous violet powder consisting of VCl_2 about 80 and VCl_3 20 per cent.—A. S.

Carbides of uranium and thorium ; Composition of the gaseous mixtures produced by the action of water on ——. P. Lebeau and A. Damiens. Bull. Soc. Chim., 1914, **15**, 367—370.

The experimental results are shown in the following table :—

	Uranium carbide.			Thorium carbide.	
	(1)	(1)	(2)		
Duration of reaction, days	6½	15	23	3	3½
Volume of gas per grm. of carbide, c.c.	35·65	34·97	32·09	55·30	56·20
Composition of gas, per cent :					
Hydrogen	49·70	49·53	28·91	59·77	59·46
Methane	14·15	11·81	19·79	3·09	3·16
Ethane	23·43	24·89	22·68	10·66	10·72
Propane	2·97	2·51	5·55	1·66	1·36
Butane	0·90	0·62	4·73	0·83	0·86
Ethylene	2·18	2·34	1·36	2·71	2·85
Propylene and homologues	5·34	5·79	14·43	6·72	6·37
Acetylene hydrocarbons	1·33	2·51	2·55	15·16	15·22

Sample (1) of uranium carbide contained 1·47 per cent. of graphite ; sample (2) contained U 91·6 per cent. and was free from graphite. The thorium carbide contained Th 88·11 per cent., combined carbon 9·21, and graphite 3·09 per cent.—A. S.

Nitrogen ; The "active" modification of ——. H. B. Baker and R. J. Strutt. Ber., 1914, **47**, 801—804. (See also this J., 1914, 311.)

A reply to Tiede and Domcke's assertion (this J., 1914, 76) that the after-glow characteristic of "active" nitrogen depends upon the presence of traces of oxygen and that it is not given by nitrogen prepared from potassium azide. Experiments are described showing that nitrogen which had been stringently purified from oxygen still exhibited the phenomenon, as did also nitrogen prepared from potassium azide.—J. R.

Nitrogen ; The active modification of ——. II. H. B. Baker and R. J. Strutt. Ber., 1914, **47**, 1049—1055. (See also preceding abstract.)

Contrary to the statement of Tiede and Domcke (this J., 1914, 254), commercial nitrogen from a cylinder still gives the after-glow characteristic of active nitrogen even after it has been purified by copper heated to 400° C. The existence of active nitrogen has been proved conclusively by its action on various metals with formation of nitrides and on organic compounds with formation of hydrogen cyanide.—A. S.

Tellurium and selenium ; Action of sodium hydrosulphite upon ——. L. Tschugaeff and W. Chlopin. Ber., 1914, **47**, 1269—1275.

Sodium telluride is conveniently obtained by heating at 70°—80° C., sodium hydrosulphite (or better, because more stable, rongalite, a double compound of formaldehyde and sodium sulphoxylate, $CH_2(OH).OSONa$ with finely divided tellurium in alkaline solution, either in closed tubes or in an atmosphere of hydrogen, until the violet colour first formed has disappeared. On cooling sodium telluride crystallises out. The mechanism of the reaction is probably as follows:—

$$OS(ONa)Na \xrightarrow{Te} OS(ONa)TeNa \xrightarrow{2NaOH} Na_2Te + Na_2SO_3 + H_2O.$$

The Na_2Te then dissolves tellurium to form violet polytellurides, which are again reduced by the hydrosulphite: $Na_2Te_2 + Na_2S_2O_4 + 4NaOH = 2Na_2SO_3 + 2Na_2Te + 2H_2O$. From sodium telluride benzyl telluride was prepared, and he above reactions were extended with similar results to elenium.—G. F. M.

Boron; Hydrides of ——. IV. Hypoborates resulting from the interaction of gaseous hydrides of boron and bases. A. Stock and E. Kuss. Ber., 1914, **47**, 810—826.

HE hydrides, B_4H_{10} and B_2H_6, are absorbed by very conentrated aqueous potassium hydroxide, and crystalline otassium hypoborate separates from the well-cooled olutions:

$$B_4H_{10}+4KOH=4KOBH_3+H_2.$$
$$B_2H_6+2KOH=2KOBH_3+H_2.$$

n dilute alkaline solution the hypoborate changes gradually nto metaborate and hydrogen is evolved. A similar change curs immediately upon acidifying:

$$KOBH_3+H_2O=KBO_2+5H.$$
$$KOBH_3+HCl+2H_2O=H_3BO_3+KCl+5H.$$

otassium hypoborate is stable in dry air. The freshly-eparad aqueous solution, which is alkaline in reaction, ssesses very marked reducing properties. Solutions of e salts of barium, magnesium, zinc, etc. yield precipitates a mixture of borate and hydroxide, while solutions of lts of silver, mercury, arsenic, etc. are reduced to the free ment. Copper sulphate solution yields a precipitate of pper hydride, and solutions of nickel salts give a highly aracteristic black deposit of nickel boride, Ni_2B. The ucture of the corresponding acid is given as $HO.B \vdots H_3$. —J. R.

d phosphorus; Formation of ——, by oxidation of phosphorus vapour. V. Kohlschütter and A. Frumkin. Ber., 1914, **47**, 1088—1100. (See also this J., 1914, 255.)

HEN oxygen is brought into contact with phosphorus pour at low pressures a dark-red, homogeneous, transent deposit is produced, which readily breaks down o red phosphorus and a compound containing the remain- phosphorus and all the oxygen present in the original sit.—J. R.

orimetric method for detecting and determining nitrates and nitrites. Letts and Rea. *See* XXIII.

Patents.

ali; Electrolytic production of —— using a mercury thode. L. T. S. Madsen. Ger. Pat. 272,476, July 8, 13.

A OLUTION of salts of several alkali metals is used as trolyte, whereby an amalgam richer in alkali metal be obtained. The process is specially applicable e mixture of potassium and sodium chlorides produced tassfurt.—A. S.

gen; Process for fixing —— by means of ferro-aluminium. Soc. Générale des Nitrures, Paris. Eng. Pat. ,030, Nov. 24, 1913. Under Int. Conv., June 7, 1913.

RO-ALUMINIUM, which may contain other elements or., titanium, etc.), is treated with nitrogen or gases ining it at a high temperature. The product contains inium nitride, and ammonia or ammonia and alumina be obtained from it by known methods.—F. Sodn.

Nitride of iron; Manufacture of —— and, in general, of metallic nitrides, especially for use as fertilisers, or as a source of production of ammonia. J. Margoles. Fr. Pat. 465,265, Nov. 24, 1913.

An oxide or other compound of a metal (especially iron) is submitted, at a high temperature (500°—1200° C.), to the action of atmospheric nitrogen, in the presence of hydrogen (prepared, for example, by electrolysis) or a gaseous mixture containing hydrogen. The nitride obtained may be treated with steam, to regenerate the metallic oxide and produce ammonia. By adding carbon, cyanides, cyanamides, or (when using sulphides) thiocyanates can be obtained. —F. Sodn.

Nitrogen compounds [from carbides]; Process and apparatus for the preparation of ——. C. Krauss, P. Stähelin, and Akt.-Ges. für Stickstoffdünger. Fr. Pat. 464,750, Nov. 11, 1913.

Carbide is transported by mechanical means through a horizontal tubular furnace, divided into preheating, heating, reaction, and cooling sections, whilst a current of nitrogen is passed in the opposite direction. Or, superposed layers of carbide are exposed in a furnace comprising a series of intercommunicating chambers, each of which constitutes in turn a heating, reaction, and cooling unit, the circulation of gas being so arranged that cold nitrogen can be admitted directly into each chamber, and any excess of gas passed from one chamber to the next. In both forms of furnace the temperature is controlled, partly by external means and partly by the admission of cold nitrogen.—F. Sodn.

Oxides of nitrogen; Production of —— by oxidation of ammonia in presence of catalysts. Badische Anilin und Soda Fabrik. Fr. Pat. 464,237, Oct. 29, 1913. Under Int. Conv., Jan. 30, 1913.

The reacting gases are filtered or otherwise treated to remove suspended particles immediately before entering the contact chamber, or, after being rendered free from dust, they pass on their way to the catalyst, only through apparatus made of nickel or other metal yielding no particles to them.—F. Sodn.

Nitrogen and oxygen [by surface combustion]; Preparation of compounds of ——. C. Krauss and P. Staebelin. Fr. Pat. 465,045, Nov. 18, 1913. Under Int. Conv., July 26, 1913.

Liquid or gaseous fuel, mixed with nitrogen and oxygen, is made to undergo surface combustion in a chamber filled with porous or granular refractory material, through which it is forced, the products being suddenly cooled (partly by expansion) and treated for the production of nitric acid by known methods. The refractory material may be mixed or coated with substances (such as rare earth oxides) which promote the reaction.—F. Sodn.

Silica, alumina, and bases; Method of manufacturing base-exchanging substances containing ——. Permutit Aktienges., Berlin. Eng. Pat. 1039, Jan. 14, 1914. Under Int. Conv., April 30, 1913.

Melts obtained in the manufacture of base-exchanging substances containing silica, alumina, and other bases are lixiviated with a solution containing active, amorphous silica, soluble colloidal silica, water-glass, or any substance containing silica capable of combination, or with a solution containing substances capable of precipitating silica, such as acids (of sufficiently low concentration to prevent excessive decomposition) or acid salts of alkali metals (*e.g.*, bisulphites or bisulphates).—F. Sodn.

Chlorates; Process of making [electrolytically] —— and apparatus therefor. G. Kolsky, Niagara Falls, N.Y. U.S. Pat. 1,092,369, April 7, 1914.

In a non-diaphragm cell for the electrolytic production of chlorates, a series of electrodes (preferably inclined) is disposed to provide an open or grid-like structure, through which the electrolyte may repeatedly circulate under the influence of the liberated hydrogen. Sufficient evolution of gas is maintained to induce active circulation and effect depolarisation, the lines of flow of the electrolyte passing electrodes of opposite polarity in rapid succession. —F. Sodn.

Compounds of chromic oxide; Manufacture of ——, starting with chromic acid or chromates. Chemische Fabriken vorm. Weiler-Ter Meer. Fr. Pat. 464,909, Nov. 13, 1913. Under Int. Conv., July 7, 1913.

Chromic acid or a chromate is reduced by means of glucose or other sugar in neutral or alkaline solution, with addition, if necessary, of sodium thiosulphate. For example, a mixture of 92 kilos. of sodium chromate, in 78 litres of water, 40 litres of glucose solution, and 22 kilos. of sodium thiosulphate is heated to 70°—80° C. The products are suitable for the preparation of normal or basic salts for use in mordanting and tanning.—F. Sodn.

Oxides and hydroxides of heavy metals; Process for obtaining —— practically free from basic salts. F. Cochlovius. Ger. Pat. 272,182, Feb. 2, 1913.

Solutions of salts of heavy metals, or wet precipitates of oxides or hydroxides, admixed with basic salts, are heated with a basic substance, such as quicklime, under pressure in an autoclave.—A. S.

Hydrogen; Process of generating ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,092,903, April 14, 1914.

A bed of fuel (*e.g.*, coke, with a small proportion of fluxing material), rendered white hot by a blast of air, is treated with heavy petroleum oil, which may also be applied to the refractory surface of the containing chamber. The gases produced during the period of "blowing" and the hydrogen formed in the gas-making stage are removed by means of steam, passed over but not through the bed of fuel.—F. Sodn.

Graphite; Chemical process of purification of natural ——. E. N. Lainé. Fr. Pat. 464,642, Jan. 17, 1913.

Crude graphite is treated with dilute acid (*e.g.*, hydrochloric acid) to extract carbonates and oxides, the washed and dried residue fused at a high temperature with sodium carbonate, sodium and potassium carbonates, or sodium hydroxide, and the product repeatedly washed with water (preferably at 80° C.), then with acidulated water, and finally with water again. The proportion of ash may be reduced from 40 to less than 1·5 per cent.—F. Sodn.

Oxides of nitrogen; Process of producing ——. H. Wolf. Assignor to Badische Anilin und Soda Fabrik. Ludwigshafen on Rhine, Germany. U.S. Pat. 1,094,182, April 21, 1914.

See Fr. Pat. 464,237 of 1913; preceding.—T. F. B.

Ammonia; Production of ——. C. Bosch, A. Mittasch, and H. Wolf, Ludwigshafen, and G. Stern, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat 1,094,194, April 21, 1914.

See Fr. Pat. 425,099 of 1910; this J., 1911, 1012.—T. F. B.

Nitrides such as that of aluminium; Process for the manufacture of ——. Soc. Générale des Nitrures, Paris. Eng. Pat. 21,366, Sept. 22, 1913. Under Int. Conv., Dec. 16, 1912. Addition to Eng. Pat. 11,091 of 1913, dated May 13, 1912.

See Fr. Pat. 457,723 of 1913; this J., 1913, 1010.—T.F.B.

Aluminium nitride; Process for the manufacture of ——. O. Serpek, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pat. 1,094,171, April 21, 1914.

See Eng. Pat. 8348 of 1912; this J., 1913, 875.—T. F. B.

Radio-active substances or vessels enabling large quantities of radio-active liquids to be obtained economically; Process for producing ——. H. Farjas, Paris. Eng. Pat. 14,530, June 23, 1913. Under Int. Conv., July 1, 1912.

See Fr. Pat. 456,990 of 1912; this J., 1913, 1028.—T. F. B.

Catalytic material [nickel suboxide] and process of producing the same. T. Boberg. Assignor to Techno-Chemical Laboratories, Ltd., London. U.S. Pat. 1,093,377, April 14, 1914.

See Eng. Pat. 4702 of 1912; this J., 1913, 705.—T. F. B.

Catalysts and the manufacture of hydrogen. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 8864, April 15, 1913. Addition to Eng. Pat. 27,955, Dec. 4, 1912.

See Fr. Pat. 459,918 of 1913; this J., 1914, 24.—T. F. B.

VIII.—GLASS; CERAMICS.

Porcelain; Observations on the burning of ——. R. Reindel. Sprechsaal, 1914, **47**, 285—287.

The behaviour of an experimental oven was studied by means of Seger cones, a pyrometer, a manometer, and analyses of the oven gases. The readings of the pyrometer showed higher temperatures than those indicated by cones, the difference amounting sometimes to 100° C at the beginning of the burn and diminishing at late stages. Temperature curves were not regular in thei ascent, but dropped at each addition of fuel. The draugh also varied from 25—50 mm. according to the conditio of the fire. Analyses of the fire-gases were conducte at cone 09a, the point at which they begin to influenc the character of porcelain. A content of 3—5 per cen CO is necessary at this temperature, but at cones 8 or 1 per cent. is sufficient to maintain the reducing characte of the oven atmosphere in regard to porcelain.—H. H. S.

Patents.

Oven with concentric chambers for the ceramic industr A. Charlier, Morialmé, Belgium. Eng. Pat. 10,39 May 2, 1913.

See Fr. Pat. 457,398 of 1913; this J., 1913, 1012.—T. F.

Production of gas-tight seals, or closures, between metal a vitreous material. Eng. Pat. 23,854. *See* XXIII.

IX.—BUILDING MATERIALS.

Patents.

Concrete; Waterproof —— and process of making same. R. K. Meade. Roland Park, Md. U.S. P 1,092,933, April 14, 1914.

Cementitious matter is mixed with "a powdered fill the particles of which have been previously coated wit thin film of mineral oil.—W. E. F. P.

Cement kilns, for transforming grey into white Portl cement; Rotary ——. M. Maguet. Fr. Pat. 464, Jan. 11, 1913.

A chamber supplied with reducing gas (from a produ is interposed between the rotary kiln and the co chamber. Ferric compounds are reduced in the redu atmosphere and re-oxidation is prevented by rapid co in an inert atmosphere (preferably by means of w or steam).—F. Sodn.

Cement mixtures; Method of lowering the sintering temperature of ——. Bruck, Kretschel und Co. Ger. Pat. 272,171, March 16, 1913.

The fine material separated in the purification of blast-furnace gas is added to the mixture of cement raw materials. —A. S.

Gypsum; Gas kiln for the burning of ——. C. M Stein et Cie. Fr. Pat. 464,613, Jan. 17, 1913.

A combustion chamber is provided at one end with a row of burners, at the other with an opening for charging and discharging. The burners are connected with controlled supplies of air and gas from a producer, and the supply of the latter is cut off before the gypsum is introduced into the heated kiln.—F. Sodn.

Wood or analogous fibrous material; Impregnation and colouration of ——. L. S. Bache. Fr. Pat. 464,791, Oct. 27, 1913.

The dried material is treated with a boiling mixture of a aturated hydrocarbon, wax, resin, stearic acid, and a olouring matter soluble in the mixture (preferably, equal weights of carnauba wax and resin, with an excess of araffin of m.pt. 40°—60° C.), until, by increase of density, t tends to sink in the bath. Impregnation is uniform, nless there be imperfection of structure, due to dry rot, tc., which is thus rendered apparent. The product nay be applied in the manufacture of antifriction bearings "*coussinets et surfaces portantes*"] which are permanently elf-lubricating.—F. Sodn.

ood; Process for preserving and fireproofing —— by impregnating with solutions of ammonium and magnesium salts and an antiseptic. Grubenholzimprägnierung Ges. m. b. H. Ger. Pat. 271,797, Nov. 16, 1912. Addition to Ger. Pat. 247,694.

he salts of nitrohydroxy-hydrocarbon-sulphonic acids re used as preservatives. Thus, the impregnating olution may contain 200 kilos. of magnesium sulphate nd 100 kilos. of ammonium sulphate in 1000 litres of ater, together with 20 kilos. of zinc nitrophenolsulphonte, or 20 kilos. of magnesium dinitrocresolsulphonate, or 0 kilos. of a mixture of mono- and disulphonates, obtained y sulphonating and then nitrating carbolic acid and eutralising with zinc oxide, magnesium oxide or carbonate, lcium hydroxide, or copper oxide.—T. F. B.

arble; Manufacture of artificial —— [from leather]. O. E. Heuschkel, London. U.S. Pat. 1,094,366, April 21, 1914.

ee Eng. Pat. 12,845 of 1910; this J., 1911, 1061.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

teel.] The Tolbot process in comparison with other open-hearth refining processes. F. Schuster. Iron and Steel Inst., May, 1914. [Advance proof.]

r Witkowitz (Silesia), the duplex process of steel manucture was abandoned for the cheaper basic open-hearth ethod. In experimental runs made in Talbot, Wellman lting) and fixed open-hearth furnaces, the first-named s found to be superior to the other types; some data e tabulated below. The quality of steel produced was dependent of the type of furnace employed :—

	Talbot.	Wellman.	Open-hearth.
scrap added to charge, per cent.	5	10—15	20
tio of cost of construction	1·659	1·259	1
tio of working costs	0·882	1·07	1
tio of total cost of production	1	1·05	1·07
as of steel produced with one lining	49,200	27,600	27,800

—W. R. S

Steel; Production of —— direct from ore. E. Humbert and A. Hethey. Iron and Steel Inst., May, 1914. [Advance proof.]

Tests were made with Swedish and Brazilian iron ores in a Héroult electric furnace of 6 tons capacity, using coke as fuel. It is concluded that the economic manufacture of steel direct from ore is practicable; that the product, by reason of its comparative freedom from hydrogen, nitrogen and other impurities, is superior, especially in toughness, to steel obtained by present methods; that the electric furnace employed should be of a type permitting violent ebullition of the bath without overflowing; that either charcoal, coke or anthracite may be used as fuel; and that anthracite electrodes will probably be most economical.—W. E. F. P.

Steel ingots; The forms in which sulphides may exist in ——. J. O. Arnold and G. R. Bolsover. Iron and Steel Inst., May, 1914. [Advance proof.]

Mild steels with varying percentages of sulphur and manganese were prepared from pure Swedish bar iron, American washed iron, ferrous sulphide specially prepared from Swedish bar and flour sulphur, and "thermit" metallic manganese. Microphotographs of typical sections were prepared. The first type (Mn below 0·1, S about 0·6) showed only pale-brown meshes of iron sulphide; the second (Mn 0·41—1·11, S 0·20—0·58) sharply segregated and sometimes juxtaposed areas of both pale-brown iron sulphide and dove-grey manganese sulphide in variable proportions determined by the ratio of sulphur and manganese; and the third (Mn 1·11, S 0·28) only dove-grey manganese sulphide. In a sample containing Mn 0·75 and S 0·45 (type 2), the manganese sulphide appeared largely in small ovoids arranged in a fan-like pattern. It is considered that these groups of manganese sulphide particles form strong evidence of the presence of a eutectic of ferrite and manganese sulphide existing in the fluid steel. This eutectic separates on (or possibly before) solidification of the steel in rounded masses which eventually decompose into their eutectic components. The specimens in which the eutectic was observed all contained aluminium.—T. St.

Sulphur in pig iron and steels; Colorimetric determination of ——. G. Misson. Iron and Steel Inst., May, 1914. [Advance proof.]

One grm. of the sample is treated with 50 c.c. of hydrochloric acid (sp. gr. 1·14) and 10 c.c. of benzine (sp. gr 0·71) in a slightly tapering glass vessel (80 mm. diam. and 95—100 mm. high), over the open end of which is placed a sheet of filter-paper (10 cm. square) which has been soaked in a solution containing 10 grms. of arsenic trioxide and 30 c.c. of concentrated hydrochloric acid per litre; the paper is covered by a piece of white felt held in place by a sheet of ebonite and a disc of lead. The hydrogen sulphide stains the paper uniformly yellow and the tint is compared by transmitted light with a standard treated in the same way.—A. S.

[*Iron-carbon.*] *The laws of the transition of the carbide-system into the graphite-system.* W. Guertler. Stahl u. Eisen, 1914, **34**, 520—525, 751—754.

The diagrams of the graphite-system and the cementite-system, and the conditions that determine the form that carbon in the iron-carbon system will take are discussed. The triangular diagram showing total carbon, graphite and combined carbon in the plane of the paper, is described, and the operations of annealing and casting cast-iron are discussed with reference to this diagram.—T. St.

Steel; New reagent for etching mild ——. W. Rosenhain and J. L. Haughton. Iron and Steel Inst., May, 1914. [Advance proof.]

The reagent is composed of: ferric chloride 30 grms., concentrated hydrochloric acid 100 c.c., cupric chloride 1 grm., stannic chloride 0·5 grm., water 1 litre, and it is necessary that the surface of the metal to which it is applied be perfectly clean. The reagent deposits a thin film of metallic copper. On hardened steels, especially of low and moderate carbon contents, the results were similar to those obtained with picric acid, etc., but the outlines of the copper films were very sharp, especially on martensite: troostite and sorbite were darkened. On practically pure carbon steels with the usual ferrite-pearlite structure, the effect was the reverse of that obtained with picric acid, etc., the pearlite being unaffected. The reagent proved specially useful for revealing the distribution of phosphorus in mild steels, giving results which compared favourably with those obtained by Stead's method of heat-tinting (this J., 1900, 1019). In addition to the typical etching effect, discoloured patches surrounding small black pits were frequently observed, usually grouped around a slag enclosure.—A. S.

Metals; The hardening of ——*, with special reference to iron and its alloys.* C. A. Edwards and H. C. H. Carpenter. Iron and Steel Inst., May, 1914. [Advance proof.]

The mechanism of annealing. The softening of metals by heating and subsequent slow cooling is attributed to the elimination, by recrystallisation, of the unstable, hard, amorphous material which exists as envelopes around the crystals, and not to any change in the nature or hardness of the crystals themselves. During this recrystallisation, which increases with the temperature and proceeds by the gradual growth of certain crystals at the expense of others, the amorphous envelopes act like ordinary electrolytes, the substance of one crystal being transferred to another. *Hardening by quenching.* The quenching of carbon steels results in severe stresses which cause very pronounced crystal twinning, the latter, apparently, being connected directly with the intensity of the thermal changes that occur when the mass is slowly cooled, and particularly with the carbide or Ar_1 inversion, At all the surfaces of slip upon which twinning occurs, amorphous layers are produced, the presence of which is the ultimate cause of hardening by quenching. In the so-called austenitic steels the special elements present give rise to the formation of new compounds which lower the temperature at which the carbon separates from solution and also decrease the velocity of the carbide change, so that rapid quenching is not necessary to preserve the mass in the same physico-chemical constitution as properly quenched carbon steels. In both cases the carbide change is inhibited by pressure; but when this is brought about by external means such as quenching, twinning of the crystals is produced, whereas when the whole of the necessary pressure is already inherent in the mass, as osmotic pressure, no internal crystalline disturbance occurs. The amount of twinning produced by quenching is proportional to the amount of the inversion which has to be suppressed by external means, or inversely proportional to the retarding influence of the special elements present; hence twinning is entirely absent when the necessary internal pressure is sufficient, as when the required amount of nickel is contained in the steel. *Constitution of martensite and austenite.* Although direct experimental proof is still wanting, the suggestion, previously made by one of the authors, that martensite and austenite are merely twin crystals of the same constituent, was further supported by the investigation of certain quenched copper-aluminium alloys analogous to the carbon steels in which martensite and austenite are found.—W. E. F. P.

Steel dies; A case of decarburisation during the hardening of ——. H. C. Greenwood. Iron and Steel Inst., May, 1914. [Advance proof.]

Steel containing C and Cr about 1 per cent. each, was covered with powdered charcoal and kept for 1½ hours at 820° C. After quenching, the face was very soft, and poorer in carbon. This did not occur when the charcoal was omitted, or replaced by sand.—W. R. S.

[Steel]. Case-hardening practice; Some recent improvements in ——. H. L. Heathcote. Iron and Steel Inst., May, 1914. [Advance proof.]

The temperature of the hardening pots is ascertained by means of an optical pyrometer, a series of dye solutions being used, calibrated so that the object just becomes visible at a definite temperature when observed through the coloured layer. Wood charcoal impregnated with soda ash and free from fine particles was found to be the best case-hardening composition: it can be used over and over again, and gives uniform results (0·9—1·1 per cent. C). Quadrant sclerometers for testing surfaces of various shapes are described (see Eng. Pat. 6622 of 1913; this J., 1914, 425). A suitable solution for examining surfaces that cannot easily be tested with a sclerometer is composed of: water 1000, alcohol 1000, nitric acid 100 c.c. On immersing for ½ to 1 minute, martensite gives brown or light blue, troostite dark blue or dark grey stains; ferrite and pearlite are hardly stained at all.—W. R. S.

Iron; The recrystallisation of deformed ——. C. Chappell. Iron and Steel Inst., May, 1914. [Advance proof.]

The effect of the extent of deformation and the temperature of the succeeding annealing on the nature of the resulting recrystallisation in iron and mild steel was studied. Deformation was produced by wire-drawing, by means of a hardened steel needle actuated by a Brinell press, and by rupture in a tensile testing machine. Violent deformation, such as that produced immediately below the Brinell needle, at the point of rupture of a pulled sample, and by wire-drawing, gave rise, on heating to 350°—500° C., to the disintegration of the original ferrite crystals. Above 500° C. new crystals appeared, which grew with great rapidity, until at 570° C. the disintegrated crystal "debris" was completely recrystallised into new crystals, smaller than those originally present. From 570° to 700° C. these crystals increased steadily in size, but above 700° C. little further change took place until complete recrystallisation occurred at Ac3. In samples subjected to deformation by the Brinell needle and by pulling, the zone of violent deformation merged into one characterised by an enormous increase in crystal size on annealing. This recrystallisation began at about 600°—650° C., but the maximum rapidity of growth occurred between 700° and 800° C., whilst from 800° C. up to the destruction of the coarse crystallisation, further growth took place only to a comparatively slight degree. In al cases the temperature of recrystallisation decreased as th degree of deformation increased. In pulled samples of iro almost free from carbon the lower limit of stress require to produce distinctive recrystallisation effects on annealing practically corresponded to the yield point. It is con sidered that the phenomena attending plastic strain ar capable of simpler explanation than by the theory of a amorphous cement or intercrystalline skin. In tests a 100° to 1000° C. permanent recrystallisation effects wer produced by deformation at all temperatures fro atmospheric up to Ac3 in practically carbonless iro In the case of mild steel the effect of carbon wa to restrict the size of the crystals developed, to mak a higher degree of stress necessary to produce growth, an to lower the temperature at which the coarse crystallini was destroyed. The recrystallisation phenomena of d formed iron may be used to determine the lines of flo produced in mechanical testing, etc.—T. St.

Manganese steel; Magnetic and mechanical properti of ——. R. A. Hadfield and B. Hopkinson. Iron a Steel Inst., May, 1914. [Advance proof.]

Manganese steel (Mn 12, C 1¼ per cent.) which w non-magnetic in its normal water-toughened form beca magnetic and brittle when heated to 520° C. and slow cooled. The change was rapid at first and then beca slower, and was not complete even after 600 hrs. heatir the final value at this temperature would probably about 66 per cent. of that for pure iron. At lo temperatures the change was much slower: after 23 d at 300° C. magnetism was just perceptible, and a 50 hours at 450°—500° C., the value was 7 per cent. of t for iron. Above 650° C. the change was more rapid but the maximum value attainable was much lower than at 520° C. At 700° C. only very slight magnetism could be attained. A steel fully magnetised at 520° C. lost its magnetism when heated above 640° C. and then quenched, the rate and extent of the loss becoming greater as the temperature was raised; the steel was almost entirely demagnetised after a few minutes at 750° C. Immersion in liquid air did not increase the magnetism of a non-magnetic steel or diminish that of a fully magnetised one, but it increased that of a steel in an intermediate condition. The change from the non-magnetic to the magnetic form was accompanied by an increase of volume and by an evolution of heat. There is a close connection between mechanical properties and magnetism, but heat treatment which almost entirely destroyed ductility only produced a slight amount of magnetism. In photomicrographs the development of a network of a hard constituent was observed which even in very small quantity made the metal brittle: this is probably the magnetic constituent. Analogous results from steels with less manganese and more carbon led to the conclusion that in all cases the magnetic form is probably stable below a certain temperature and the non-magnetic form above it. The transition at this temperature is very low and the effect of manganese is probably to lower this temperature slightly, and to reduce the velocity of the transition very greatly.—W. H. P.

on-nickel alloys; Resistometric studies of some ——. A. P. Schleicher and W. Guertler. Z. Elektrochem., 1914, **20**, 237—252.

IRES of three alloys containing respectively Ni 35·25, 0·6, and 25·2 per cent. were heated *in vacuo* in an electric rnace, and their electrical resistance measured at different mperatures. There was a pronounced discontinuity the temperature-resistivity curve at about 420° C. for the ·25 per cent. alloy and at 700° C. for the 30·6 per cent. oy. The 25·2 per cent. alloy in its original condition ve abnormally low values, but the resistance became gher with each successive heating until the wire became bilised and gave a regular curve with a discontinuity 900° C. The significance of these results is discussed connection with the constitution of the alloys and their gnetic properties.—W. H. P.

rome steels; The magnetic properties of a graded series of —— at ordinary and low temperatures. M. B. Moir. Phil. Mag., 1914, **27**, 830—842.

steels (containing Cr 1, 4·05, 8, 12, 16 and 20 per cent. pectively) were tested at 15° and —190° C. (liquid air) the forged and rolled condition, after annealing from ° C., and after quenching from 900° C.; after every nge of temperature, each specimen was subjected a process of reversals at the new temperature before urther magnetic test was made. The effect of lowering temperature was to diminish the susceptibility for fields and to increase it for high fields. In the case of ealed specimens, the value of the magnetising force which the curves corresponding to 15° C. and —190° C. ectively, crossed, increased with the chromium tent up to 12 per cent. and then decreased; immersion quid air produced a permanent effect not obliterated n the specimen regained a temperature of 15° C. In the of quenched specimens, the crossing of the curves urred at very high values of the magnetising force; ersion in liquid air had no permanent effect. In all s the residual magnetism and the coercive force were ter at —190° C. than at 15° C.—W. E. F. P.

; Influence of molybdenum upon the corrodibility of —. J. N. Friend and C. W. Marshall. Iron and eel Inst., May, 1914. [Advance proof.] (See also is J., 1913, 537.)

LS without and up to Mo 4·1 per cent. were subjected e action of tap water, 3 per cent. salt solution, dilute uric acid (0·05 and 0·5 per cent.), and alternate wet dry tests. Molybdenum up to 4 per cent. did not a marked influence upon the corrodibility by tap water, salt solution, and 0·05 per cent. sulphuric acid. The "corrosion factors" (relative corrosion compared with that of a carbon steel taken as standard) for the 0·5 per cent. acid was almost identical with the mean factors obtained in the preceding tests. In the wet and dry tests, carbon increased the resistance to corrosion while molybdenum decreased it. More than 1 per cent. Mo in steel appears to be undesirable.—W. R. S.

Blast-furnace gas purification; Development of dry-cleaning in ——. F. Müller. Iron and Steel Inst., May, 1914. [Advance proof.]

An account of the dry process for the purification of blast-furnace gas (this J., 1911, 286; 1912, 1035), and of its progress. The first large plant started working in 1911 at the Halbergerhütte, near Saarbrücken, Prussia. In addition to this there are now in operation 12 installations in Germany, 5 in France, 4 in Belgium, and 1 in England; and in course of erection or on order, 7 in Germany, 6 in France, 4 in Russia, 2 in Belgium, and 2 in the United Kingdom.—A. S.

Zincs; Corrosion of [commercial] —— of various compositions. E. Prost. Bull. Soc. Chim. Belg., 1914, **28**, 94—99.

The presence in zinc of lead, cadmium or iron in larger proportion than usually found in refined zinc leads to increased corrosion by acids. Minute quantities of arsenic, antimony, copper or tin, especially the two former, accelerate very pronouncedly the rate of corrosion, more or less independently of the actual percentage of impurity present.—G. F. M.

Copper-tin and copper-zinc alloys; Effect of annealing on quenched ——. A. Portevin. Comptes rend., 1914, **158**, 1174—1177.

Copper-tin.—The increase in hardness produced by annealing at low temperature has been observed previously (this J., 1910, 1457) An alloy containing Cu 80·11 per cent. was quenched from 700° to 20° C., annealed at from 300° to 600° C., and examined microscopically. The chilled material showed the α and β phases out of equilibrium; after annealing, the α constituent appeared in the form of fine needles in the region occupied by β. *Copper-zinc.*—A very pure brass containing Cu 57·91 per cent. was chilled from 825°, and annealed at 400°—800° C. The hardness was increased by chilling and still more by annealing at 400° C. but decreased again at higher temperatures. The chilled metal was composed of β crystals, within which thin bands of the α-constituent formed on annealing, this structure being destroyed by coalescence at 800° C.—W. R. S.

Alloys; Electrolytic separation of —— and their metallographical and mechanical investigation. II. The copper-tin bronzes. R. Kremann, C. T. Suchy, J. Lorber, and R. Maas. Monatsh. Chem., 1914, **35**, 219—288. (See also this J., 1914, 28.)

Good deposits of bronze can be obtained from electrolytic baths containing tin and copper in the presence of potassium cyanide or of tartrates. To obtain coherent deposits of bronze foil the bath should contain at least 1 grm.-mol. of caustic soda per litre. The copper anode remains passive under such conditions, and the resulting anodic oxidation causes a deterioration in the tartrate baths, the tartrate being oxidised and the copper salt reduced. Micrographic and electromotive investigations of the deposits were made, together with determinations of hardness. Deposits from cyanide electrolytes had a much more uniform composition than those from a tartrate electrolyte, and on all grounds the former are the more satisfactory.
—W. H. P.

Lead-arsenic alloys; The solidification diagram of —— and the melting point of arsenic. W. Heike. Int. Zeits. Metallog., 1914, **6**, 49—57.

Cooling curves of lead-arsenic alloys with As up to 82·3 per cent. (atomic) gave a eutectic point at 288° C. and As

8·25 per cent. (atomic). Lead and arsenic were miscible in all proportions when molten, and yielded neither solid solutions nor chemical compounds. Extrapolation gave the melting-point of arsenic as 852° C. A space diagram in which pressure is taken into consideration, as well as concentration and temperature, is briefly discussed.—T. St.

Patents.

[*Iron-nickel*] *Alloy.* E. D. Gleason, New York, Assignor to Neu-Metals and Process Co., Long Island City, N.Y. U.S. Pat. 1,093,557, Apr. 14, 1914.

An alloy of Fe (Swedish) 80—120 (preferably 110), Ni 80—120 (90), Cu 1 and Al 4 parts.—W. E. F. P.

Furnace; Liquid fuel heated tipping —— for melting, smelting, refining, and other like purposes. S. W. Price, London. Eng. Pat. 5436, Mar. 4, 1913.

On one side of a vertical crucible furnace, mounted on trunnions, is a combustion chamber in which one or more burners are disposed so that the flame enters the furnace tangentially. Liquid fuel and compressed air or steam are supplied to the burners through flexible connections, so that the charge may be poured while the burners are in operation. From a bracket fixed to the upper part of the apparatus a pouring table is suspended, a mould upon which remains in line with the pouring spout when the furnace is tilted.—W. E. F. P.

Melting-furnace. G. Mellen, East Orange, N.J., Assignor to United Aluminium Ingot Co. U.S. Pat. 1,092,938, Apr. 14, 1914.

A reverberatory furnace having an inclined hearth which is extended at the upper end to the base of the stack and at the lower end to form a sump, adjacent to which is a receiving pot for the molten metal. Vertical shields (partitions) are disposed within the sump and pot, respectively, the space between the two being enclosed to form a refining chamber.—W. E. F. P.

Furnace; Electric —— for medium temperatures particularly for melting copper and its alloys. E. Stassano, Turin, Italy, and N. Petinot, Niagara Falls, N.Y. U.S. Pat. 1,093,494, April 14, 1914.

A closed cylindrical melting chamber, of approximately elliptical vertical cross-section and arranged with its axis horizontal, is located eccentrically within an outer envelope, the space between being filled with refractory material with the greater thickness in the lower portion of the furnace. Each electrode is enclosed in an external cylinder, and connected with a hollow rod through which water is circulated, and which can be moved longitudinally so as to control the position of the electrode. The chamber is provided with an air-lock charging arrangement, by means of which the charging hole is opened and simultaneously a funnel is brought over the hole.—B. N.

[*Open-hearth*] *Furnaces; Regenerative, reversible ——.* The Knox Pressed and Welded Steel Co. Fr. Pat. 464,808, Nov. 11, 1913. Under Int. Conv., May 16, 1913.

The cooling box inserted in an opening in the brickwork which separates the air and gas inlet ports is formed with an arched central portion of refractory material which forms the roof of the gas-inlet port. The box has a slight downward inclination, and the water-supply pipes extend from either end and have their discharge openings near the centre.—W. H. C.

Separating machines; Magnetic ——. H. H. Thompson, Aldridge, Staffs., and A. E. Davies, Hockley Heath, Warwickshire. Eng. Pat. 9725, April 25, 1913.

The separator is of the built-up drum type, the drum consisting of relatively thin discs of magnetic material placed side by side, so that discs of smaller diameter alternate with those of larger diameter, and thus form a number of annular projecting magnetic edges.—B. N.

Electroplating apparatus. T. R. Canning, Birmingham. Eng. Pat. 17,603, July 31, 1913.

The plating barrel is carried by a spindle supported upon arms so that the barrel is wholly immersed in the electrolyte, and without stopping its rotation can be raised from the plating vat and lowered into the swilling vat, or the reverse. The driving mechanism is arranged between the walls of the tank.—B. N.

Electroplating apparatus; Rotary ——. C. J. Charlton, South Benfleet. U.S. Pat. 1,093,384, April 14, 1914

Inside a conical drum, provided with supporting rings and two metal plates for closing the ends, is an inner tapered perforated drum, polygonal in cross-section, which is supported by seatings carried by the end plates of the outer drum. Metal bands are fitted around the outer drum and are connected by bolts and nuts with anodes on the inner surface of the drum. Both drums are carried on a rotating shaft, and the larger ends are closed by a metal plate which acts as the cathode and is also mounted on the shaft, a nut on a screw-threaded portion of the shaft acting against a cross-frame and pressing the metal door against a wooden lining covering a portion of the inner surface of the door.—B. N.

Aluminium and its alloys; Flux and process for purifying ——. G. Mellen, East Orange, N.J., Assignor to United Aluminium Ingot Co. U.S. Pats. 1,092,935 and 1,092,936, April 14, 1914.

A mixture of sodium chloride and sulphur is added to the molten metal, or the latter is stirred with a rod composed of this mixture, so as to cause agitation of the metal by sulphur vapour.—W. E. F. P.

Aluminium; Method of increasing the resistance [*to corrosion*] *of ——.* J. Vogelsanger. Ger. Pat. 272,043, April 22, 1913.

The aluminium is subjected to the action of an electric current in a boiling aqueous solution of alum, borax, and sodium hydroxide, and is then treated with nitric acid and lime water. Aluminium so treated is not corroded on exposure to the weather or by organic acids, and has an increased resistance to compression and to bending. —A. S.

Steel, iron, etc.; Hardening or treatment of ——. A. W Machlet, Elizabeth, N.J. U.S. Pat. 1,092,925, April 14 1914.

See Fr. Pat. 389,547 of 1908; this J., 1908, 985.—T. F.

Cementation of articles of iron, steel, and alloys of stee Process for the ——. F. Giolitti, Turin, Assignor Soc. Anon. Italiana Gio. Ansaldo Armstrong & C Genoa, Italy. U.S. Pat. 1,093,844, April 21, 1914.

See Fr. Pat. 415,985 of 1910; this J., 1910, 1314.—T. F.

Pig-iron; Method of improving ——. V. Stobie, Sheffie U.S. Pat. 1,093,892, April 21, 1914.

See Eng. Pat. 16,001 of 1912; this J., 1913, 831.—T. F.

Roasting furnaces for ores and the like. C. Gabrielli, Pa Eng. Pat. 8635, April 12, 1913. Under Int. Co April 13, 1912.

See Fr. Pat. 453,808 of 1912; this J., 1913, 795.—T. F

Metals or alloys; Treatment of —— to render them ductile malleable. Westinghouse Metallfaden Glühlampenfa G.m.b.H., Vienna. Eng. Pat. 11,017, May 9, 1 Under Int. Conv., May 13, 1912. Addition to Eng. 12,869 of 1912, dated June 7, 1911.

See Addition of May 10, 1913, to Fr. Pat. 445,208 of 1 this J., 1913, 1074.—T. F. B.

Zinc metal from zinc ores; Method of and apparatus for recovering ——. E. Herter, Leipzig-Gohlis, Germany. Eng. Pat. 16,035, July 11, 1913. Under Int. Conv., July 15, 1912.

See Fr. Pat. 460,404 of 1913; this J., 1914, 86.—T. F. B.

Gold, silver, and platinum; Process for the recovery of —— from extremely dilute solutions, particularly ocean water. E. Baur, Zürich, and O. Nagel, Vienna. Eng. Pat. 16,898, July 23, 1913.

See Fr. Pat. 460,680 of 1913; this J., 1914, 88.—T. F. B.

Ore concentration; Method and apparatus for ——. E. H. Nutter, New York, and T. J. Hoover, Assignors to Minerals Separation, Ltd., London. U.S. Pat. 1,093,463, April 14, 1914.

See Eng. Pat. 23,949 of 1910; this J., 1912, 31.—T. F. B.

Ovens [for ores, etc.]. Eng. Pat. 8505. *See* I.

XI.—ELECTRO-CHEMISTRY.

Tantalum electrodes; Use of ——. O. Brunck. Chem.-Zeit., 1914, **38**, 565—566. (See also this J., 1912, 1135.)

Wegelin (Chem.-Zeit., 1913, **37**, 989) obtained better deposits of zinc and copper on a platinum wire gauze cathode than on one of perforated sheet tantalum. This, however, is to be attributed to the different forms of the electrodes, for with an electrode of tantalum wire gauze, deposits were obtained equal in quality to those obtained with a platinum gauze cathode under similar conditions. Oesterheld (this J., 1913, 833) found that tantalum cathodes became brittle in use. This is true, however, only when relatively high current densities are used, and does not apply to electro-analytical operations, where current densities of 1—2 ampères per sq. cm. are usually employed.—A. S.

Patents.

Electrodes. F. Krupp A.-G., Essen, Germany. Eng. Pat. 6055, March 10, 1914. Under Int. Conv., April 15, 1913.

The carbon electrode is provided with a water-cooled metallic head, which has a conical bearing surface and rests in a metallic support, to which the conductor for the current is attached. The electrode is kept in place by its own weight.—B. N.

Electrodes in electric arc furnaces; Protecting the ——. J. I. Bronn and W. Schemmann, Lothringen, Germany. Eng. Pat. 29,259, Dec. 18, 1913. Under Int. Conv., Dec. 18, 1912.

Incombustible gases, air, water vapour, or mixtures of these, are delivered from slits or nozzles against the electrodes at or above the points where they enter the furnace, and a gas pressure, in excess of that in the furnace, is created for preventing the escape of furnace gases or flames. The steam may be generated or superheated by the radiant heat from the furnace.—B. N.

Cathode for electrolytic furnaces. G. O. Seward, East Orange, N.J., and F. von Kügelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 1,092,178, April 7, 1914.

The furnace, for the separation of metals lighter than their fused salts, comprises a central cathode, an outer anode, and an intermediate annular insulating diaphragm, within which the metal floats on the electrolyte in electrical contact with the upper part of the cathode. The latter is provided with a surrounding skirt projecting downwards, which separates the cathode from the electrolyte except at its upper part, and the current therefore flows in opposite directions in the inner and outer portions, thus minimising the magnetic or inductive effects.—B. N.

Electrodes; [Active material for] Storage battery ——. H. C. Hubbell, Newark, N.J. U.S. Pat. 1,092,267, April 7, 1914.

Nickel oxide is briquetted, then heated in a reducing atmosphere, and, without substantial exposure to air, immersed in an alkali solution. The damp material is ground, dried, mixed with nickel hydroxide or its equivalent, and again briquetted.—B. N.

Furnace; Electric ——. J. W. Brown, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,093,382, April 14, 1914.

The furnace, provided with heating electrodes, is divided into an outer, an intermediate and an inner vertical channel, through which the charge is passed successively in alternate directions, so that the material in the outer channel forms a heat-absorbing envelope.—B. N.

Furnace; Electric ——. R. S. Bicknell, New York. U.S. Pat. 1,093,968, April 21, 1914.

The furnace, of the resistance type, is provided with a number of branched non-metallic resisters, each of which has more than two electrodes, and which are so arranged that, by changing the path of the current, the resistance of that portion of the circuit comprised by the resister is raised or lowered.—B. N.

Furnace; Electric —— and process of heating substances uniformly and at a controllable temperature in an electric arc. E. F. von Wilmowsky, Boston, Mass., Assignor to O. Pieper, Potsdam, Germany. U.S. Pats. 1,094,354, 1,094,355, and 1,094,381, April 21, 1914.

(1) Parallel electrodes, provided with mechanical supports at both ends, are arranged concentrically with an air gap of considerable width between them, and are surrounded by the turns of a solenoid. Each electrode is provided with a divided circuit, connected to each of the ends, and means are provided for supplying the branches of each circuit with pulsating currents of substantially one and the same periodicity, for controlling the electric discharge. (2) An electric arc is established between electrodes located in a substantially uniform magnetic field, and transverse to the flux of the same, thus spreading the arc; the current of gas to be treated is passed through the furnace in contact with the arc. (3) Concentric cylindrical electrodes, with means for producing an arc between them, are spaced apart, the intermediate space forming the furnace chamber, and a solenoid is arranged so that its magnetic axis coincides substantially with that of the electrodes. Independent regulators are in electrical circuit with the electrodes and solenoid respectively, and by means of carbon pencils, movable through the outer electrode towards and from the inner electrode, the current may be supplied at different levels to the outer electrode. Means are provided for closing the upper and lower ends of the furnace chamber, and for continuously feeding material through it.—B. N.

Brush for dynamo-electric machines. E. G. Gilson, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,093,614, April 21, 1914.

The brush comprises a moulded mass of metallic particles consolidated by heating, and contains copper, an alloying metal softer than copper, such as tin, graphite, as a lubricant, and 2 to 5 per cent. of iron.—B. N.

Gases; Production of —— by electric arc. R. Haddan, London. From International Ionizing Process Co., Wilmington, Del., U.S.A. Eng. Pat. 8033, April 5, 1913.

See Fr. Pat. 463,728 of 1913; this J., 1914, 427.—T. F. B.

Electrical furnaces; Process of heating ——, more particularly applicable to the manufacture of aluminium nitride. Soc. Générale des Nitrures, Paris. Eng. Pat. 24,347, Oct. 27, 1913. Under Int. Conv., Dec. 14, 1912.

See Fr. Pat. 463,390 of 1912; this J., 1914, 427.—T. F. B.

Electric induction heater or furnace. A. Helfenstein Vienna. U.S. Pat. 1,093,328, April 14, 1914.

See Eng. Pat. 14,164 of 1912; this J., 1913, 432.—T. F. B.

Process of making chlorates and apparatus therefor. U.S. Pat. 1,092,369. *See* VII.

Electrolytic production of alkali, using a mercury cathode. Ger. Pat. 272.476. *See* VII.

Treatment of liquids [oils, etc.] by nascent ozone. Eng. Pat. 8772. *See* XII.

Process of making catalysers [for hydrogenating fats]. U.S. Pat. 1,092,206. *See* XII.

Process for producing 1.3-diols. U.S. Pat. 1,094.224 *See* XX.

Process for producing 1.3-glycols. U.S. Pats. 1,094,315 and 1,094,316. *See* XX.

XII.—FATS; OILS; WAXES.

Linseed oil; Detection of "gloss oil" [rosin oil] in ——. A. Thurston. Oil, Paint, and Drug Reporter, Apr. 20, 1914, 50.

The Liebermann-Storch reaction will not detect 50 per cent. of "gloss oil" from rosin in linseed oil. Concentrated nitric acid (one drop added to 4 or 5 drops of the oil) gives a more reliable reaction. Pure "gloss oil" gives a violet-red tint changing to violet-red, and the colour given by mixtures of linseed oil with 50 per cent. of "gloss oil" is equally pronounced. Mixtures containing from 5 to 25 per cent. of the rosin oil give yellow to greenish-yellow colorations after standing for a few seconds.—C. A. M.

Almond and apricot kernel oils; Acidity of ——. J. C. Umney. Perfum. and Essent. Oil Rec., 1914, **5**, 101—102.

The acidity of 23 samples of almond oil varied from 0·6 to 9·2 per cent. (calculated as oleic acid). An oil of high acidity was found to be satisfactory in odour and taste after keeping for six months. The range of acidity for 34 samples of peach and apricot kernel oils was from 0·6 to 5·97 per cent. After the apricot kernel oil with the highest acidity had been kept for 12 months, the odour and taste were very unsatisfactory. The oils examined had been pressed in England or France.—F. Shdn.

Oil-nut from the Philippines. Cocoanut oil industry. Oil, Paint, and Drug Rep., April 27, 1914. [T.R.]

The Bureau of Science of the Philippine Government at Manila is investigating a new oil-bearing nut that has been discovered on the island of Catanduanes, whence the nuts were forwarded by natives under the impression that they were candle-nuts. The nuts so far have not been exactly identified, though the bureau reports that they belong to the family *Meliaceae*, genus *Amoora* or *Dysoxylum*. The dry nuts yield 45 per cent. of a dark, fatty oil that makes a good commercial grade of soap. It is of a non-drying character and is said also to be unsuited for edible purposes.

The manufacture of cocoanut oil from Philippine copra at Manila has come to the front rapidly in the last year or so. The exports of the oil from the Philippines in 1912 amounted to 1,450 pounds, valued at $40 gold; the exports in 1913 amounted to 11,022,064 pounds, valued at $1,146,339.

Oleic acid; Action of halogens on —— and determination of iodine values of oils. W. Meigen and A. Winogradoff. Z. angew. Chem., 1914, **27**, I., 241—244.

The Wijs method of determining the iodine values of oils is considered to be the best on account of its rapidity and because the formation of substitution products is inhibited by the hydrogen ions of the acetic acid. Of the different reagents, the Waller modification of Hübl's solution retained its strength best on keeping; a solution which required (per 25 c.c.) 47·6 c.c. of $N/10$ thiosulphate when freshly made required 40·5 c.c. after keeping for one year. The action on oleic acid of chlorine, bromine, and iodine, separately and in admixture with each other was studied. Chlorine reacted most and iodine least energetically. When chlorine and iodine in equivalent proportions were used more chlorine than iodine was absorbed; chlorine showed a greater tendency towards substitution. The formation of hydrogen halides is due only to substitution. When the iodine value of an unknown substance is to be investigated, the use of a chlor-iodine solution in carbon tetrachloride is recommended, as the amount of substituted halogen can be estimated by extracting the hydrogen halide with water and titrating with standard alkali.—R. G. P.

Soap solutions; Studies of the constitution of ——. Alkalinity and degree of hydrolysis of soap solutions. J. W. McBain and H. E. Martin. Chem. Soc. Trans., 1914, **105**, 957—977. (See also this J., 1914, 323.)

The degree of hydrolysis and true alkalinity of soap solutions was determined by measuring the electromotive force, a hydrogen electrode being used. The dissociation of water under these conditions at 90° C. was calculated as $69{\cdot}7 \times 10^{-14}$. The hydrolysis of concentrated soap solutions was a fraction of 1 per cent., and was only 6·6 per cent. in the case of 0·01 N solutions of sodium and potassium palmitates. Hence, the high electrical conductivity of soap solutions is not due to free alkali. The alkalinity of soap solutions was not appreciably reduced by the addition of free palmitic acid (one equivalent): whilst the alkalinity of solutions containing an excess of alkali was practically that of the added alkali. Apparently there was no formation of basic soap in the presence of 0·1 N alkali. In the presence of sodium chloride the alkalinity was first decreased and then again increased. All the samples of commercial soaps examined gave alkaline solutions, the toilet soaps to a greater extent than the household soaps, but in each case the alkalinity was less than that of the sodium palmitate solutions. The low alkalinity of the soap solutions indicates that the detergent action of soap is physical rather than chemical, and this view is supported by the fact that Reychler's "hydrogen soap" (hexadecylsulphonic acid) (Kolloid. Zeits., 1913, **12**, 277), where hydrolysis is out of the question, has detergent powers.—C. A. M.

Patents.

Ozone; Treatment of liquids [oils, etc.] by nascent ——. A. Breydel, Brussels. Eng. Pat. 8772, April 14, 1913.

The ozoniser is disposed in a vessel containing the material to be treated, such as oils, liquid greases and fats or the like. A hollow electrode is provided with small orifices, so that the air or oxygen is discharged opposite to a second electrode in such a manner that the nascent ozone is utilised at the surface of the electrode, whilst at the same time the gas agitates and mixes the liquid to be treated. If necessary, an auxiliary ring or coil may be used to inject air, with the object of aerating and further agitating the liquid.—B. N.

Fats; Process for melting animal and vegetable ——. W. McDonnell, Limerick. Eng. Pat. 8784, April 14, 1913.

The fat is melted in a jacketed pan having a perforated false bottom covered with a cloth to serve as a filter, the separation being promoted by revolving beaters. (Reference is directed to Eng. Pat. 5235 of 1879.)—C. A. M.

Catalysers [for hydrogenating fats]; Process of making —— C. Ellis, Montclair, N.J. U.S. Pat. 1,092,206, April 7 1914.

An electric current of arc-forming strength is passe between electrodes of nickel or material containing nick in presence of water or other liquid medium, and finely-divided nickel or nickel precipitate from the erosi is collected.—C. A. M.

Catalytic agents [for hydrogenating oils]; Process for regenerating —— Naamlooze Vennootschap Ant. Jurgens Vereenigde Fabr. Fr. Pat. 465,256, Nov. 24, 1913. Under Int. Conv., Dec. 18, 1912.

THE spent catalytic agent is heated gently to destroy organic matter, the metallic residue dissolved in acid, and the metal re-precipitated upon an inorganic basis, such as kieselguhr.—C. A. M.

Fats; Saponification of industrial —— by means of electrolysed saline lyes. L. G. A. Andrault. Fr. Pat. 464,248, Oct. 30, 1913.

THE fat is treated with electrolysed salt solution poor in soda in insufficient quantity for saponification. This will neutralise free fatty acids, with separation of the resulting soap, and the saponification is then completed by means of a second electrolysed salt lye richer in soda. The lye from the second stage will contain the bulk of the glycerin.—C. A. M.

Soap containing hydrocarbons; Manufacture of a stable ——. C. Pleines. Fr. Pat. 464,335, Oct. 31, 1913. Under Int. Conv., Nov. 6, 1912.

HYDROCARBONS are incorporated with soap containing an excess (up to 5 per cent.) of fat.—C. A. M.

Soap; Process for the manufacture of ——. A. L. Mowry, F. A. Secord, C. H. Peters, and A. P. Paterson. Fr. Pat. 464,777, Sept. 25, 1913.

MACHINERY is claimed for a rapid process of cooling and hardening the soap paste into the form of a prism, which is then cut into tablets.—C. A. M.

Soaps containing mercury; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,820, June 20, 1911.

FATTY acids of the oleic series are treated with mercuric acetate in alcoholic solution, the acetic acid residue is removed from the product by treatment with an alkali halide solution, and the resulting mercury derivative of the fatty acid is converted into its alkali salts. The soaps thus formed contain mercury in combination with a carbon atom, in which form it is not ionised.—T. F. B.

Preparing acid esters from esters lower in hydrogen. Ger. Pat. 271,985. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Colophony; Melting points of acids derived from ——. L. Paul. Chem. Rev. Fett Ind., 1914, 21, 102—105

THE acid of the constituent of colophony sparingly oluble in dilute soda solution (this J., 1914, 429), swells up and shows a rise of m. pt. (from 74°—75° C. to 103°—05° C.) in its transformation into the constituent readily oluble in soda solution. The other product previously lescribed melting at 130° to 135° C., and the acid (probbly γ-abietic acid) formed in the distillation of the onstituent soluble in petroleum spirit, are also probably econdary derivates from the decomposition of colophony e.g. in the treatment with steam to remove oil of turentine). The rapid transformation of colophony into ater-soluble constituents accounts for the want of tability of colophony varnishes on exposure to weather. —C. A. M.

PATENTS.

Distemper; Process of manufacture of a powdery medium for ——, *for both internal and external work.* F. Beckmann. Fr. Pat. 464,437, Nov. 5, 1913.

N intimate mixture of finely powdered slaked lime, 300; ugar, 150; dextrin, 150; gum arabic, 100; and magne-um sulphate, 25 parts, is moistened with water until it tains the consistence of moderately thick oil paint, and ter ten minutes is still further diluted and filtered. —E. W. L.

Condensation products from phenol, formaldehyde and the like; Process for manufacturing ——. K. Tarassoff, Moscow, Russia. Eng. Pat 528, Jan. 8, 1914.

CONDENSATION products, which although hard, are less brittle than bakelite and similar products, are obtained by the action of aldehydes such as formaldehyde, upon mixtures of phenols with sulphonated fats and oils, as, for instance, sulphonated castor-oil, prepared by treating 100 parts by weight of oil with 30 parts of sulphuric acid (sp. gr. 1·842), and washing the product with water and a solution of common salt. For example, 200 parts of commercial carbolic acid are mixed with 50 parts of sulphonated castor oil, 130 parts of 40 per cent. formalin, and 200 parts of water acidified with sulphuric acid. The mixture is stirred and heated until the reaction begins. The resinous mass obtained is washed with water and with a solution of sulphur dioxide in order to keep it colourless. About 300 parts of a white opaque, fusible product are obtained.—E. W. L.

Phenolic condensation products; Process of comminuting ——. J. W. Aylsworth, East Orange, N.J. U.S. Pat. 1,092,512, Apr. 7, 1914.

THE components of the condensation product are dissolved in a suitable solvent and heated so as to cause interaction without allowing the solvent to escape. This causes the resulting condensation product to contain pores filled with solvent, which facilitate its subsequent comminution. —C. A. M.

Lacquers; Process of manufacture of solutions or ——. Chem. Werke vorm. H. Byk. Fr. Pat. 464,617, Nov. 3, 1913. Under Int. Conv., Nov. 8, 1912.

ESTERS of lactic acid, particularly ethyl lactate, are employed as solvents for nitrocellulose and other cellulose esters such as the acetate and formate, as also for certain resins such as copal, sandarac and colophony, in the preparation of lacquers. Such solutions may be diluted with liquid hydrocarbons, more particularly those of the aromatic series, halogen derivatives thereof, ethers, acetone, alcohols, and mixtures of these solvents. For example, 10 parts by weight of acetylcellulose may be dissolved in a mixture of 50 parts by volume of ethyl lactate and 30 parts of benzene; or 50 parts of ethyl lactate, 30 parts of trichloroethylene and 20 parts of alcohol.—E. W. L.

Lampblack obtained by decomposing hydrocarbons or hydrocarbon mixtures; Process for freeing —— from gaseous admixtures. K. Bosch. Ger. Pat. 271,901, Feb. 28, 1913.

THE lampblack is carried from the decomposition chamber through heated tubes to a vessel in which it is vigorously centrifuged; it is then passed through a second heated tube to a suitable receptacle. A pulverulent product, free from mechanically combined gases, is obtained.—T. F. B.

Printing-ink; Process of making ——. M. Wolff, London. U.S. Pat. 1,094,283, April 21, 1914.

SEE Eng. Pat. 30,037 of 1912; this J., 1913, 1162.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENTS.

Rubber from hydrocarbons; Process of preparing —— resembling —— from animal or vegetable colloids or albuminoids by treatment in vacuo with or without the addition of other materials; W. Plinatus. Fr. Pat. 465,047, Nov. 18, 1913.

1.3-BUTADIENE (erythrene) or a homologue thereof, such as isoprene, is saturated with dry aqueous ammonia and subjected to heat and pressure.—A. S.

Elastic substances [artificial rubber]; Process of preparing ——. R. B. Earle, Cambridge, Mass., Assignor to Hood Rubber Co. U.S. Pat. 1,094,317, April 21, 1914.

1.3-BUTADIENE (erythrene) or a homologue thereof is mixed with 1—3 per cent. of a higher fatty acid, heated in a closed vessel at 100°—120° C. until the mass solidifies (1—3 weeks), and any unchanged hydrocarbon and by-products removed by distilling with steam.—A. S.

Rubber, horn and ivory ; Process of manufacture of products resembling —— from animal or vegetable colloids or albuminoids by treatment in vacuo, with or without the addition of other materials. W. Plinatus. Fr. Pat. 465,047, Nov. 18, 1913.

The incorporation of gelatin, on the one hand, or of casein and albumin, on the other, with other ingredients—water, glycerin, etc.—necessary for the production of soft or hard masses resembling rubber, horn and ivory, may be effected much more completely in a partial vacuum, with the result that subsequent segregation of the constituents is prevented, whilst the masses obtained are free from water and from air-bubbles. The addition of subsidiary ingredients such as camphor, resins, fats, oils, waxes, tar, asphaltum, rubber and reclaimed rubber, cellulose esters, starch, dextrin, sulphur and various mineral fillers, may take place either before or during the treatment *in vacuo* ; and the product may be hardened subsequently by means of the usual hardening agents.—E. W. L.

Elastic or plastic masses ; Process for the preparation of ——. J. Stockhausen. Fr. Pat. 465,306, Nov. 25, 1913. Under Int. Conv., Dec. 20, 1912.

An intimate mixture of gelatin, 125 ; glycerin, 125 ; camphor, 5 to 20 ; sulphur ; and colophony, 10 to 50 grms., is heated for several days, and 4 per cent. formaldehyde, 10 to 20 ; or sodium bichromate, 3 to 10 grms. is then incorporated with it.—E. W. L.

Process of producing isoprene. U.S. Pats. 1,094,222 and 1,094,223. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Willow barks ; Classification of —— by means of chemical reactions. G. Powarnin and A. Barabanow. Collegium, 1913, 276—282.

The experiments were made with extracts prepared from barks of 34 Russian willows (22 pure varieties and 12 hybrids). The general reactions were : dark brown precipitate with copper acetate, with barium hydroxide, and, with the exception of *S. viminalis*, with calcium hydroxide ; brownish yellow precipitate changing to brownish green with lead acetate ; brown ring, colouration and precipitate with concentrated sulphuric acid ; light red to yellow precipitate with formaldehyde and hydrochloric acid ; light brown colouration with silver nitrate ; brown colouration with nitrous acid ; light red stain on a pine chip (this fails in some cases) ; yellowish red to brown precipitate with quinine hydrochloride ; green to brownish green colouration with ammonium vanadate ; yellow to cherry-red precipitate with concentrated hydrochloric acid ; lemon yellow to orange precipitate with bromine water ; yellow to brown colouration with sodium molybdate. The reactions of the tannins from the different varieties are tabulated, and these allow of the division of the barks from the pure varieties into two groups characterised by giving (1) an immediate precipitate with copper sulphate and ammonia, a violet colour with ferric chloride, and a cherry-red to violet colour with gold chloride : *S. viminalis* is typical of this group ; (2) no precipitate at first with copper sulphate and ammonia, a green colour with ferric chloride, and a brown colour with gold chloride : a typical member of this group is *S. purpurea*. Characteristic for certain varieties are : *S. viminalis*, a white precipitate, gradually turning brown, with calcium hydroxide ; *S. pentandra*, a green colour with ammonium molybdate ; *S. babylonica* light brownish green, *S. repens* dark green and *S. lanata* dirty green with sodium tungstate ; *S. Lapponum* pink, *S. purpurea* greenish yellow, *S. pentandra* yellow, and *S. Wiegeliana* dark brown with disodium phosphate. The reactions show that the willows contain two classes of tannin. The barks from the hybrids gave in general reactions representing the combined effects of the tannins of the pure varieties from which the hybrid had been bred.—A. S.

Tannin of the bark of Salix alba × viminalis. G. Powarnin and N. Schurawlew. Collegium, 1913, 283—291.

The bark of *Salix alba* × *viminalis* contains, in addition to phlobaphenes, two tannins giving different reactions with copper sulphate and ammonia and with ferric chloride (see preceding abstract). The one tannin (from *S. viminalis*) may be separated from the other (from *S. alba*) by fractional precipitation of a methyl alcohol solution with ether. The tannin of *S. alba* is a yellow or white tannoside, which yields anhydro- and oxy-phlobaphenes, and on hydrolysis yields protocatechuic acid. *S. viminalis* contains free sugar ; its tannin yields pyrogallol on hydrolysis. It is noted that in the analysis of tanning materials both free and combined sugar should be determined.—A.S.

Tanning materials ; Pentoses in ——, and the detection of mangrove. H. C. Reed and A. Schubert. J. Amer. Leather Chem. Assoc., 1914, **9**, 131—135 (See also this J., 1914, 151, 152.)

The yellow colour followed by a red precipitate produced by adding phloroglucinol to the hydrochloric acid distillate is not necessarily an indication of the presence of methylfurfural since other aldehydes, such as formic, acetic and anisic, give the same reaction. Filter paper steeped in aniline hydrochloride gives, with furfural, an immediate cerise colouration whilst with methylfurfural it gives a yellow colour turning brick red, with anisaldehyde a yellow not turning to crimson, with acetaldehyde and formaldehyde no colouration, and with paraldehyde a crimson colouration. Pentoses, pentosans and methylpentoses may be formed during the distillation with hydrochloric acid by hydrolysis of glucosides and other substances present in tanning extracts. Furfural is a general decomposition product of carbohydrates, and methylfurfural which is formed by the hydrolysis of rhamnose with dilute acids is produced when substances are present which yield rhamnose by the action of acids : quercetrin, sophorin (from blackthorn berries), xanthorhamnin, hesperidin and frangulin yield rhamnose under these conditions. This may also introduce an error in the determination of sugar in tanning materials, since the sugars present as ascertained by hydrolysis include the sugars formed in the operation itself and not naturally present as such ; xylan, for example, yields xylose, which reduces Fehling's solution. In distillation tests with hexose sugars, reactions, with the phloroglucinol test, similar to those from the pentose and methylpentose sugars were obtained. Dextrose in large amount gave the methylfurfural reaction, in small amount, a negative test ; lævulose in all cases gave a negative test The following extracts gave the furfural reaction with phloroglucinol : quebracho, myrobalans, sulphite-cellulose, sumac and chestnut. Gambier gave a drab precipitate with a colourless solution, showing absence of pentose or methylpentose sugars or of glucosides or other materials yielding these by hydrolysis. The precipitate obtained with phloroglucinol and the distillate from mangrove extract was not of the distinct brick-red colour given by the methylfurfural phloroglucide obtained from rhamnose but was of a brown colour. The character and method of extraction of the mangrove bark had an influence on the colour obtained by the test. Methylpentoses or compounds forming them were apparently more readily extracted than were pentoses or furfural-forming compounds. Quercitron or black oak bark containing quercitrin which yields rhamnose on hydrolysis gave th methylfurfural test similarly to mangrove, as did als cutch. The value of the proposed test for distinguishin mangrove is open to doubt.—D. J. L.

Tanning materials in admixture ; Determination of —— R. H. Wisdom. J. Amer. Leather Chem. Assoc., 191 **9**, 136—139.

Solutions of the strength used in the official methods analysis were prepared from different extracts and 200 c. of each were shaken with 5 grms. of pure degummed boiled-off silk, allowed to stand overnight, and the si squeezed and dried. Each extract produced a distincti colour on the silk and various makes of the same materi varied little from the standard for that material. Furth evidence for identification was obtained by dipping pieces of the impregnated silk in solutions of reagents, allowing the colour to develop, washing and comparing the resulting colour with the standard. The colour produced by lime water on silk previously impregnated with mangrove extract was characteristic and shown by no other material tested.—D. J. L.

Tanning purposes ; Water and its purification for ——. M. F. Corin. J. Amer. Leather Chem. Assoc., 1914, 9, 143—158.

Water for tannery use should be free from turbidity and contamination, soft and free from iron. To remove turbidity and bacteria, the best coagulant for tanners' use is aluminium sulphate, added as a 3—5 per cent. solution ; when there is not sufficient alkalinity in the water to precipitate all the alum, slaked lime or soda is previously added. Hard water is less objectionable when used for unhairing purposes than in any other part of the tannery, but when sodium sulphide alone is used, a proportionate waste of that material is caused. For soaking, washing and bating purposes and in the yard and leach house, temporary hardness is a great disadvantage. If a hide is transferred from a lime liquor to water high in calcium bicarbonate, lime becomes fixed in the hide as carbonate, causing rough grain and stain and discolouration in the tan liquors. For neutralising temporary hardness, an acid which forms an easily soluble calcium salt and which has no effect on the liquors if used in excess, is preferable, such as lactic or acetic acid. Hardness is very objectionable in making up fat-liquors. For each German degree of hardness (17 parts per million) 1¼ lb. of soap will be wasted for every 1000 galls. of water used. Lime soaps adhere to the leather and cause trouble in the glazing. The efficiency of water-softening plants using slaked lime, and alkalis, is greatly increased by heating the water slightly by means of exhaust steam. Water entirely free from hardness and low in sodium carbonate can be obtained by first applying the chemical process followed by the "Permutit" process. Any iron present may be removed by use of manganese-permutite (a zeolite in which sodium has been replaced by manganese by treatment with manganese chloride and permanganate solutions) whereby it is completely oxidised and retained as hydroxide on the filter.—D. J. L.

Reversible transformation of gum and gelatin from the emulsoid into the suspensoid condition. Scarpa. *See* XVII.

Patents.

Leather ; Process of colouring artificial ——. E. Girzik, Vienna. Eng. Pat. 4668, Feb. 23, 1914. Under Int. Conv., Dec. 18, 1913.

A solution of say 10 kilos. of nitrocellulose in one of the known solvents, is mixed with softening oils and with about 5 kilos. of aluminium hydroxide, spread, in one or more layers, on one side of an undyed cotton fabric, and allowed to dry. The fabric is then dyed in an acid bath with a basic aniline dye.—E. W. L.

Leather substances ; Method of manufacturing ——. C. Rössler, Hamburg. Eng. Pat. 19,787, Sept. 1, 1913. Under Int. Conv., Sept. 2, 1912.

Leather or leather waste is ground with granular non-fibrous substances (*e.g.*, magnesium oxide, kieselguhr, metallic pigments or organic substances) and treated with a binding agent (*e.g.*, solution of magnesium chloride or sulphate, tar oils or mineral oils, etc.). For example the ground product may be mixed with glycerin and slaked lime, and then with linseed oil as binding agent. Substances thus obtained may be made into plates or slabs, or used in the production of jointless floors.—C. A. M.

Leather ; Process for graining and rendering impermeable split, inferior and weak ——. C. Krug and H. Böllert. Fr. Pat. 464,842, Nov. 12, 1913. Under Int. Conv., April 16, 1913.

The leather is dried in a vacuum, treated with a solution of resin in carbon bisulphide, alcohol, ether, amyl alcohol, petroleum spirit, benzene acetone or ketones or mixtures of these, and then exposed to formaldehyde vapour under diminished pressure.—D. J. L.

Chrome tanning ; Process for ——. F. Hirsch. Ger. Pat. 271,585, March 13, 1913.

The chromic acid solution is reduced by means of aluminium bisulphite or zinc bisulphite, or a mixture of the two, without addition of acid ; retardation of reduction may be adjusted by addition of an acid or of an alkali or alkaline-earth bisulphite together with an acid. When aluminium bisulphite is used, aluminium hydroxide is precipitated in the hide, and the advantages of a basic tannage are obtained in addition.—T. F. B.

Glue [*Vegetable*] *; Manufacture of* ——. Perkins Glue Co. Third Addition, dated Oct. 28, 1913, to Fr. Pat. 436,297, Nov. 11, 1911. (See this J., 1913, 761.)

A vegetable glue having the required properties of viscosity, cohesion and adhesion is prepared by mixing a product of very high viscosity with one or several carbohydrates of lower viscosity. For example it may be made from a mixture of starches, one of which has been treated too long or too strongly with oxidising or hydrolysing agents and another which has not been treated sufficiently to produce a good glue.—D. J. L.

Horn or ivory ; Manufacture of products similar to —— *from albuminous materials and neutral or acid esters of higher alcohols.* W. Plinatus. Fr. Pat. 465,048, Nov. 18, 1913.

Albuminous substances of animal or vegetable origin, *e.g.*, albumin or casein or their derivatives such as the alkali albuminates, are treated with neutral or acid esters of higher alcohols or amino-fatty acids. The albuminous matter becomes hard and coagulated and is subsequently mixed with organic materials such as resins, sulphur, camphor, pitch, paraffin, oils, rubber or cellulose derivatives in suitable solvents.—D. J. L.

XVI.—SOILS ; FERTILISERS.

Soils and kaolin ; Adsorption phenomena in ——. J. E. Harris. J. Phys. Chem., 1914, 18, 355—372.

Evidence is brought forward in favour of the view that the acidity of soils, at any rate of those of the sandy loam type, is not due to insoluble organic acids of the nature of humic acid, but to the selective adsorption of bases from the salts in the soil solution, the solution being thus left acid. The amount of base adsorbed on treating such a soil with a neutral salt depended on the salt used, being greater for sodium acetate than for potassium nitrate and sodium chloride. When a soil was treated several times with each of these salt solutions the differences in their acidity became greater with each application. Preliminary treatment with dilute acid, followed by thorough washing, increased the power of a soil to liberate acid from salts, presumably because the originally adsorbed base was removed by the acid, thus allowing the soil to adsorb much more : the effects produced by $N/2$ and $N/80$ sulphuric acid were almost identical. Kaolin in its natural condition did not affect a salt solution, but after treatment with acid and washing, it behaved in just the same way as a soil towards neutral salts. The effect of acid on the kaolin varied with the concentration, which indicates that its action consisted, not in neutralising adsorbed basic material, as in the case of soil, but in rendering some of the silicates colloidal and capable of adsorbing bases. In no case was the acid merely adsorbed by the soil or kaolin and then liberated on treatment with a salt. Using barium chloride as the neutral salt the base was adsorbed in quantities practically equivalent to the amount of acid liberated. After boiling with concentrated sulphuric acid for seven hours to remove all organic matter, and then washing out all the acid, the soil was still capable of liberating as much acid from a salt solution as a soil which had only been treated with $N/20$ sulphuric acid. This shows that in such soils the adsorbing agent is probably a hydrated silicate and not organic matter. —W. H. P.

Soils ; Occurrence and nature of carbonised material in ——. O. Schreiner and B. E. Brown. Bull. U.S. Dept. Agric., Bureau of Soils, No. 90, Dec. 1912.

The coarser fractions of well disintegrated soil were subjected to elutriation first with mixtures of bromoform and carbon tetrachloride and then with water, to separate and roughly fractionate the lighter organic material. This was separated by a process of mechanical assortment, aided by the lens or microscope, into the following types : (1) plant material and (2) animal material, both of organised structure, (3) charcoal particles, (4) lignite particles, (5) coal particles, and (6) other materials some of which suggest intermediate formations. All these types probably exist in finer subdivision in the finer fractions of the soil. The coal and charcoal types in particular were found in all kinds of soil, in ordinary subsoils and in samples collected at depths of 15 to 50 feet below the surface. A relatively large fraction of soil organic matter may consist of these resistant forms, which would become available only with extreme slowness. An analytical method depending on graded or moderated oxidation which would give some indication of the availability of the organic matter is desirable. The wide occurrence and the characteristic appearance and nature of the various particles suggest their actual formation in the soil to some extent. —W. H. P.

Soils ; Action of manganese in ——. J. J. Skinner, M. X. Sullivan, J. H. Beattie, F. R. Reid, and H. Winckelmann. Bull. U.S. Dept. Agric., Bureau of Soils, No. 42, Apr. 3, 1914.

In pot experiments with wheat in a poor soil, manganese salts in the proportion of 5 to 50 parts per million had a stimulating effect, larger quantities being often injurious. In a good soil no stimulating effect was observed. Wheat was also grown in aqueous extracts of the soils and the oxidising power of the roots tested by adding aloin solution in the last two days of growth, the extent of the change from pale yellow to red being measured colorimetrically. The manganese always improved the oxidising power of the roots. In extracts from poor soils this led to increased growth, and in some cases to the removal of harmful organic compounds which probably were the cause of retarded oxidation in the untreated extracts. In extracts from good soils the stimulated oxidation appeared to be excessive, and the growth was consequently diminished. In a five-year field test on a silty clay loam soil of acid character, 50 lb. of manganese sulphate per acre had a harmful effect on wheat, rye, maize, cowpeas, and potatoes, and decreased the already low oxidising power of the soil. The catalytic power of the soil as measured by the rate of decomposition of hydrogen peroxide was only slightly if at all increased. These effects may be due to the acid character of the soil, and treatment with manganese salts is not suitable for a soil of such a nature which is in need of liming.—W. H. P.

Bacterial action in soils as a function of food concentration and of insoluble organic matter. O. Rahn. Zentr. Bakt. u. Parasitenk., II. Abt., 1913, **38**, 484—494. Expt. Stat. Record, U.S. Dept. Agric., 1914, **30**, 217—218.

From experiments with sand of different degrees of fineness, it was concluded that bacterial activity in soils depends upon the size of grain, water content, and concentration of nutrient substances. In the decomposition of peptone by *Bac. mycoides* the final reaction product was always the same for a given concentration of nutrient material, only the speed of decomposition varying with the size of grain and water-content of the soil : in other cases both the speed of decomposition and the final product were affected by the last-named factors. In relatively dry soils, spongy organic substances, such as cellulose, had a dehydrating effect and diminished bacterial action, but in wet soils they promoted ventilation and hence increased the activity of aerobic bacteria.—A. S.

Partially sterilised soils ; Growth of plants in ——. E. J. Russell and F. R. Petherbridge. J. Agric. Sci., 1913, **5**, 248—287.

The growth of plants in partially sterilised soils showed the following important differences from that in untreated soils. Germination was generally retarded, but occasionally there was a partial acceleration affecting some of the seeds only. There was generally an acceleration in growth up to the appearance of the third or fourth leaf, but some times, especially in soils heated to 100° C., a marked retardation. The retardation was on the whole more frequent during dull winter days than in brighter weather and was accompanied by a dark leaf colour, and either a purple pigment or a tendency for the leaves to curl downwards, the whole suggesting an attempt on the part of the plant to reduce assimilation. Later on the pigment disappeared and the curling ceased. Growth became rapid and proportional to the plant food present. Plants grown in soils heated to 100° C. showed a very remarkable fibrous root development and had larger leaves of deeper colour, stouter stems and shorter internodes. They flowered earlier and more abundantly and their dry matter contained a larger percentage of nitrogen and sometimes of phosphoric acid. The roots and stems gave up their mineral food constituents more completely to the fruit. Plants grown on soils heated to 55° C. or treated with volatile antiseptics showed fewer of these effects. There was only rarely retardation in seedling growth, but usually an acceleration, sometimes a rapid one, followed by steady growth. No special root development or shortening of internodes occurred but there was a marked improvement in the percentage of nitrogen and phosphates in the dry matter, and in the translocation of these materials to the fruit. The principal chemical difference was that in partially sterilised soils ammonia accumulated and nitrates were absent. The aqueous extract of the partially sterilised soil was much richer in nitrogen than that of untreated soils. Soils heated to 100° C. contained decomposition products which dissolved in water to a brown solution. Some of these products proved specially suited for the nutrition of certain moulds. —W. H. P.

Experiments on the rate of nitrification. Beesley. *See* XIXB.

Patents.

Superphosphate ; Apparatus for use in the manufacture of ——. G. H. Lynen, Passaic, N.J. U.S. Pat. 1,093,141, April 14, 1914.

A movable platform is introduced into the superphosphate chamber and engages adjustable walls therein, so as to form a receptacle for the material to be removed. Means are provided for subsequently withdrawing the walls and passing the platform beneath an unloading device outside the chamber.—F. Sodn.

Fertiliser from silicious, potassium-bearing rocks and minerals containing phosphoric acid ; Process of producing a ——. Chem. Fabr. Rhenania and A. Messerschmitt. First Addition, dated Oct. 14, 1913, to Fr. Pat. 462,357, Aug. 13, 1913 (this J., 1914, 327).

The lime used as described in the chief patent (*loc. cit.*) may with advantage be partly replaced by alkali, *e.g.* sodium carbonate, and the process may be carried out in two stages, the silicious rock (*e.g.* leucite) being calcined with 30 per cent. of lime, and the resulting double silicate of lime and potassium finely pulverised and heated with the ground phosphatic mineral to incipient fusion. The use of 5 to 10 per cent. of sodium carbonate facilitates the progress of the reaction.—E. W. L.

Fertilisers obtained by means of chemical reactions an compounds, for use either as simple fertilisers, or, i admixture, as complete manures. E. T. Aucher. Fr Pat. 464,285, Oct. 8, 1913.

An aqueous solution of 200 kilos. of ferrous sulphate i added gradually, with constant stirring, to milk of lim containing 100 kilos. of lime. The mixture is allowed t stand for several hours, the water run off through a coal dust filter, and the sediment washed twice with water, and then spread out on earthenware trays, dried in an oven at 90° C. or more, and granulated. Copper sulphate and other metallic salts capable of decomposition by alkalis may be used in place of iron sulphate; and nitrogenous, phosphatic, potash and gypsum fertilisers may be added to the residue after filtering. The fertilisers are quite harmless to vegetable life, and act not only as fertilisers but as remedies in chlorosis and other plant diseases.—E. W. L.

XVII.—SUGARS; STARCHES; GUMS.

Molasses; Extraction of sugar from cane ——, and the elimination of the reducing sugars by fermentation. L. Pellet. Intern. Sugar J., 1913, **15**, 222.

To remove reducing sugars from cane molasses, and thus cause the crystallisation of a greater amount of sucrose than would otherwise be possible, the author recommends diluting the molasses to 20° Brix, and inoculating with a yeast, which ferments the reducing sugars but not the sucrose. After fermentation at 30°—34° C., the mixture is distilled, the alcohol collected, and the extraction of the sucrose in the residue effected as in the case of beetroot molasses.—J. P. O.

Dextrose; Action of ammoniacal copper hydroxide on ——. A. Windaus and A. Ullrich. Z. physiol. Chem., 1914, **90**, 366—368.

Dextrose, which yields 4-methylimidazole when treated with certain metallic hydroxides and ammonia (this J., 1905, 515), yields imidazole-4-carboxylic acid when treated with ammoniacal copper hydroxide.—L. E.

Carbohydrates and related substances; Oxidation of —— by means of potassium persulphate. J. K. Wood and N. Walker. Chem. Soc. Trans., 1914, **105**, 1131—1140.

Aldoses are almost quantitatively oxidised by potassium persulphate in the cold, the process being greatly accelerated by small quantities of silver sulphate. Galactose, arabinose, and xylose are oxidised at about the same rate, dextrose and polyhydric alcohols more slowly, whilst ketoses and disaccharides are attacked somewhat more rapidly than the aldoses.—G. F. M.

Honey; Determination of sulphur in —— and in other materials containing much sugar. F. E. Nottbohm and H. Weinhausen. Z. Unters. Nahr. Genussm., 1914, **27**, 581—587.

In the determination of total sulphur in such substances as honey, fruit syrups and wines, correct results are obtained by treating 20 grms. of the sample in a Kjeldahl flask with 0·2 grm. of magnesium carbonate and 50 c.c. of nitric acid; when the preliminary violent action is over, the flask is heated over a spirit flame and quantities of nitric acid are added from time to time until nitrous gases cease to be evolved. The solution is then transferred to a basin, evaporated on a water-bath, the remaining nitric acid removed by repeated evaporation with hydrochloric acid, and the sulphuric acid determined in he usual way.—W. P. S.

Gum and gelatin; Reversible transformation of —— from the emulsoid into the suspensoid condition. O. Scarpa. Rend. Soc. chim., ital., 1914, [2], **5**, 375—379. Kolloid-Zeits., 1914, **14**, 210.

F alcohol be added gradually to a 2 per cent. aqueous olution of gum or gelatin, the solution becomes opalescent nd then turbid. The opalescent solutions, provided the lcohol content does not exceed certain limits, are very table and have properties resembling those of suspension-colloids, the viscosity, for example, being only slightly igher than that of aqueous alcohol of similar concentra-iou. On addition of water the solutions become clear gain, the gum solution in the cold and the gelatin solution n warming. The colloidal particles in the opalescent olutions bear a negative electric charge. Solutions of sodium, potassium, barium or ferric chlorides, potassium chromate, copper, ammonium, or ferric sulphates, hydrochloric, nitric, or sulphuric acids, or potassium hydroxide precipitate the gum, whilst mercuric chloride renders the solution clear. The gelatin solution is coagulated by mercuric or ferric chlorides, or copper sulphate, and rendered clear by sodium, potassium, or barium chlorides, potassium chromate, ammonium or ferric sulphates, nitric or sulphuric acids, or potassium hydroxide. The coagulum produced in the gum solution is, in most cases, soluble in cold water, but that produced by potassium chromate or ferric chloride is insoluble both in cold and hot water. The gelatin coagulum is soluble in hot water and has the properties of an emulsion-colloid.—A. S.

Dibenzoylglucoxylose: a natural benzoyl derivative of a new disaccharide. Power and Salway. *See* XX.

Patents.

Sugars [from sawdust]; Process of producing fermentable ——. F. E. Gallagher, Troy, N.Y., and H. S. Mork, Allston, Mass. Eng. Pat. 14,938, June 28, 1913. Under Int. Conv., July 15, 1912.

Lignocellulose, *e.g.*, sawdust, is heated with chlorine water (containing chlorine equivalent to 0·2 per cent. of the dry sawdust) or with a mixture of nitric and hydrochloric acids (in quantities equivalent to 1·13 and 1·17 per cent. respectively of the dry sawdust) for say 30 minutes at a pressure of 135 ℔. Or the sawdust is treated with chlorine at the ordinary temperature for several hours and then, without removal of the chlorine, heated with dilute mineral acid, *e.g.*, sulphuric acid in quantity equivalent to 1 per cent. of the dry sawdust.—L. E.

Process for obtaining trehalose and a vegetable acid. Ger. Pat. 271,789. *See* XX.

XVIII.—FERMENTATION INDUSTRIES.

Invertose; A thermo-stable form of ——. O. Durieux. Bull. Soc. Chim. Belg., 1914, **28**, 99—101.

When an extract of yeast was boiled the whole of the invertase was not killed, the filtered solution being still active. At 80° C. the enzyme was absorbed by, and precipitated with the coagulable proteins, and the filtered solution was inactive. Some of the invertase was, however, still undestroyed, and present in the precipitate, for by treating this with boiling water, the enzyme was restored to the liquid, and after filtration the latter was active.—G. F. M.

Invertase action; Reversibility of ——. A. Blagowestschenski. Biochem. Zeits., 1914, **61**, 446—457.

Following the lines of experiments carried out by Kohl (see this J., 1908, 825) the author studied the course of inversion of sucrose by glycerin-extracts of yeast in presence of toluene, and also the prolonged action of invertase preparations on solutions of invert sugar. He states that there is no conclusive evidence for the synthesis of sucrose by invertase. The kinetics of inversion may be expressed by the equation for unimolecular reactions. A diminution of the velocity constant towards the completion of hydrolysis, is probably due to combination of the enzyme with the hydrolytic products. When invertase preparations are allowed to act upon solutions of invert sugar, there is a possibility of some maltose (or isomaltose) being synthesised by the action of maltase which is present in some invertase preparations.—J. H. L.

Fermentations in the C_3-series. C. Neuberg and J. Kerb. Ber., 1914, **47**, 1309—1315.

In consequence of experiments showing that glyceric acid is not fermentable by living yeast, the authors reject the hypothesis of v. Lebedeff (this J., 1914, 368) that this acid is an intermediate product of alcoholic fermentation. The small quantities of acetaldehyde produced by the action of dried yeast on dilute solutions of glyceric acid (*loc. cit.*) are probably due to autofermentation of the yeast, stimulated by the presence of the acid.—J. H. L.

Amylo-process of fermentation. O. Grove. J. Inst. Brew., 1914, 20, 248—261.

THE amylo-process, which is used in many of the largest distilleries of France, Italy and Spain, is characterised by the use of mould fungi instead of malt for the saccharification of the starch and by the rigorous application of pure culture methods on a large scale. The organisms employed, originally isolated from "Chinese yeast," belong to the groups *Mucor* and *Rhizopus.* The most satisfactory one, *R. Delemar*, converts starch into dextrose and also slowly ferments the latter, but in practice a special yeast (see Will, this J., 1913, 1123) is added to effect fermentation. During saccharification the mould is kept submerged in the liquid, otherwise sporulation occurs, accompanied by oxidation of starch. In submerged cultures of the mould, sections of the filaments become detached in the form of oval cells (gemmæ) which germinate more rapidly than the true spores, so that when a very rapid saccharification is required the mash is treated with a "bub" of the mould instead of the spore culture usually employed. The principal raw materials of the amylo-process are rice, maize, manioc, dari, millet and potatoes. The method of working maize is given in detail. The starch has first to be liquefied as completely as possible For this purpose the maize is coarsely ground and agitated for 1 hour with two parts of water containing hydrochloric acid (usually 6—8 litres of concentrated acid per 1000 kilos. of maize), and then introduced into the first of two cookers, in which the pressure is raised to 60 lb. per sq. in. in 15—20 mins. and maintained for 15—30 mins. whilst a small quantity of steam is allowed to blow off in order to keep the mash in agitation. From the first cooker the material is blown into a second similar one the inlet to which is somewhat constricted so as to cause disintegration of the solid particles by sudden expansion (cp. Boidin, Eng. Pat. 19,633 of 1907, this J., 1908, 586). The pressure in the second cooker is kept at 30 lb. per sq. in. for 20—30 mins. and then the mash is blown into the fermentation vat. This is a vertical, air-tight cylinder with dome-shaped ends. The usual capacity is 1000 hl. (22,000 galls.) corresponding to a mash of 20—25 tons of maize. The contents are cooled to 40° C. by running water over the outside of the vessel (10—12 hours) and a current of sterilised air is passed upwards through the mash all the time. A pure spore culture of the mould, grown on moistened rice, is then introduced, rigorous precautions being taken to avoid infection of the mash with foreign organisms. During the first 21 hours, the temperature falls to 36·5° C., the sp. gr. of the filtered mash does not change, and no sugar is formed. After a further interval of 8 hours, a pure culture of the yeast is introduced; if added at an earlier stage it hampers the development of the mould. Vigorous fermentation sets in after 24 hours and the air current can be stopped. Fifty-three hours after inoculation with the mould, the quantity of sugar present is at its maximum, about 11·4 per cent., and afterwards it falls rapidly, and the process is complete within 4 days from inoculation. The final gravity of the filtered mash is about 1,000, the (apparent) reducing sugar is 0·3 per cent., the acidity 0·6 grm. per litre, and the mash gives no blue colouration with iodine. It is possible to work more quickly by saccharifying by means of a "bub" of the mould, 1/10 of the volume of the total mash, and made in a similar but smaller air-tight vessel. When manioc and potatoes are employed, malt is used instead of hydrochloric acid, to assist liquefaction of the starch. Potatoes are first ground to a fine mass, warmed to 65° C., mixed with crushed malt and water, stirred and warmed to 70°—75° C. for 15 mins., and then transferred to the cooker. Powdered manioc, mixed with 3 parts of water, is similarly treated with malt. No saccharification should take place, because the sugar would be caramelised in the cooker. The yield of alcohol obtained by the amylo-process is considerably higher than by other methods, for no dextrins are left unfermented and the fermentation is pure. The alcohol produced contains less foreshots and tailings and much less fusel oil than that obtained by non-aseptic fermentation. After the distillation of the fermented mash, the residue is filtered hot and the draff pressed and dried; the pressed cakes contain 20 per cent. of oil which is extracted with petroleum spirit and the dried residue is sold as cattle food. A sample of this residue contained water 8·53, oil 2·96, albuminoids (N × 6·25) 47·5, cellulose 8·27, extractive bodies 30·44 and salts 2·30 per cent. The amylo process is particularly suited for use in hot climates. Its use in this country is at present prohibited by the Excise Authorities. —J. H. L.

Beer; Rate of fermentation of priming solutions when added to ——. J. L. Baker and H. F. E. Hulton. J. Inst. Brew., 1914, 20, 241—247.

PRIMING may have two distinct objects, *viz.*, to impart sweetness and palate-fulness to running beers, and to induce and augment rapid conditioning. The materials most frequently used are cane sugar (candy), invert sugar, and dextrinous syrups prepared by the action of acids on starch. The effect of priming on running beers is more or less transitory, for the added sugar really brings about a continuance of the primary fermentation over a period which depends on a number of factors including treatment of the beer in the cellar. The authors' experiments indicate that cane sugar primings, added in the customary amounts, are completely inverted within 24 hours, and, contrary to the generally accepted view, are fermented at substantially the same rate as invert sugar primings. If beer in barrels is well mixed with priming solution, and the barrels are then shived up, rolled well and left for some time (*e.g.*, 16 hours) before the shives are cut out, about 40—75 per cent. of the added sugar is fermented within seven days; but if, after the priming has been well mixed in, the barrels are not shived up or rolled, practically no fermentation occurs for the first 2 or 3 days, and the amount of sugar fermented at the end of five days is small, *e.g.*, 9 per cent. of that added. —J. H. L.

Colloids in beers; Determination of ——. R. Marc. Kolloid-Zeits., 1914, 14, 181—186.

THE method described (see page 564) for the determination of colloids in effluents, may also be applied to the examination of beers, the sample being diluted with 10 times its quantity of water and 20 c.c. shaken with 10 grms. of finely powdered barium sulphate. The difference between the refraction before and after this treatment as ascertained in a Zeiss interferometer is a measure of the colloid content. Pale beers were found to contain a smaller quantity of colloids than dark beers, but when referred to the total dry solids of the beer, the colloid content was fairly constant at about 7·2 per cent. Of the colloids present in beer, starch and albumin are adsorbed more readily than dextrin, and by using 10 c.c. of the diluted beer and only 1 grm. of barium sulphate, selective adsorption was effected, the colloid content indicated (referred to the total dry solids) ranging, in six different beers, from 2·55 to 4·6 per cent. By repeated treatment with a relatively small quantity of adsorbent, fractional adsorption of the colloidal constituents could be effected and the results would give some indications of the character of the colloids present in a given sample of beer.—A. S.

Yeast; Beer ——, *a valuable fodder.* P. Dönhoff. Z. Spiritusind., 1914, 37, 263—269.

BY boiling pressed beer yeast for a few hours in a steam-heated, double-bottomed copper, a liquid and perfectly stable product is obtained which forms a valuable adjunct to swine fodder. The price at which the product can be sold (M. 4 per 100 kilos., or 2s. per cwt.) appears to render the process practicable even in small breweries.—L. E.

Grape must; Nitrogenous matter of ——. R. Marcille. Comptes rend., 1914, 158, 1199—1201. (See this J., 1913, 547.)

THE fermentation of musts that have been freed from volatile nitrogenous matter is not always abnormally slow. The volatile nitrogen always disappears almost completely during fermentation, and the yeast often utilises a considerable proportion of the organic nitrogen, a proportion which is much diminished by addition of ammonia to the must.

The ripening of the grapes is accompanied by a decrease of the volatile and organic nitrogen in the must.—L. E.

Aspergillus niger (Sterigmatocystis nigra V. Tgh.); Value of zinc for the growth of —— in deep media. M. Javillier. Comptes rend., 1914, **158**, 1216—1219. (See this J., 1912, 247, 912.)

Lepierre's statement that zinc does not accelerate the growth of *Aspergillus niger* in media of such depth that the ratio, volume of liquid : free surface, exceeds 2, is incorrect. The catalytic action is as well marked in deep as in shallow media.—L. E.

Determination of sulphur in honey and other materials containing much sugar. Nottbohm and Weinhausen. *See* XVII.

Patents.

Alcoholic beverages; Method of, and apparatus for treating and bottling beer, cider, sparkling wines, and other ——. D. E. Robbins, Sidley, Sussex. Eng. Pat. 8420, April 9, 1913.

The liquor, immediately before chilling and bottling, is allowed to undergo "bottle fermentation" in a large chamber which can be hermetically closed. It is withdrawn through outlet pipes of small diameter leading from the floor of the chamber. To prevent solid matter deposited during the fermentation from passing into the outlet pipes, a tray is supported a little above the floor of the chamber and over the outlet pipes, and a flange or a raised portion is provided on the floor of the chamber, around the outlet pipes, and within the area covered by the tray, the outlet pipes being connected with this raised portion.—L. E.

Brewing apparatus. C. B. Davis, New York. U.S. Pat. 1,094,059, April 21, 1914.

An apparatus for use in the brewing industry for separating liquids from solids, comprises a sieve and a number of hinged plates which can be moved into contact with the underside of the sieve so as to seal the perforations.—L. E.

Mash-filter for the separation of beer wort from grains. C. Rath. Ger. Pat. 271,200, Sept. 10, 1912.

The mash-filter consists of a series of closed chambers separated from one another only by filter-cloths and assembled in a closed casing in the manner of a filter-press. The mash enters the filter-chambers from a common inlet pipe and the wort passes through the filter-cloths into the adjacent chambers and flows away through passages provided for the purpose. Water is then introduced into the empty chambers on one side of the filter-chambers, and percolates through the press-cake into the chambers on the opposite side, whence it flows away to a receptacle.—A. S.

Vinegar; Apparatus for the manufacture of ——. A. Menegault, Arcueel, France. Eng. Pat. 27,260, Nov 26, 1913.

The acetifying vats are barrel-shaped, and a hoop on the bulge of each vat has 4 spiral grooves in which an endless rope makes 3 turns, the rope passing round each vat in succession. A drum, mounted on a shaft operated by an electric motor, and having oppositely directed spiral grooves at the ends, winds the rope. In each vat is a mercury thermometer: when the temperature rises, say to 37° C., the mercury closes the electric circuit, the motor is started, and the vats rotate; or rotation at definite intervals may be insured by an electric clock provided, at various points, with tappets which make contact with the hand and close the circuit.—L. E.

Producing fermentable sugars [from sawdust]. Eng. Pat. 14,938. *See* XVII.

Process for treating potatoes. Eng. Pat. 17,614. *See* XIXa.

XIXa.—FOODS.

Flour; Decrease of the quantity of gluten in ——. J. A. F. Balland. Comptes rend., 1914, **158**, 1103—1106.

In the period 1869 to 1880, the average quantity of moist gluten yielded by flours was 29·1 per cent. (or 9·7 per cent. of dry gluten), whilst for the period 1905 to 1914, the average was 24·7 per cent. The decrease does not appear to be due solely to degeneration of the wheat caused by intensive cultivation, but more probably to alterations in the milling processes and to the treatment (bleaching, moistening, etc.) to which the flour is subjected subsequently. —W. P. S.

Lard; Detection of beef and mutton fats in —— by Bömer's method. H. Sprinkmeyer and A. Diedrichs. Z. Unters. Nahr. Genussm., 1914, **27**, 571—581.

Application of Bömer's method (this J., 1914, 33, 323) to numerous samples of genuine lard, beef and mutton fats, and mixtures of the same, yielded results showing that the method is capable of detecting the presence of 10 per cent., and in many cases 5 per cent., of beef or mutton fat in lard. Lards rendered by the authors yielded a difference value of 4·4° to 7·4° (*i.e.*, the difference between the m.pts. of the least soluble glycerides and those of the corresponding fatty acids), whilst the value Mg+2d (m.pt. of the glyceride+twice the difference value) varied from 73·1 to 76·5. In the case of beef and mutton fats the difference value lay between 0·8 and 1·2 and the value Mg+2d between 65·2 and 67·3. With mixtures containing from 5 to 10 per cent. of beef fat the value Mg+2d was always below 72 and in the greater number of cases below 70. The presence of hydrogenated (hardened) fats in lard affects the value Mg+2d to about the same extent as does the presence of beef fat.—W. P. S.

Alum in foods; Use of ——. Report of Remsen Board. Oil, Paint, and Drug Rep., May 4, 1914. [T.R.]

The United States Department of Agriculture has issued a bulletin announcement of the final decision by the Remsen Referee Board on the general subject of alum in foods. The conclusions of the Board are summed up as follows:—

Aluminium compounds when used in the form of baking powders in foods have not been found to affect injuriously the nutritive value of such foods, nor in small quantities, have they been found injurious to health. The same holds true for the amount of aluminium which may be included in the ordinary consumption of aluminium baking powders furnishing up to 150 mgrms. of aluminium daily. Aluminium compounds when added to foods, in the form of baking powders, in large quantities, up to 200 mgrms. or more per day, may provoke mild catharsis and in very large quantities usually provoke catharsis, due to the sodium sulphate which results from the reaction. The aluminium itself has not been found injurious to health, beyond the production of occasional colic when very large amounts have been ingested. When mixed or packed with a food, the quality or strength of the food has not been found to be thereby reduced, lowered or injuriously affected.

Beer yeast, a valuable fodder. Dönhoff. *See* XVIII.

Patents.

Potatoes; Process for treating ——. E. Enders, Breslau, Germany. Eng. Pat. 17,614, July 31, 1913.

The potatoes, which are first peeled if the product is for human consumption, are cut up or mashed to pulp, treated with a small quantity of water if necessary, and freed from most of the juice by pressure or in any other suitable manner. The residue is boiled or steamed with or without addition of water, and finally dried at 80°—110° C. The juice is saccharified, fermented and distilled, alcohol and a liquid cattle food being obtained.—L. E.

Food composition for stock. A. D. Little, Boston, Mass., Assignor to Standard Alcohol Co., New York. U.S. Pat. 1,092,221, April 7, 1914.

Substances containing cellulose are treated with a hydrolysing agent containing chlorine under conditions suitable to the formation of sugars; the hydrolysing agent is then converted into sodium chloride and excess of moisture is removed from the mass.—W. P. S.

Milk and other liquids; Treating—. G. M. S. Tait, Washington, D.C. U.S. Pat. 1,094,380, April 21, 1914.

The bottles, in which the milk is to be pasteurised, are first washed and scalded, and, whilst still above 130° F. (54·4° C.), the unpasteurised milk, preheated to about 130° to 150° F. (54·4°—67·8° C.), is added, the heating being continued at about 130° to 140° F. (54·4°—60° C.) to complete the pasteurisation.—B. N.

Milk; Artificial —— and process and apparatus for making the same. G. Rigler, Kolozsvár, Hungary. Eng. Pat. 18,382, Aug. 13, 1913. Under Int. Conv., Oct. 29, 1912.

See Fr. Pat. 461,131 of 1913 this J., 1914, 215.—T. F. B.

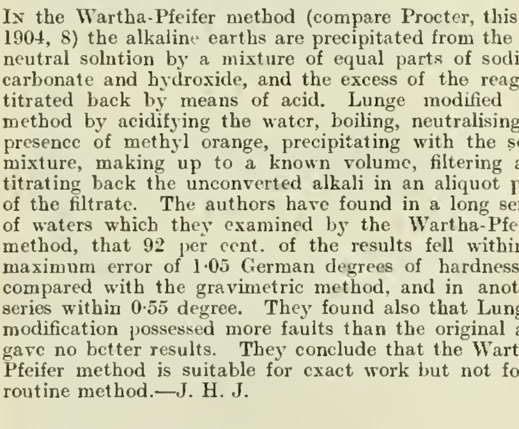
XIXb.—WATER PURIFICATION; SANITATION.

Hardness of waters; Determination of —— by the methods of Wartha-Pfeifer and Blacher. J. Zink and F. Hollandt. Z. angew. Chem., 1914, **27**, 235—237.

In the Wartha-Pfeifer method (compare Procter, this J., 1904, 8) the alkaline earths are precipitated from the hot neutral solution by a mixture of equal parts of sodium carbonate and hydroxide, and the excess of the reagent titrated back by means of acid. Lunge modified the method by acidifying the water, boiling, neutralising in presence of methyl orange, precipitating with the soda mixture, making up to a known volume, filtering and titrating back the unconverted alkali in an aliquot part of the filtrate. The authors have found in a long series of waters which they examined by the Wartha-Pfeifer method, that 92 per cent. of the results fell within a maximum error of 1·05 German degrees of hardness as compared with the gravimetric method, and in another series within 0·55 degree. They found also that Lunge's modification possessed more faults than the original and gave no better results. They conclude that the Wartha-Pfeifer method is suitable for exact work but not for a routine method.—J. H. J.

Nitrification; Experiments on the rate of ——. R. M. Beesley. Chem. Soc. Trans., 1914, **105**, 1014—1024.

Solutions containing 100 mgrms. of combined nitrogen in 500 c.c., together with the necessary inorganic salts were sterilised and then inoculated with 1 c.c. of an infusion of hydrolytic and nitrifying organisms from a secondary contact bed for sewage treatment. The solutions were protected from contamination, frequently shaken and aerated, and periodic determinations of "ammoniacal," "nitrous" and "nitric" nitrogen made. Trithiourea and aniline sulphate were not nitrified, the latter becoming converted into ammonia. Asparagine was apparently immediately hydrolysed chemically, half of its nitrogen being liberated as ammonia. From this point, however, as in the other substances examined, urea, uric acid, glycine, methylamine sulphate, acetamide, ammonium oxalate and ammonium sulphate, its nitrification pursued the normal course. All nitrified at about the same rate, the curve being of the type shown in the figure. Not more than 95 per cent. of the original nitrogen was recovered as nitrate in any case, the loss being due to aeration and interaction between ammonia and nitrous acid. In the cases of ammonium oxalate and ammonium sulphate, where all the nitrogen should have been found as ammoniacal, nitrous or nitric, a remarkable temporary deficiency (as much as 40 per cent.) was found in the middle of the period, suggesting that there are other stages besides the ones named in the nitrification of ammonium compounds. —W. H. P.



Colloids in effluents; Simple method for the determination of ——, and the use of the liquid-interferometer in the examination of water. R. Marc and K. Sack. Kolloidchem. Beihefte, 1914, **5**, 375—410.

An account of further work on the application of the interferometer to the examination of waters and effluents (see this J., 1912, 559). To determine colloids in effluents, 20 grms. of the latter are shaken for half an hour with 10 grms. of an insoluble substance, preferably carefully purified barium sulphate, in the form of a fine crystalline powder, and, after separating the insoluble matter, the clear solution and the original effluent are examined in the interferometer: the decrease in the refraction is proportional to the quantity of colloids in the effluent. By determining the permanganate consumption (due to the organic colloids) before and after shaking with barium sulphate, indications as to the relative quantities of organic and inorganic colloids can be obtained. Experiments of this kind showed that in most purification processes, especially in filtration through soil, the organic colloids are rapidly removed, whilst the inorganic colloids remain unaffected.

The determination of the refraction by means of the interferometer may also be used in place of, or as an adjunct to, the determination of the total soluble matter in water analysis. For waters of similar kind and origin the quotient of the refraction and dry residue is practically constant: with waters of different kinds this quotient is higher the lower the quality of the water.—A. S.

Water and its purification for tannery purposes. Corin. *See* XV.

Colorimetric method for detecting and determining nitrates and nitrites. Letts and Rea. *See* XXIII.

Patents.

Water; Means for softening ——. G. Buchner, München, Germany. Eng. Pat. 22,647, Oct. 7, 1913.

The water is treated with a mixture of disodium phosphate and borax, to which may be added alkalis, alkaline earths or their carbonates or phosphates, magnesium or aluminium carbonates or phosphates, or organic acids.—W. P. S.

Water; Sterilisation of —— by means of bromine. M. Riegel. Ger. Pat. 272,271, April 30, 1913.

The water is treated with hydrochloric acid and with a solution of bromine in potassium bromide, and free acid and bromine are subsequently removed by addition of the calculated quantity of sodium sulphide, sodium carbonate or other alkaline substance.—A. S.

Sewage sludge and the like; Apparatus for drying ——. J. Bromet, F. Thorman, and H. C. Wood, Tadcaster, Yorks. Eng. Pat. 7822, April 3, 1913.

A slightly inclined, rotating cylinder is heated externally by gases from a furnace and is provided internally with scrapers, pegs, teeth and lifting plates so that the sludge, whilst passing through the cylinder, is brought into intimate contact with a current of hot air which is circulated continuously through the cylinder and a heater until it is saturated with moisture, when it is passed into the combustion chamber of the furnace. Two similar drying cylinders may be used in series.—W. P. S.

Sewage and other waste liquids; Apparatus for the treatment of ——. T. K. Irwin, London. Eng. Pat. 20,816, Sept. 15, 1913.

The sewage is treated with precipitants or neutralising agents, then delivered into a tank from the top of which it overflows and passes through a screen on to a filter. The liquid passing from the filter is aerated by means of a centrifugal machine and then passes through a screen on to a second filter. While in the first tank the liquid may be heated and the waste gases from the furnace supplying the heat may be employed for drying the sludge removed from the tanks and screens.—W. P. S.

Waste liquids; Method of separating foreign matter from ——. W. Loebel, Leipzig, Germany. Eng. Pat. 19,596, Aug. 29, 1913.

The liquid is allowed to fall from a pipe on to a flat plate, or sprayed or injected against vertical plates, or made to flow down a series of steps in order to separate air bubbles from the suspended particles, and is then led into a settling tank.—W. P. S.

Tanks for separating combustible liquids and solid matters from waste water. A. Kützer, Leipzig-Stünz, Germany. Eng. Pat. 27,977, Dec. 4, 1913.

A tank for separating oil, petrol, etc., from waste water, has a discharge pipe for the aqueous portion of the waste water, this pipe extending outside the tank from the bottom to a point near the top. Baffle-plates in the tank direct the lighter portions, such as oil, petrol, etc., towards the centre of the top of the tank where they overflow into a vertical central pipe; the latter passes through the bottom of the tank and its upper edge is just above the level of the water outlet. A bell, extending over nearly the whole width of the tank, is placed over the central pipe, and the waste water is admitted to the tank over the upper surface of this bell. In a modified form of the tank, a receptacle for the oil, etc., is substituted for the central pipe.—W. P. S.

Disinfectant. F. Hoffmann-La Roche und Co. Ger. Pat. 271,732, Nov. 15, 1910. Addition to Ger. Pat. 263,332 (see this J., 1913, 1028).

The disinfectants consist of mixtures of soaps and halogen-ethylenes: the halogen compounds may be dissolved in soap solutions in presence of acetone, alcohol, or suitable salts, or the halogen-ethylenes may be mixed with solid or semi-solid soaps in presence of similar substances to render the product soluble in water.—T. F. B.

Water; Process and apparatus for purifying natural —— *by means of sunlight and artificial light.* A. Koch, Hannover-List, Germany. Eng. Pat. 9486, April 22, 1913. Under Int. Conv., April 23, 1912.

See Fr. Pat. 456,953 of 1913; this J., 1913, 1083.—T. F. B.

Water; Process and apparatus for purifying ——. Maschinen- und Waggonbau-Fabriks Akt.-Ges., vorm. H. D. Schmid, and F. R. von Suess, Vienna. Eng. Pat. 25,715, Nov. 10, 1913. Under Int. Conv., Nov. 11, 1912.

See Fr. Pat. 464,670 of 1913; this J., 1914, 500.—T. F. B

Sewage and refuse separator. B. Kaibel, Darmstadt, Germany. U.S. Pat. 1,093,994, April 21, 1914.

See Fr. Pat. 456,425 of 1913; this J., 1913, 1028.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Peru balsam. K. Dieterich. Ber. deuts. Pharm. Ges., 1914, **24**, 225—232. (See also this J., 1914, 159.)

When distilled in a current of steam, Peru balsam yielded about 5 per cent. of a thick yellowish oil having an odour like that of the original material (see following abstract). Volatile substances added as adulterants can be detected in this way. A sample of balsam about 50 years old showed normal values, though variations in some of the colour reactions were noticed. Irregularities in the preparation of a genuine balsam may also cause abnormal colour reactions in the nitric acid and zone tests.—F. Shdn.

Peru balsam; Essential oil obtained by the steam distillation of ——. A. W. Sortell. Ber. deuts. Pharm. Ges., 1914, **24**, 233—234.

The oil (see preceding abstract) had the sp. gr. 1·0869 at 17° C., saponification value 245·7, and $[\alpha]_D = +1\cdot876°$. After saponifying the oil had sp. gr. 1·002 and $\alpha_D = +4°$ at 20° C. Benzyl alcohol and peruviol were found to be present in the saponified oil, the greater portion of which distilled at 98° C. at 16 mm. Benzoic and cinnamic acids were produced by the hydrolysis.—F. Shdn.

Rose oil; Composition and adulteration of ——. N. Petkow. Z. öffentl. Chem., 1914, **20**, 149—153.

Owing to the use of artificial substances such as "steareoptene" and "ceril" for adulterating rose oil their importation into Bulgaria has been forbidden. The characters of genuine rose oil (six samples), a concrete prepared by extracting the flowers with light petroleum, and specimens of artificial stearoptene and ceril are shown in the following table:—

	Rose oil.	Concrete.	Stearoptene.	Ceril.
M. pt.	—	—	38·5° C.	—
Saponif. value	9·4—12·4	38·5	5·6	10·3
Acid value	1·1— 1·9	7·1	2·0	1·2
Ester value	8·3—10·9	31·4	3·5	9·1
Refractometer reading	43·9—51·2 at 25° C.	62 at 60° C.	13 at 50° C.	43 at 40° C.
Iodine value	170·8—189·1	51·3	4·6	174·4
Optical rotation	—1·04° to —2·9°	—	—	—
Sp. gr. at 25° C.	0·8535—0·861	—	—	—

The corresponding figures for a number of adulterated oils are also given.—F. Shdn.

Carbon tetrachloride; Use of—for the extraction and determination of the active principles of drugs and medicinal plants. G. Gori. Boll. Chim. Farm., 1913, **52**, 891—895. Chem. Zentr., 1914, **1**, 1377—1378.

At 20° C. 100 parts of carbon tetrachloride dissolve: caffeine 0·258 part, quinine 0·544, strychnine 0·220, brucine 2·030, cocaine 31·942, atropine 1·760, morphine 0·025, codeine 2·940, papaverine 0·518, narcotine 1·040, and narceine 0·002 part: theobromine is insoluble. In the determination of caffeine in kola nut powder and green coffee, carbon tetrachloride gives results agreeing with those obtained by use of chloroform. In the analysis of tho fluid extract of kola, the caffeine may first be determined by extraction with carbon tetrachloride, and then the theobromine by extracting the residue with chloroform.—A. S.

Essential oils; Relative permanence of ——. J. C. Umney. Perfum. and Essent. Oil Rec., 1914, **5**, 99—100.

Definite quantities of essential oils were put on blotting paper, which was then exposed to a free current of air at about 15° C. For permanence of odour, the following oils stand out in the order given: patchouli, sandalwood, cinnamon leaf, cassia, Java citronella, origanum, thyme, neroli. With certain oils, for instance, anise, almond and ylang ylang oils, the character of the odour altered on exposure.—F. Shdn.

Essential oils; Determination of volatile acids in ——. J. C. Umney. Perfum. and Essent. Oil Rec., 1914, **5**, 116—118.

The apparatus consists of a 3-litre Jena glass flask for generating steam, connected with a long-necked 150 c.c. Jena flask, an efficient splash head being fitted to the latter which leads to a vertical Davies' condenser delivering the distillate into a 500 c.c. conical flask. About 2 grms. of the oil are weighed into the small long-necked flask, 15 c.c. of neutralised alcohol and a little phenolphthalein are added, the whole heated just to boiling on the steam bath and the acid number ascertained by titrating with *N*/10 alcoholic potassium hydroxide. 25 c.c. of *N*/2 alcoholic potassium hydroxide (best prepared from 90—96 per cent. alcohol distilled over potash) are then added, the whole boiled under a reflux apparatus for an hour, the excess of alkali neutralised with *N*/2 sulphuric acid after the addition of 40 c.c. of water free from carbon dioxide, a few drops of *N*/2 alcoholic potassium hydroxide added, the liquid evaporated on the water bath, and 10 c.c. of dilute phosphoric acid (3·5 c.c. of 88 per cent. acid with 100 c.c. of water) added. The distillation apparatus should be treated to a preliminary boiling of at least half an hour's duration, and steam allowed to blow through the connecting tubes and condenser to remove carbon dioxide. The small flask is then connected up and heated by a small flame whilst the water in the large flask is kept boiling as rapidly as possible. The distillation is continued till 250 c.c. have been collected, which should take about 30 minutes. The free acid is determined in the distillate by means of *N*/10 sodium hydroxide, using phenolphthalein as indicator. Satisfactory results can also be obtained by using the method of Gladding for the estimation of acetic acid in calcium acetate (see this J., 1909, 467).—F. Shdn.

Essential oils; Constituents of ——. Separation and properties of the sesquiterpenes (gurjunenes) in East Indian copaiba oil; derivatives of the sesquiterpenes. F. W. Semmler and W. Jakubowicz. Ber., 1914, **47**, 1141—1153. (See also this J., 1914, 436.)

A crude gurjunene of sp. gr. 0·922 at 20° C., $n_D = 1·50737$, and $\alpha_D = -55°$ was oxidised by chromic acid dissolved in glacial acetic acid, the product washed with water and sodium carbonate solution and distilled. The fraction boiling between 118° and 150° C. at 10 mm. and with $\alpha_D = +10°$ was again oxidised in the same way and fractionated. The fraction boiling between 118° and 140° C. at 10 mm. was oxidised further with a cooled solution of permanganate in acetone. After again fractionating and distilling over sodium, pure tricyclogurjunene (cedrene type), $C_{15}H_{24}$, was obtained. This boiled at 120°—123° C. at 13 mm., had the sp. gr. 0·9348, $n_D = 1·50275$ and $\alpha_D = +74·5°$. The higher boiling fractions when treated with semicarbazide solution gave a semicarbazone of m.pt. 237° C. The ketone, $C_{15}H_{22}O$, obtained therefrom by decomposing with phthalic anhydride had the b.pt. 163°—166°C. at 10 mm., m.pt. 43° C., sp. gr. 1·017 at 20° C., $n_D = 1·52700$, $\alpha_D = +123°$ (see this J., 1910, 898). Reduction with sodium and alcohol gave gurjunene alcohol, $C_{15}H_{24}O$, m.pt. 104° C., b. pt. 155°—159°C., sp. gr. 1·001, $n_D = 1·51859$, $\alpha_D = +34°$. Tricyclodihydrogurjunene (cedrene type), $C_{15}H_{26}$, was obtained by reducing the sesquiterpene with hydrogen in the presence of platinum. It had the b. pt. 120° C. at 8 mm., sp. gr. 0·9258, $n_D = 1·49775$, $\alpha_D = -37·5°$. The tricyclogurjunene was also obtained from the semicarbazone of m. pt. 237° C. by heating with sodium ethoxide in alcohol to 160° C. This sesquiterpene gave no colouration when the solution in glacial acetic acid was treated with sodium nitrite solution and concentrated sulphuric acid (Turner's reaction). The original crude gurjunene contained a large proportion of tricyclene-gurjunene (α-gurjunene), which was separated after fractionation and had the characters: b. pt. 114°—116° C., sp. gr. 0·918 at 20° C., $n_D = 1·5010$, $\alpha_D = -95°$. This substance as well as the original crude sesquiterpene gave a violet colouration when tested by Turner's reaction. When oxidised by means of permanganate, an indifferent oxidation product was formed boiling between 165° and 180° C. at 12·5 mm. and with $\alpha_D = -69°$. The crude sesquiterpene became dextro-rotatory after heating to 290° C. and only combined with two atoms of hydrogen in the presence of platinum.
—F. Shdn.

Camphor dissolved in olive oil; Specific rotatory power of ——. H. Malosse. Bull. Soc. Chim., 1914, **15**, 358—359.

The values for the specific rotatory power of camphor when dissolved in olive oil at different concentrations are tabulated and shown in a curve-diagram. For solutions containing from 75 to 95 per cent. by weight of olive oil the results may be expressed by the following formulæ, where *c* represents grms. of camphor in 100 c.c. of solution, *p*=grms. of camphor and *q*=grms. of oil in 100 grms of, solution:—

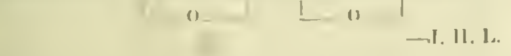
$$[\alpha]^{15}_{D} = 57·9 - 0·53399c + 0·02834c^2 - 0·0005023cq^3$$
$$[\alpha]^{15}_{D} = 57·9 - 0·4894p + 0·023805p^2 - 0·0003867p^3$$
$$[\alpha]^{15}_{D} = 139·69 + 7·3294q - 0·092205q^2 + 0003867^3$$

—A. S.

Dibenzoylglucoxylose: a natural benzoyl derivative of a new disaccharide. F. B. Power and A. H. Salway. Chem. Soc. Trans., 1914, **105**, 1062—1069.

The bitter taste of the leaves and stems of the Australian shrub, *Daviesia latifolia*, R.Br., is due to the presence of considerable quantities of a crystalline dibenzoyl derivative, $C_{25}H_{28}O_{12}.H_2O$, of a new disaccharide $C_{11}H_{20}O_{10}$. The benzoyl compound melts at 147°—148°C., is sparingly soluble in cold water, ether and chloroform, but readily soluble in alcohol and hot water, from which prismatic needles containing one molecule of wate separate on cooling. It is lævorotatory ($[\alpha]_D = -106·7$ in methyl alcohol solutions), non-reducing, and yields penta-acetyl derivative melting at 203° C. The benzoy groups are eliminated by caustic alkalis in the cold, and th product, obtained by evaporating a methyl alcohol solutio *in vacuo*, forms an amorphous, horn-like solid, $C_{11}H_{2}O_{1}$ nearly colourless, which rapidly absorbs water from th air. This product is very soluble in water, moderatel soluble in alcohol, possesses a sweet taste, does n reduce Fehling's solution or yield an osazone, and it aqueous solutions are lævorotatory ($[\alpha]_D$=about −30 When hydrolysed with acids it yields dextrose and pentose, evidently xylose. The change in optical rotati ("inversion") which accompanies complete hydroly (by heating for 10 mins. at 80° C. with mineral acids

5 per cent. concentration) accords with the conclusion that the disaccharide is a glucoxylose, and the following formula is suggested :—



$$HO.CH_2{\cdot}CHOH{\cdot}CH(CHOH)_2CH{\cdot}O{\cdot}CH(CHOH)_2CH{\cdot}CH_2OH.$$

—I. H. L.

Grignard reagent ; Action of chromic chloride on the ——. G. M. Bennett and E. E. Turner. Chem. Soc. Trans., 1914, 105, 1057—1062.

Attempts to prepare organo-metallic derivatives of chromium by the action of anhydrous chromic chloride on Grignard reagents (organo-magnesium compounds) failed : instead, a reaction took place of the type :

$$2CrCl_3+2C_6H_5.MgBr= C_6H_5.C_6H_5+2CrCl_2+MgCl_2+MgBr_2 ;$$

and the method proved very satisfactory for the preparation of diarylhydrocarbons. Grignard reagents from bromobenzene, benzyl bromide, *a*-bromonaphthalene, and *p*-iodotoluene gave excellent yields of diphenyl, *s*-diphenylethane (dibenzyl), *aa*-dinaphthyl, and 4 : 4′-dimethyl diphenyl respectively. It was not found possible to obtain 2 : 2′-dimethyldiphenyl from *o*-iodo- or *o*-bromotoluene in this way, and only a very poor yield of di-isoamyl was obtained from isoamyl iodide.—A. S.

Hydroxylamine ; Detection and determination of ——. H. Schroeder. Chem. News, 1914, 109, 205.

Angelis' test (this J., 1895, 771) for hydroxylamine is modified thus :—The liquid to be tested is carefully neutralised with hydrochloric acid or sodium hydroxide, and 2 c.c. are shaken with 1 mgrm. of solid sodium nitroprusside and 1 c.c. of *N*/10 sodium hydroxide, and rapidly heated to 100° C. in a water-bath. In the presence of hydroxylamine, at a concentration of 0·01 per cent., a magenta colouration is developed. By diluting the liquid to 50 c.c. in a Nessler tube, the hydroxylamine may be estimated colorimetrically by comparison with a standard solution, or colour standards may be made for permanent use from a mixture of methyl orange and phenolphthalein. —J. F. B.

Light ; Supposed chemical changes by the action of ——. E. Sernagiotto and A. Baron Hoschek. Z. physiol. Chem., 1914, 90, 437—440.

The authors repeated some of the experiments of Inghilleri on photochemical synthesis (this J., 1911, 986 ; 1912, 793), but were unable to confirm his results. The amount of methyl alcohol formed by the interaction of formaldehyde and water was not appreciably increased by exposing the reaction mixture to sunlight. Only a trace, at most, of methyl formate was produced by the action of light on a mixture of formaldehyde solution and methyl alcohol. The " new " alkaloid obtained by Inghilleri by the action of light on a mixture of formaldehyde, ammonia and methyl alcohol, proved to be hexamethylenetetramine. A mixture of glycerol and oxalic acid, whether exposed to, or protected from light, yielded only a very small quantity of butyric acid, and, as a control experiment showed, this acid appears to be derived from the glycerol alone.—L. E.

Patents.

C-Allylsalicylic acid. L. Claisen, Godesberg, Germany, Assignor to Synthetic Products Co., New York. U.S. Pat. 1,094,123, April 21, 1914.

A C-allylsalicylic acid is claimed, in which the allyl group probably occupies the position adjacent to the hydroxyl group, and which crystallises in needles of m. pt. 96° C. : it is a valuable antipyretic (see Ger. Pat. 268,982 ; this J., 1914, 277).—T. F. B.

Isoprene ; Process of producing ——. L. P. Kyriakides and R. B. Earle, Assignors to Hood Rubber Co., Boston. U.S. Pats. 1,094,222 and 1,094,223, April 21, 1914.

(1.) Isoprene is obtained by passing the vapours of an isoamylene oxide over a dehydrating catalyst (*e.g.*, heated aluminium silicate), at less than atmospheric pressure ; the catalyst may be heated to between 400 and 600° C. (2.) The vapours of a methylbutane-diol, such as 1.3-dihydroxy-2-methylbutane, are passed over a heated dehydrating catalyst at a reduced pressure.—T. F. B.

1.3-*Diols ; Process for producing* ——. L. P. Kyriakides and R. B. Earle, Cambridge, Mass., Assignors to Hood Rubber Co. U.S. Pat. 1,094,224, April 21, 1914.

Ketone-alcohols are converted into 1.3-diols by electrolytic reduction in acid media, *e.g.*, in sulphuric acid solution using lead electrodes.—T. F. B.

Aldol ; Process of producing ——. R. B. Earle and L. P. Kyriakides, Cambridge, Mass., Assignors to Hood Rubber Co. U.S. Pat. 1,094,314, April 21, 1914.

Acetaldehyde, either in the form of vapour or liquid, is brought in contact with an alkaline condensing agent. For example, liquid acetaldehyde is brought in contact with dry slaked lime, the resulting liquid is removed, the acetaldehyde in the liquid is evaporated, and the process is repeated until a concentrated solution of aldol is obtained.—T. F. B.

1.3-*Glycols ; Process for producing* ——. R. B. Earle and L. P. Kyriakides, Cambridge, Mass, Assignor to Hood Rubber Co. U.S. Pats. 1,094,315 and 1,094,316, April 21, 1914.

(1.) Aldols are reduced electrolytically to 1.3-glycols in alkali carbonate (sodium bicarbonate) solution, using a mercury cathode, at a temperature below 20° C. A current density between 4 and 5 amps. per 100 sq. cm. of cathode surface, at 5 to 16 volts, may be used. (2.) The 1.3-glycols (β-glycols) are produced by reducing 1.3-ketone-alcohols electrolytically, at a mercury cathode, in sodium bicarbonate solution, below 20° C., using a current density of 3 to 6 amps. per 100 sq. cm. cathode surface at over 3 volts.—T. F. B.

Pharmaceutical or medicinal compound [a-bromo-isovaleryl-p-phenetidide] and process for producing the same. P. Bergell, Berlin-Wilmersdorf, Assignor to J. D. Riedel A.-G., Berlin-Britz, Germany. U.S. Pat. 1,094,296, April 21, 1914.

a-Bromo-isovaleryl bromide is added slowly, with stirring, to a solution of *p*-phenetidine in benzene, and the liquid is heated, filtered, and allowed to cool : a-bromo-isovaleryl-*p*-phenetidide is thus obtained, of m. pt. 151° C., sparingly soluble in water, easily soluble in alcohol, ether, and benzene, and slowly decomposed by alcoholic alkali solutions. It possesses soporific and strong antineuralgic properties.—T. F. B.

Trehalose and a vegetable acid ; Process for obtaining ——. R. Worms. Ger. Pat. 271,789, Nov. 16, 1912.

Selaginellacenes are extracted with a solvent (*e.g.*, aqueous alcohol), and the extract, which is free from chlorophyll and resin, is treated for the recovery of the carbohydrate and acid. For example, a substance such as alcohol may be added, in which the trehalose is sparingly soluble. The solution contains a new acid, *selaginellic acid*, which is distinguished by the fact that it forms golden yellow solutions with alkalis. It can be separated from the extract by means of its lead salt, or by extraction with a solvent which is immiscible with water.—T. F. B.

Dihydroxybenzene-arsinic acid ; Process for preparing a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,892, Nov. 12, 1912.

The treatment of 4-hydroxybenzene-1-arsinic acid with potassium persulphate in aqueous-alkali solution, results in the introduction of a second hydroxyl group into the benzene nucleus, with the formation of a dihydroxybenzene-arsinic acid.—T. F. B.

3.3′-Diamino-4.4′-dihydroxyarsenobenzene ; Process for preparing neutral derivatives of —— soluble in water. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,893, Feb. 1, 1913. Addition to Ger. Pat. 245,756.

3.3′-Dinitro-4.4′-dihydroxyarsenobenzene is used in place of the corresponding diamino compound or the 3-nitro- or 3-amino-4-hydroxybenzene-1-arsinic acid in the processes described in the principal patent or in Ger. Pats. 260,235, 263,460, and 264,014 (see this J., 1912, 604 ; 1913, 960, 1039).—T. F. B.

3.3′-Diamino-4.4′-dihydroxyarsenobenzene ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,894, Feb. 1, 1913. Addition to Ger. Pat. 206,456.

3-Nitro-4-hydroxybenzene-1-arsinic acid, or 3.3′-dinitro-4.4′-dihydroxyarsenobenzene or 3-nitro-4-hydroxybenzene-arsenoxide is reduced by means of hypophosphorous acid or of phosphorous acid and potassium iodide or hydriodic acid, preferably in presence of acetic acid (see also Ger. Pats. 269,886 and 269,887 ; this J., 1914, 375).—T. F. B.

Organic arsenic compounds ; Process for preparing easily soluble ——. H. Bart. Ger. Pat. 272,035, May 14, 1912.

Derivatives of arsenobenzene or of phenylarsine which contain an amino group, alone or in addition to other substituents, are treated with aldehydesulphonic acids in equimolecular proportions. The alkali salts of the products are easily soluble in water. They are applicable to medicine.—T. F. B.

Aromatic mercury compounds ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 272,289, Jan. 30, 1913.

Aromatic arsenic compounds which contain tervalent arsenic, are treated with mercuric oxide or a mercury salt. In this reaction, which may be carried out in acid, neutral, or alkaline solution, the mercury replaces the arsenic, which is split off in the form of arsenious acid, and the mercury becomes attached to the benzene nucleus, producing compounds of the type, Ar.Hg.X, or Ar.Hg.Ar. —T. F. B.

Acid esters from esters lower in hydrogen ; Process for preparing ——. K. H. Wimmer. Ger. Pat. 271,985, July 6, 1912.

Glycerides or other esters of unsaturated fatty acids are hydrogenated by means of hydrogen or gaseous mixtures containing hydrogen in presence of a catalyst and a substance which combines with water. The hydrolysis of the ester is avoided by this process.—T. F. B.

Reduction of organic compounds by means of hydrogen in presence of palladium ; Process for the ——. Naaml. Vennootsch. Ant. Jurgens' Vereenigde Fabrieken. Ger. Pat. 272,340, March 26, 1912.

Palladium in a coherent form, *e.g.*, in filings or in coherent coatings on other substances, is used as catalyst in the reduction of organic compounds by hydrogen. The use of the metal in this form has the advantage over using the metal in powder that it is easily separated from the product of the reaction, and it can be regenerated by simple ignition.—T. F. B.

Salts of lower fatty acids ; Process for preparing a mixture of ——. J. Ederer. Ger. Pat. 272,036, April 23, 1913.

Comminuted wood is extracted with lime water or other alkaline solution in a diffusion battery at the ordinary temperature on with gentle heat, and at the ordinary pressure, until the solution is saturated with the salts of the lower fatty acids ; the liquid is then evaporated. The yields of fatty acids obtainable by this method vary between 1 to 2 per cent. for pine wood and 5 to 6 per cent. for beech, calculated on the air-dried wood. The acids consist mainly of acetic acid with 1 to 3 per cent. of formic acid and a trace of butyric acid.—T. F. B.

Lecithin preparations obtained by treating egg-yolk with acetone ; Process for purifying the ——. G. Fendler. Ger. Pat. 272,057, Feb. 15, 1913.

The lecithalbumin preparations, obtained by extracting egg-yolk with acetone, are thoroughly moistened with water or with an aqueous liquid such as milk, and the mass is dried at the ordinary temperature or by heating. This process removes the unpleasant taste due to the solvent, and is preferable to the purification of the product by washing with water, which is liable to remove certain valuable salts and albuminous substances.—T. F. B.

Agar-agar preparation giving clear solutions ; Process for preparing an ——. E. Merck. Ger. Pat. 272,145, June 22, 1913.

Commercial agar-agar is dissolved in hot water, filtered, and congealed by freezing ; after it has become liquid again it is separated from the aqueous liquid and washed with cold water until the washings contain no residue, whereupon it is dried. The final washing process may be replaced by repeated freezings and thawings, the aqueous liquid being separated after thawing and sufficient water added to make up the original volume. This treament removes the portion of the crude agar which is soluble in cold water and which does not set.—T. F. B.

Polymethylene-bis-imino acids and their salts ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 272,290, Nov. 13, 1912.

Polymethylenediamines or their homologues are treated with cyanides and aldehydes or ketones, and the resulting dinitriles are converted into the corresponding acids by the usual methods ; the acids may then be converted into salts, particularly copper salts. The copper salts are very easily assimilated, and may be used for the treatment of infectious diseases, especially tuberculosis.—T. F. B.

Cantharidyl-ethylenediamine ; Process for preparing salt-like double compounds from ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 272,291, March 21, 1913. Addition to Ger. Pat. 269,661 (see this J., 1914, 375).

The condensation product from cantharidine and ethylenediamine is treated with heavy metal salts other than gold salts. The products are suitable for use in medicine. —T. F. B.

Compound containing silicon ; Process for preparing a ——. H. Weyland. Ger. Pat. 272,338, Feb. 15, 1913.

Urea is heated with silicon tetrachloride. The product contains silicon and has the properties of a weak acid, forming a soluble sodium salt, from which the free compound is obtained by treatment with carbon dioxide. It may be used for medicinal purposes.—T. F. B.

Soluble colloidal substances ; Process for preparing ——. L. Sarason. Ger. Pat. 272,386, Sept. 2, 1913.

Solutions of nucleinic acid are used as colloidisers in the preparation of hydrosols by the known methods. The products are very stable.—T. F. B.

Aluminium acetate compounds soluble in water ; Process for preparing ——. Kalle und Co. A.-G. Ger. Pat. 272,516, July 7, 1912.

Hexamethylenetetramine is added to a solution o aluminium acetate, and preferably also a substance whic increases the solubility of the acetate in water, such as glycerin, mannitol, citric acid, lactic acid, or tartaric acid. The resulting solution may be evaporated to dryness, giving products which dissolve in water. The new double compounds may be used for medicinal purposes.—T. F. B.

Lactide ; Manufacture of ——. G. B Ellis, London. From Chem. Werke vorm. Dr. H. Byk, Berlin. Eng. Pat. 8771, April 14, 1913.

See Fr. Pat. 456,824 of 1913 ; this J., 1913, 1086.—T. F. B.

Ethers of monohydric alcohols and polyhydric substitution products of aromatic hydrocarbons ; Process for the production of ——. C. Torley, Brussels, and O. Matter, Troisdorf, Germany. Eng. Pat. 9451, April 22, 1913.

See Fr. Pat. 457,843 of 1913 ; this J., 1913, 1003.—T. F. B.

Salicylic acid compound : Process for the manufacture of a ——. H. Weitz, Berlin-Wilmersdorf, Germany. Eng. Pat. 9715, April 25, 1913. Under Int. Conv., May 24, 1912.

See Ger. Pat. 262,328 of 1912 ; this J., 1913, 925.—T. F. B.

Acyl sulphuric acids and the alkali and earth alkali metal salts of acyl sulphuric acids ; Process for the manufacture of ——. E. C. R. Marks, London. From Naamlooze Vennootschap Fabriek van Chemische Produkten, Schiedam, Holland. Eng. Pat. 12,130, May 24, 1913.

See Fr. Pat. 461,539 of 1913 ; this J., 1914, 219.—T. F. B.

Isoprene and erythrene ; Manufacture of ——. P. A. Newton, London From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,321, June 9, 1913. Addition to Eng. Pat. 19,919, Sept. 7, 1911.

See Addition of June 10, 1913, to Fr. Pat. 439,381 of 1912 ; this J., 1913, 1129.—T. F. B.

Bismethylaminotetraminoarsenobenzene ; Manufacture of aqueous solutions of ——. C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. Eng. Pat. 1667, Jan. 21, 1914. Under Int. Conv., Jan. 23, 1913.

See Ger. Pat. 269,660 of 1913 ; this J., 1914, 374.—T. F. B.

Turpentine or turpentine oil ; Depolymerisation of ——. A. Heinemann, London. U.S. Pat. 1,092,838, April 14, 1914.

See Eng. Pat. 1953 of 1912 ; this J., 1913, 252.—T. F. B.

Pharmaceutical compounds [alkoxymethyl esters of cresotinic acids]. J. Callsen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,094,119, April 21, 1914.

See Eng. Pat. 16,387 of 1913 ; this J., 1913, 1030.—T. F. B.

Keto compounds from ketones and alkylaminomethanes or tetra-alkyldiaminomethanes : Process of producing ——. G. Merling and O. Chrzescinski, Elberfeld, and H. Köhler, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,094,159 and 1,094,160, April 21, 1914.

See Eng. Pat. 14,231 of 1913 ; this J., 1913, 1128.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Photographic silver-prints ; Process of converting —— into coloured prints. A. Traube, Charlottenburg, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,093,503, April 14, 1914.

See Fr. Pat. 376,051 of 1907 ; this J., 1907, 1029.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Mercury fulminate ; Electrolytic determination of mercury in ——. M. S. Losanitsch. Monatsh. Chem., 1914, **35**, 307—309.

The fulminate (0·4 to 0·5 grm.) previously dried at 70°—80° C., is treated with such a quantity of concentrated nitric acid (2·5 to 3·5 c.c.) that after decomposition there shall be sufficient free acid remaining to yield a solution suitable for direct electrolysis. The decomposition is aided by careful warming and finally by boiling. The solution is then made up to about 120 c.c. and electrolysed by an ordinary or a rapid method. The deposit (on a gauze electrode) is washed with water and absolute alcohol, and is then dried over potassium hydroxide in the presence of mercury, and weighed.—W. H. P.

Patents.

Explosive. A. E. Charbonneaux, San Francisco, Cal. U.S. Pat. 1,093,767, April 21, 1914.

A mixture of the ammonium salt of a hydrocarbon sulphonic acid, such as ammonium naphthalenesulphonic acid, potassium chlorate, and potassium permanganate. —O. E. M.

Explosives ; Manufacture of ——. I. B. T. von Tarnow. Fr. Pat. 465,082, Nov. 20, 1913.

Aluminium powder is incorporated with a nitro-hydrocarbon of the aromatic series (*e.g.*, mono-, di-, or trinitrobenzene, aniline tetranitrate, or methylaniline tetranitrate) and ammonium perchlorate, with or without the addition of soluble nitrocellulose and hydrocarbons or carbohydrates, such as paraffin wax, cellulose, etc., and an alkali nitrate the base of which will combine with the chlorine liberated in the explosion, and thus render the explosive suitable for use in mines, etc. Suitable proportions are :—aluminium 9, sawdust or cellulose 9, trinitrobenzene 12, potassium nitrate 30, and ammonium perchlorate 40 per cent.—C. A. M.

Explosives of the Sprengel class ; Manufacture of ——. T. Hawkins, Balmain, N.S.W. Eng. Pat. 17,307, July 28, 1913. Under Int. Conv., Sept. 23, 1912.

See Fr. Pat. 461,332 of 1913 ; this J., 1914, 222.—T F. B.

Nitrocellulose ; Process for the preparation of ——. K. Schniter, Frankfort, Assignor to Verein. Kunstseidefabriken A.-G., Kelsterbach on Maine, Germany. U.S. Pat. 1,093,012, April 14, 1914.

See Fr. Pat. 455,011 of 1913 ; this J., 1913, 886.—T. F. B.

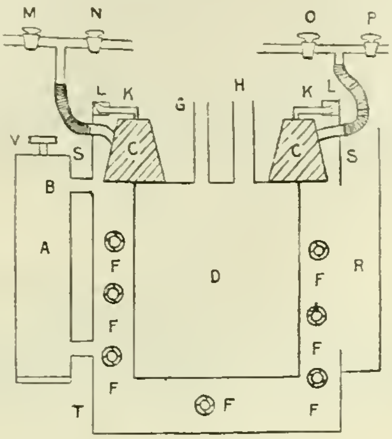
XXIII.—ANALYTICAL PROCESSES.

Tyndall effect in colloidal solutions ; Measurement of the ——. W. Mecklenburg. Kolloid-Zeits., 1914, **14**, 172—181.

The Tyndallmeter devised by the author and Valentiner for measuring the intensity of the Tyndall effect in turbid or colloidal solutions (see Z. Instrumentenkunde, June, 1914), is based on the principle of observing directly the intensity of the Tyndall light in a direction perpendicular to the axis of the rays producing the effect and comparing it with the original intensity of these rays, for which purpose a portion of the beam of light is separated from the remainder and its intensity diminished by means of smoked glasses and a combination of Nicol prisms until it is equal to that of the Tyndall light. The results of some experiments on a colloidal stannic acid solution are given and it is suggested that the Tyndallmeter will prove useful for the comparison of colloidal solutions, for studying coagulation, in the examination of effluents, and in analytical problems.—A. S.

Calorimeter; An adiabatic ——. F. W. Gray. Chem. Soc. Trans., 1914, **105**, 1010—1014.

To reduce radiation losses to a minimum the calorimeter is placed during an experiment, in a chamber, D, which can be kept at a constant temperature. This chamber is a metal vessel immersed in water in a metal vessel, T, and forced upwards by its buoyancy against three corks, C, bearing against arms, K, hinged at L. The water in T is circulated by a stirrer, V, in the chamber, A, and the temperature is adjusted as required by passing hot or cold water through the coil of flexible copper tubing, F, by suitably adjusting the water-taps, M, N, O, P. The temperature of the water in T is observed by a Beckmann thermometer in the chamber, R. Openings, G, H, are provided in D for the thermometer and stirrer of the calorimeter. The apparatus is made of nickel-plated brass, and the flexible copper tube is soldered to brass end-pieces which are joined by rubber tubing to brass tubes, S.—A. T. L.



Flame reactions. II. W. D. Bancroft and H. B. Weiser. J. Phys. Chem., 1914, **18**, 281—336.

From a survey of the available data with regard to the luminosity of gases, it is concluded that an absolutely transparent gas will emit no light at any temperature unless a chemical reaction takes place. A coloured vapour may emit thermal luminescence but it does not follow that all light from coloured vapours is due to thermal causes, even when the radiation has a lower intensity than that of a black body at the same temperature. Since luminescence is often due to chemical action the authors made a qualitative study of the flame reactions of tin and copper and their salts with a view to deciding what reactions cause the luminescence. Care was taken to distinguish between colours due to emission and to absorption respectively. The reaction tin→stannous ion gave a carmine colour, and tin→stannic ion a green colour, the latter being more intense as a rule. The differences between the spectra of the halides of tin were due to differences in the absorption and emission of light by the halogens. In flames containing copper the reaction copper→cuprous ion gave a green colour, Cu→ cuprous salt a red and cuprous ion→cupric ion, or cupric salt, a blue colour. The intensity of the green luminescence was so great that the unaided eye could not distinguish any blue in the ordinary copper flame even though the copper was burning chiefly to cupric salt. The violet red colour of undissociated cupric chloride vapour (observed when chlorine acts upon very hot copper) must not be mistaken for luminescence.—W. H. P.

Manganese reaction; Study of Marshall's ——. E. Schowalter. Z. Unters. Nahr. Genussm., 1914, **27**, 553—562.

Marshall's reaction, which depends on the oxidation of manganese salts to permanganate by means of ammonium persulphate in the presence of silver salts, has been used for the determination of small quantities of manganese in water with good results (see this J., 1913, 447). With quantities of manganese exceeding a few mgrms., however, there is tendency for manganese dioxide to separate out during the oxidation. The following modification enables relatively large amounts of manganese to be determined. The manganese salt (equivalent to not more than 0·2 grm. of manganese) is dissolved in water, 30 c.c. of nitric acid, sp. gr. 1·24, and 8 grms. of ammonium persulphate are added, and the mixture is diluted to 100 c.c.; this solution is then added, in small quantities at a time, to a solution consisting of 10 c.c. of $N/10$ silver nitrate solution, 15 c.c. of nitric acid, 10 grms. of ammonium persulphate, and 35 c.c. of water, this solution having been heated previously to 50° C. The whole is maintained at 50° C. for 10 minutes, then cooled, and the permanganate titrated with arsenious acid solution. The reaction is a catalytic one in which silver peroxide acts as catalyst.—W. P. S.

Nitrates and nitrites; An extremely delicate colorimetric method for detecting and determining ——. E. A. Letts and F. W. Rea. Chem. Soc. Trans., 1914, **105**, 1157—1161.

The diphenylamine reagent for nitrates and nitrites is not suitable for the purpose of a quantitative estimation, but if diphenylbenzidine, the intermediate product of its oxidation to the blue dye, is substituted for it the reaction is available as the basis of a delicate colorimetric method. 0·5 c.c. of the solution to be tested (or smaller quantities made up to this volume if the solution is too strong), are mixed with 1·2 c.c. of sulphuric acid, and 0·3 c.c. of a 0·02 per cent. solution of the reagent in concentrated sulphuric acid, and the colour compared after standing for 10 mins. with that obtained from standard nitrate solutions under similar conditions. Nitrites can be similarly determined after previous oxidation with potassium permanganate.—G. F. M.

Methoxyl [group]; Determination of ——*, in substances containing sulphur.* A. Kirpal and T. Bühn. Ber., 1914, **47**, 1084—1087.

The decomposition of the methoxyl group is effected in the usual way according to the method of Zeisel, preferably with the addition of acetic anhydride. The disturbing influence of hydrogen sulphide upon the determination is eliminated by using pyridine as the absorbent for the methyl iodide: the resulting pyridine methiodide may be titrated directly with silver solution in the absence of pyridine and its salts. A current of hydrogen carries the volatile reaction-products into a receiver consisting of two test-tubes, each containing 3 to 4 c.c. of pyridine, followed by a small flask containing water. The reaction is usually complete after about an hour's heating. The contents of the three receiving vessels are then evaporated as far as possible in a glass dish upon the water-bath. The residue, which crystallises on cooling, is dissolved in water and titrated with $N/10$ silver solution using sodium chromate as indicator. To obtain the best end-point a slight excess of the silver solution is run in; a measure amount of $N/10$ sodium chloride solution is then added and the excess titrated with the silver solution. Result are quoted which show the method to be very accurate —J. R.

Direct iodometric determination of soluble iodides. Stüw *See* VII.

Determination of sulphur in spent oxide by combustio Somerville. *See* VII.

Some errors in the determination of rare earths as hydroxid Smith and James. *See* VII.

Colorimetric determination of sulphur in pig iron and stee Misson. *See* X.

Use of tantalum electrodes. Brunck. *See* XI.

Detection of "gloss oil" [rosin oil] in linseed oil. Thurston. *See* XII.

Action of halogens on oleic acid, and determination of iodine values of oils. Meigen and Winogradoff. *See* XII.

Classification of willow barks by means of chemical reactions. Powarnin and Barabanow. *See* XV.

Pentoses in tanning materials, and the detection of mangrove. Reed and Schubert. *See* XV.

Determination of tanning materials in admixture. Wisdom. *See* XV.

Determination of sulphur in honey and other materials containing much sugar. Nottbohm and Weinhausen. *See* XVII.

Determination of colloids in beers. Marc. *See* XVIII.

Detection of beef and mutton fats in lard by Bömer's method. Sprinkmeyer and Diedrichs. *See* XIXa.

Determination of hardness of waters by the methods of Wartha-Pfeifer and Blacher. Zink and Hollandt. *See* XIXb.

Determination of colloids in effluents and use of the liquid-interferometer in the examination of water. Marc and Sack. *See* XIXb.

Use of carbon tetrachloride for the extraction and determination of the active principles of drugs and medicinal plants. Gori. *See* XX.

Determination of volatile acids in essential oils. Umney. *See* XX.

Detection and determination of hydroxylamine. Schroeder. *See* XX.

Electrolytic determination of mercury in mercury fulminate. Losanitsch. *See* XXII.

Patents.

Gas-tight seals, or closures, between metal and vitreous material [glass]; Production of ——. H. J. S. Sand, Nottingham, and F. Reynolds, Muswell Hill. Eng. Pat. 23,854, Oct. 21, 1913.

Clean surfaces of lead, or other metal or alloy of sufficient plasticity, and vitreous material, such as glass, are caused to adhere so as to remain in perfect contact under varying conditions of temperature, by melting the metal in a vacuum, or in an indifferent or reducing atmosphere, in a space adjoining the point of sealing. Gas-tight joints between vitreous material and metal wire are obtained by introducing or sealing the wire into position, and then allowing lead or similar metal (melted as above) to flow into a cup or recess in the vitreous material so as to cover the projecting end of the wire. If necessary, the seal may be rendered perfect by applying pressure to the surface of the lead (*e.g.*, by admitting air before it solidifies).—F. Sodn.

Photometers; Table ——. C. Carpenter, London. Eng. Pat. 1239, Jan. 16, 1914.

For testing rapidly a number of different samples of gas, separate burners are used, each movable on its own slide and provided with its own connections, meter, governor and cock. The burners can be withdrawn into light-tight boxes. The slides for the several burners are directed radially towards the "photoped" (photometer screen), which is pivoted and is adjusted for each burner so as to be perpendicular to the line bisecting the angle between the beams of light from the testing burner and the standard burner. A small screen is mounted in front of the photometer screen in order to cut off those portions of the beams which would overlap upon the photometer screen. This small screen may be mounted in such a way that its position is adjusted automatically according to the angular adjustment of the photometer screen.—A. T. L.

Apparatus for taking samples of powdered or liquid substances. Eng. Pat. 7354. *See* I.

Process and apparatus for determining by weight quantities of gas, steam or other vapour or liquid. Eng. Pat. 8012. *See* I.

XXIV.—MISCELLANEOUS ABSTRACTS.

Palladium: The rate of solution of hydrogen by ——. A. Holt. Roy. Soc. Proc., 1914, A., 90, 226—237.

The shape of the curves representing the rate of solution of hydrogen by palladium points to the existence of two forms of the metal. The results indicate an initial phenomenon of surface diffusion associated with the α-form of the metal, followed by solution in the β-form. The case appears to be analogous to the "sorption" of gases by charcoal and other solids. Palladium black yields smooth rate curves which denote the absence of one of the forms of the metal.—J. R.

Deliquescence. Part I. Deliquescence of salts of ammonium bases. C. J. Peddle. Chem. Soc. Trans., 1914, **105**, 1025—1039.

The paper deals mainly with a comparison of the deliquescence of the salts of some substituted ammonium bases. The substances (1 grm.) were dried and then sifted until the particles passed through a 30-mesh but were retained by a 60-mesh sieve. They were exposed in weighing bottles of 25 mm. diam., placed in a glass dish over distilled water in a Scheibler desiccator, in the upper part of which was an air fan working at a rapid rate; the whole apparatus was placed in a constant temperature bath at 25° C. The results are given in the form of curves and tables. The rate of absorption varied considerably for different compounds, but was greatest during the third hour of exposure in the case of the most deliquescent compounds and the values of $g \times 1000$ (g = grms. of water absorbed per grm. of substance) at the end of 3 hours were used for purposes of comparison. The compounds giving the highest values were: tetrapropylammonium chloride, 154; diethylamine hydrochloride, 164·9; propylamine hydrochloride, 170·9; tetraethylammonium chloride, 219; dimethylamine hydrochloride, 220·5; ethylamine hydrochloride, 260·5; calcium chloride, 212·8; phosphorus pentoxide, 224·1. Ethylamine hydrochloride in 12 hours absorbed 14 per cent. more moisture than did phosphorus pentoxide.—A. S.

Proteins: Methylation of —— *[by diazomethane].* J. Herzig and K. Landsteiner. Biochem. Zeits., 1914, **61**, 458—463. (See also Skraup and Krause, this J., 1909, 956.)

The finely powdered material was left to stand for ten days with an excess of an ethereal solution of diazomethane, which was subsequently removed by distillation or filtration, and the solid was washed with alcohol, ether and water. By this treatment, repeated in most cases, casein, serum albumin, gelatin, edestin, and silk-fibroin were converted into products containing about 4—5 per cent. of methoxy groups and 4—5 per cent. of methyl groups attached to nitrogen. Control analyses of the substances named, before treatment with diazomethane, gave in all cases positive results, *viz.*, 0·18—0·64 per cent. of methoxy groups (possibly due to traces of alcohol retained by the preparations) and 1·07—1·78 per cent. of methyl groups attached to nitrogen (similar values have been obtained with amino-acids). The nitrogen of protamines and polypeptides appears to be more readily methylated than that of the compounds mentioned above.—J. H. L.

PATENT.

Tobacco leaves; Production of artificial —— from tobacco waste. K. K. Oesterreichische Tabakregie. Ger. Pat. 272,328, July 14, 1911.

TOBACCO waste from the manufacture of cigars or cigarettes is beaten to a pulp with a concentrated solution of alkali hydroxide or carbonate and then treated in the ordinary manner on a paper-making machine so as to yield finally a sheet of pure tobacco-substance.—A. S.

Books Received.

FUEL-BRIQUETTING INVESTIGATIONS. JULY, 1904, TO JULY, 1912. By C. L. WRIGHT. U.S. Bureau of Mines, Washington. Bulletin 58.

THIS Bulletin contains the results of investigations on the briquetting of various American fuels, and deals chiefly with the briquetting of lignites and coals, the examination of the "binders" used, and the testing of the briquettes.

NUCLEIC ACIDS. THEIR CHEMICAL PROPERTIES AND PHYSIOLOGICAL CONDUCT. By WALTER JONES, Ph.D. MONOGRAPHS ON BIOCHEMISTRY. Edited by R. H. A. PLIMMER, D.Sc., and F. G. HOPKINS, M.A., D.Sc., F.R.S., etc. Longmans, Green & Co., 39, Paternoster Row, London, New York, Bombay and Calcutta. 1914. Price 3s. 6d. net.

VOLUME (9¾ by 6¼ ins.) containing 97 pages of subject matter, 17 of bibliography, and an alphabetical index of subjects. The matter is classified as follows:—PART I. Chemical properties of nucleic acids. (i.) Introduction. (ii.). Thymus nucleic acid. (iii.) Yeast nucleic acid. PART II. Physiological conduct of nucleic acids. IV. Conclusion. APPENDIX. Preparation of thymus nucleic acid. Analytical chemistry of the purine derivatives. Preparation of guanine and adenine from nucleic acid. Demonstration of the purine ferments.

THE SIMPLER NATURAL BASES. By GEORGE BARGER. M.A., D.Sc. Professor of Chemistry in the Royal Holloway College, University of London. MONOGRAPHS ON BIOCHEMISTRY. Edited by R. H. A. PLIMMER, D.Sc., and F. G. HOPKINS, M.A., D.Sc., F.R.S. Longmans, Green & Co., 39, Paternoster Row, London, New York, Bombay and Calcutta. 1914. Price 6s. net.

VOLUME (9¾ by 6¼ ins.) containing 165 pages of subject matter, 45 pages of bibliography and references, and an alphabetical index of subjects. The text is classified as follows:—I. Amines derived from protein. II. ω-Amino acids and bases containing a carboxyl group. III. Betaines. IV. Choline, etc. V. Creatine, creatinine, glycocyamine and guanidines. VI. Adrenaline. VII. Bases of unknown constitution. VIII. Practical chemical methods and details.

PRAKTIKUM DER CHEMISCHEN, BIOLOGISCHEN UND BAKTERIOLOGISCHEN WASSERUNTERSUCHUNG. Von Professor Dr. O. EMMERLING. Verlag von Gebrüder Borntraeger, W 35, Schöneberger Ufer 12a, Berlin. 1914. Price M 7.20.

VOLUME (9¾ by 6¼ ins.) containing 190 pages of subject matter, with 171 illustrations, 6 pages of bibliographic references, and an alphabetical index of subjects. The work commences with a dedication and preface, and the matter is classified as follows:—I. The chemical investigation of drinking waters, etc., ordinary water, and waste-water (sewage). II. Biological and microscopic investigation. III. Bacteriological investigation of water. IV. Conclusions as to the nature and condition of waters, etc.

THE FUELS USED IN TEXAS. By W. B. PHILLIPS and S. H. WORRELL. Bulletin of the University of Texas, No. 307. Scientific Series No. 35.

THE composition and calorific value of bagasse, coals, natural and manufactured gas, lignites, and fuel oils, are dealt with in this report.

ANORGANISCHE PEROXYDE UND PERSALZE. Von Dr. C. FREIHERRN VON GIRSEWALD. [Sammlung Vieweg, Heft 2.] Tagesfragen aus den Gebieten der Naturwissenschaften und der Technik. Friedr. Vieweg und Sohn, Braunschweig, 1914. Price M.2.40.

VOLUME (8½ by 5½ ins.), containing 98 pages of subject matter, classified as follows:—I. HYDROGEN PEROXIDE. A. Constitution. B. General characteristics of the derivatives of hydrogen peroxide, and their nomenclature. C. Technical methods of preparation of the hydroperoxides. D. Trade marks, etc., also materials added to aid in preservation. E. Uses of the peroxides. II. DERIVATIVES OF HYDROGEN PEROXIDE. A. Inorganic peroxides. B. Per-acids and per-salts.

BRENNEREIFRAGEN. Kontinuierliche Gärung der Rübensäfte. Kontinuierliche Destillation und Rektifikation. Von D. SIDERSKY. [Sammlung Vieweg, Heft 6.] Friedr. Vieweg und Sohn. Braunschweig. 1914. Price M.160.

VOLUME (8½ by 5½ ins.), containing 49 pages of subject matter, with 24 illustrations, and classified as follows:—I. Continuous fermentation of beet juices. II. Continuous distillation and rectification.

PHARMACOLOGY, CLINICAL AND EXPERIMENTAL. A groundwork of medical treatment, being a Text-Book for students and physicians. By Dr. HANS H. MEYER, of Vienna, and Dr. R. GOTTLIEB, of Heidelberg, Professors of Pharmacology. [Authorised translation into English by Dr. JOHN TAYLOR HALSEY.] F. B. Lippincott Company, Philadelphia and London. 1914 Price 25s. net.

VOLUME (9½ by 6¼ ins.), containing 582 pages of subjec matter, with 65 text illustrations, 7 in colour, and 2 pages of alphabetical index (subjects). The text i classified as follows:—I. PHARMACOLOGY of the mot nerve-endings. II. Of the central nervous system. II Of the sensory nerve-endings. IV. Of the vegetati nervous system. V. Of the eye. VI. Of the digestio VII. Of the reproductive organs. VIII. Of the circul tion. IX. Of the respiratory system. X. Of the ren function. XI. Of the secretion of sweat. XII. Of th metabolism. XIII. Of the muscles. XIV. Of th blood. XV Of heat regulation XVI. Of inflammatio XVII. Etiotropic pharmacological agents. XVII Factors influencing pharmacological reactions.

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Manchester Section.

Meeting held at the Grand Hotel on Friday, March 6th, 1914.

MR. JULIUS HÜBNER IN THE CHAIR.

A NEW PROCESS FOR PRODUCING FAST PRINTS ON TEXTILE FIBRES.

BY DR. HERBERT LEVINSTEIN.

The method usually employed for producing fast prints from coal tar or other dyestuffs depends on the use of (1) mordant dyestuffs; (2) ice colours; (3) vat dyestuffs; (4) oxidation colours. A typical representative of each of these four classes is (1) Alizarin Red; (2) Paranitraniline Red; (3) Indigo Blue; (4) Aniline Black. All these processes have one principle in common. A more or less soluble substance is first applied to the fibre, and is subsequently precipitated inside the fibre in an insoluble form.

The general method of using a mordant dyestuff in calico printing consists in mixing the dyestuff and mordant together into a thickened paste, which will not run, printing or padding, and drying. After drying the goods are steamed, and it is important to note that the combination of the dyestuff and mordant must not take place before the operation of steaming. A premature formation of the lake must be avoided, as it is essential that the fibre should be penetrated by the dyestuff prior to combination with the mordant. For this reason a mordant is usually employed which cannot react during drying, and is only decomposed into its active constituent during steaming.

The new process is due to the observation that a large number of dyestuffs form insoluble compounds when heated with formaldehyde. It depends on exactly the same general principle as the other methods of producing fast prints, and the procedure is very analogous to that in use with mordant dyestuffs. The dyestuffs employed are soluble. They are mixed into a paste with a suitable thickening agent together with formaldehyde, or preferably with a substance which will develop formaldehyde when the printed goods are steamed, and which will not react with the dyestuff during the previous operations of printing and drying.

Such a substance is hexamethylenetetramine, which is readily prepared in a state of sufficient purity by mixing together commercial ammonia with commercial formaldehyde in the correct molecular proportions. The mechanism of the reaction is thus entirely that of the older process. As the goods are steamed the fibre is penetrated by the soluble dyestuff, formaldehyde is slowly set free as the ammonia is driven off, and combines to form an insoluble precipitate inside the fibre. The most interesting results have been obtained with dyestuffs, which like mordant dyestuffs, are true adjective dyestuffs, and have no affinity whatever for the cotton fibre. On the other hand it has also been found possible to print various substantive dyestuffs in the same manner.

At the moment the process is in its infancy, and so far has been used only for the preparation of fast orange, brown and black shades. Preliminary work makes it appear probable that the process is capable of wider development and I venture, therefore, to class it, though with some diffidence, as a new general method for the production of fast prints.

An orange coloured and a black printed cloth have been prepared to show the results obtained respectively with an adjective and a substantive dyestuff. The printing recipes, the fastness of the printed material, and the properties of the condensation products of these two dyestuffs may be taken as typical of a number of dyestuffs wihch have already been investigated. To obtain the orange a simple monoazo dyestuff containing resorcinol as an end component (see English patents 29,021/12, 1123/13 (Cognates), 3427/13 and 4316/13) has been used. This type of dyestuff was among the earliest products made by Peter Griess, the discoverer of the azo dyestuffs, and has been known since 1877. It is remarkable when the extraordinary intensity is considered with which this field has been cultivated and extended since that date, that this reaction with formaldehyde has hitherto escaped observation.

The following is the printing recipe for the orange. The small quantity of formaldehyde used is worth noting, as it indicates the completeness of the reaction.

500 c.c. thickening.
100 c.c. Printing Orange 15 in paste.
5 c.c. neutral hexamethylenetetramine solution.

Thickening.

300 grammes Indian corn starch.
625 c.c. gum tragacanth (6 per cent.).
1250 c.c. water.
60 c.c. olive oil.
60 c.c. glycerin.

Mix the hexamethylenetetramine well with the cold thickening, and then add the colour quite cold. Print, dry, and steam for one hour without pressure. Soap in 0·2 per cent. boiling soap solution for five minutes.

The print is of a bright orange shade, quite fast even to boiling soap solution. The fastness is due to the insoluble nature of the formaldehyde condensation product which has been precipitated within the fibre.

Similar condensation products may be readily obtained in substance. Thus if the dyestuff be treated with a boiling aqueous solution of formaldehyde, either as the free acid or in the form of a salt, sparingly soluble bright orange products are obtained. The substances obtained from the salts and the free acid are in some cases different. These condensation products possess points of interest, and are at present being examined. There seems little doubt that different products possibly polymeric to each other can be obtained by varying the conditions of the reaction.

The black print has been obtained from Vulcan Black GS, a polyazo substantive cotton dyestuff, with the following recipe.

Dissolve 60 grms. of Vulcan Black GS in paste in 180 c.c. boiling water and 3 c.c. caustic soda (3·2 per cent. solution), and add to 20 grms. maize starch and 20 grms. water. Boil, cool down to below 30 C. and add 40 c.c. hexamethylenetetramine solution. Print, dry, and steam for 40 minutes without pressure. The fastness to hot soaping of the printed shade is very good, but the white is just tinted by boiling 1% soap solution.

As in the case of the orange dyestuff described above Vulcan Black GS may be readily condensed with formaldehyde in substance, forming typically colloidal black condensation products practically insoluble in any of the common solvents. In this case too differences may be detected in the products obtained according to the conditions of the reaction.

The formation of what is probably the lowest condensation product proceeds with great rapidity with this dyestuff, which possesses great affinity for formaldehyde.

Discussion.

The Chairman said he had experimented with the orange. The printing process had by no means reached its final stage, though he was of opinion that the method would eventually prove to be a very simple one. The orange produced a very rich colour and quite as fast as Paranitraniline Red. If a whole range of dyestuffs of this type could be introduced they would prove an altogether unique departure in calico printing.

Mr. E. Crowther observed that alizarin colour makers endeavoured to avoid the long steaming referred to by using a Mather and Platt's short steamer. Would this be sufficient, and also would it be practicable to utilise the new process in the presence of an alkaline solution, and would fixation take place in the presence of acid? There were two styles of printing which required those conditions. Apparently the fastness to soap and alkali was very much enhanced, but did such fastness apply to such laundry detergents as chlorine or such home-applied agents as Persil or Omo, which behaved like perborates? The modern test for fast printing was very severe. Many of the alizarin colours were unsuitable for some markets, and it was necessary to employ vat-dyes.

Mr. R. de F. Shepherd inquired whether in addition to being fast to washing the new colours were fast to light.

Mr. L. E. Vlies said they had to go back 15 years to the first use of formalin for the fixation of azo dyestuffs, namely, to Geigy's process for rendering the direct cotton dyestuff Diphenyl Black fast to washing. Probably that dye was not so fast as the Vulcan colours introduced by Messrs. Levinstein, and it also required a greater amount of formalin for its fixation. This process was certainly new to calico printing, and it was very surprising that 15 years should go by, without any novel employment of formaldehyde for improving the fastness of dyes. The use of hexamethylenetetramine was also quite new. He had always been under the impression that this body would not decompose into its component parts in neutral or alkaline solution, but only in the presence of acid. What amount of formalin was necessary to fix the new dyes? Was it excessive, or roughly in proportion to the two molecular weights in question? Dr. Levinstein mentioned the products in substance, and stated that he might find some use for them. That was likely to be the case, especially as they were colloids. The market was in need of new coloured substances for lithographic and pigment printing work. It was satisfactory to learn that the products were soluble in benzene, as they might be used for dyeing in this solution.

Mr. J. Baddiley observed that the phenol-formaldehyde condensation was a very well-known one, but until comparatively recent times chemists had neglected it on account of the non-crystalline nature of the products. The process was explainable by the theory put forward by Baekeland to explain his synthetic resinous products. In the case of a resorcin dye, condensation probably took place through the steps Baekeland described, namely, a benzyl alcohol derivative was first obtained by the action of one molecule of formaldehyde. This intermediate product then condensed with a second molecule of the dyestuff by loss of water, and the process went on repeating itself until a molecule was formed which was resistant to all sorts of action. He was of opinion there was every possibility of obtaining a complete range of shades by this process.

Mr. F. Scholefield said that the condensation product was so readily formed, and was so insoluble, that one would imagine the combination might take place by the decomposition of the hexamethylenetetramine, so that there might be some amount of lake formation before the actual steaming process. It would be interesting to know what could be done in the way of discharges and resists.

Mr. J. Hübner said it was quite possible for a lake formation to take place prior to printing. That was the reason why he had previously stated that the printing process had not reached its finality. Experiments were still in progress. He did not, however, think there would be any difficulty in this respect.

Mr. Gilbert Gunn inquired whether it was possible to dye pulp in the beater or in a revolving boiler.

Mr. Hübner replied in the negative, as practically a boiling temperature would be necessary, unless decomposition could be produced by some addition, or on drying on the cylinders.

Dr. Levinstein stated it had been done in a beater.

Mr. Gunn asked if it was anticipated that the new process would be cheaper than the ordinary process of dyeing. For some classes of paper very deep and fast dyes were required, especially for casings which were largely used in the calico industry, something being required which would not bleed and would stand the action of weak alkali and acid.

Mr. Hübner said experiments would be made in the direction indicated by Mr. Gunn. Possibly decomposition might take place on the drying cylinders, if the colour did not run away on the wire.

Mr. Gunn replied that if the pulp were first treated, and the dye to some extent fixed in the boiler, dyeing being already done in that way, it would be possible to retain a very large percentage by the time the cylinders were used.

Mr. R. de F. Shepherd inquired whether it was necessary to use the hexamethylenetetramine or whether the formalin could not be used directly in the case of dyeing paper pulp.

Dr. H. Levinstein, in reply, said he had not tried this particular substance for dyeing paper pulp, it being merely typical of a large class of dyes which could be made. Several pertinent questions had been asked with regard to the practical value of the printing process, to most of which he was for the moment unable to reply. He had brought the results forward as being more in the nature of an interesting chemical reaction than of a valuable technical process. He was still conducting experiments with regard to the steaming. The condensation took place so readily that he imagined it would be quite feasible to use the small Mather and Platt steamer. Condensation could be, and was preferably, carried out by means of an alkaline printing paste. He believed that an acid printing paste would be unsuitable on account of the fact that the dyestuff was not soluble as a free acid. The fastness to chlorine of the orange dye described was poor, but they had made others which appeared to be much better. The particular substance in question was a mono-azo dyestuff derived from resorcinol. A large number of analogous dyes could be made in that way, of which only a comparatively small number had been tried. He had not tried the action of perborates. The fastness to light of the dyestuff was good, being about equal to that of Paranitraniline Red, but it did not compare with an alizarin dyestuff with regard to fastness to light. The process of J. R. Geigy referred to by Mr. Vlies was one to increase the fastness to washing of substantive dyes by after-treating them on the fibre with formaldehyde. The process described by him was quite a different matter, *viz.*, a new method of producing fast prints with dyes of which many were not substantive, and he had not referred to the Geigy process as this had nothing in common with it.

As regards the constitution of the substances about which Mr. Baddiley had spoken, he had no knowledge of how the condensation products were formed, but he should imagine something of the kind took place: certainly two or more molecules must be linked together in some way. As regards discharging and the use of paraformaldehyde, and the decomposition of the printing paste, nothing had been tried. Premature formation of the lake had been observed, but could be prevented.

SOME NEW DERIVATIVES OF INDIGO.

BY DR. HERBERT LEVINSTEIN.

The first synthesis of indigo was by A. von Baeyer and took place in 1880; it was first marketed in 1897 by the Badische Anilin und Soda Fabrik. The first patent for brominated indigo was taken out in 1900. In this year Rahtjen produced a mixture of indigo, 5-bromo- and 5.5′-dibromo-indigo, known as Indigo R and 2 R, by brominating indigo in glacial acetic acid. In 1907 Engi produced 5-bromo-, 5.5′-dibromo-, 5.7.5′-tribromo-, and 5.7.5′.7′-tetrabromo-indigo by brominating at a higher temperature in a neutral solvent. Penta- and hexabromides have also been obtained by methods which are now well known. It is remarkable that seven years should have elapsed between the discovery of Rahtjen and that of Engi, which has had such valuable technical results.

Friedlaender has recently shown that the active constituent of the ancient Tyrian purple is identical with 6.6′-dibromo-indigo. This substance produces a shade more violet than ordinary indigo, whereas the shade of the 5.5′ isomeride is greener. By this synthesis an interesting link was forged between the dyes of a semi-mythological past with the latest development of modern scientific industry.

In 1905 came the beautiful discovery of thioindigo by Friedlaender. Great activity ensued in the investigation of indigoid dyestuffs in the coal tar dye factories, for these discoveries opened a large field for scientific research which seemed · offer prospects of reaping a technical harvest.

On looking through the notes for those years it seemed to me that the brominated sulphur, selenium, and arsenic compounds of indigo, and 5.5′-dihydroxy-7.7′-disulphonaphthylindigo, a new derivative of β-naphthylindigo, which were prepared at Blackley at that time, may be of some small general interest. The preparation of the first series of compounds is largely due to the initiative of Dr. M. Wyler, who carried out the experimental work, while for the products derived from 5-hydroxy-7-sulpho-2-naphthylglycine I am greatly indebted to the co-operation of Dr. O. Diehl.

There are two publications concerning brominated indigo sulphides, if they may be so called, both by Cassella (see Ger. Patents 220,321 and 220,629 of 1909, since allowed to lapse). In the second patent the formula of the product obtained is given as $(C_{16}H_6N_2O_2Br_3)_2S$.

Our object was to examine this compound and find out whether other substances besides sulphur were capable of entering the indigo molecule in the way suggested by the above formula. Both selenium and arsenic reacted in a very similar manner to sulphur, but unfortunately the analytical data obtained did not enable us to draw any conclusions as to the constitution of the bodies obtained. The preparation of all the derivatives is practically identical in method. To 15 parts of indigo suspended in nitrobenzol 32 parts of bromine are added: 1·8 parts of sulphur, or an equivalent molecular proportion of As, As_2O_3, or As_2O_5 are then added and after 12 hours' standing the mixture is gradually heated up to 180° C. and kept at that temperature for several hours.

As regards the mechanism of the reaction, it should be noted that neither sulphur, selenium, arsenic, As_2O_3, nor As_2O_5 react under the above conditions in the absence of bromine. The formation of the bromo-compound of sulphur, selenium, or arsenic is the first step and this compound then acts on the indigo.

For analysis the dyestuff was in every case reduced to the leuco compound with hydrosulphite, filtered, reprecipitated by means of a current of air and dried.

In the case of the sulphur compound the figure for sulphur corresponded fairly well with the above formula. In the cases of selenium, arsenic, As_2O_3, and As_2O_5, the figures for selenium and arsenic were considerably lower. The As_2O_5 is the most reactive of these substances and the tribromo-indigo derivative prepared in the presence of As_2O_5 contained 5·19 % and 5·25 % As.

The introduction of sulphur, selenium, or arsenic into the indigo ring has but little effect on the shade. Thus all the tribromo derivatives give shades similar in character to those of tribromo-indigo. In the case of the arsenic indigos, mono-, di-, tri-, and tetrabromo derivatives were made, and in each case the arsenic derivatives correspond roughly in shade with the derivatives of indigo containing the same quantity of bromine.

The preparation of 5·5′-dihydroxy-7.7′-disulphonaphthylindigo is interesting on account of the very smooth manner in which it may be obtained from 5-hydroxy-7-sulpho-2-naphthylglycine, 20 grms. of which are slowly and carefully added to 60 c.c. concentrated sulphuric acid at 100° C. The temperature is then raised to 170° until no further reaction is observed. After cooling, the brownish yellow sulphuric acid solution is poured on to 300—400 grams of finely ground ice and the indigo is filtered off, washed with ice water, and dried on the water bath. Yield 19 grms. The substance has a strong bronzy lustre and exhibits a characteristic dichroism. It is sparingly soluble in cold water, more readily in hot. On the addition of caustic soda the aqueous solution is nearly decolorised, showing only a faint green coloration. With soda there is no discoloration in the cold, but on heating the solution becomes green. The colour of the alkaline solution is discharged by heating with hydrosulphite. When dissolved in concentrated sulphuric acid it produces a beautiful fluorescence and a deep blue solution when poured into cold water.

The new substance dyes a green shade on wool from a weakly acid bath, and also possesses a noticeable affinity for the vegetable fibre, as might be expected from the orientation of the substituent groups in the naphthalene nucleus.

Bromination takes place readily in glacial acetic acid, four atoms of bromine being taken up. The bromine compound is soluble in alcohol, and more soluble in water than the unbrominated compound. The bright blue aqueous solution becomes green on the addition of caustic soda; a much more intense shade than that of the unbrominated compound. Melting either the brominated or the unbrominated product with alkali leads to complete breaking up of the molecule, but by the action of 30 per cent. fuming hydrochloric acid a substance was obtained which is in all probability tetrahydroxynaphthylindigo.

Discussion.

Mr. **Hübner** said that for cotton dyeing indigo was being gradually replaced by dyestuffs which produced faster shades. As regards wool-dyeing indigo still maintained its position. The Committee of the Textile Institute appointed to go into the question of indigo-dyed cotton goods had only held one meeting and then dissolved. Upon that Committee was a representative of the Admiralty, who stated that the Department had used nothing but indigo for the blue collars which the sailors wore, but they were now on the look-out for a colour faster than indigo, which they thought they could obtain.

Mr. E. **Crowther** considered there was something in the process of dyeing with indigo which caused part of the colour to be absolutely fast to washing. Had the author made any dyeing experiments with derivatives of indigo? There appeared to be a tremendous amount of waste colour on indigo-dyed cotton of deep shades, and if it were possible to dye a lighter shade of similar fastness to the residual colour obtained by a heavy soaping of a deep shade, naval men would be satisfied.

Mr. **Hübner** stated that it was well-known that very light shades were most difficult to remove by washing, even in the case of ordinary direct dyeing colours.

Mr. L. E. **Vlies** observed that in the author's description of the progressive bromination of indigo, two particular positions in the molecule remained unattacked. He was not quite clear which these were, as two methods of indicating them were possible. They could be positions 4.4′ or 6.6′. If Dr. Levinstein adapted the method of starting the count from the imido group counter clockwise on the left side of the formula, then he was correct in his statement. The 6.6′-dibromoindigo, one of the dyestuffs present in the mollusc, *Murex brandaris*, could only be obtained indirectly, such as by the internal condensation of the glycine of 4-bromo-2-aminobenzoic acid. It was remarkable that on further bromination, this body still gave reddish-violet dyestuffs, whereas the products of the direct bromination of indigo gradually became greener and weaker in shade. It was of interest to note that the hexabromo-indigo contained over 65 per cent. of bromine. Such a large nonchromophoric addition to the molecule would readily account for the diminished tinctorial power.

Mr. **Clegg** asked whether the author had succeeded in introducing arsenic and selenium into thioindigo.

Dr. H. **Levinstein** agreed that indigo was a poor cotton dyestuff in comparison with modern dyes, though perhaps it was still the finest wool dye. Alizarin or anthracene blues would stand originally a longer time without fading, but when they had finished their work they mostly did so as a dirty puce colour, while indigo, though becoming weaker, retained its blue colour. For that reason alone indigo ought to hold its own on wool for many years to come. With regard to Mr. Vlies' query concerning the constitution of Tyrian purple, the statement made in the paper was correct. In reply to Mr. Clegg, they had been content with preparing the selenium and the arsenic derivatives of indigo, and did not pursue the matter further. There did not appear to be any prospect of selenium or arsenic derivatives finding technical application.

New York Section.

Meeting held at Chemists' Building, on Friday, April 24th, 1914.

MR. G. W. THOMSON IN THE CHAIR.

THE CHEMISTRY OF PINE OIL.

BY MAXIMILIAN TOCH.

One of the industries which has developed as a result of the policy of conservation in the United States is the manufacture of useful products from resinous woods. Enormous quantities of the latter, which in previous years were considered of little or no use and were deliberately burned in huge burners especially constructed for the purpose, or which were simply allowed to go to waste, are now being economically and profitably manipulated for the recovery of turpentine, pine oil, and rosin, or the production of tar oils, pine pitch, and charcoal.

The two commercially important methods in vogue are, first, the steam and solvent or extraction process, and second, the destructive distillation process.

Mr. H. T. Yaryan has taken out letters patent on a process for extracting turpentine and rosin from resinous woods, which very well illustrates the extraction method as practised to-day. Resinous wood, reduced to fine chips by passing through a wood chipper, is charged into an iron vessel through a charging door at the top. The wood rests upon a false bottom over a coil supplied with superheated steam for producing and maintaining the proper temperature within the iron chamber. The door at the top and the discharge door at the bottom are closed, and the current of superheated steam is driven into the mass of chips. This is continued until the more volatile turpentine has been vaporised and driven over into the condensers. The wood in the extraction vessel is left charged with a small percentage of heavy turpentine, together with pine oil and rosin. Steam is shut off, the excess moisture in the hot wood is removed by connecting the vessel with a vacuum pump, and finally a liquid hydrocarbon (b.pt. 240°—270° F.) is sprayed over the top and allowed to percolate down through the pores of the wood. The resinous materials are thus thoroughly and completely extracted, and passed into a storage tank, from which they are pumped into a still used for separating the component parts of the solution. From the still the hydrocarbon solvent is readily separated from the heavier pine oils by distillation under reduced pressure, on account of the great difference in the boiling point between the pine oils and the hydrocarbon solvent, the former boiling between 350°—370° F. The pine oils are in turn separated from the rosin by distillation with superheated steam.

This process has been worked on an enormous scale by the Yaryan Naval Stores Company[*], with plants at Brunswick, Ga., and Gulfport, Miss. This Company's Brunswick plant alone utilises from 500—600 tons of wood each 24 hours—probably a larger consumption than the combined pine wood destructive distillation plants of the country.

Other so-called "low temperature" processes deserve mention as possessing features of merit, although sufficient data does not appear to be available to show their true value when operated on a large commercial scale. The Hough process, for example, is to be considered essentially a preliminary treatment in the manufacture of paper pulp from resinous woods. Chipped wood is placed in a retort and subjected to the action of a dilute alkali. The rosins are saponified and the soap separated from the alkaline liquor by cooling and increasing the a kali concentration to the desired degree. The rosin soap may be sold as such, or treated with acids for recovery of the rosin. The turpentine and pine oils are recovered either by preliminary treatment with steam or during the early stages of the cooking process.

It will be noted that in the low temperature processes the only products recovered are turpentine, pine oils, and rosins, the first two removed by the action of steam, either saturated or superheated, and the latter by extraction by use of a neutral volatile solvent or a saponifying agent. The so-called "spent wood" may be used either for the manufacture of paper pulp or as a fuel to generate the power necessary to carry out the process.

In the destructive distillation process, the wood, in the form of cordwood 4 ft. to 6 ft in length and 4 in. to 8 in. in diameter, is placed in a horizontal retort and the temperature gradually raised until the wood is thoroughly carbonised. The factor of greatest importance in the successful operation of this process is temperature control, as it is essential that the turpentines and pine oils be removed in so far as is possible before the temperature at which the resins and wood fibre begin to decompose is reached. The total volume of distillate, as well as the percentage volume of each of the several fractions thereof, is largely dependent on the degree of temperature control.

Destructive distillation of resinous wood was first carried out in earthen trenches, the combustion being controlled by partially covering the wood with earth. Tar and charcoal were the only products recovered. Then came the beehive oven, operated in much the same crude manner, but recovering the more volatile distillates, in addition to tar and charcoal. This was in turn superseded by the horizontal retort, externally heated, hot gases being circulated either through an outer shell or through pipes within the retort. Next came the bath process, wherein the cord wood was immersed in a bath of hot pitch or rosin, thereby volatilising the turpentine and lighter pine oils and dissolving the heavier oils and rosins. After this preliminary treatment the bath was withdrawn and the wood subjected to straight destructive distillation.

More recently[*] a retort has been devised utilising the basic principle of the laboratory oil bath. The retort is heated by means of a layer of hot petroleum oil which is kept continually circulating between the retorts and an outer cylindrical shell that completely surrounds the retort proper. In this way it is claimed that the temperature of distillation can be accurately controlled. The turpentine and pine oil obtained are fractionated and rectified by subsequent steam distillation. In running the retort the temperature of the oil bath is so regulated that the heat inside does not exceed 450° F. before all the turpentine and pine oil have been distilled.

The products of destructive distillation by the severa processes are in each case of very much the same genera nature, namely, turpentine, pine oils, tar oils, pine tar pitch, and charcoal. In some instances low grade rosi oils are also produced.

"Light wood" does not refer to woody fibre which has low specific gravity. The name originated from the fac that this particular wood is so rich in oil and resino material that it is readily used for lighting fires. In th southern portion of the United States little bundles "light wood" are for sale in strips about ¼ in. in diamet and 1 in. long. When a flame is applied to one of the strips of wood it becomes useful for lighting fires, hen the name "light wood." I have seen "light wood" rich in resins and oily material that by transmitted lig a thin section looked like translucent ruby glass. It this particular wood which is most used for the distillati of wood turpentine, pine oil, and rosin.

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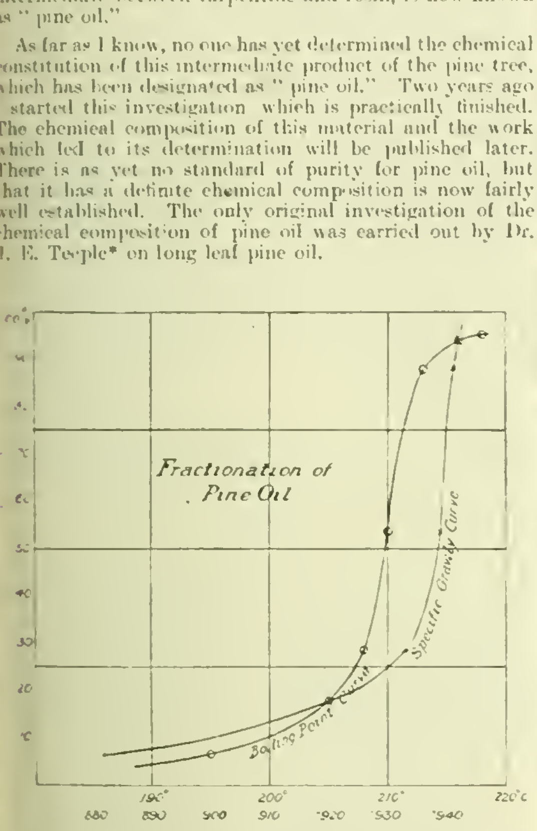
[*] The following is a list of the Yaryan U.S. patents: 915,400, 915,401, and 915,402, March 16, 1909; 922,369, May 18, 1909; 934,257, Sept. 14, 1909; 964,728, July 19, 1910; 992,325, May 16, 1911 (see this J., 1909, 431, 664. 1096; 1910, 1023; 1911, 815).

[*] T. W. Pritchard, this Journal, 1912, **31**, 418.

The product from that type of pine tree from which turpentine is obtained has always been regarded as producing two materials when the sap has been collected and distilled. The one material is turpentine, and the other rosin. About ten years ago, when destructive and steam distillation of pine wood became a practical industry, a third substance was recovered. This material, intermediate between turpentine and rosin, is now known as "pine oil."

As far as I know, no one has yet determined the chemical constitution of this intermediate product of the pine tree, which has been designated as "pine oil." Two years ago I started this investigation which is practically finished. The chemical composition of this material and the work which led to its determination will be published later. There is as yet no standard of purity for pine oil, but that it has a definite chemical composition is now fairly well established. The only original investigation of the chemical composition of pine oil was carried out by Dr. J. E. Teeple* on long leaf pine oil.



Dr Teeple says: "The commercial long leaf oil, as it comes on the market, is either clear and water white, containing 3 or 4 per cent. of dissolved water, or it may have a very faint yellow colour and be free from dissolved water. The specific gravity ranges from 0·935 to 0·947, depending on freedom from lower boiling terpenes. A good commercial product will begin distilling at about 206° to 210° and 75 per cent. of it will distil between the limits 211°—218°, and 50 per cent. of it between 213°—217°. A sample having a density of 0·945 at 15·5° showed a specific rotation of about $[\alpha]_D^{20^\circ}$—11°, and an index of refraction of N_D 1·4830. In fractional distillation of the oil the specific gravity of the various distillates rises regularly with increasing temperature, becoming steady at about 0·947 at 217°.

"If the oil consists essentially of terpineol, $C_{10}H_{18}O$, it should be easy to convert it into terpin hydrate, $C_{10}H_{20}O_2+H_2O$, by the method of Tiemann and Schmidt.† The conversion was found to proceed easily when the oil was treated with 5 per cent. sulphuric acid, either with or without admixture with benzine. If agitated continuously, the reaction is complete within 3 or 4 days. If, on the other hand, the mixture is allowed to stand quietly, the formation of terpin hydrate extends over several months and produces most beautiful large crystals, which, without recrystallising, melt at 117°—118°. When recrystallised from ethyl acetate they melt at 118°. The yield is about 60 per cent. of the theoretical. This forms such a simple, cheap, and convenient method of making terpin hydrate that it will doubtless supersede the usual manufacture from turpentine, alcohol, and nitric acid, and instead of terpin hydrate serving as raw material for the manufacture of terpineol, as heretofore, the reverse will be the case."

The term "pine oil," as now understood, is the heavy oil obtained from the fractionation of crude steam distilled wood turpentine. When the sap of the pine tree is subjected to distillation in a current of steam the volatile liquid—turpentine—consists almost entirely of the hydrocarbon, pinene ($C_{10}H_{16}$). When, however, the trunk, stumps, and roots of the same tree have been allowed to remain on the ground for a number of years and are then steam distilled, there is obtained, in addition to the turpentine and rosin, certain heavier oils formed by hydrolysis and oxidation as a result of exposure to the atmosphere. To the heavier oils thus formed and yielded up in the process of steam distillation the term "pine oil" is properly applied.

Pure pine oil has a very pleasant aromatic odour, similar at times to the oil of caraway seed or the oil of juniper seed. When pine oil is impure it is very difficult to use it for interior work on account of its pernicious odour of empyreumatic compounds. It has been used to a considerable extent for making paints which should dry without a gloss, and as a "flatting" material it has been very successful. It has the excellent quality of flowing out well under the brush and of not showing brush marks, the latter because it evaporates so very slowly. It is a very powerful solvent, and many of the acid resins which have a tendency to separate when they are insufficiently heated with drying oils will remain together when pine oil is added. Pine oil can be used to a considerable extent as a diluent in nitrocellulose solutions, and as a cooling agent for the reduction of varnishes it also has excellent qualities. The author takes this opportunity of stating that on previous occasions his recommendations concerning new and useful materials for the paint and varnish industry have been misunderstood in some instances, and it is to be hoped that these remarks will not be misinterpreted. Pine oil is a new and useful material, but it is by no means a substitute for linseed oil or turpentine or any of the other materials now on the market. It has properties peculiar to itself, and when intelligently used is of considerable value.

Practically all the pine oil obtainable contains a small percentage of water in solution, to which it clings rather tenaciously, and it is by no means a simple matter to dehydrate this material. A rather complex apparatus for dehydrating the material is necessary with temperature control, but the test which the author has devised for the determination of water is quite simple. If 5 c.c. of pine oil are mixed with 1 c.c. of a neutral mineral oil, like benzine, kerosene, or benzol, and a perfectly clear solution is obtained on shaking, no water is present; but if there is any water present in the pine oil the water appears as a jelly, and a milky solution is obtained which does not separate after long standing. The fact that pine oil will take up a considerable quantity of water and still remain clear makes it useful for emulsion paints such as are very much in vogue at the present time for the interior of buildings, and it has been suggested that the addition of water up to 5 per cent. for such a purpose is beneficial on new walls. The United States Bureau of Chemistry* has developed a method for the determination of moisture by the use of calcium carbide; this is being investigated at our laboratories, but on account of its being a gas-volumetric method is not quite feasible for general use in technical laboratories.

I am glad to acknowledge here the assistance which was given to me by Mr. C. A. Lunn for the samples of raw materials and information sent me.

A number of commercial samples of pine oil were dehydrated and analysed. The tables given below indicate the results obtained:—

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* J. Amer. Chem. Soc., 1908, **30**, 412 (see this J., 1908, 346).

† Ber., **28**, 1781.

* U.S. Dept. Agric. Bur. Chem. Circ., 97.

Analyses of pine oils.

Sample No.	Sp. gr. at 15½° C.	Colour.	Acid value.	Iodine value.	Flash* point.
S-12,200..	0·9423	Faintly yellow	0·68	142·5	170° F.
S-12,201..	0·9427	Not quite WW	0·29	118·4	175°
S-12,496..	0·9338	WW	0·51	125·4	145°
S-14,499..	0·9330	Straw colour	0·59	161·5	160°
S-14,500..	0·9291	Pale amber	0·49	173·9	148°
S-14,501..	0·9355	Straw colour	0·70	143·2	168°
S-14,560..	0·9382	WW	0·17	129·8	175°
S-14,561..	0·9350	Straw colour	0·73	142·7	160°
S-14,562..	0·9583	WW	0·27	124·4	176°

* Open cup (Tagliabue tester).

Ultimote analysis.

Sample Number.	C.	H.	O.
S-12,200	78·1	11·5	10·4
S-12,201	77·9	11·4	10·7
S-12,496	77·0	11·1	11·9
S-14,499	81·8	10·6	7·6
S-14,500	80·9	10·6	8·5
S-14,501	79·0	11·4	9 6
S-14,560	78·4	11·2	10·4
S-14,561	79·6	11·5	8·9
S-14,562	78·3	11·1	10·6
Average	79·0	11·2	9·8
Terpineol (theoretical)	77·85	11·77	10·38
French turpentine*	87·7	11·9	
American turpentine*	87·7	12·1	
Wood turpentine*	85·7	12·1	2·2
Pine oil, first runnings	84·3	11·8	3·9
Distillate pine oil, 174—195° C.	82·6	11·4	6·0

* M. Toch—"The Chemistry and Technology of Mixed Paints," D. Van Nostrand Company, publishers, New York.

Fractional distillation of commercial pine oil.

Temperature	Fraction in %	Total distillate.	Sp. gr. 15·5° C.
Water 100°	2	2	
174—194	5	7	0·882
194—205	11	18	0·920
205—208	10	28	0·933
208—210	25	53	0·939
210—213	35	88	0·941
213—216	6	94	0·942
216—218	1	95	0·942
218—	4	99	

Evaporation of pine oils on steam bath.

Sample.	Loss after 9 hours.
S-12,200	93·4%
S-12,201	96·3%
S-12,496	97·3%
S-14,499	93·8%
S-14,500	85·7%
S-14,501	92·7%
S-14,560	98·6%
S-14,561	95·1%
S-14,562	98·7%

After evaporation a small, hard residue, similar in appearance to pale rosin, was left. In the case of S-14,999 and S-14,500, the residue was very dark, almost black, due probably to impurities in the pine oils.

Evoporation of pine oil ot roam temperature—65° F.

Sample.	2 hrs.	4 hrs.	6 hrs.	8 hrs.	24 hrs.	32 hrs.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
S-12,200	27·8	43·8	52·2	67·2	96·7	96·7
S-12,201	20·3	31·8	41·8	50·8	92·4	92·7
S-12,496	39·4	46·9	58·6	70·0	97·5	97·5
S-14,499						
S-14,500						
S-14,501	36·8	56·6	69·8	80·4	95·5	95·5
S-14,560	39·5	58·9	70·5	82·5	96·5	96 5
S-14,561	46·4	68·0	81·0	88·7	94·0	94·0
S-14,562	24·6	35·3	46·0	53·2	88·8	90·4

Nottingham Section.

Meeting held at Nottingham on Wednesday, April 29th, 1914.

MR. S R. TROTMAN IN THE CHAIR.

SOME PRACTICAL OBSERVATIONS IN THE PREPARATION OF LIME-ARSENIC PAINTS.

BY R. FARADAY INNES, F.I.C.

The great irregularity in the physical state and chemical composition of lime-arsenic paints led me to test the effect of altering the various conditions of preparation.

Text-books on tanning recommend that red arsenic should first be sprinkled over the lime, hot water added, and the mixture stirred; this practice is followed by the trade and is presumably regarded as the best.

I find that this method does not give the best results, judging by the amount of sulphydrate-ions formed. This was considered to be the only determination necessary, and was carried out using Blockley and Mehd's method (this Journal, 1912, 369) with E/5 nickel chloride as external indicator.

The first experiments were done in 6 in. open dishes, but it was found that there was considerable loss of SH-ions after about ¼ hour, especially if the mixture was kept warm, owing most likely to oxidation. This oxidation is not so likely on a large scale, so further experiments were conducted in long-necked 500 c.c. flasks in order to approximate to working conditions.

On using calcium hydrate and hot water a higher result was obtained than by the usual method. So I tried slaking the lime first and then adding red arsenic immediately the slaking was over. Higher and more consistent results were obtained.

The influence of time and temperature are shown in the subjoined table. In experiments A to D. 13·2 grms. of calcium hydrate were treated in a dish. and in E to G in a flask. Experiments H and I were made by treating 10 grms. of quicklime in a flask :—

	c.c. water added.	Temp. of water °C.	Sampled after hours.	Temp. maintained in °C.	Grms. S in solution.	% soluble S on total sulphur.
A ..	25	15	¼	Room	0·104	56
	25	15	½	Room	0·104	56
	25	15	2½	Room	0·099	54
B ..	25	60	¼	Room	0·122	66
	25	60	½	Room	0·109	59
	25	60	2¼	Room	0·099	54
C ..	50	90	¼	80	0·112	60
	50	90	½	80	0·083	45
	50	90	2	80	0·005	3
D	50	90			0·118	64†
E ..	50	60	¼	60	0·123	66
	50	60	½	60	0·128	69
	50	60	2	60	0·136	74
F ..	50	90	¼	90	0·160	86
	50	90	½	90	0·158	85
	50	90	2	90	0·146	79
G	50	90	2	90	0·153	83*
H ..	35	90	¼	90	0·160	86
	35	90	½	90	0·157	85
	35	90	2	90	0·115	62
I	50	90	¼	90	0·150	81‡

* In hot flask kept corked. † Evaporated to dryness in ½ hour. ‡ Slaked together.

Experiments on a larger scale confirmed these results and conclusions.

It was further found that lime slaked in such a way as just to boil the water but not to cause excessive ebullition. gave a paint (whether with or without the arsenic) very much finer and more voluminous than by slaking with small quantities of water at a time. This latter method caused hard lumps of unslaked lime, due to local overheating (Procter's Principles of Leather Manufacture, pp. 122 and 142)

Expressed briefly the conclusion arrived at is:—Let the lime be as fully hydrated as possible, and yet as hot as possible before adding the red arsenic. Then stir very thoroughly. Do not let the lime slake dry and crumble.

This confirms the work of Levi and Manuel published in "Hide and Leather," May 7th, 1910.

Working on a large scale it was not found possible to get exactly the same results every time. This is partly due to the fact that the paint is always made as nearly as possible to the same consistency regardless of the amount of water required, this latter being a variable quantity.

Another observation was that a red arsenic containing about the same amount of sulphur as another does not necessarily give the same amount of sulphur into solution as sulphydrate, whether slaked as above or in the usual way. With a good red arsenic containing say 37 per cent. of total sulphur one ought to get about 32 per cent. into solution, equal to about 86½ per cent. calculated on the total sulphur. I have had, however, numerous samples of red arsenic only yielding 20·4 per cent., 17·6 per cent., and 16·0 per cent. "available" sulphur, and a sample of yellow arsenic only yielded 11·2 per cent., though its total sulphur was 32·6. This is obviously a different material to the usual yellow arsenic, as Prof. Procter states that he obtains even better results with yellow than with red.

Although red arsenic is said to be realgar (As_2S_2) containing 29·96 per cent. S, samples I have analysed contain from 34—37 per cent. As_2S_3 (yellow arsenic) contains 39·09 per cent. S.

Therefore in examining deliveries a total analysis does not give nearly such useful information as a determination of the "available" sulphur. For this, a method based on F or H has been found to give reliable results.

DISCUSSION.

Mr. R. F. INNES, in reply to a question from Mr. Law, said that no experiments with larger proportions of arsenic had been made, because in his own case it never exceeded 10 per cent., and generally was about half that. Prof. Stiasny had found that arsenic must not be in excess, even locally, and when adding it the mixture must be well stirred. The sulphydrate ions, in conjunction with the OH ions, were the active unhairing principle. In reply to Mr. Pentecost, the arsenic itself, so far as was known, played no part in unhairing, and only a small part went into solution, not even enough to kill the bacteria present. A mixture of sodium sulphide and calcium chloride was not in favour with tanners. In reply to Mr. Merriman, the insoluble arsenic was removed with the hair, and the soluble arsenic with the hydrate and sulphydrate by washing.

NOTE ON THE RELATION BETWEEN THE "FEEL" OF LEATHER AND ITS APPEARANCE UNDER THE MICROSCOPE.

BY R. FARADAY INNES, F.I.C.

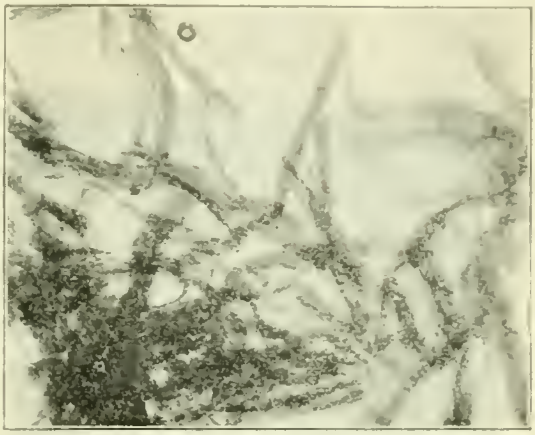
The following remarks refer to chrome-tanned goatskins for glacé-kid. The photographs are from the finished leather and are magnified 75 times.

The sections were prepared by shaving in sections parallel to the fibres of the skin as thinly as possible by hand with a razor (not with a microtome). The width of the sections averaged 0·17 mm. They were then teased out as thoroughly as possible with needles. It was very much easier to tease out sections of mellow well-feeling skins than sections of hard tinny skins: in all cases of the former the section could be teased out as easily as cotton-wool, but in the latter cases the section seemed more like a piece of thick string, and it was only possible to separate the skin into "lumps." These consisted of masses of fibre still cemented firmly together. Where the fibres are stunted and short this has been caused by their having originally been cemented together so firmly that on attempting to tease them out they have been torn. Had the interfibrillar cement been removed the fibres

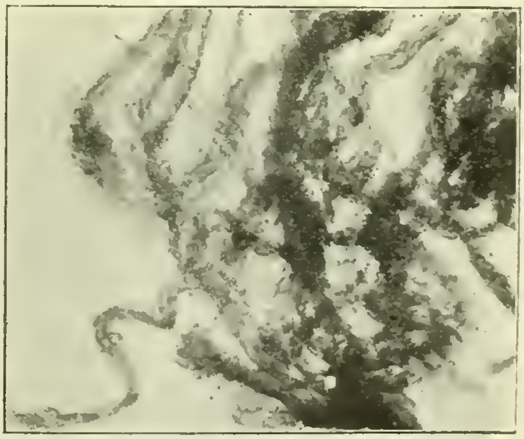
I.

L.N. 1861 B.

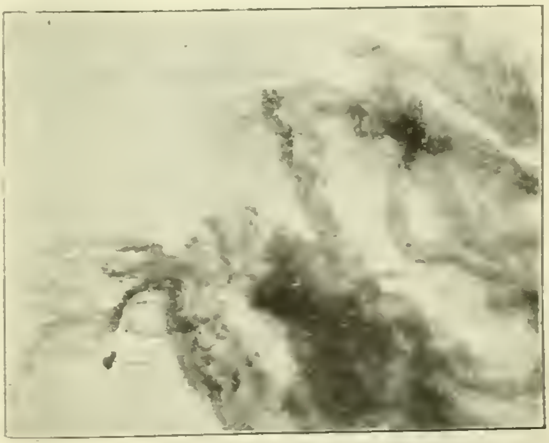
Extra 3 weeks in mellow lime.
Fine grain, soft feel.



Extra 3 weeks in a fresh lime.
Break, grain not so fine, more stretchy.



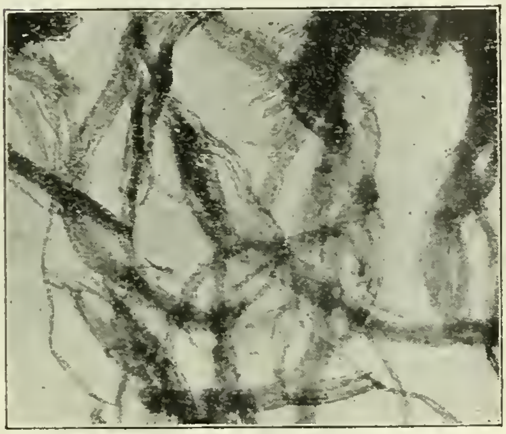
L.N. 1861 A.



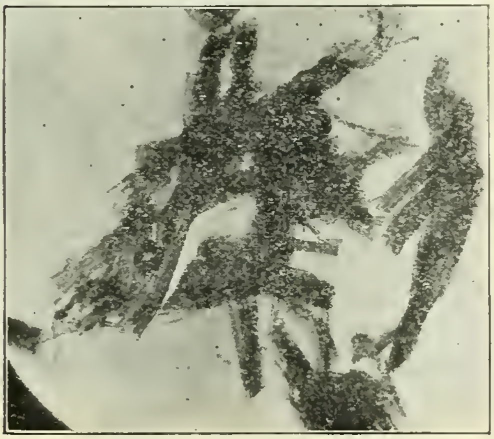
themselves could have been separated whole. Thus a long-fibred section is an index of nice feeling, soft, mellow leather, and a short-fibred one, of hard leather.

II.

L.N. 1908 (i.)
Soft and full.



L.N. 1908 (ii.)
Not lively, coarse feel.



Analyses of two samples of glacé kid.

	Moisture.	Ash.	Cr_2O_3.
Sample A.	Per cent.	Per cent.	Per cent.
Grain side	15·62	7·98	6·07
Middle	18·60	5·54	4·28
Flesh-side	15·83	7·35	4·28
Flesh	11·5	8·1	3·5
Check.			
Grain-side	16·65	7·70	5·97
Middle	18·39	5·71	4·15
Flesh-side	16·62	7·69	4·46
Sample B.			
Grain-side	17·05	6·67	4·20
Middle	18·63	5·47	3·31
Flesh-side	17·17	6·46	3·14
Check.			
Grain-side	17·27	6·54	3·75
Middle	18·24	5·62	3·26
Flesh-side	17·38	6·37	3·14

Figures are calculated on undried sample.

Where the fibres are well separated but are fragile-looking and have a lot of loose ends and a "shaggy" or "ragged" appearance, this is due to excessive action of calcium hydroxide. In this particular example the skin had been in a fresh lime-liquor an extra three weeks and was characterised by a "break" and also stretchiness.

A similar lot of skins had an extra three weeks in a mellow liquor instead of a fresh liquor. This turned out very well and had no break.

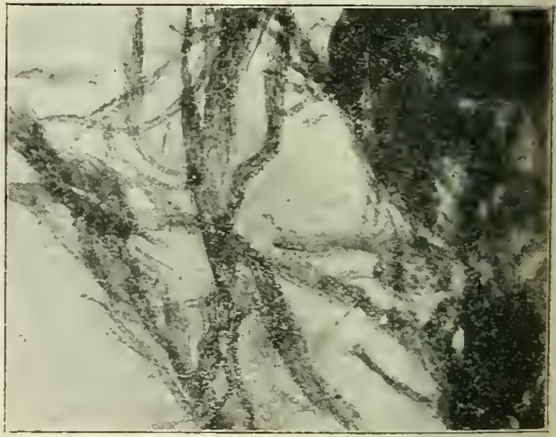
The photos show examples of:—Under-liming (fibres short and stuck together); proper liming (fibres long, well defined, and sound—nothing but fibres); and over-liming (fibres long but "ragged" and fragile).

Another small point of interest is that as the fibres approach from flesh to close under the grain they get finer and merge into a much more compact formation, and the chromium content of the grain-side is about half as much again as in the middle and flesh-side as shown by the figures in the foregoing table.

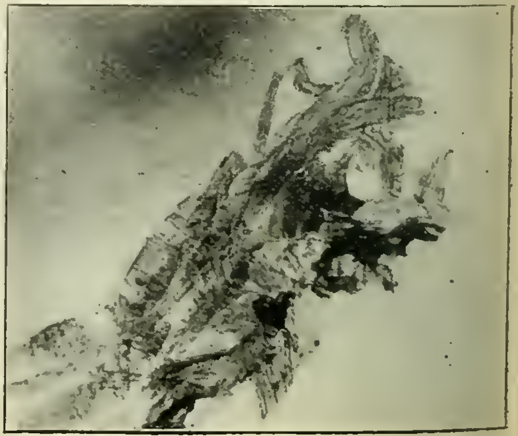
This short note confirms Prof. Procter's remarks on the great use of the microscope in leather chemistry. Chemical analysis shows all the skins to contain the normal amount of chromium, but gives no information as to possible causes of harshness, tinniness, or break in the leather. It seems to me that this method of examination should be applied systematically in the earlier stages and that in liming control, analysis of liquors should be supplemented with a micro-examination of the fibres in a

III.

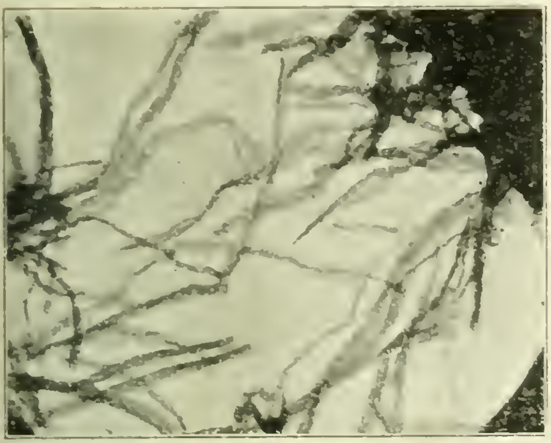
Full, soft and supple.
W.



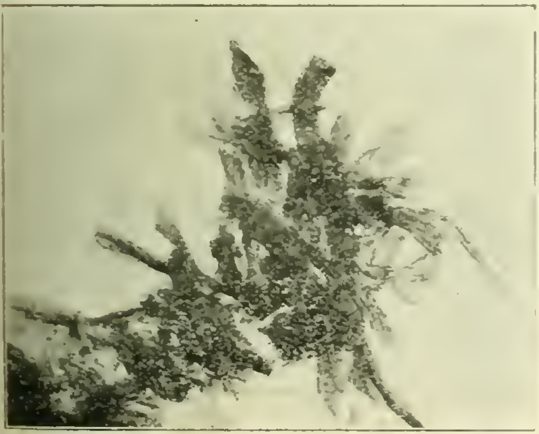
Hard and empty.



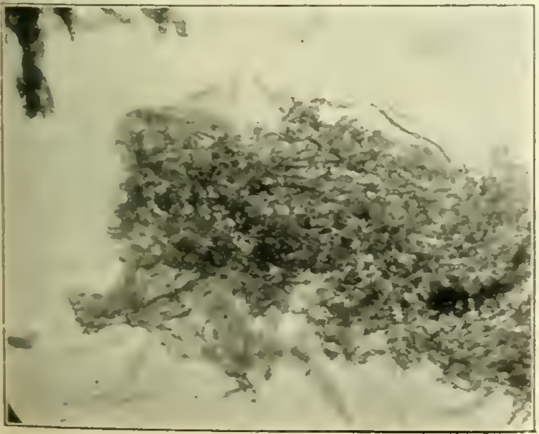
IV.
L.N. 1902 (i.
Full, fairly well feeling



L.N. 1902 (ii.)
Very firm skin.



L.N. 1902 (iii.)
Very grainy, firm and hard.



manner similar to the examination of steel-rails, etc., where chemical analysis is of little real value unless supported by metallographic examination.

I will conclude by expressing my indebtedness to the Board of Directors of the British Chrome Tanning Company (1909), Ltd., for permission to publish these results obtained in their laboratory.

Discussion.

Mr. S. R. **Trotman** said that the paper showed how a chemist, by the aid of the microscope, could find out things which could not be discovered in any other way.

Mr. D. J. **Law** noted the different chromium content in the two sets of figures, and wondered if there were any corresponding difference in the character of each. The pieces of leather and their corresponding photographs showed very clearly the underlying cause of the difference in the feel of the skin. The higher chrome content of the grain might throw some light on its constitution.

Mr. S. J. **Pentecost** suggested that treatment with sulphonated oils might possibly affect the feel of the leather.

Mr. R. F. **Innes**, in reply, said that the skin with the higher chromium content was very well-feeling and supple, and of better quality than the other; but he had come across well-feeling supple leather with the lower chromium content, so that this really was not such an important factor as the condition of the fibres.

Obituary.

WALTHER FELD.

Walther Feld was born on November 4th, 1862, in Neuwied, Germany. He was educated in Zürich, Leipsic, and Munich, and then acted as assistant to Professor Rüdorff in Berlin. Participating in the production of Fehling's Handwörterbuch, his first independent step was one of a literary character. With Professor G. von Knorre he succeeded in devising a method for separating manganese and iron, and in a method for preparing a copper silicide, patented in 1888, and leading to the successful production of silicon-bronze. After engaging in the manufacture of barium carbonate and oxide, and hydrogen peroxide, and in founding large works for these industries, he turned his attention to the extraction of the sulphur of gasworks residues, and of cyanogen from crude coal gas, and he devised an apparatus, known as Feld's gas-washer, for the removal of the sulphur and cyanogen compounds from coal gas. Feld succeeded in solving the problem of so extracting from the crude coal gas the sulphur and ammonia as to produce directly ammonium sulphate, thus utilising the sulphur of the crude gas to replace that from other sources, otherwise represented by the sulphuric acid employed in the usual ammonium sulphate process. To this end the crude coal gas is washed with an ammonium polythionate solution, the polythionate becoming reduced by the sulphur of the gas to ammonium thiosulphate with separation of pure free sulphur. This sulphur is burnt to form sulphur dioxide, with which the thiosulphate is re-converted into polythionate. When the wash liquor is thus sufficiently concentrated by enrichment with polythionate, the latter by heating is converted into ammonium sulphate, sulphur, and sulphurous acid. The two latter return to the cycle of operations, the ammonium sulphate being recovered by mere evaporation of the solution.

Walther Feld died on the 15th March at Linz-am-Rhein.

JOSEPH WILSON SWAN.

Born in Sunderland, October 31st, 1828, Sir Joseph Wilson Swan, D.Sc., F.R.S., was early destined for a scientific career. Indentured as apprentice to a pharmaceutical chemist in Sunderland, he found himself in congenial surroundings. The routine gave him an excellent training for in those days the pharmacist had to make many chemicals which are now prepared on the manufacturing scale.

Another formative influence in Swan's life was his hearing a lecturer of that day named Stait who, among other things, showed his audience a small incandescent lamp the filament of which was made of iridio-platinum. This afterwards brought about the experiments which culminated in the carbon filament now so familiar to everyone in the Edison-Swan lamp. Leaving Sunderland, he joined Mr. Mawson, chemist, Newcastle-upon-Tyne, first as an assistant and later as a partner. Swan was the means of introducing, as part of the business, the manufacture and supply of philosophical and scientific apparatus, and here too he began the manufacture of collodion for photographic purposes in which industry his firm were the pioneers. The nitrocellulose required was prepared by Sir Joseph himself, and for many years he devoted time and thought to improvements in its manufacture. His next achievement was the discovery of how to increase the sensitiveness of dry plates, and he was the first to produce the "rapid plate." So far back as 1882, a Swan plate photographed a flash of lightning in the ten-thousandth part of a second.

He was, perhaps, the first fully to grasp the advantages of carbon as a material for the filaments of incandescent lamps. By 1860 he had made carbon filaments by heating strips of paper packed in crucibles with powdered charcoal, and, mounting these carbonised strips in glass vessels exhausted of air, he raised them to a red heat by means of an electric current from primary batteries. But the vacuum was imperfect and the carbons soon burnt up. He returned to the question 17 years later and found that, in really high vacua such as were obtained by the Sprengel mercury air pump, carbon filaments were durable. At first the filaments were made by carbonising paper, then by dipping thread in sulphuric acid, and lastly by squirting collodion into a coagulating solution. Suitable lengths of the tough threads were packed in charcoal and carbonised in a kiln. In February, 1879, he exhibited his lamp at a meeting of the Newcastle Chemical Society, and the first considerable display took place at the Newcastle Literary and Philosophical Society on October 20th, 1880. In the meantime, Edison had been working independently on the subject, and various questions of priority arose which later were amicably settled.

Swan also invented the autotype carbon process. He employed a tissue "as pliant as paper and smooth as glass, formed of collodion on the one side, and of gelatin impregnated with ammonium bichromate, carbon (Indian ink) and saccharine matter (sugar) on the other." The process was at once adopted, notably in France. Swan found that the greater or smaller relief in carbon prints in the parts more or less acted upon by light afforded a means of forming a metallic matrix by electro-typing or by pressure in soft metal, and the prints so yielded, constituted, by a species of casting, facsimiles of the original carbon picture in gelatin. He so modified the process that an electrotype of a granular carbon print could be adapted to ordinary copper plate printing, thus devising the first practical photogravure process

He was a co-inventor of Woodbury type, and, with Mr. Kendall, of a process for making cyanides from atmospheric nitrogen, carbonate of potash, and carbon. He also made improvements in accumulators by devising a method of making cellular lead plates, by which the capacity of the batteries per unit of weight was increased.

At the Inventions Exhibition in 1885, he exhibited not only threads and fibres, but woven fabrics of artificial silk; he did not, however, follow the matter up. He devised the first miner's electric safety lamp. During his researches on electrotyping he observed accidentally that the addition of a little gelatin to the bath much improved the quality of copper deposits. The outcome of this observation was the utilisation of currents of from 1000 to 1500 ampères per sq. ft. of cathode, and the reeling of copper wire during electro-deposition from the bath through a die.

Swan was active in many fields. He took out more than sixty patents. He was elected a Fellow of the Royal Society in 1894. The Legion of Honour was bestowed on him in 1881. He was made a Knight in 1904, in which year also the Royal Society granted him the Hughes Medal. He received the Medal of the Society of Chemical Industry in 1902. He was President of the Institution of Electrical Engineers in 1898–99, of the Society of Chemical Industry in 1900–1901, and of the Faraday Society in 1908. The City of Newcastle was about to present its freedom to him when he died on May 27th in his 86th year.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows; Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris 3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Lubricating oil; Repeated use of —— after filtration. G. F. Fenno. Min. and Eng. World, 1914, 40, 835—836.

In an installation fitted with a Richardson central oiling and filtering system, a high-grade mineral oil was supplied continuously to the bearings, and after filtration and removal of water was used over and over again. After 18 months the oil was found to have increased somewhat in sp. gr. and viscosity, owing to admixture with some of the cylinder oil. The fresh oil showed a slightly lower coefficient of friction on low-bearing pressures, whilst the friction coefficient of the filtered oil was lower on higher-bearing pressures, but the difference was so small as to be negligible under working conditions. The saving in cost of oil with a plant using two Richardson filters, each taking about 75 galls. per hour, is estimated at $2000 (£410) per month.—C. A. M.

Rate of evaporation in a vacuum pan. Deerr. *See* XVII.

Patents.

Centrifugal machines. H. Broadbent, Huddersfield. Eng. Pat. 8376, April 9, 1913.

A differential motion between the feed screw and the basket is obtained by means of gearing which is either carried by and rotates with the centrifugal members, or one of them, or is mounted on but not rotated with them. —W. H. C.

Centrifugal extractor. E. F. Poland, Boston, Mass. U.S. Pat. 1,094,589, April 28, 1914.

The extractor is carried and driven by the shaft of an electric motor arranged vertically beneath it, the end of the shaft being supported in a socket carried by a spherical boss attached to the casing of the motor. The boss is mounted in a spherical step-bearing on the base-plate of the machine, which also carries two upright shafts mounted resiliently and passing through sleeves carried by arms projecting radially from the motor casing. The shaft may thus oscillate in all directions.—H. H

Hydro-extractor. E. F. Poland, Boston, Mass. U.S. Pat. 1,094,590, April 28, 1914.

In a hydro-extractor having a belt drive, the belt pulley is controlled by a lever connected with the lid of the extractor, so that the machine can only be started when the lid is shut.—H. H.

Rotary mixers and like machines, and process for mixing bituminous material with stone and sand by the application of heat. L. F. Kaye, New York, and The British Silicate Engineering Co., Ltd., London. Eng. Pat. 8599, April 11, 1913.

The perforations or gratings in the "risers" or agitator blades are provided with means by which they can be opened or closed at will so as to retain the materials or allow them to pass through. Steam, gases or other materials can be introduced or withdrawn from the mixer through hollow trunnions which carry the agitating gear.—W. H. C.

Separating liquids from elastic fluids [e.g. water from compressed air]; Apparatus for ——. B. Woollard, Catford, and P. Brotherhood, Ltd., Peterborough. Eng. Pat. 11,733, May 20, 1913.

The air and water enter the top of a cylindrical chamber and are deflected towards the periphery by a conical deflector. Immediately below is the conical top of a float which again deflects the liquid outwards and allows the air or gas to enter the body of the float and so reach the gas-discharge pipe which extends downwards from the top of the vessel into the interior of the float. When sufficient liquid has accumulated in the bottom of the vessel the float operates the liquid-discharge valve. —W. H. C.

Furnaces. C. D. McCourt, Streatham Common, Surrey. Eng. Pat. 12,952, June 4, 1913.

The materials to be heated are placed in a closed chamber provided with doors for access to the interior and with heating tubes which extend transversely across the chamber. The whole is placed within a furnace and the materials are heated by transmission through the walls of the chamber and the tubes and through the closing doors.—W. H. C.

Deposition of carbon in reversing furnaces; Method of preventing ——. F. Tschudy, Birmingham, Ala. U.S. Pat. 1,093,895, April 21, 1914.

When changing over the regenerators of a set of coke-ovens or other regenerative reversing furnace, air is drawn through both systems of regenerators for a short time, to remove remaining products of combustion and any carbon residues.—W. H. C.

Measuring the velocity of flow of gases and vapours; Apparatus for ——. J. T. Morris, London. Eng. Pat. 25,923, Nov. 12, 1913.

The wires of a Wheatstone bridge are exposed to the gas current and the alteration in the resistance due to the cooling effect of the current is compared with the resistance of similar wires which are sheltered from the cooling effect of the stream of gas. The instrument is calibrated to indicate the velocity of the gases in suitable units.—W. H. C.

Pouring wet, adhesive masses into drying pans or the like; Apparatus for ——. Act.-Ges. fur Anilin-Fabrikation, Berlin. Eng. Pat. 1355, Jan. 17, 1914. Under Int. Conv., Aug. 27, 1913.

The wet mass is discharged from the filter-press or other apparatus into a box closed at the bottom by a slide. On withdrawing the slide the mass descends until it rests on a tray placed beneath the box. The slide is then pushed back, cutting off a slab of the material, which is spread out in an even layer by a "nose" or wire attached to the front end of the slide.—W. H. C.

Drying gases; Apparatus for ——. C. H. Leinert, Chicago, Ill. U.S. Pat. 1,093,869, April 21, 1914.

The apparatus consists of a pair of concentric annular "equalising chambers" having a cooling chamber between them and another cooling chamber within the inner "equalising chamber." A number of pipes pass through each of the "equalising chambers" and communicate with the inner cooling chamber so that the gas flowing from the inner chamber serves to cool the gas passing through the "equalising chambers."—W. H. C.

Filter. O. M. Lamsens, Detroit, Mich. U.S. Pat. 1,093,999, April 21, 1914.

A drum formed of cylindrical sections and having dished ends all bolted together, is rotated by means of hollow trunnions which serve also as inlet and outlet ports. Cylindrical filters are attached to filter-heads fitted over openings in the end plates of the sections and the drum is partly filled with suitable granular scouring material. —W. H. C.

Reaction-tower. E. Hoefling. Ger. Pat. 272,608, July 29, 1913.

The tower is provided inside with projections arranged after the fashion of a spiral staircase.—A. S.

Liquefying gas mixtures and separating the constituents; Processes for ——. R. Mewes, Berlin. Eng. Pat. 9944, April 28, 1913.

See Fr. Pat. 456,027 of 1913; this J., 1913, 944.—T. F. B.

Filter press fabrics. F. E. Carman, Jamaica, N.Y., U.S.A. Eng. Pat. 11,538, May 17, 1913. Under Int. Conv., May 17, 1912.

See Fr. Pat. 457,953 of 1913; this J., 1913, 999.—T. F. B.

Distillation: Process and apparatus for continuous ——. F. Raschig, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,230, June 19, 1913. Under Int. Conv., Oct. 26, 1912.

See Ger. Pat. 260,060 of 1912; this J., 1913, 692.—T. F. B.

Extraction apparatus; Cooler for ——. R. Oekel, Bonn, Germany. U.S. Pat. 1,095,165, April 28, 1914.

See Eng. Pat. 8110 of 1913; this J., 1914, 341.—T. F. B.

Furnace; Regenerator ——. Poetter Ges. m. b. H. Fr. Pat. 465,480, Nov. 29, 1913.

See Eng. Pat. 26,411 of 1913; this J., 1914, 408.—T. F. B.

Purifying, clarifying, deodorising, decolorising, and rendering electro-active solids, liquids, semi-liquids, and gases, also unctuous and hygroscopic substances; Process for ——. R. Marcus. Fr. Pat. 465,569, Dec. 1, 1913.

See Ger. Pat. 268,057 of 1912; this J., 1914, 188.—T. F. B.

Drying rooms. E. Rosenberg. Fr. Pat. 465,768, Dec. 5, 1913. Under Int. Conv., May 23, 1913.

See Eng. Pat. 12,070 of 1913; this J., 1913, 1147.—T. F. B.

Absorption, reaction, mixing, and cooling towers; Material for filling ——. Nitrogen Products and Carbide Co., Ltd., and H. Nielsen. Fr. Pat. 465,937, Dec. 9, 1913. Under Int. Conv., Nov. 15. 1913.

See Eng. Pat. 26,269 of 1913; this J., 1914, 241.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke-ovens; Working —— in conjunction with blast-furnaces. H. J. Freyn. Scient. Amer. Suppl., 1914, **77**, 246—247.

The use of a mixture of coke-oven gas and blast-furnace gas for driving gas engines is suggested. A mixture of 1 part of coke-oven gas (500 B. Th. U.) and 15 parts of blast-furnace gas (100 B. Th. U.) would have a calorific value of 125 B. Th. U. per cb. ft., and the calorific value of the mixture could be kept constant automatically by means of recording calorimeters arranged to control electric circuits for working the gas throttle valves. When a blast-furnace was put out of operation, it might be used as a gas producer of the slagging type, burning small coke, raw coal and coke breeze, so as to produce a gas which would have the same calorific value as the suggested mixture.—A. T. L.

Combustion of gas; Partial and intermittent ——. E. E. Somermeier. J. Ind. Eng. Chem., 1914, **6**, 374—378.

Mixtures of air with hydrogen and with natural gas were ignited in different ways (electrically heated wire, spark from induction coil, gas flame) and under different conditions in regard to volume and pressure of the gaseous mixture. Variations in these conditions led to considerable differences in the results. For the same percentage of combustible constituent and the same method of ignition, more vigorous reactions were obtained in small than in large volumes of gas, but the absolute amount of gas burned was greater when larger volumes were used. In a previous paper (this J., 1914, 343), as a result of calculations, it was stated that mixtures containing more than 2 % of natural gas or 5·9 % of hydrogen are potentially explosive. The present experiments indicate that to produce a vigorous reaction, when using ordinary methods of ignition, only a small excess of hydrogen but a very large excess of natural gas or methane above the calculated amount is required. —A. S

Cholesterol in petroleum oils; Alleged occurrence of ——. W. Steinkopf and H. Winternitz. Chem.-Zeit., 1914, **38**, 613—614.

No cholesterol could be detected in the lævo-rotatory fractions of certain Java oils (this J., 1912, 631), and the fractions of higher b.pt. of two Java oils and an Argentine oil, which showed a pronounced lævo-rotation, were also found, by the digitonin test, to contain none. It is possible, however, that the optical activity was due to the presence of decomposition products of cholesterol.—C. A. M.

Alcohol Motor Fuel Committee. Times, May 21, 1914. [T.R.]

The Alcohol Motor Fuel Committee of the Imperial Motor Transport Council, which was appointed to consider the question of alcohol as a substitute for petrol, has issued a preliminary report, calling attention to the importance of rendering the British Empire independent of fuel supplies from foreign countries, and pointing out that crops from which alcohol could be obtained might be cultivated in many parts of the Empire.

Repeated use of lubricating oil after filtration. Fenno. *See* I.

Physiological characteristics of acetylene, with respect to its use in mining. Smith. *See* XIXb.

Patents.

Explosions in mines; Method or means for suppressing —— by the use of non-combustible dust. R. Cremer, Leeds. Eng. Pat. 1493, Jan. 20, 1914. Under Int. Conv., Jan. 20, 1913.

Non-combustible dust such as stone dust is formed into walls, banks, slabs, or columns, which are placed along the sides of mine roadways, etc. The dust may either be enclosed in wicker work, wire gauze, mill board or the like, or it may be formed into briquettes and bound with cement, concrete, tar, sizing, or clay. Coal dust can be swept from the surface of the slabs, etc., without waste of stone dust, and in the event of explosion the slabs are blown into the roadway and become broken up, thus increasing the non-combustible flame-cooling surface. —H. H.

Freeing smoke from soot and like material; Method and means for ——. K. Bombhard, Charlottenburg, Germany. Eng. Pat. 6123, March 12, 1913.

The smoke is passed through an enlarged flue so as to reduce its speed and allow soot to settle. The deposit is removed from the flue by a scraper conveyor which travels along the bottom in the same direction and at approximately the same speed as the smoke. The conveyor may be in the flue itself or in a compartment separated from the flue by a partition which extends from the roof to a point short of the floor of the flue, the latter being inclined towards the conveyor chamber. —W. H. C.

Coking processes and apparatus therefor. J. Moeller and H. C. Woltereck, London. Eng. Pat. 3375, Feb. 10,1913.

The retorts are arranged in pairs, one of each pair being charged with coal and the other with coke. They are heated to about 700° C. and superheated steam at 400° to 600° C. is introduced at low pressure into those containing coal. The mixture of hydrocarbon vapours and superheated steam produced is passed through the retorts containing coke which acts as a contact material decomposing the heavy oils into lighter hydrocarbons. The vapours are passed through a condenser and the uncondensed gases utilised for heating the retorts. The pipes and connections are so arranged that the process may be made continuous.—H. H.

Vertical retorts for use in the manufacture of gas. Drakes Ltd. and A. Dobson, Halifax, Yorks. Eng. Pat. 8524, April 11, 1913.

Heating flues for a secondary supply of air are arranged outside the combustion chambers surrounding the lower portions of vertical gas retorts. The air is led from the flues into the combustion chambers through vertical passages having dampers so arranged that the height at which the air enters the chambers can be varied.—H. H.

Retorts for use in the manufacture of gas for illuminating and heating purposes. S. L. Elborne, Peterborough, and H. Godsal, London. Eng. Pat. 9176, April 18, 1913.

Fireclay retorts are rendered impervious to gases by means of a clay such as China stone which becomes incipiently vitrified at the highest temperature of manufacture of the retort. The added clay may be incorporated with the fireclay, or it may form a layer not less than ¼ inch thick, either inside or outside the retort.—H. H.

Regenerative retort bench. R. B. Brown, Milwaukee, Wis., Assignor to Riter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pat. 1,094,523, April 28, 1914.

The combustion chambers beneath a bench of retorts are provided with walls separate from the supporting walls of the bench itself so as to form additional flues or ducts between the combustion chamber and retort bench walls. Adjustable baffles are fitted in the flues.—H. H

Coal; Carbonisation of ——. V. B. Lewes, Greenwich. Eng. Pat. 9988, April 28, 1913.

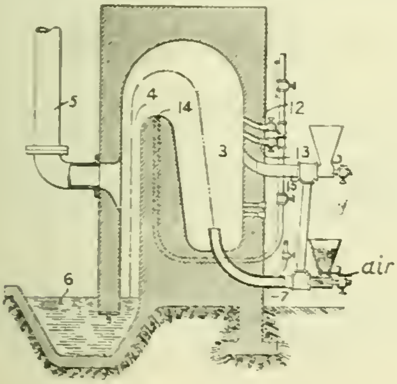
To obtain a large proportion of light hydrocarbon vapours, a minimum of heavy tar, and a uniformly carbonised residue containing sufficient volatile matter to form easily ignited smokeless briquettes, coal or shale is carbonised by radiant heat whilst falling, in a finely divided state, through the upper part of a vertical retort maintained at 1000°—1200° C. The heating gases pass downwards through flues around the retort, the lower part of which is at 400° C. The partially carbonised residue in the lower part of the retort is withdrawn continuously by a screw conveyor, the speed of which is adjusted so as to maintain the level of coke in the retort at the point at which distillation by radiant heat ceases.—A.T.L.

Gas. F. P. Peterson, Tulsa, Okla. U.S. Pat. 1,094,864, April 28, 1914.

THE easily liquefiable constituents of natural gas consisting mainly of ethane, propane, and butane, are substantially freed from methane, pentane, and higher paraffins, and the mixture liquefied.—H. H.

Gas-producer. J. H. Hirt, El Paso, Tex., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,094,897, April 28, 1914.

THE fuel is injected upwards from pipes, 7, 15, into a chamber, 3, which communicates with a passage, 4, dipping into a water seal, 6, and provided with a gas outlet 5.



Steam or moist air is introduced through pipes, 12, 13, 14, arranged in advance of the fuel inlets.—H. H

Gas; Process of making ——. H. Burgi, Springfield, Mass. U.S. Pat. 1,095,806, May 5, 1914.

COAL is passed continuously downwards through a vertical retort heated externally. Enriching hydrocarbons are admitted by a pipe extending through the upper part of the fuel column and delivering at a point where the temperature is suitable for cracking these hydrocarbons, and the gases produced at all parts of the retort are withdrawn from the cracking zone.—A. T. L.

Lighting gas; Manufacture of ——. Cie. Française du Centre et du Midi pour l'Eclairage au Gaz. Fr. Pat. 466,197, Feb. 24, 1913.

COAL is distilled in a closed retort and gases having respectively high candle-power and high calorific power are drawn off from separate outlets, the gas of high candle-power being formed when the charge of fresh coal first comes in contact with the hot walls of the retort. This gas is mixed with a suitable quantity of water-gas. The gas of high calorific power consists chiefly of methane, hydrogen and carbon monoxide; it is mixed with water-gas and passed over reduced nickel at 300° C., forming a gas containing 50 % methane. This gas may also be mixed with water-gas.—A. T. L.

Water-gas, oil-gas or both; Production of —— *in horizontal coal-gas retorts.* A. Le Morvan. Fr. Pat. 466,309, Feb. 27, 1913.

AN iron tube, pierced with holes throughout its length, is introduced into the centre of the mass of incandescent coke in the retort, and water or steam is forced through the tube. A second tube may be provided for injecting oil for making carburetted water-gas, or a single tube may be used, the steam passing through an injector nozzle so as to draw in oil.—A. T. L.

Water-gas; Manufacture of ——. Dellwik-Fleischer, Wassergas Ges. m. b. H. Fr. Pat. 466,421, Dec. 20, 1913. Under Int. Conv., Aug. 6, 1913.

IN making water-gas from bituminous coal, the air blast is introduced at an intermediate point of the height of the fuel column and passes downwards, the products escaping from the lower part of the producer. During the gas-making period, steam is blown upwards through the whole height of the fuel column. The water-gas formed in the lowest part of the fuel column thus passes through a zone of higher temperature and then through fuel which is not completely carbonised, becoming enriched with methane, tar, ammonia, benzene, etc.—A. T. L.

Gas; Manufacture of —— *from bituminous fuel.* Dellwik-Fleischer Wassergas Ges. m. b. H. Fr. Pat. 466,422, Dec. 20, 1913. Under Int. Conv., March 12, 1913.

THE producer is blown alternately with air and with steam and air. During the air-blow, air admitted above, and also at the middle of the height of the fuel column passes downwards to an outlet beneath the grate. When the fuel has been raised to a sufficiently high temperature, steam is blown in beneath the grate, and air or air and steam at a higher level where the production of water-gas ceases, the gas being drawn off from the top of the fuel column. —A. T. L.

Fuel wastes; Method of utilising ——. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,094,390, April 21, 1914.

FUEL from which tar and other volatilisable materials have been driven by heat is mixed with waste carbonaceous dust and converted into gaseous fuel in a gas producer. —H. H.

Gas washer. W. B. Osborne, Sewickley, Pa., Assignor to Riter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pat. 1,094,466, April 28, 1914.

THE gas is passed vertically through a casing having a number of spraying nozzles adapted to project horizontal sprays of liquid alternately from opposite sides of the casing. Baffles are provided to direct the gas in a tortuous path.—H. H.

Gas-washer or scrubber. W. J. Fiddes, Tottenham. U.S. Pat. 1,095,835, May 5, 1914.

THE scrubber comprises a vertical cylindrical casing divided into a number of superposed compartments. An agitator, rotating on a central vertical shaft, comprises a series of horizontal plates in each compartment of the scrubber provided with inclined angle rings on both surfaces, the rings on the bottom of one plate projecting between those on the top of the next lower plate.—A. T. L.

Scrubbers for purification of gas. C. Heine. Fr. Pat. 466,349, Dec. 18, 1913.

THE gas is passed through a casing containing baffle-plates spaced apart from each other and from the wall of the casing, and arranged at an angle to the path of the gas. Water or other liquid or gaseous purifying agent is injected in the direction of flow of the gas so as to be thrown with the gas against the baffles, and water is also injected vertically downwards in order to counteract the tendency of the hot gases to circulate upwards. —A. T. L.

Hydrocarbons; Treatment of ——. J. Rosen, Paris. Eng Pat. 10,208, April 30, 1913.

Coal tar, petroleum residue or other hydrocarbon, is caused to flow through a series of cylindrical vessels provided with baffles, and a strong current of air is forced through the liquid in fine streams in the opposite direction. No external heat is used, but oxidation proceeds more rapidly and to a definite degree in each successive chamber. The oxidation may be started by cold air containing ozone or an added proportion of oxygen.—A. T. L.

Hydrocarbon residues; Process of and apparatus for distilling and cracking light ——. A. F. G. C. P. J. von Groeling, Vienna. Eng. Pat. 10,213, April 30, 1913.

The vapours from the still are passed through cracking tubes, which may be arranged in the furnace setting so as to be heated by the gases which heat the still, and thence through a dephlegmator. The crude oil flows to the still through the cracking tubes which contain spiral baffles to mix throughly the vapours from the still with the liquid flowing in the opposite direction to the still.
—A. T. L.

Liquid fuel for internal combustion engines; Method of treating —— and means therefor. G. E. Heyl and T. T. Baker, London. Eng. Pat. 11,756, May 20, 1913.

The liquid fuel is sprayed into an atmosphere of hydrogen at the ordinary temperature, and then passed through or over a catalytic agent consisting of aluminium or nickel powder in order "to promote the retention of the hydrogen."—W. H. C.

Hydrocarbon liquids; Increasing the [lighting and heating] efficiency of —— and material for effecting such results. A. W. Swanberg, Minneapolis, Min. U.S. Pat. 1,092,461, April 7, 1914.

Low-grade gasolene or naphtha is mixed per gall. with 1 oz. of a powder consisting of 7 parts of naphthalene and 3 parts of anthracene. To increase further the lighting or heating power, ½ oz. of sulphuric acid and ½ oz. of wood alcohol may be added.—A. T. L.

Petroleum; Process of and apparatus for distilling ——. J. W. Van Dyke and W. M. Irish, Assignors to The Atlantic Refining Co., Philadelphia, Pa. U.S. Pat. 1,095,438, May 5, 1914.

A three-way cock is provided in the pipe leading from the still to the condenser, and at the end of a run, the vapours remaining in the still are blown out by means of steam, through the cock and a branch pipe, so as not to contaminate the first runnings from the next charge.
—A. T. L.

Liquid fuel for internal-combustion engines; Manufacture of ——. J. Andrews. Fr. Pat. 466,050, Dec. 11, 1913.

Naphthalene (800—1000 parts) is mixed with kerosene (4 parts) and heated under pressure at 170°—180° F. (77°—82° C.) with a product obtained by distilling at 225°—230° F. (107°—110° C.) under a pressure of 60—70 lb. per sq. in., a mixture of sulphur, 1 part, concentrated ammonia, 8—10 parts, and water, 800—1000 parts. The naphthalene is converted into volatile oils which separate from the aqueous layer; the oily product is purified by treating with sulphur dioxide under pressure. Another process consists in heating 800 parts of naphthalene and 2 parts of kerosene with a solution of 1 part of nitre in water and 2 parts of concentrated ammonia, at 160°—180° F. (71°—82° C.) under pressure. The product distils at 180° to 300° F. (82°—149° C.) and has the sp. gr. 0·74.
—A. T. L.

Ovens for generating gas and producing coke. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 16,318, July 15, 1913.

See Fr. Pat. 460,517 of 1913; this J., 1914, 68.—T. F. B.

Lighting and heating gas and hydrogen; Process and apparatus for making —— by decomposing the vapours of oil, tar, or liquid hydrocarbons. Berlin-Anhaltische Maschinenbau-A.-G. Fr. Pat. 466,040, Dec. 10, 1913. Under Int. Conv., Jan. 27, 1913.

See Ger. Pat. 267,944 of 1913; this J., 1914, 190.—T. F. B.

Gas producers. A. Franks and G. Sanders. Fr. Pat. 466,199, Dec. 15, 1913. Under Int. Conv., Dec. 16, 1912.

See Eng. Pat. 28,936 of 1912; this J., 1914, 68.—T. F. B.

Generator gas; Purifier for ——. Berlin-Anhaltische Maschinenbau-A.-G. Fr. Pat. 465,472, Nov. 28, 1913. Under Int. Conv., Dec. 11, 1912.

See Ger. Pat. 271,112 of 1912; this J., 1914, 472.—T. F. B.

Fuel; Process of treating liquid —— to produce vapour. A. T. Porter, New York. Eng. Pat. 10,047, April 29, 1913.

See U.S. Pat. 1,064,086 of 1913; this J., 1913, 743.
—T. F. B.

Preventing deposition of carbon in reversing furnaces. U.S. Pat. 1,093,895. *Se* I.

Gas-analysis apparatus. U.S. Pat. 1,089,390. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood distillation under diminished pressure. A contribution to the problem of utilisation of wood waste. M. Adams and C. Hilton. J. Ind. Eng. Chem., 1914, **6**, 378—382.

The yield of oil of turpentine from a given sample of dry wood by destructive distillation was increased by 10—20 % by working under diminished pressure.—A. S.

Patent.

Process of treating wood with a view to its conversion into carburetted alcohol. Fr. Pat. 465,534. *See* XVIII.

III.—TAR AND TAR PRODUCTS.

Water-gas tar; Composition of ——. C. R. Downs and A. L. Dean. J. Ind. Eng. Chem., 1914, **6**, 366—370.

Tar obtained in the purification of carburetted water-gas was subjected to systematic fractional distillation, and the distillates and residue examined. The tar was practically free from bases, phenols and free carbon, and its hydrocarbon constituents were similar to those of ordinary coal tar, paraffins and naphthenes being present, at the most, only in small quantities. Benzene, toluene, xylenes, mesitylene, naphthalene, and anthracene could be prepared from the tar by methods similar to those used with coal tar.—A. S.

Benzene nitrating apparatus; Explosion of a cast iron ——. P. Pikos. Chem.-Zeit., 1914, **38**, 626—627.

Benzene (880 kilos.) had been run into a still containing sodium nitrate (920 kilos.) and sulphuric acid (1200 kilos.). The benzene had been run in too rapidly and had partially volatilised, and the excess of nitric acid had probably formed di- and trinitrobenzene, especially as the charged apparatus had been allowed to stand for two days. At the end of this period part of the contents had crystallised. Water was added, and the still, with all openings closed, was heated up again. On attempting to empty the contents, by compressed air, a violent explosion occurred. It is considered that the dilute acid, produced by the addition of water, reacted with the iron of the still, and reduced the nitrobenzene to β-phenylhydroxylamine and p-aminophenol, the latter being oxidised to azoxybenzene which decomposed explosively on heating.—G. W. McD.

o-Nitro-p-diazonium-phenol and the constitution of the "diazo-phenols." A. Klemenc. Ber., 1914, **47**, 1407—1416.

Of the three possible constitutional formulæ for the "diazo-phenols" the author prefers the diazonium type, $\mathrm{R}{<}^{\mathrm{O}}_{\mathrm{N:N}}$, on various grounds, of which the chief is the formation of o-nitro-p-diazonium-phenol on heating o-nitroanisole-p-diazonium chloride in acetic acid to 80° C. This compound is also formed on diazotising p-amino-o-nitroanisole at 70°—80° C. It crystallises in yellow leaflets which explode violently at 168° C. or when struck; when boiled with alcohol, it yields o-nitrophenol.—O. E. M.

Patents.

Benzol; Purification of waste sulphuric acid from the refining of ——. A. Gasser. Ger. Pat. 272,130, Oct. 24, 1912.

The acid is agitated vigorously by a current of warm compressed air, whereby the impurities become agglomerated and can be skimmed off from the surface of the acid. The compressed air used for cooling the brickwork of chamber-ovens or coke-ovens may be used for purifying the acid, when the manufacture of benzol is carried on at the same works as the manufacture of gas or coke.—A. S.

Pitch; Manufacture of ——. Deutsch-Luxemburgische Bergwerks- und Hütten A.-G. Ger. Pat. 272,189, April 2, 1913.

Tar is heated with the waste sulphuric acid obtained in the refining of benzol.—A. S.

Chloro-derivatives of the anthraquinone series; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 15,937, July 10, 1913.

See Fr. Pat. 460,432 of 1913; this J., 1914, 18.—T. F. B.

Nitro bodies; Purification of ——. O. Silberrad, Buckhurst Hill. U.S. Pat. 1,095,937, May 5, 1914.

See Eng. Pat 799 of 1912; this J., 1912, 1055.—T. F. B.

a-Arylides of β-naphthisatin; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 466,165, Dec. 13, 1913. Under Int. Conv., May 2, 1913.

See Eng. Pat. 30,072 of 1913; this J., 1914, 246.—T. F. B.

Treatment of hydrocarbons. Eng. Pat. 10,208. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

ndigo syntheses; New ——. W. Madelung. Annalen, 1914, **405**, 38—95.

A detailed description of the experimental investigations elating to the synthesis of indigo from di-indyl (from xaltoluide) and from indole, a brief account of the results f which has been given previously (this J., 1913, 972).—A. S.

yclic ketones [vat dyestuffs]; A new method for the preparation of ——. I. A. Schaarschmidt. Annalen, 1914, **405**, 95—127.

he method consists in the condensation of o-halogen-nzoquinone- or -anthraquinone-nitriles with amines to rm o-cyanoimines, and further condensation of the tter into acridone-derivatives. It may also be applied to the production of high molecular thioxanthones (see also Ger. Pat. 269,800; this J., 1914, 116). The preparation of a number of cyano-anthraquinone derivatives and of acridones therefrom is described. 1-Cyano-2-bromoanthraquinone and condensation products therefrom not containing a second anthraquinone residue in addition to the 1-cyanoanthraquinone nucleus give blue vats. Introduction of a second anthraquinone residue leads to the production of reddish-brown to red vats. These compounds have relatively slight affinity for vegetable fibres unless alkali salts are added to the bath. The trianthraquinonyl-cyano-derivatives, on the other hand, give intense dyeings from the vat without addition of salts. The anthraquinone-mono- and di-acridones obtained by further condensation from the cyano-imine derivatives are valuable vat dyestuffs giving shades of good fastness. The resistance to boiling soap solution can be increased by halogenation. The colours of the vats yielded by the acridones prepared and the shades they produce on cotton are shown in the following table:—

Compound.	Colour of vat.	Shade on cotton.
Acridone from 1-cyano-2-p-chlorophenylaminoanthraquinone	red	orange yellow
1-N-2-Anthracridone	violet blue	red
1.2.2'.1'-Dianthraquinoneacridone	blue violet	reddish orange
1.2.2'.3'-Dianthraquinoneacridone	red	orange yellow
Trianthraquinonediacridone from di-(1-cyano-2-anthraquinonyl-)-1'.5'-diaminoanthraquinone	violet blue	brownish red
Trianthraquinonediacridone from di-(1-cyano-2-anthraquinonyl-)-1'.8'-diaminoanthraquinone	violet blue	reddish brown
Trianthraquinonediacridone from di-(1-cyano-2-anthraquinonyl-)-1'.4'-diaminoanthraquinone	violet	violet blue
Anthraquinonemethylanthrapyridoneacridone	red	red

—A. S.

Lichens; British dye ——. A. Edge. J. Soc. Dyers and Col., 1914, **30**, 186—189.

Cudbear was formerly made in considerable quantities in Scotland, generally by the action of ammonia and air on *Lecanora tartarea* and *Urceolaria calcaria*; *Evernia prunastri*, *Umbilicaria vellea*, *U. pustulata*, *Parmelia perlata*, *Lecanora pallescens*, and some other lichens of less commercial value also give a purple colour by this method. The dyestuff made from these British lichens is not equal in brilliancy to that from the *Roccellae* (Orchil). In the case of the Crottles, which are still largely used for dyeing browns on the home-spuns of Harris, Lewis, Donegal, Shetland, etc., the dyestuff appears to be ready formed in the plant and is obtained by simple extraction. The best known are *Parmelia saxatelis* or Black Crottle and *P. omphalodes*, while others are *P. caperata* or Stone Crottle, *P. ceratophylla* or Dark Crottle, *P. parictina*, and a few species of *Sticta*, especially *S. pulmonaria* or Hazel Crottle. These lichens undergo no preparation, being gathered in July or August, when they are richest in colouring matter, and simply dried in the sun. They dye without addition to the bath and do not form lakes. Fine shades of brown are obtained, fast to acids and alkalis, but less fast to light than a mixture of Metachrome Brown B and Metachrome Orange 3R, although in fading an agreeable tone is maintained.—J. B.

Dyestuffs; Diffusion of some ——. R. O. Herzog and A Polotzky. Z. physik. Chem., 1914, **87**, 449—489.

The diffusion of a large number of dyestuffs into water from a 0·25 % aqueous solution and into a 5 % gelatin gel from a solution in 5 % gelatin was studied. The detailed results are tabulated.—A. S.

Patents.

Azo dyes; Manufacture of ——. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy, Basle, Switzerland. Eng. Pat. 26,908, Nov. 22, 1913. Under Int. Conv., Dec. 13, 1912. Addition to Eng. Pat. 25,866, Feb. 1, 1912.

See Ger. Pat. 270,831 of 1912; this J., 1914, 416.—T. F. B.

Azo dyestuffs; Process for preparing ——. Fabriques de Couleurs d'Aniline et d'Extraits ci-dev. J. R. Geigy. First Addition, dated Nov. 6, 1913, to Fr. Pat. 450,866, Nov. 4, 1912. Under Int. Conv., Dec. 13, 1912.

See Ger. Pat. 270,831 of 1912; this J., 1914, 416.—T. F. B.

Disazo dyes for cotton; Yellow —— *and process of making them.* A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 1,094,448, April 28, 1914.

See Fr. Pat. 461,039 of 1913; this J., 1914, 19.—T. F. B.

Triazoles; Process for making aromatic ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 466,367, Dec. 18, 1913. Under Int. Conv., March 10, 1913.

See Eng. Pat. 29,224 of 1913; this J., 1914, 247.—T. F. B.

Indigo dyestuffs; Mode of preparing finely-divided or colloid ——. A. Schmidt and A. Steindorff, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,094,683, April 28, 1914.

See Eng. Pat. 20,324 of 1910; this J., 1911, 1110.—T. F. B.

Sulphur dyestuffs; Leuco-alkali preparations of —— *and process of making same.* A. Schmidt and A. Steindorff, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,095,237, May 5, 1914.

See Fr. Pat. 440,061 of 1912; this J., 1912, 712.—T. F. B.

Anthraquinone-thiazoles; Producing ——. F. Kačer, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,095,731, May 5, 1914.

See Eng. Pat. 21,615 of 1912; this J., 1913, 694.—T. F. B.

Vat-dyes; Reddish-brown ——. O. Bally and H. Wolff, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,095,780, May 5, 1914.

See Addition of April 1, 1911, to Fr. Pat. 365,920; this J., 1911, 1153.—T. F. B.

Azo dyestuffs; Process for producing yellow ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 465,930, Dec. 9, 1913. Under Int. Conv., April 9, 1913.

See Eng. Pat. 8415 of 1913; this J., 1914, 414.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Flax and hemp; Natural colouring matters of —— *and analytical characters of the raw and bleached fibres.* A. Bianchi and G. Malatesta. Annali Chim. Appl., 1914, 1, 281—291.

Unbleached flax and hemp when tested by the method of Green and others (this J., 1907, 1083) may give results indicating the presence of acid colours, and it is necessary always to apply confirmatory tests to the colour after it has been transferred to wool. Raw flax contains at least two colouring matters, one precipitated by basic lead acetate and the other not. The reddish-yellow aqueous solution of the former when treated with calcium hypochlorite solution is partially bleached in a short time and after some hours gives a yellow precipitate. The other colouring matter gives a clear yellow solution; on treatment with calcium hypochlorite the colour changes to pink after a short time and after some hours is completely bleached. Unbleached hemp also contains two colouring matters, one precipitated by basic lead acetate and the other not. The characters of the different kinds of raw and bleached flax are given as follows:—

	Ash.	Fat and wax.*	Aqueous extract.	Remarks.
	%	%	%	
Raw	0·6—1·2	1·3—2 or more	3—4	Contains notable quantities of natural colouring matter.
Washed	0·6—0·8	1·2—1·5	1—2	Little natural colouring matter.
Bleached	rather less than in "washed"		1—1·5	No colouring matter.
"Cream"	0·4—0·8	1—2	about 2	Characteristic reddish-yellow tint; yields chlorides to cold water.

* Extracted by carbon tetrachloride.

—A. S.

Casein for coated papers. E. Sutermeister. Paper Making, 1914, 33, 140—143; 187—190.

Casein is precipitated either by a mineral acid or by natural souring; hydrochloric acid gives quite a different product from sulphuric acid, and the natural curd differs from both; the rennet curd is not suitable for paper coating. For testing the solubility, 50 grms. of casein, ground to pass through a 20-mesh sieve are mixed with 200 c.c. of water and 7·5 grms. of borax; the mixture is heated on a water bath and stirred until the mixture becomes homogeneous. The temperature should not exceed 82° C. nor the time of stirring 10 minutes. Some samples of casein require slightly more borax, some show a small quantity of white flaky residue. For determining the strength of the casein a direct coating-test should be made:—50 grms. of casein are placed in a tared beaker with 190—200 c.c. of water and the necessary amount of borax to effect complete solution. When dissolved, the weight of the solution is made up to 250 grms. 100 grms. of fine clay, dried at 100° C., are ground with 70 c.c. of water in a separate vessel, the mixture is weighed, together with a copper spatula and 30 grms. of the casein solution (=6 grms. of casein to 100 of dry clay) are stirred in. A sheet of paper is evenly coated on a level surface with this mixture, using a curved steel scraper; th mixture is weighed again and more casein added to bring the proportion of casein up to 7 per 100 of clay. Succes sive coatings are thus made with various mixtures up t 11 % of casein. When all are dry, portions ar selected equally and evenly coated and short sticks o sealing-wax stuck vertically by melting upon the coate surface. These are pulled off, when cold, with a vertica pull and that proportion of casein is said to be stron enough which shows an even layer of paper fibres adherin to the coating pulled off on the end of the wax. Fo standardising this test it is necessary to work with standar samples both of clay and paper, large quantities bein stocked, since variations in the quality of these caus variations in the absolute results of the test. The pr portion of moisture in casein, on drying at 105° C., shoul not exceed 12·3 %.—J. F. B.

Analysis of the fatty substances of linen and hemp. Bianc and Malatesta. *See* XII.

Patents.

Cellulose; Preparation of pure ——. J. Daniel and F. Benoist. Fr. Pat. 465,471, Nov. 28, 1913. Under I Conv., Sept. 16, 1913.

Cellulose materials, *e.g.* raw cotton, are digested un a pressure of 1—4 atmos. with a liquid containing 2 %

sodium hydroxide, 1 of sodium carbonate, 1 of sodium sulphite and 0·1 of ethylene trichloride, for 4—12 hours. —J. F. B.

Cellulose acetates; Treatment of —— to modify their solubility in various solvents. V. J. A. Pauthonier. Fr. Pat. 466,009, Dec. 10, 1913.

The solubility of celluloso acetates is modified by partial hydrolysis by the action of water or a dilute acid. The treatment is liable to be irregular owing to the precipitation of a portion of the ester by the aqueous reagent. This irregularity is prevented by carrying out the hydrolysis by the addition of an anhydrous agent which is a solvent of the constituents of the mixture and which is capable of combining with the liberated acetic anhydride, while furnishing a hydroxyl group to produce the hydrolysis. Suitable agents are: acetone, phenol and chloral hydrate; when necessary, these may be diluted with glacial acetic acid.—J. F. B.

Cellulose; Manufacture of threads of hydrated ——. A. Pellerin. Fr. Pat. 466,292, Nov. 20, 1913.

Viscose solutions are squirted from a large number of fine orifices into a coagulating bath and the whole mass of threads so formed is drawn off by means of a drum, the speed of which can be accurately regulated. The drum may be used either as a winding drum or a guide roller. The mass of threads is cut up and treated by carding or drawing machinery as a sliver, being spun into yarn by the methods employed for textile fibres. The fineness, cross-section and lustre of the component filaments may be varied by varying the speed of the drum. —J. F. B.

Paper pulp; Manufacture of ——. F. L. Stewart. Fr. Pat. 465,732, Dec. 4, 1913.

The raw material is digested with an oxidising agent, *e.g.* dilute nitric acid, chromic acid or a mixture of dilute nitric and hydrochloric acids under a steam pressure of 4—5 atmos. for 10—30 mins., then drained, washed and neutralised with a 5—10 % solution of sodium hydroxide with which it is boiled for 5—30 mins. The pulp is bleached with ordinary bleach liquor which is gradually brought to the boiling point, a small quantity of dilute nitric acid being then added. The cellular matter of the plants is separated by this process from the fibres and may be collected for use as a filling material.—J. F. B.

Paper pulp; Treatment of ——. R. Marx. Fr. Pat. 466,334, Dec. 17, 1913. Under Int. Conv., May 2, 1913.

See Eng. Pat. 10,353 of 1913; this J., 1914, 20.—T. F. B.

Use of sulphite-cellulose extracts for the preparation of varnish. Fr. Pat. 466,196. *See* XIII.

Process of treating wood with a view to its conversion into carburetted alcohol. Fr. Pat. 465,534. *See* XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing [mordanting]; The theory of ——. III. W. D. Bancroft. J. Phys. Chem., 1914, **18**, 385—437.

A critical review of the literature on the theory of mordanting leads the author to conclude that there is no evidence of chemical union, but only of adsorption, the mordant, in the case of aluminium salts at any rate, consisting essentially of a colloidal solution of the metallic hydroxide. The difference between the behaviour of wool and of cotton is merely one of degree and would be expected from the "lesser adsorbing power of cotton."—J. B.

Hydroxy- and di-hydroxyanthraquinones; Physical-chemical examination of —— with special reference to their mordant-dyeing properties. G. F. Hüttig. Z. physik Chem., 1914, **87**, 129—168.

The values obtained for the dissociation constants indicate that the hydroxyl group is more strongly acid in the β- than in the α-position. In the following list the arrangement is in the order of increasing acidity: α-hydroxyanthraquinone, anthrarufin (αα), quinizarin (αα), chrysazin (αα), alizarin (α,β), β-hydroxyanthraquinone, anthraflavin (ββ) Monosodium alizarate is hence regarded as the β-salt. No relationship seems to exist between the mordant-dyeing property and the dissociation constant or the solubility. Concerning the nature of lakes the author regards actual salt-formation as the primary process, which may be followed by adsorption or other secondary processes.—J. B.

Prussian blue; Determination of —— in textile fibres. H. E. Williams and W. P. Dreaper. J. Soc. Dyers and Col., 1914, **30**, 191—192.

A reply to Farrel and Goldsmith's criticism of the authors' suggested substitution of the factor 2·18 for the conventional one of 1·5 for the conversion of the ferric oxide obtained by igniting the precipitated Prussian blue in the determination of Prussian blue in dyed and weighted silk (this J., 1912, 1076; J. Soc. Dyers and Col., 1913, 18). It is claimed that the suggested factor gives the real increase in weight of the cloth, which it is more important to know than the mere percentage of ferrocyanogen present. The suggested factor 0·01355 to be used instead of the usual factor 0·00955, when the estimation is carried out by distillation with cuprous chloride and acid is defended on the ground that the latter figure gives a result which is 30% below the actual weight of Prussian blue present on the fibre, owing to the large amount of water of hydration present in Prussian blue. This water varies under different conditions of formation of the blue but the suggested figure is based on experience and the possible error is not greater than the experimental error in the analysis.—J. B.

Copper on woollen cloth; A test for ——. A. Edge. J. Soc. Dyers and Col., 1914, **30**, 188—189.

Copper stains so faint as not to be detected by the ferrocyanide test, showed up on dyeing with dyestuffs sensitive to copper, *e.g.*, Acid Alizarin Violet N, Cyprus Green B, Diamond Green 3G. The cause of the stains was friction of the cloth on a brass part of the milling machine.—J. B.

Analysis of Turkey-red oil. Herbig. *See* XII.

Patents.

Silk-weighting; Process of removing tin from phosphate liquors used in ——. E. Meili, Hawthorn, N.J., Assignor to Weidmann Silk Dyeing Co., Paterson, N.J. U.S. Pat. 1,094,671, April 28, 1914.

Phosphate baths which have been used in the tin-phosphate method of weighting silk are regenerated by adding sodium silicate to the hot bath, the precipitated silicic acid carrying down with it the tin and other metallic impurities.—J. B.

Dyeing, bleaching, centrifuging, etc., textile materials; Apparatus for ——. W. Resch, Binningen, Switzerland. U.S. Pat. 1,095,028, April 28, 1914.

The casing of a hydro-extractor is connected with a circulating pump. The interior of the drum of the hydro-extractor is fitted with removable boxes having perforated ends which register in fluid-tight connection with the perforated portions of the walls of the drum. Means are provided for raising the drum so that its upper end engages in fluid-tight connection with the upper portion of the casing, whereupon liquid can be circulated by the pump through the boxes and casing in either direction. —J. B.

Amylaceous substances ; Process for rendering —— soluble. Maison Lepetit, Dollfus et Gansser. Fr. Pat. 466,275, May 29, 1913. Under Int. Conv., March 10, 1913.

PANCREAS or pancreas extract is used for converting starch or analogous substances into partially or completely soluble products, *e.g.*, in the manufacture of dressing or finishing preparations or for removing mucilaginous substances from fabrics.—L. E.

Bucking ; Composition of matter suitable for ——. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,095,793, May 5, 1914.

SEE Fr. Pat. 392,858 of 1908 ; this J., 1909, 89.—T. F. B.

Textile materials ; Gaseous or like treatment of ——. J., T., and E. Brandwood, Bury. U.S. Pat. 1,095.796, May 5, 1914.

SEE Eng. Pat. 1762 of 1913 ; this J., 1914, 133.—T. F. B.

Textile materials ; Gaseous or similar treatment of ——. J., T., and E. Brandwood. Fr. Pat. 465,556, Dec. 1, 1913. Under Int. Conv., Jan. 22, 1913.

SEE Eng. Pat. 1762 of 1913 ; this J., 1914, 133.—T. F. B.

Textile fibres ; Apparatus for treating —— with liquids and gases. J., T., and E. Brandwood. Fr. Pat. 465,722, Dec. 2, 1913. Under Int. Conv., March 3, 1913.

SEE Eng. Pat. 5280 of 1913 ; this J., 1914, 133.—T. F. B.

Silk ; Process for weighting —— with hæmatoxylin. F. Müller. Fr. Pat. 465,449, Nov. 28, 1913. Under Int. Conv., April 5, 1913.

SEE Eng. Pat. 26,735 of 1913 ; this J., 1914, 418.—T. F. B.

Dyeing, bleaching, or similarly treating textile goods on rollers or similar apparatus. J., T., and E. Brandwood. Fr. Pat. 465,501, Nov. 29, 1913. Under Int. Conv., Jan. 8, 1913.

SEE Eng. Pat. 551 of 1913 ; this J., 1914, 133.—T. F. B.

Dyeing and printing by means of naphthazarin derivatives ; Process for ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 465.900, Feb. 17, 1913.

SEE Eng. Pat. 12,790 of 1913 ; this J , 1914, 197.—T. F. B.

Dyeing or otherwise treating fabrics or textiles ; Cylinder for use in ——. J., T., and E. Brandwood. Fr. Pat. 465,977, Nov. 28, 1913. Under Int. Conv., Jan. 7, 1913.

SEE Eng. Pat. 436 of 1913 ; this J., 1914, 133.—T. F. B.

Dyeing vegetable fibres deep orange-red or brown shades ; Process for —— and dyestuffs ad hoc. H. Levinstein, J. Baddiley, and Levinstein, Ltd. Fr. Pat. 465,979, Nov. 29, 1913. Under Int. Conv., Nov. 29, 1912.

SEE Eng. Pat. 27,525 of 1912 ; this J., 1913, 1005.—T. F. B.

Printing textile fabrics and similar goods. H. Levinstein, and Levinstein, Ltd. Fr. Pat. 466,224, Dec. 16, 1913. Under Int. Conv., Dec. 17, 1912, and Jan. 15, 1913.

SEE Eng. Pats. 29,021 of 1912 and 1123 of 1913 ; this J., 1914, 73.—T. F. B.

Manufacture and application of a new soap. Addition to Fr. Pat. 448,490. *See* XII.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Ammonia ; Plant for the synthetic manufacture of ——. Chem. Zeit., April 23, 1914. [T.R.]

THE Badische Anilin und Soda Fabrik has decided to increase its capital by £900,000 to cover the cost of erecting plant for the synthetic production of ammonia by the Haber process. The works will be capable of producing eventually 130,000 tons of ammonium sulphate annually.

Arsenic in hydrochloric and sulphuric acids : Determination of ——. R. F. Tarbell. J. Ind. Eng. Chem., 1914, **6** 400—401.

IN the process described, the arsenic is converted into hydrogen arsenide which is passed through a solution of iodine in gasoline, whereby it is converted into arsenic tri-iodide Twenty-five grms. of the acid are treated with 35 grms. of zinc and 1 c.c. of stannous chloride solution (50 grms. Sn per litre). The sp. gr. of hydrochloric acid is first adjusted to about 1·1 and that of sulphuric acid to about 1·40 by addition of either water or arsenic-free acid. The reaction is allowed to proceed for about 2 hours, with warming if necessary, then 20 c.c. of sulphuric acid, of sp. gr. 1·4 are added, and the reaction allowed to continue for 1 hour more. The evolved gases are passed through a solution of lead acetate to remove hydrogen sulphide, and then through a bulb tube containing 80 c.c. of purified 60° gasoline, 20 c.c. of water, and 20 c.c. of a solution of iodine in purified gasoline (0·6773 grm. per litre). (The gasoline is purified by washing twice with sulphuric acid, then with dilute sodium hydroxide and with water.) The contents of the bulb tube are subsequently shaken with 200 c.c. of sodium arsenite solution (0·264 grm. arsenic trioxide, 1 grm. sodium carbonate, and 1 grm. sodium bicarbonate per litre), the aqueous layer removed and tho excess of arsenite titrated with iodine solution (0·6773 grm. iodine and 1·2 grms. potassium iodide per litre). The equations given are :—

$$AsH_3+3I_2=AsI_3+3HI\ ;$$
$$2AsI_3+3H_2O=As_2O_3+6HI\ ;$$
$$As_2O_3+2I_2+2H_2O=As_2O_5+4HI.$$

1 c.c. of the solution of iodine in gasoline is equivalent to 0·00005 grm. arsenic.—A. S.

Ammonia ; Conversion of —— into nitric acid or ammonium nitrate, from an economic standpoint. O. Dieffenbach. Chem. Ind., 1914, **37**, 265—269.

THE cost of converting ammonia into nitric acid and ammonium nitrate is compared with that of fixing it as ammonium sulphate, the relative cost of production, per unit of nitrogen, and the selling price being given for each. The computed values indicate that oxidation to nitric acid (even at its present price) is less remunerative than conversion into sulphate. But in factories producing calcium nitrate as a fertiliser from synthetic nitric acid. where the value of the nitrogen (per unit) in the dilute acid employed necessarily cannot be greater than that ir ammonium sulphate or Chili saltpetre, the absorption o ammonia by nitric acid is shown to be more economica than by sulphuric acid, and it is suggested tha the production of ammonia from calcium cyanamide o aluminium nitride should be combined with the manufacture of nitric acid by the Birkeland-Eyde process.
—F. SODN

Metallic sulphates ; Action of chloroform on ——. Metho of preparing anhydrous chlorides. A. Conduché. Compte rend., 1914, **158**, 1180—1182.

THE anhydrous metallic sulphate was placed in a boat i a tube and dried by a current of carbon dioxide. Chlor form vapour was then passed through the heated tub With copper sulphate sulphurous and sulphuric anhydrid and chlorides were formed at 250° C. Between 250° ar 300° C., the sulphate was completely transformed in cupric chloride. Above 400° C. cuprous chloride w formed. Other sulphates such as those of lead, magnesiu calcium, etc., decomposed at somewhat higher temper tures.—F. SHDN.

Hydrosulphite ; The action of hydrogen sulphide on sodi ——. F. S. Sinnatt. J. Soc. Dyers and Col., 19 **30**, 189—191.

HYDROGEN sulphide is without action on dry hyd sulphite but reacts rapidly in the presence of wat sulphur being precipitated in a granular form and th sulphate together with small amounts of sulphate a sulphite remaining in solution. The amounts of absorbed and of sulphur and thiosulphate produced agreed approximately with the equation: $Na_2S_2O_4+H_2S=Na_2S_2O_3+H_2O+S$, the hydrosulphite apparently acting as an oxidising agent. (See also Binz, this J., 1905, 800.) —J. B.

Magnesite discovery in South Australia. Board of Trade J., May 14, 1914. [T.R.]

An extensive deposit of high grade magnesite has been discovered near Tumby, on Eyre's Peninsula. It should be possible to deliver the crude magnesite at Port Adelaide for about 25s. per ton.

Magnesium in calcium salts; Method for the determination of ——. J. C. Hostetter. J. Ind. Eng. Chem., 1914, **6**, 392—396.

Specimens of a large number of calcium salts from both American and foreign manufacturers were found to contain considerably larger quantities of magnesium salts than stated by the makers. Small quantities of magnesium in calcium salts could not be determined accurately when the calcium was separated as oxalate or carbonate, even when the precipitation was repeated, as an appreciable quantity of magnesium was invariably retained by the precipitate. Satisfactory results were obtained by removing the calcium as sulphate but the method was too tedious for ordinary use. The author recommends a preliminary concentration of the magnesium as hydroxide in a precipitate containing but a small proportion of calcium, which can then be analysed accurately by the usual methods. Ten grms. of the calcium salt are dissolved in dilute hydrochloric acid, the solution boiled to expel carbon dioxide, sulphur dioxide or the like, neutralised with sodium hydroxide in presence of methyl orange, and the magnesium and a portion of the calcium precipitated as hydroxides by adding a quantity of calcium oxide equivalent to 0·3—0·5 grm. of calcium carbonate or by a suitable excess of sodium hydroxide. Calcium nitrate, acetate, formate or oxalate should first be ignited to oxide, of which a portion is reserved for effecting the precipitation, and the remainder dissolved in hydrochloric acid. The hydroxide precipitate is dissolved in dilute hydrochloric acid, the calcium removed by two successive precipitations as oxalate, and the magnesium in the filtrate precipitated as magnesium ammonium phosphate.—A. S.

Magnesium salts; Action of —— on complex compounds of aluminium, iron, and bismuth with organic substances. A. Quartaroli. Gaz. chim. ital., 1914, **44**, I., 418—443.

If a solution of a magnesium salt, containing sufficient ammonium chloride to prevent precipitation of the magnesium by ammonia, be added to a solution of chloride of iron or aluminium, and the whole treated with ammonia, a precipitate of a basic ferrite or aluminate containing per atom Fe up to 6 and per atom Al up to 5 atoms Mg, is produced. Also, iron, aluminium, and bismuth may be precipitated quantitatively by a suitable excess of a magnesium salt from solutions in which they are present in the form of complex ions with hydroxy-acids or polyhydric alcohols. In some cases basic ferrites and aluminates are precipitated as before; in others the precipitate also contains organic matter, probably owing to a molecular transformation of the complex salt into an ordinary basic salt: in the case of iron and aluminium this basic salt is capable of combining with magnesium, but with bismuth the precipitated basic salt is free from magnesium.—A. S.

Acids; Acid salts of dibasic ——. III. Oxalates. E. Jungfleisch and P. Landrieu. Comptes rend., 1914, **158**, 1306—1311.

It has already been shown that the acid salts of camphoric acid are compounds of the acid with the normal dimetallic camphorate, being analogous in composition to acid salts of monobasic acids (Comptes rend., 1913, **157**, 826; 1914, **58**, 445). It is now found that acid potassium oxalate has the corresponding composition, $K_2C_2O_4,H_2C_2O_4$, the alt being decomposed by water into the normal oxalate nd free acid.—L. E.

Ferric sulphates; The various normal, basic and acid ——. F. Wirth and B. Bakke. Z. anorg. Chem., 1914, **87**, 13—46.

Methods of preparing the different salts are indicated, as is also their behaviour towards water and steam. After hydrolysis the residue was always more basic in character than the solution. Dehydration occurred more and more readily with increasing acid nature of the salt: thus, ferric hydroxide itself could only be dehydrated at high temperatures. The isotherms of coquimbite, $Fe_2(SO_4)_3,9H_2O$, and ferric tetrasulphate, $Fe_2(SO_4)_3,H_2SO_4,8H_2O$, both for water and sulphuric acid at 25° C. are given. The existence of α- and β-copiapite, $3Fe_2O_3,8SO_3,27H_2O$ and $2Fe_2O_3,5SO_3,18H_2O$, respectively, was confirmed and quantitatively investigated. Ferric sulphate solutions dissolve ferric hydroxide giving strongly basic solutions, which, however, are acid to litmus; it is suggested that these solutions contain colloidal ferric hydroxide. The crystalline separations from solutions of differing acidity are also exhaustively described.—J. R.

Ferric sulphate and aluminium sulphate; Mutual solubility of ——. F. Wirth and B. Bakke. Z. anorg. Chem., 1914, **87**, 47—51.

At 25° C. no double salt could be caused to crystallise from solutions containing ferric and aluminium sulphates, neither could the formation of mixed crystals be established. Solutions containing more aluminium sulphate than is denoted by the relationship $Fe_2O_3:Al_2O_3=1:0{\cdot}3831$, deposited aluminium sulphate, in other cases ferric sulphate was deposited. At the same temperature the solubility of aluminium sulphate could be diminished by so much as 62·28 % through the addition of ferric sulphate, while the solubility of ferric sulphate could be diminished at the most by 29·04 % by addition of aluminium sulphate.—J. R.

Cobalt [and copper] oxides; Higher ——. A. Metzl. Z. anorg. Chem., 1914, 86, 358—368.

Iodine and sodium hydroxide gave with cobalt sulphate solution a black precipitate of cobalt peroxide, CoO_2, and the same oxide, mixed with metallic silver, was obtained by oxidising the cobalt solution with silver nitrate and caustic alkali. Hydrogen peroxide, in presence of sodium bicarbonate, gave an unstable olive green precipitate, of the composition, $CoCoO_3,CoCO_3$, and, under like conditions, copper sulphate was similarly oxidised, giving the compound $Cu_2CuO_4,CuCO_3$.—F. Sodn.

Copper peroxite [peroxide]. L. Moser. Z. anorg. Chem., 1914, **86**, 380—388. (Compare this J., 1907, 687.)

Pure copper peroxite, CuO_2,H_2O, was prepared by the action of hydrogen peroxide, at a low temperature, on an alcoholic solution of cupric chloride, containing potassium hydroxide, or on copper hydroxide suspended in alcohol; also by acting on finely divided copper hydroxide with an ethereal solution of hydrogen peroxide, at about 0° C. The dry peroxide decomposed explosively on warming; it gave almost the calculated quantity of hydrogen peroxide when treated with very dilute acids at about 0° C.—F. Sodn.

Lead oxides; Determination of the higher ——. I. Iodometric method. J. Milbauer and B. Pivnicka. Z. anal. Chem., 1914, **53**, 345—359.

Diehl's original iodometric method of determining the higher oxides of lead (Z. anal. Chem., 1907, **46**, 64) shows several sources of error. The following modification gave the best results: A weighed quantity of the oxide (0·5 grm. of red lead or 0·2 grm. of lead dioxide) was added to a well-cooled solution of 5 grms. of sodium acetate aod 0·5 grm. of potassium iodide in a mixture of 100 c.c. of water and 5 c.c. of glacial acetic acid. The iodine liberated was titrated as rapidly as possible with $N/100$-sodium thiosulphate solution. Slowness in titration and rise of temperature are sources of error. The change in iodine-value of thiosulphate solutions on keeping was also investigated. $N/10$-solutions showed relatively small changes, and constant values were attained only after about a week: but in the case of $N/100$-solutions the change occurred over much longer periods and in some cases the iodine-value fell to 50 % of the original. Dilute thiosulphate solutions should thus be frequently standardised.—J. R.

Ceric oxide; Products of the incomplete reduction of ——. A. Damiens. Bull. Soc. Chim., 1914, **15**, 372—375.

STERBA (Comptes rend., 1902, **136**, 1056) claimed to have obtained an oxycarbide of cerium, $CeC_2.2CeO_2$, by the reduction of cerium dioxide with a limited quantity of carbon. The author studied the action of progressively increasing quantities of carbon on cerium dioxide, and found that reduction proceeds in three stages:

$$2CeO_2+C=Ce_2O_3+CO;$$
$$Ce_2O_3+9C=2CeC_3+3CO;$$
$$CeC_3=CeC_2+C.$$

In all cases the product contained red crystals, probably mixed crystals of CeC_3 and fused cerous oxide, which were only slowly attacked by water and yielded solely acetylene hydrocarbons (completely absorbed by an alkaline solution of potassium and mercuric iodides) on treatment with acid.—A. S.

Beryllium; Oxalate and acetate of ——. F. Wirth. Z. anorg. Chem., 1914, **87**, 7—8.

AT 25° C. 100 c.c. of water dissolves 63·2 grms. of beryllium oxalate, $BeC_2O_4.3H_2O$, while 100 grms. of $N/10$-sulphuric acid dissolves 72·65 grms. and 100 grms. of $N/10$-oxalic acid dissolves 75·92 grms. of the same salt. The increased solubility in presence of free oxalic acid is attributed to the formation of beryllium-oxalic acid, $Be(C_2O_4H)_2$. The basic acetate, $Be_4O(CH_3COO)_6$, dissolves slowly when shaken with water at 40° C. and is thereby decomposed. 100 grms. of chloroform dissolves 33·3 grms. of the basic acetate at 18° C. and the resulting solution is very stable towards reagents.—J. R.

Scandium; Sulphate and oxalate of ——. F. Wirth. Z. anorg. Chem., 1914, **87**, 9—12.

AT 25° C. the pentahydrate, $Sc_2(SO_4)_3,5H_2O$, is stable, but somewhat above 100° C. this salt is converted into the dihydrate. At 25° C. 100 c.c. of water dissolves 54·61 grms. of the pentahydrate, which is thus the most soluble of the sulphates of the rare-earth metals. The solubility falls considerably in the presence of small amounts of sulphuric acid. The crystalline, hydrated oxalate, $Sc_2(C_2O_4)_3,5H_2O$, is most conveniently obtained by the addition of hydrochloric acid to its hot saturated solution in ammonium oxalate. In dilute sulphuric acid it is the least soluble of the oxalates of the rare-earth metals.—J. R.

Scandium; Alkali double oxalates of ——; *scandium-sulphuric acid and scandium sulphide.* F. Wirth. Z. anorg. Chem., 1914, **87**, 1—6.

SCANDIUM oxalate is readily soluble in hot solutions of alkali oxalates or ammonium oxalate, and the corresponding double oxalates separate on cooling. These substances possess the general formula, $Sc_2(C_2O_4)_3.3R_2C_2O_4,10H_2O$, and may be regarded as the alkali salts of a complex scandium-oxalic acid, $[Sc(C_2O_4)_3]H_3$. They are nearly insoluble in cold water and in cold solutions of alkali oxalates. The ammonium double salt is soluble in saturated ammonium oxalate solution. The scandium was determined by precipitation with ammonia from the solution of the ignited salt in dilute hydrochloric acid. Scandium hydroxide is somewhat soluble in potassium hydroxide solution, and hydrogen peroxide precipitates scandium peroxide from the solution thus obtained. Hydrochloric acid added to the hot solution of the double oxalates causes the separation of scandium oxalate, $Sc_2(C_2O_4)_3,5H_2O$. Scandium sulphate dissolves at ordinary temperatures in sulphuric acid of sp. gr. 1·6, and, upon keeping, scandium-sulphuric acid separates as white crystals of the composition, $Sc_2(SO_4)_3.3H_2SO_4$ or $[Sc(SO_4)_3]H_3$. Scandium sulphide, Sc_2S_3, is a light-yellow substance obtained by heating the sulphate in a current of hydrogen sulphide.—J. R.

Scandium; Contribution to the knowledge of ——. J. Sterba. Z. Elektrochem., 1914, **20**, 289—295.

SCANDIUM was isolated from wolframite residues by dissolving the oxides in hydrochloric acid and precipitating with ammonium fluoride. To separate pure scandium salt from this precipitate, lead, copper, etc., were precipitated with hydrogen sulphide from acid solution of scandium chloride; iron and manganese from solutions of the double scandium potassium carbonate, the former with potassium hydrogen sulphide and the latter with iodine in potassium iodide solution; molybdenum was removed as sulphide by precipitation in presence of formic acid; and thorium, yttrium and ytterbium by the precipitation of the double scandiam sodium carbonate, combined with the fractional crystallisation of scandium formate. A specroscopically pure scandium oxide was thus obtained. The observation of J. R. Meyer that scandium forms complex water-soluble fluorides was confirmed, and based upon this, a simple and complete separation of scandium from the other rare earths was devised.—G. F. M.

Nitrogen peroxide; Rate of dissociation of ——. W. L. Argo. J. Phys. Chem., 1914, **18**, 438—450.

EXPERIMENTS were made to determine if any appreciable time is required to establish equilibrium between NO_2 and N_2O_4 in nitrogen peroxide gas after an alteration of pressure. The oscillations of stationary sound waves were used to create very rapid changes of pressure. It was found that there was no appreciable lag in the re-establishment of the equilibrium, this being true for the dry gas and for gas containing 0·32 % by vol. of water vapour.
—J. B.

Hydrogen peroxide and sodium perborate; Decomposition of ——, *in alkaline solutions.* R. Schenck, F. Vorländer and W. Dux. Z. angew. Chem., 1914, **27**, 291—296.

DETERMINATIONS of the stability of hydrogen peroxide in alkaline solutions showed the velocity of decomposition to be dependent upon the concentration of the hydroxyl ion. The stability was increased, however, by the addition of sodium pyrophosphate, in spite of the alkaline reaction of solutions of that substance. This result is attributed to the formation of a perpyrophosphate, $Na_2P_2O_7,2\frac{1}{2}H_2O_2$, which is perfectly stable when isolated. Sodium pyrophosphate exerted a similar protective influence upon solutions of sodium perborate, in which the following equilibrium is regarded as existing:— $4NaBO_3+5H_2O\rightleftarrows Na_2B_4O_7+2NaOH+4H_2O_2$. In agreement with this, solutions of hydrogen peroxide were preserved by the addition of equivalent amounts of borax and sodium hydroxide. In both cases the protective action is inhibited by the addition of very small amounts of free alkali.—J. R.

Heavy chemicals in the United States. Oil, Paint, and Dru Rep., May 11, 1914. [T.R.]

IMPORTS of bleaching powder into the United States i 1913 amounted to 30,800 short tons, compared wit 37,120 tons in 1912, 41,450 tons in 1911, 50,500 ton in 1910, 45,700 tons in 1909, and 56,600 tons in 190 Imports from England have decreased from abou 30,000 tons in 1911 to 22,250 tons in 1913, whilst German supplies about 6000 tons annually. The output b American works amounts to about 90,000 tons, of whic about 30,000 tons is exported.

The output of caustic soda in 1913 reached about 190,0 tons, of which about 20,000 tons was exported. Th exports to Canada average 15,000 to 20,000 drums a yea

Arsenic was imported to the extent of 4130 tons in 191 which decreased to 3340 tons in 1913. Imports fro Europe have practically ceased, the only material source foreign supply being Canada. The output last year in t United States was 2375 tons, and in 1912, 3141 tons.

Volumetric determination of free sulphurous acid. Kedesdy. *See* XXIII.

PATENTS.

Sulphuric acid; Leaden chambers for use in the manufacture of ——. A. Nemes, Brussels. Eng. Pat. 24,223, Oct. 25, 1913.

A FRAMEWORK of flat and angle-iron bars, rigidly joined together, carries the bottom or tray of the chamber, and is secured to the iron uprights, which support the walls of the chamber, and which are suspended from the roof of the shed enclosing the chamber. The uprights, which are of circular section, are flattened at intervals, and the parts thus deformed are embraced by lead bands, which are "soldered" to the walls of the lead chamber and hold the latter in position. Collars, secured by pins, may replace the flattened projections on the uprights, the fastening bands in that case resting upon the collars. The bottom of the chamber rests on a wooden floor, which enables leakages of acid to be readily detected.—O. R.

Ammonia; Manufacture of —— from nitrogen and hydrogen. N. Caro. Ger. Pat. 272,638, Oct. 14, 1910.

A MIXTURE of soda-lime, potash-lime, or the like with titanium or vanadium, or both, is used as catalyst in the synthesis of ammonia from nitrogen and hydrogen under pressure at a high temperature. The catalyst is less sensitive than metals of the iron group to contact poisons, so that commercial hydrogen, obtained, for example, by the decomposition of hydrocarbons, can be used in the process.—A. S.

Cyanamide-producing apparatus. V. M. Weaver, Harrisburg, Pa. U.S. Pat. 1,093,749, April 21, 1914.

THE reaction chamber contains inclined grate bars which can be constantly agitated, and an adjacent heating plate with imbedded gas-heating pipe; the plate is heated by a burner beneath. Calcium carbide is fed continuously over the plate and bars and nitrogen forced upwards through the bars, which are perforated. The imbedded gas-heating pipe may receive nitrogen from an external source or gas from the heating zone for re-circulation. —F. SODN.

Nitrogenous compounds; Process of making ——. T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,093,819, April 21, 1914.

SILICON carbide and a metal, *e.g.*, iron, are heated together in contact with substantially pure nitrogen.—F. SODN.

Metallic bodies; Method for the protection of —— agains the action of nitrous fumes. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 465,739, Dec. 4, 1913.

To protect them against the action of nitrous fumes, metallic surfaces are supplied with a sufficient quantity of water, which is allowed to flow in a thin layer over them. It is not necessary to use alkaline solutions, since the thin film of metallic oxide formed, effects the required protection.—T. ST.

Litharge; Process and installation for the manufacture of ——. E. Barthelmess. Fr. Pat. 466,129, Dec. 13, 1913.

A PEAR-SHAPED oxidation chamber, mounted in an inclined position, communicates at its lower wide end with a melting pot for lead, the whole being enclosed in the masonry of a furnace and heated externally by the furnace gases. A central rotating shaft passes longitudinally through the oxidation chamber and carries scrapers which remove deposits from the wall of the same, and also, at its lower end, a centrifugal wheel which dips into the melting pot and pulverises the molten lead, and, at the same time, acts as a fan, drawing in air or other gas containing oxygen and creating an upward draught through the oxidation chamber, so that the finely divided litharge produced by oxidation of the lead is discharged at the upper end, whence it is carried by a conveyor to collecting vessels. The gas is returned to the oxidation chamber after passing through heating flues in the masonry of the furnace. A regulated quantity of water is introduced into the current of gas just before it is drawn into the oxidation chamber by the fan.—A. S.

Oxides of nitrogen; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 9263, April 19, 1913.

SEE Fr. Pat. 464,237 of 1913; this J., 1914, 549.—T. F. B.

Salt similar to refined salt; Process for making table —— from molten sodium chloride. G. Bergen and L. Stolz. Fr. Pat. 465,897, Dec. 8, 1913. Under Int. Conv., Dec. 9, 1912.

SEE Ger. Pat. 269,427 of 1912; this J., 1914, 312.—T. F. B.

Calcium nitride [cyanamide]; Process for making ——. J. H. Lidholm, and Dettifoss Power Co., Ltd. Fr. Pat. 465,379, Nov. 27, 1913. Under Int. Conv., Feb. 24, 1913.

SEE Eng. Pat. 28,524 of 1913; this J., 1941, 256.—T. F. B.

Asbestos; Purification of ——. W. R. Whitney, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,094,505, April 28, 1914.

SEE Eng. Pat. 24,259 of 1911; this J, 1912, 722.—T. F. B.

Hydrogen; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,978, June 4, 1913.

SEE Fr. Pat. 463,114 of 1913; this J., 1914, 313.—T. F. B.

Hydrogen; Impts. in and apparatus for the production of ——. A. Messerschmitt, Stolberg, Germany. Eng. Pat. 17,691, Aug. 1, 1913.

SEE Fr. Pat. 461,624 of 1913; this J., 1914, 313.—T. F. B.

Hydrogen; Production of —— by the iron reaction process. A. Messerschmitt, Stolberg, Germany. Eng. Pat. 18,942, Aug. 20, 1913.

SEE Ger. Pat. 268,339 of 1912; this J.,1914, 137.—T. F. B.

Hydrogen; Reducing and oxidising vessel for producing —— by the action of reducing gases and steam on iron ore. Berlin-Anhaltische Maschinenbau-A.-G. Fr. Pat. 465,474, Nov. 28, 1913. Under Int. Conv., Dec. 11, 1912.

SEE Eng. Pat. 28,390 of 1913; this J., 1914, 256.—T. F. B.

[Sulphurous] fume-destroying process. S. W. Young, Palo Alto, Assignor to The Thiogen Co., San Francisco. U.S. Pat. 1,094,767, April 28, 1914.

SEE Fr. Pat. 450,786 of 1912; this J., 1913, 602.—T. F. B.

VIII.—GLASS; CERAMICS.

Zirconium dioxide; Production of fireproof articles from ——. O. Ruff, H. Seiferheld, and O. Bruschke. Z. anorg. Chem., 1914, **86**, 389—400. (See this J., 1913, 866.)

CRUCIBLES prepared from zirconium dioxide (mixed preferably with 1% of dry starch and 3% of magnesia), and fired first at 1450° C. and then at 2200° C., were found to be almost impervious and to resist a temperature of over 2200° C. in the vacuum electric furnace. They were successfully employed in determining the boiling point of pure iron, etc. and for fusing tungsten alloys. —F. SODN.

Patents.

Furnace-slag ; Process for obtaining from —— a material similar to ordinary pottery or the like. M. Chiapponi, Paris. Eng. Pat. 24,141, Oct. 24, 1913. Under Int. Conv., March 3, 1913.

See Fr. Pat. 455,381 of 1913 ; this J., 1913, 945.—T. F. B.

Enamel on sheet iron ; Process for preparing an ——. L. Honigmann. Fr. Pat. 465,574, Dec. 1, 1913. Under Int. Conv., April 4, 1913.

See Eng. Pat. 28,398 of 1913 ; this J., 1914, 355.—T. F. B.

Retorts for use in the manufacture of gas for illuminating and heating purposes. Eng. Pat. 9176. *See* IIa.

IX.—BUILDING MATERIALS.

Patents.

Waterproofing and colouring bricks, tiles, earthenware and the like. H. A. H. Moore, London. Eng. Pat. 10,493, May 5, 1913.

Bricks and the like are wholly or partially immersed in a bath, heated to about 300° F. (149° C.), of white refined paraffin wax, to which a quantity of fine clear rosin is added prior to the addition of aniline dye or other colouring medium.—B. N.

Concrete blocks or articles ; Induration of ——. J. S. Rigby, Liverpool. Eng. Pat. 11,498, May 17, 1913.

Induration of concrete is effected by steam supersaturated with moisture. In or on the floor of a closed chamber containing the concrete blocks or articles is a number of boxes filled with pumice-stone or like material, and to which water is supplied. The steam is passed through these boxes and thus becomes supersaturated with moisture.—O. R.

Cementitious product and process of making same. Process of making a cementitious composition. W. E. Carson, Riverton, Va. U.S. Pats. 1,094,876 and 1,095,180, April 28, 1914.

(1). An intimate, finely ground mixture of highly aluminous slag and quicklime is partially hydrated, so as to form compounds capable of setting on the further addition of water. (2.) Quicklime is added to clay, which has been pugged with just sufficient water to slake the lime and yield a dry product, the mixture being then roasted below the sintering point, say at 600°—800° F. (315°—426° C.). —O. R.

Fibrous material [silicon oxycarbide] and process of making the same ; Refractory ——. E. Weintraub and F. A. Kroner, Lynn, Mass., Assignors to General Electric Co. U.S. Pat. 1,094,352, April 21, 1914.

A mixture of silicon, or material yielding it, and a catalyst (*e.g.*, calcium fluoride) is heated (preferably to 1300°—1400° C.) in a space enclosed, at least partially, by a porous wall through which oxides or other gaseous compounds of carbon are allowed to diffuse.—F. Sodn.

Drying of wood and other substances. E. Wiart, Suresnes, France. Eng. Pat. 10,198, April 30, 1913.

See Fr. Pat. 449,913 of 1912 ; this J., 1913, 476.—T. F. B.

Roof coverings ; Manufacture of ——. A. Maschke, Brussels. Eng. Pat. 1155, Jan. 15, 1914. Under Int. Conv., Jan. 20, 1913.

See Ger. Pat. 264,407 of 1913 ; this J., 1914, 138.—T. F. B.

Artificial stone from natural-rock waste ; Process for the production of ——. W. Laufer, Cracow, Austria-Hungary. U.S. Pat. 1,094,727, April 28, 1914.

See Eng. Pat. 18,883 of 1912 ; this J., 1913, 290.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Slag ; Utilisation of the waste heat of ——. Times, May 21, 1914. [T.R.]

Much has been done in the last few decades to utilise the heat in iron blast-furnace slags, the annual production of which amounts to close on 200,000,000 tons. If their temperature is taken at 1500° C. the quantity of heat they contain must be enormous, all of which is wasted.

Efforts were made some years ago by the late Sir Lowthian Bell to save this heat, but the state of engineering achievement in his time did not permit a satisfactory solution of the problem. Further experiments have been in progress at the Clarence Works of Messrs. Bell Brothers, Middlesbrough, for some four years, the patents being in the hands of the Slag Power Company. The first plan was to drop the molten slag as it comes from the blast furnaces into water, and use the steam thus produced in a low-pressure turbine. But the considerable quantities of hydrogen and sulphuretted hydrogen produced along with the steam gave rise to difficulties in connection with obtaining the high vacuum necessary to the efficient working of the turbine. These difficulties were overcome, but a quantity of fine sulphur was also produced, and this it was found impossible to eliminate from the steam. Yet if it had not been removed it would have damaged the blades of the turbine with which it came into contact, and would also have blocked the steam passages. Another difficulty was caused by the fact that the hot blast-furnace slag when thrown into water froths up into a foam-like substance, which floats, and means had to be devised for submerging it and for removing it from the water.

Instead of attempting to use directly in the turbine the dirty steam generated by the contact of the slag with the water, the plan finally adopted was to employ it indirectly for generating clean steam by means of a heat exchanger, the particular form adopted being a Kestner single-effect climbing film evaporator. The hot slag is run direct from the blast furnace into the primary generator, in which an upright shaft with four blades revolves, keeping the water in constant rotation. When the slag drops through the orifice the velocity of its fall carries it well below the lip, and before it rises to the surface it is swept by the moving water past the orifice and inside the seal. An elevator then lifts it from the generator and drops it through a second seal ; by this time it is waterlogged and sinks, and it is then collected by a second elevator, which drops it into railway trucks for removal. The dirty steam passes from the generator to the evaporator, where it is used to produce clean steam, which is employed in the turbine. In the case of copper slag the second elevato is not required, since the slag does not float in water bu immediately sinks.

Over 740 kilos. of water have been evaporated pe 1000 kilos. of blast-furnace slag containing 550,00 calories ; deducting 18,000 calories removed with th slag at 100° C. and 42,000 removed with the water take up by the slag (on the assumption that it absorbs 50 % o water), the available heat is 490,000 calories, or, if a allowance of 25% is made for loss, 367,500 calories, whic divided by 622 give 590 kilos. of steam. As the result o many experiments the average efficiency of the evaporato is found to be 91%, but taking it at only 80% the amoun of clean steam available for the turbine is 472 kilos., an this with a consumption of 13 kilos. of steam per hors power, which is an excess of that guaranteed by th makers of the turbine with a vacuum of 28·5 in. and vacuum of 7 in. over the water in the evaporator, mean a yield of over 36 h.p. per 1000 kilos. of slag. Copper sla contains less heat than blast furnace slag, the amou being found by experiment to be from 318 to 350 calori per kilo., and therefore by a similar calculation 1000 kilo will produce 281 kilos. of clean steam, equivalent to yield of, say, 21 h.p. in the turbine.

It is estimated that with a 1000-kw. plant with 75 load the cost of generating 1 kw. would be 0·32d., where with a high-pressure steam plant using coal at 14s. 6d. ton it would be 0·48d., the economy realised by the a of the heat from the slag being thus 0·16d. per kw., whi under the conditions stated would amount to £4,300 a year. It is stated that the upkeep of the generator and evaporator is small. As the slag goes directly into the water, only steam at 100° C. comes in contact with the plant, which is thus not subjected to any great differences of temperature, while experience indicates that there is no action from the gases on the plates or tubes of the evaporator, provided they are kept clean.

Manganese ore deposit in Minnesota. Board of Trade J., May 14, 1914. [T.R.]

An extensive deposit of very high grade manganese ore has been discovered on the Cayuna Range, in the northern part of Minnesota.

Sheet iron for roofing ; Nature of the protective oxidised coating of ——. Matweeff. Rev. Mét., 1914, **11**, 480—482.

The protective coating of roofing (Russian) iron, although consisting mainly of the magnetic oxide, also contains ferrous oxide, present in a compact state in contact with the metal and forming a kind of skeleton in which the protective but porous and friable magnetic oxide is held. —W. E. F. P.

[*Steel*]. *Crucible v. electric furnaces.* C. T. Nesbitt. Chem. World, 1914, **3**, 131—132.

With electric power costing 0·66d. per kilowatt-hour (the price in Sheffield), the melting costs for the production of steel in crucible and electric furnaces are about the same—£2 10s. per ton. The electric furnace has the advantage as regards output, which more than balances the higher initial cost. It has also an immense advantage in that the commonest scrap or pig iron can be converted into steel equal to the best crucible-made product, and of any desired carbon content, with certainty and without trouble. The labour costs of the two processes are about the same.—T. St.

Iron, steel and nickel ; Relation between the variations of magnetism and electrical resistance of —— at high temperatures. K. Honda. Rev. Mét., 1914, **11**, 483—488.

Determinations were made with pure nickel (up to 800° C.), pure iron (up to 900°—1000° C.) and steels containing respectively C 0·64 and 1·30% (up to 900° C.) In each of the temperature-resistance curves a break occurred at the temperature corresponding to the disappearance of ferromagnetism. The variations of resistance between 100° and 200° C. corresponding to magnetic alteration in steels were very slight. The results confirm the view that the magnetic transformation is not an allotropic change but only a progressive alteration, with temperature, of the property of one phase. (See also this J., 1914, 83.)—W. E. F. P.

Titanium-iron alloys. J. Lamort. Ferrum, 1914, **11**, 225—234.

Alloys with Ti up to 24 %. were examined by the method of thermal analysis and microscopically. Three constituents were observed, viz., a solid solution of titanium in iron, an eutectic (Ti 13·2 %, m. pt. 1298° C.), present in alloys with Ti 6·3—19·9 %, and crystals, probably of Fe_3Ti (Ti 22·31 %). The temperature of the magnetic transformation point was lowered in direct proportion to the titanium content, being 690° C. for Ti 21 %. In Brinell tests with a load of 500 kilos., he hardness rose from 96 for pure iron to 484 with Ti 1·5 % ; with a load of 1000 kilos. alloys with Ti over 5 % fractured Commercial samples of ferro-titanium ree from carbon contained practically no titanium itride. The titanium content varied considerably n different parts of large pieces. In ferro-titanium ntaining carbon the titanium was present in some ases wholly as metal and in others wholly as nitride, nd this is probably the cause of the contradictory reports to the effect of titanium on the properties of iron nd steel. The addition of the same brand of ferro-itanium might in two cases yield different results according to the conditions of temperature, etc., as affecting the possible formation of nitride. In making the analyses the samples were treated with hydrochloric acid in a current of carbon dioxide, when the nitride remained undissolved. The dissolved titanium was titrated with a standard solution of ferric chloride with ammonium thiocyanate as indicator. The residue was ignited to oxide, and silica removed by means of hydrofluoric acid. —T. St

Iron ; Effect of addition agents in the electro-deposition of ——. O. P. Watts and N. H. Li. Met. and Chem. Eng., 1914, 12, 343.

The use of a pure chloride electrolyte is not practicable, but the admixture of some ferrous chloride with a sulphate solution improves the smoothness of the deposit ; but more satisfactory deposits are obtained by the addition of ammonium oxalate or formin (hexamethylenetetramine). —B. N.

Platinum (and iridium). A. Hänig. Oesterr. Zeits. Berg- u. Hüttenw., 1914, **62**, 203—204.

The estimated total production of platinum metal from the Urals is given as : 1907, 310,000 ; 1908, 250,000 ; 1909, 264,000 ; 1910, 275,000, and 1911, 300,000 oz. troy. The world's annual production of iridium probably does not exceed 5000 oz., most of which is used in the form of platinum alloys ; those with less than 10% Ir are ductile and malleable ; with 10—20 %, hard and difficult to work. In 1911 it was valued at £12 13s. per oz. Reference is made to the possibility of considerable quantities of platinum being produced, in the near future, at a mine in Wenden, Westphalia. —W. R. S.

Mercury recovery plant at Fresnillo. C. Robinson. Eng. and Min. J., 1914, **97**, 953—954.

Old "Patro" tailings (containing mercury) are treated by hyposulphite leaching for the recovery of silver in one department of the plant of the Fresnillo Co., Zacatecas, Mexico. The silver sulphide precipitated from the solution contains 200—300 grms. of mercury per ton, and the metal is recovered in a roasting furnace, which has a distilling hearth composed of fireclay tiles resting on a concrete foundation, from which it is separated by an iron plate, to stop leakage. The vapours pass from the furnace through a flue to four lines of condensing tubes, constructed of vitrified tiles cooled by water sprays. The open ends of the condensing tubes are sealed by water in a tank with inclined bottom and well for collection at the lower end.—O. R.

Lead [in ores] ; Volumetric method for the determination of ——. A. Alder and M. F. Coolbaugh. J. Ind. Eng. Chem., 1914, **6**, 398—400.

From 0·5 to 1 grm. of ore is treated with nitric acid and if necessary, with a small quantity of hydrochloric acid, and evaporated with a few c.c. of concentrated sulphuric acid. The residue is treated with 100 c.c. of water, boiled vigorously, 10—15 c.c. of alcohol added, and the lead sulphate filtered off, washed with a mixture of 1 % sulphuric acid and 10 % alcohol and then with alcohol, and dissolved in 10—15 c.c. of a hot 10 % solution of sodium hydroxide, the filter being washed successively with hot water, hot water acidulated with nitric acid, and water containing a little sodium hydroxide. The solution is treated with a few drops of phenolphthalein and a slight excess of potassium iodate, heated, and a slight excess (15—29 drops) of nitric acid of sp. gr. 1·2 added. The whole is heated to boiling, cooled slightly, treated with 15—20 c.c. of alcohol, cooled, filtered, and the filter washed with dilute alcohol (1 : 3) until the wash water gives no test for iodate when treated with hydrochloric acid, ammonium thiocyanate, and chloroform. The filter and precipitate are transferred to a flask, treated with 40—50 c.c. of dilute hydrochloric acid (1 : 2·5) and 3—5 c.c. of chloroform, and titrated with ammonium thiocyanate solution (2·5 grms. per litre until the chloroform is coloured violet. With ores rich in lead, 10—15 c.c. of hydrochloric acid of sp. gr. 1·1 should be added before the end point is reached. The equations given are:

$$3Pb(IO_3)_2+4NH_4CNS+16HCl=$$
$$6ICl+3PbCl_2+4NH_4Cl+4H_2SO_4+4HCN+2H_2O;$$
$$6ICl+NH_4CNS+4H_2O=$$
$$6I+NH_4Cl+H_2SO_4+5HCl+HCN.$$—A. S.

Zinc in its ores; Rapid determination of ——. Direct application of Frary's method to the analysis of ores. S. Zublena. Annali Chim. Appl., 1914, 1, 302—313.

From 2 to 5 grms. of the ore are evaporated with 30 c.c. of concentrated sulphuric acid and a small quantity of hydrofluoric acid, then diluted with water, the insoluble sulphates filtered off, and the solution diluted until it contains 25—30% H_2SO_4, and treated with hydrogen sulphide at 70° C. The whole is made up to 200 c.c., filtered through a dry filter, and 150 c.c. of the filtrate boiled to expel hydrogen sulphide, nearly neutralised with sodium carbonate, heated to boiling and added, in small portions, with vigorous agitation, to a boiling solution of sodium hydroxide (7—8 grms. per 0·1 grm. Zn). The whole is boiled for 5 mins., rapidly cooled, diluted to 500 c.c., and filtered through an alundum filter. In 100 c.c. of the filtrate the zinc is determined electrolytically by Frary's method (this J., 1907, 875, 1257).—A. S.

Copper ores; Notes on the leaching of oxidised —— by modified Dorr classifiers at the Butte-Duluth mine. C. S. Herzig. Inst. Min. and Met., May 21, 1914. [Advance proof.]

The old method consisted in crushing to about ½ in.-mesh and leaching in vats with 10% sulphuric acid for 48 hours; the extraction varied between 50 and 70 per cent. The introduction of Dorr classifiers, in which wood was substituted for metal in all parts in contact with the acid, resulted in an extraction of 85% after one hour's leaching. Six classifiers, 8 ft. wide, are used in series; the first four, 30 ft. long, for acid treatment, the last two, 15 ft. long, for washing with water. The ore is crushed to 10-mesh size, mixed with acid, and fed on to the first machine; the slime overflows at the lower end and is treated separately, while the coarser pulp drops into the second classifier which receives fresh acid. The overflow from the second, third and fourth machine is electrolysed; that from the last classifier but one is fed on to the first, while the wash from the last is treated with scrap iron.—W. R. S.

Copper mattes; Treatment of —— in the basic converter at the works of Korabach (Ural, Kishtim district.) K. D. Kolasnikow. Rev. Mét., 1914, 11, 519—543.

Mattes containing Cu 7—49, Fe 26—60, S 23—25%, are "blown" in two stages. The white matte, produced in the first stage, generally approximates to Cu_2S in composition. The coarse copper from the second stage contains Cu 98—99%, together with about 97% of the gold and 40% of the silver present in the white matte. The slag (containing Cu 1—2%) varies in composition from $3FeO,SiO_2$ to $2FeO,SiO_2$ according to the composition of the matte bath and the temperature. The complete data relating to the treatment of about 100 kilos. of matte containing Cu 33·5% are given and discussed in detail. —W. E. F. P.

Brass; Electrolytic deposition of ——. C. W. Bennett and A. W. Davison. Met. and Chem. Eng., 1914, 12, 340.

Brass cannot be deposited on a rotating cathode, except from cyanide solutions and then not satisfactorily. The ratio Cu : Zn in solutions suitable for the deposition of a brass varies not only with variations of free cyanide, but also with the rate of rotation of the cathode; beyond a certain limiting speed zinc alone is deposited.—B. N.

Cyanide in electroplating solutions; Determination of free —. G. E. F. Lundell. Met. and Chem. Eng., 1914, 12, 340.

A measured quantity of the cyanide solution, preferably containing from 0·2 to 0·5 grm. of cyanide, is diluted to 100 c.c., treated with 1 c.c. of ammonia solution, and 1 c.c. of a solution of 8·9 grms. of dimethylglyoxime in 1 litre of 95% alcohol, and titrated with a standardised nickel ammonium sulphate solution (containing 15·3 grms., with 5 c.c. of concentrated sulphuric acid, diluted to 1 litre) until a permanent red precipitate is formed. In the reaction one mol. of the nickel sulphate combines with 4 mols. of potassium cyanide.—B. N.

Sodium and potassium salts; Electrolysis of fused mixtures of ——. B. Neumann and E. Bergve. Z. Elektrochem., 1914, 20, 271—275.

The m. pt. of sodium hydroxide can be reduced by addition of potassium hydroxide to 167° C. (58·4% KOH). The addition of sodium carbonate to this mixture raises the m. pt. Sodium carbonate added to sodium hydroxide lowers the m. pt. to a minimum at 280° C. (17% Na_2CO_3), and a mixture of potassium and sodium carbonates (48·5% K_2CO_3, m. pt. 690° C.) will lower it to 265° C., when the melt will contain 79·3% NaOH. The electrolysis of mixtures of the fused salts yields alloys of potassium and sodium. With a constant current density the percentage of potassium in the alloy increases with that in the melt, and from a mixture of NaOH 60 and KOH 40%, the alloy contains the metals in the same ratio as the melt. With an increasing current density the potassium content of the alloy increases slowly both from hydroxide and carbonate melts.—W. H. P.

Metals; Internal strains in cold-wrought ——, and some troubles caused thereby. E. Heyn. Inst. of Metals, May, 1914. [Advance proof.]

Self-straining is produced where portions of a solid are given a tendency to assume different lengths, and when by cohesive forces they are hindered from following this tendency, and are forced to adapt themselves to a common length by elastic deformation. In a cold-drawn rod, the core tends to be stretched more than the outer layers, and hence is under compression whilst the outer layers are in tension. Cold-rolling and cold-hammering produce tension in the core and compression in the outer layers. By removing one portion, the other is allowed to assume its true length, and by measuring the change in length, a measure of the former strain is obtained. By removing successive thin layers the distribution of the longitudinal strains across a bar may be studied. Similarly by removing the core and measuring the change in diameter a measure of the transverse strains is obtained. Such measurements made on portions of the same material after annealing at different temperatures have shown that internal strains are partially removed at temperatures much below that at which the effects of cold work are completely removed. Several special cases are discussed, and it is shown that fracture and cracking of engineering materials are often the result primarily of considerable internal strain, the forces determining the fracture being relatively small. Liability to cracking, especially in alloys of copper and zinc, may often be revealed by dipping the piece in mercury or in solutions of mercury salts. It is possible to remove internal strains by alternate cold-drawing and cold-rolling. Results of tensile tests are largely dependent upon the amount of internal stresses, and upon the distribution of the latter over the sectional area of the bar tested. The tensile strength may even appear to be lowered instead of raised by cold work, owing to the effect indicated by the tensile test being completely masked by the effect of internal strain.—T. St.

Metals; Solidification, cellular networks and growth of grains in ——. F. Robin. Rev. Met., 1914, 11, 489—512.

By slow cooling, samples of aluminium, lead and tin were obtained in which, without any dendritic formation, the boundaries of the grains coincided exactly with the figures (network of lines) produced by contraction. It is suggested that the metal solidities in the amorphous condition and becomes divided (as indicated by the lines of contraction) into separate portions, each of which subsequently crystallises in one piece having a oniform orientation. The cellular network of metals is apparently not connected with local variations in density, but is favoured by the presence of impurities. The structure is formed abruptly in pure metals without apparent crystallites, and increases with a slight tinkling sound on cooling; it follows the contraction figures of amorphous materials, and is regarded as the result of concentration at the moment of solidification, due to crystallitic solidification or compression: it is not produced in bismuth (which expands on solidification). The growth of the grains on annealing is effected by the junction of crystals having the same orientation, or, more frequently, by diffusion across the joints the grains which develop being those having the greater internal tension and not necessarily the larger ones.—W. E. F. P.

Cadmium, copper and zinc. Physico-chemical studies on ——. I. E. Cohen and W. D. Helderman. Z. physik. Chem., 1914, **87**, 409—430.

Measurements of density after varying thermal treatment, and dilatometric measurements showed that cadmium, copper, and zinc, like tin and bismuth exist in a metastable form at ordinary temperature. The transition temperature is about 60 C. for cadmium and 70° C. for copper, but the value for zinc has not yet been determined. The transitions take place very slowly both above and below these temperatures so that all forms of the pure metals hitherto obtained are mixtures of at least two constituents, and their physical and mechanical constants refer to undefined systems. In the case of copper and cadmium the transition temperature varies a few degrees with the previous history and thermal treatment of the metal, suggesting the possible existence of three modifications.—W. H. P.

Metals and alloys; A method of obtaining a measure of the colour of ——. F. C. Thompson and E. Sinkinson. Chem. World, 1914, **3**, 132—135.

Details are given of a method of photographing metal surfaces under constant conditions of exposure and and development. The density of the resulting negatives is measured in a Sanger-Shepherd densometer, and the ratio of the density of the negative given by silver to that of the negative given by another metal is taken to express the degree of colour of that metal. Pure silver, and silver containing Cu 7·5 % were found to be indistinguishable, as were also pure copper, and copper with Sn 8·3 %. A German silver composed of Cu 57, Ni 7, Zn 36 %. gave a slightly higher colour figure than one composed of Cu 55, Ni 15, Zn 30 %.—T. St.

Colloidal gold solutions; Chemical and physico-chemical observations in the preparation of ——. W. Halle and E. Pribram. Ber., 1914, **47**, 1398—1401.

Attempts to prepare colloidal gold solutions containing particles of uniform size by Donau's method (Monats. Chem., 1913, **34**, 335) of bringing a hydrogen flame in contact with the surface of a dilute aqueous gold solution gave irregular results. It was observed that the gold solution (or pure water) after contact with the hydrogen flame contained small quantities of nitrous acid, and experiments in which the gold salt was reduced by nitrous acid irectly gave satisfactory results, colloidal gold solutions ontaining particles of uniform size and of different olours being easily obtained. For example 0·1 grm. f sodium nitrite was dissolved in 285·5 c.c. of water, he calculated quantity of $N/10$ sulphuric acid (14·5 c.c.) as added, and portions of 5 c.c. of this solution were reated with: (1) 145 c.c. of water and 3 drops of gold hloride solution (1 : 100), (2) 195 c.c. of water and 4 drops f gold chloride solution, and (3) 245 c.c. of water and 5 rops of gold chloride solution. After a short time lution (1) was of a uniform blue colour, solution (2) violet, and solution (3) red. In vessels of glass which yielded traces of alkali to the water, blue or bluish violet solutions were always obtained.—A. S.

Colloidal solutions of base metals; Preparation of aqueous —— by disintegration. D. Zavrieff. Z. physik. Chem., 1914, **87**, 507—510.

Colloidal aqueous solutions of aluminium, iron, magnesium, copper, lead, nickel, and mercury were prepared by electrical disintegration of the metals by oscillatory discharges produced by means of an induction coil or an influence machine.—A. S.

Working coke-ovens in conjunction with blast-furnaces. Freyn. *See* IIa.

Colorimetric determination of cobalt, nickel, iron, and copper. Hüttner. *See* XXIII.

Patents.

Steel; Manufacture of ——. G. J. Boyle, Doncaster. Eng. Pats. 1306, Jan. 16; 11,778, May 20; 12,961, June 4; 14,431, June 21; and 16,821, July 22, 1913.

A bath of molten steel of considerably greater depth than width, is subjected to the action of an electric current, which is caused to pass through the depth of the charge, so as to enable slag, gases, etc., to rise to the surface; the purified metal is discharged from the bottom of the receptacle.—W. E. F. P.

Iron and steel; Process for the manufacture of a metal combining the properties of ——. Syndicat de Procédés Métallurgiques. Fr. Pat. 464,717, Jan. 20, 1913.

Refined iron or steel is treated with alkali- and ammonium-salts (free from S. P. As, etc.) to modify the working qualities of the metal. For example, steel (1 ton) is rendered extra hard by treatment with a mixture of potassium bichromate (300 grms.), sodium bichromate (500), sodium chloride and bicarbonate (each 250), sodium borate and aluminate, potassium nitrate and ammonium chloride (each 100 grms.). The hardness is diminished by using smaller proportions of bichromates, borate and aluminate, and a soft metal is obtained by omitting these constituents from the mixture.—W. E. F. P.

Manganese-steel ingots: Process of treating ——. C. G. Osborne, Chicago, Ill. U.S. Pat. 1,094,090, April 21, 1914.

The ingots are stripped, quenched from a temperature of not less than 750° C., and then re-heated to about 1175° C.
—W. E. F. P.

[*Ferro-vanadium.*] *Metallurgical process.* W. F. Bleecker, Pittsburgh, Pa. U.S. Pat 1,094,114, April 21, 1914.

The high-carbon alloy, obtained by heating a mixture of ferric and vanadium oxides with fluxes and excess of reducing agent, is re-heated with a similar mixture containing no reducing agent to produce ferro-vanadium of low carbon content.—W. E. F. P.

Iron or its alloys: Cementation of ——. M. Caplain and L. Krieger. Fr. Pat. 465,715, Feb. 12, 1913.

The metal is embedded in carbon and heated in a current or atmosphere of nitrogen.—W. E. F. P.

Copper or other metals; Process for refining ——. W. S. Rockey and H. Eldridge, New York. Eng. Pat. 7409, March 28, 1913.

Copper is melted in an oil-fired furnace in a reducing atmosphere, and runs from the hearth into a ladle by way of a conduit which serves as a flue for the products of combustion. The roof of the conduit is shaped to deflect the issuing gases into the ladle, above which are a hood and vertical pipe for carrying away the gases. The metal is thus subjected to a refining deoxidising atmosphere until it is poured into the moulds.—T. St.

Copper alloys ; Process of producing ——. H. Bryda, Blackstone, Mass. U.S. Pat. 1,095,078, April 28, 1914.

Tin (1½ parts), quicklime (1½), tartar (1), magnesia (1) and sal ammoniac are added in succession to molten copper (16 parts), the mixture being stirred after each addition and allowed to stand for 30—45 mins. before pouring. —W. E. F. P.

Ores ; Apparatus for concentrating ——. S. Michaelis, Aranyida, Hungary. Eng. Pat. 10,972, May 9, 1913.

In the concentration of ores by flotation (with oil and acidulated water), incompletely isolated ore particles are separated from the residue obtained by removal of the first concentrate, by means of a rotary disc, of inverted, conical shape, provided, near the centre, with openings for the escape of gangue and, below the rim, with an annular channel in which the partly isolated, oily ore particles—suspended in acidulated water and moved over the rim by centrifugal action—are collected. A small cone having an annular channel around the rim is disposed beneath the disc for the purpose of collecting the escaping gangue. —W. E. F. P.

Ores ; Process for recovering metalliferous constituents of ——. J. T. Terry, jun., San Francisco, Cal. U.S. Pat. 1,094,760, April 28, 1914.

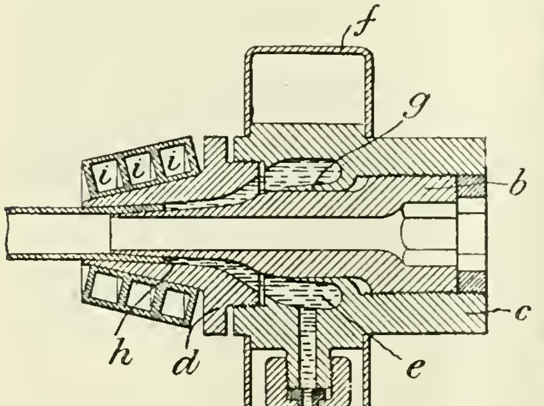
Non-sulphide ore pulp is treated with gaseous hydrogen sulphide, then subjected to reduced pressure, and finally concentrated by flotation. Before treatment with hydrogen sulphide the ore may be mixed with a soluble metallic salt to produce "nuclei for the formation of sulphide granules and coagulations."—W. E. F. P.

Concentration of oxide or carbonate ores by the flotation process. E. Langguth. Ger. Pat. 272,919, May 9, 1913.

The ore is treated with a solution of salts of aniline or its homologues, with or without addition of oil, and then concentrated by flotation in the usual manner.—A. S.

Lead or other metals or alloys ; Apparatus for the manufacture of tubes, cable casings and other products of indefinite length from molten ——. H. Debauge, Paris. Eng. Pat. 5230 of 1914, date of appl., March 6, 191 .

The molten metal is forced continuously through a die (see Fig.) comprising three main concentric parts, *b*, *c*, *d*, *b* and *d* being adjustably screwed into *c* for the purpose of regulating the thickness of the tube wall. The metal passes through the pressure pipe, *a*, into the chamber, *e*, which is maintained at a constant temperature by a bath of the metal contained in the bell, *f*, the latter being filled by tilting the apparatus. To prevent leakage through the screw joint between *b* and *c*, the central part of *c* is provided with a tubular portion of thin metal which slides on the inner part of the die and acts like the cup leather of a hydraulic press. From the chamber, *e*, the metal passes to the outlet nozzle around which a series of annular cooling chambers, *i*, are disposed for the purpose of regulating the position (*i.e.*, distance from the orifice) at which solidification of the metal is effected.—W. E. F. P.



Wire, plates and the like having a coating of gold ; Method for the manufacture of ——. E. Max, London, and F. Kammerer, Pforzheim, Germany. Eng. Pat. 27,222, Nov. 26, 1913.

The wire is coated electrolytically with gold and then passed between pressure rollers at a temperature lower than the softening point of the core to weld the deposit to the latter.—W. E. F. P.

[Gold and silver.] Metals ; Process of extraction of precious ——*from their carrier.* E. E. Howson, Salt Lake City, Utah. U.S. Pat. 1,093,700, April 21, 1914.

The ore pulp is made to form a relatively thin layer and the solution is removed from below during the formation of this layer. A solvent is then added, the mass agitated with a current of warm air, the solvent removed from below, a wash solution added, the mass again agitated with air and the solution removed as before.—W. E. F. P.

Air for blast furnaces ; Method of drying ——. M. W. Johnson, jun., Birmingham, Ala. U.S. Pat. 1,093,859, April 21, 1914.

The air is refrigerated at furnace pressure, the condensed moisture removed, and the dried air warmed by interchange of heat with the moist compressed air.—W. E. F. P.

Titanium carbide ; Method of producing a compound containing ——. A. J. Rossi and W. F. Meredith, Niagara Falls, N.Y., Assignors to The Titanium Alloy Manuf. Co., New York. U.S. Pat. 1,094,022, April 21, 1914.

A bath of molten metal, *e.g.*, iron, mixed with titanium oxide and carbon, is heated sufficiently to produce more titanium carbide than metallic titanium, and is then rapidly cooled to promote retention of the carbide particles.—F. Sodn.

Metals ; Process for extracting ——*from ores.* H. S. MacKay, Assignor to MacKay Process Co., Norwich, Conn. U.S. Pat. 1,094,371, April 21, 1914.

A solvent for ores is formed from the elements of the ore, by roasting (with or without addition of sulphur), leaching and electrolysing, the composition of the solvent and of the electrolyte being controlled by the character of the roast.—W. E. F. P.

Metallizing-furnace. E. P. Mathewson and F. Laist, Anaconda, Mont. U.S. Pat. 1,094,802, April 28, 1914.

The furnace consists of six superposed, communicating hearths—the upper ones for oxidation and the lower ones for reduction. The third hearth from the bottom is fired directly, the two below being muffle hearths heated externally by combustion chambers and supplied internally with solid reducing material. The waste gases from the combustion chambers are diverted to the directly-fired hearth, and the roasted ore is mixed with the reducing material in the muffle hearths.—W. E. F. P.

Furnace ; Metallurgical ——. U. Wedge, Ardmore, Pa. U.S. Pats. 1,094,953 and 1,094,954, April 28, 1914.

(1). In a furnace of the superposed-chamber type, two "manifolds"—one for supplying, and the other for receiving, air—are disposed within the central shaft and are connected with the interiors of the chambers by pipes and the hollow rabble arms. (2). The floor of each chamber is divided, by a low, circular partition, into two concentric zones along which different materials may be separately propelled by the action of one set of rabble arms. Means are provided for charging and discharging the concentric portions independently.—W. E. F. P.

Blast-furnace. J. M. Jantet. Fr. Pat. 466,241, Dec. 16, 1913.

A portion of the gases leaving the blast-furnace is aspirated through valve-controlled pipes and re-delivered to the furnace at the level of the tuyères.—T. St.

Furnace; Electric —— [for the production of ferro-alloys]. Soc. Electro-Métallurgique de Saint-Béron. Fr. Pat. 466,116, Feb. 20, 1913.

The material is contained in a crucible communicating below, by means of a channel, with a second crucible thus preventing entrance of slag into the latter, which has a pouring orifice at a level normally above that of the molten metal. Two electrodes, for the arrival and return of the current, are disposed above the first crucible and are movable vertically by a screw, so that when forced into the material some is discharged from the pouring orifice. These electrodes may be used only for leading in the current, which is then taken away by other electrodes around or above the second crucible. By employing electrodes of great cross-section, the furnace may be used as a resistance instead of an arc furnace.—B. N.

Furnace; [Metallurgical] Electric arc ——. I. Rennerfelt. Fr. Pat. 466,291, Nov. 17, 1913. Under Int. Conv., Dec. 5, 1912, and July 18, 1913.

The external iron envelope of the fusion chamber is divided into several equal sections, and each section carries a similar group of electrodes arranged in a plane perpendicular to the longitudinal axis of the furnace. Each group consists of two horizontal electrodes and a vertical one placed in the middle, or two horizontal electrodes, each turning on an axis so as to be displaceable in a vertical plane, may operate with one or more contacts in the base of the furnace. In another form, two vertical electrodes and two horizontal ones, operating from opposite sides of the furnace, are arranged in the same vertical plane. The furnace is turned about a horizontal axis, at one end, transverse to the longitudinal axis, whilst the other end may be raised or lowered; or the turning axis may be in the middle of the furnace or parallel to the length of the furnace. Openings are provided in one of the extreme walls above the normal level of the slag, so that on tilting the furnace the slag is rapidly poured, and openings closed by refractory material are arranged below for casting the charge. The vertical electrodes are connected to the common point of a diphase current, and the horizontal electrodes to the extremities of the phases. —B. N.

Ores; Treatment of sulphide, oxide, carbonate, and other ——. N. H. M. Dekker. First Addition, dated Feb. 5, 1913, to Fr. Pat. 445,768, July 4, 1912.

Certain oxide ores are best mixed with charcoal, sulphur, etc., before being treated with the polysulphate as described in the chief patent (see Eng. Pat. 18,488 of 1911; this J., 1912, 930). Sulphurous acid is thus formed which acts in the nascent state on the ores with formation of sulphates.—T. St.

[*Aluminium.*] *Metals; Solder for ——.* G. Koenig. Fr. Pat. 464,716, Jan. 20, 1913.

An alloy of Sn 60, Al 30 and Sb 10 parts by weight. —W. E. F. P.

Aluminium or its alloys; Preparing the surfaces of —— for receiving a metallic deposit. L'Aluminium Français. Fr. Pat. 464,720, Jan. 20, 1913.

To prepare aluminium articles for electro-plating an adherent metallic coating, free from occluded hydrogen, s produced upon them by immersing them in an acid hydrochloric) or alkaline bath containing tin or other uitable metal in solution, rinsing, immersing in a saturated olution of ammonium alum or other aluminium salt, and then for a few seconds in a solution of sulphuric or/and nitric acid.—W. E. F. P.

Nickel or other metals; Deposition of —— on aluminium, or other metals, glass or porcelain. L'Aluminium Française. Fr. Pat. 464,721, Jan. 20, 1913.

The article to be coated is immersed in a solution of a salt of the metal to be deposited, to which have been added ammonium or other alkali or metallic phosphites or hypophosphites, the solution being heated to increase the speed of deposition.—B. N.

Silvering aluminium, iron and steel electrolytically, without a preliminary coppering. P. F. L. Bévenot. Fr. Pat. 466,193, Feb. 24, 1913.

The metal is first coated electrolytically with a thin firmly-adherent layer of an alloy of nickel and silver by employing an electrolyte containing nickel, silver and potassium cyanides. A thicker deposit of silver may then be obtained from an ordinary plating bath.—B. N.

Zinc; Manufacture of pure zinc oxide or metallic ——. H. W. de Stucklé. Fr. Pat. 465,816, Dec. 6, 1913. Under Int. Conv., Dec. 7, 1912.

Precipitation (from solution of the sulphate, chloride, etc.), is effected by ammonium sulphite in the presence of ammonia or ammonium carbonate. The zinc sulphite is calcined to oxide and the sulphur dioxide evolved absorbed in a neutral, acid, or feebly alkaline solution of ammonium sulphite, the resulting ammonium bisulphite being reconverted into normal sulphite (for further use) by the addition of ammonia recovered from the filtrate from the original precipitation.—W. E. F. P.

Blende, and ores and metallurgical products containing blende; Method of dead-roasting ——. W. Buddeus. Fr. Pat. 466,397, Dec. 19, 1913. Under Int. Conv., Feb. 26, 1913.

Powdered blende is made into briquettes with an agglomerant such as calcium silicate, with the addition, if desired, of combustible substance. The porous nature of the briquettes permits of the sulphur content being reduced by roasting to below 1 to 2%.—T. St.

Zinc from residues, slags, and low-grade ores; Process and furnace for obtaining ——. O. Uehlendahl. Ger. Pat. 271,826, Feb. 15, 1913.

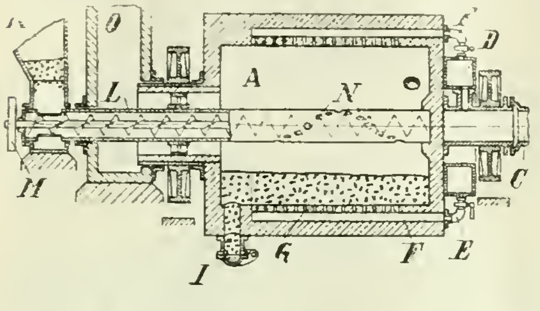
The charge is distributed on a number of movable hearths which pass successively through a tunnel furnace, a freshly-charged hearth being introduced at one end when a hearth containing a charge from which the zinc has been completely expelled is removed at the other end. The heating gases pass through the furnace in the opposite direction to the charge. The freshly charged hearths are not introduced directly into the furnace but into an intermediate chamber communicating therewith and not traversed by the heating gases. The tunnel furnace may be divided into two communicating parts through which the heating gases are passed independently, or it may be annular, the hearths taking a circular course. Other modified forms are also described.—A. S.

Zinc or other easily volatile metals; Process for obtaining ——. R. von Zelewski. Ger. Pat. 272,537, Dec. 8, 1912.

Zinc is obtained from a charge of the sulphide and calcium carbide by heating in large brickwork muffles similar to coke ovens, which are heated in the usual manner or electrically, the walls serving as a heating resistance. —A. S.

Metalliferous materials; Process and apparatus for treating materials, especially ——, with a view to roasting, reduction, volatilisation of metals, concretion, etc. F. C. W Timm. Fr. Pat. 465,951, Oct. 30, 1913. Under Int. Conv., Nov. 2, 1912.

The apparatus (see Fig.) consists of a horizontal or slightly inclined, cylindrical, rotary furnace, A, in the lining of which are disposed perforated sections, G, which communicate, through longitudinal passages, F, in the furnace wall with pipes, E, through which air is passed from an annular duct, D, supplied by a tuyère, C. The cylinder is charged with the material through an opening (not shown) similar to the discharge opening, I (both being normally closed), and carbon or carbonaceous matter added, in small quantities at a time, through openings, N, in a portion of the horizontal pipe, L, through which the carbon is conveyed from a hopper, K, by means of a worm actuated by a pulley, M. The gases and volatile products pass from the cylinder to the chamber, O, and are drawn off.—W. E. F. P.



Phosphate slag; [Thomas process] Method of converting the whole of the phosphorus into fluid ——, soluble in citrates, in the manufacture of steel by treating pig-iron and ore in the open-hearth furnace. Deutsch-Luxemburgische Bergwerks- und Hütten-Akt.-Ges. Fr. Pat. 466,016, Dec. 10, 1913.

To prevent the passage of phosphorus back to the metal, the slag is removed at two successive stages in the refining of the steel. After about $1\frac{1}{2}$ hours, when decarburisation first becomes intense, a large proportion of the phosphorus has been removed from the metal, and the slag is tapped off. Fresh ore is then added. Dephosphorisation again becomes rapid and decarburisation slow. After about an hour the latter again becomes intense, and the slag is again removed. If much silicon be present, it is removed in a preliminary acid slag, formed almost immediately by the addition of sufficient ore just to oxidise it, and a minimum quantity of lime. In a test the first dephosphorisation slag contained 21·94 % P_2O_5 of which 20·8% were soluble in citrates, and the second 19·6% P_2O_5, of which 18·71% were soluble.—T. St.

Alkali metals; Manufacture of —— by electrolysis of melted salts or mixtures of these. R. J. McNitt. Fr., Pat. 466,205, Dec. 15, 1913. Under Int. Conv., Jan. 2. 1913.

The zone of electrolysis, near the bottom of the bath, is placed under pressure by using a deep layer of the molten electrolyte; or the cathode chamber may be subjected to the pressure of an inactive gas, and pressure maintained in the anode chamber by preventing the escape of the gaseous products.—B. N.

Aluminium; Alloy of ——. R. Suchier. Fr. Pat. 466,293, Nov. 29, 1913.

A strong and light alloy of aluminium with 0·5 to 10% Ni and Cr.—T. St.

Metals or alloys, especially iron; Process for protecting —— against oxidation. K. Kaiser. Ger. Pat. 272,451, Jan. 21, 1913.

The metal is coated with a solution of a metallic salt, to which dextrin, gum, glue, shellac or the like may be added, then dried and heated to redness. Salts, especially the nitrates, of thorium, aluminium, magnesium, zirconium, and chromium, are mentioned. The metal becomes coated with a firmly adherent layer of the oxide of the metal the salt of which has been used.—A. S.

Iron; Method of working pure ——. R. B. Carnahan, jun., Middletown, Ohio, U.S.A. Eng. Pat. 28,571, Dec. 11, 1913. Under Int. Conv., Jan. 16, 1913.

See U.S. Pat. 1,090,115 of 1914; this J., 1914, 424.—T. F. B.

Furnace: Electric —— [for making steel]. T. Levoz, Heer, Belgium. U.S. Pat. 1,094,912, April 28, 1914.

See Fr. Pat. 417,597 of 1910; this J., 1911, 32.—T. F. B.

Iron ore and other minerals; Process for agglomerating ——. G. Crusius. Fr. Pat. 465,452, Nov. 28, 1913. Under Int. Conv., Nov. 30, 1912.

See Eng. Pat. 27,536 of 1913; this J., 1914, 488.—T.F.B.

Tungsten; Process for manufacturing articles or objects of ——. O. Voigtländer, Essen on Ruhr, Germany. Eng. Pat. 6911, March 20, 1913. Under Int. Conv., March 23, 1912.

See Fr. Pat. 455,313 of 1913; this J., 1913, 949.—T.F.B.

Tungsten; Manufacture o ——. C. Gladitz. Fr. Pat. 465.613, Dec. 3, 1913. Under Int. Conv., Dec. 3, 1912.

See Eng. Pat. 27.859 of 1912; this J., 1914, 204.—T.F.B.

Magnetic separators. F. Krupp Akt.-Ges. Grusonwerk, Magdeburg-Buckau, Germany. Eng. Pat. 24,355, Oct. 27, 1913. Under Int. Conv., Nov. 27, 1912.

See Fr. Pat. 454,156 of 1913; this J., 1914, 425.—T. F. B.

Aluminium and its alloys; Flux for —— and process for manufacturing the same. J. C. Gelly, Paris. Eng. Pat. 26,026, Nov. 13, 1913. Under Int. Conv., Nov. 15. 1912.

See Fr. Pat. 464,505 of 1913; this J., 1914, 489.—T. F. B.

Electroplating apparatus; Rotary ——. C. J. Charlton, South Benfleet. Eng. Pat. 30,047, Dec. 30, 1912.

See U.S. Pat. 1,093,384 of 1914; this J., 1914, 554.
—T. F. B.

Electroplating apparatus; Rotary ——. C. J. Charlton. Fr. Pat. 464,421, Nov. 4, 1913. Under Int. Conv., Dec. 31, 1912.

See U.S. Pat. 1,093,384 of 1914; this J., 1914, 554.—T.F.B.

Metals and their alloys; Process for the electrodeposition of ——. P. Marino. Fr. Pat. 466,105, Dec. 12, 1913. Under Int. Conv., Dec. 16, 1912.

See Eng. Pat. 28,953 of 1912; this J., 1914, 86.—T. F. B.

Metals; Process for the production of varied colorations and black shades on ——. F. A. Roux, Assignor to Soc. l'Aluminium Francais, Paris. U.S. Pat. 1,095,357, May 5, 1914.

See Fr. Pat. 464,722 of 1913; this J., 1914, 489.—T.F.B.

Galvanising or otherwise treating steel, iron, and other metals. H. H. Field, M. Howarth, and E. A. Atkins. Fr. Pat. 465,486, Nov. 29, 1913. Under Int. Conv., Nov. 30, 1912.

See Eng. Pat 27,641 of 1912; this J., 1914, 425.—T. F. B.

Precious metals; Process and apparatus for extracting, separating, and recovering —— from their ores. D. C. Reinohl. Fr. Pat. 466,072, Dec. 11, 1912.

See U.S. Pat. 1,081,516 of 1913; this J., 1914, 88.—T.F.B.

XI.—ELECTRO-CHEMISTRY.

Alternating current; The influence of superimposed —— on electrolysis by direct current. O. Reitlinger. Z. Elektrochem., 1914, 20, 261—269. (See also this J., 1911, 1221 and 1914, 426.)

The passage of an alternating current in addition to the direct current during electrolysis reduces the overvoltage and by diminishing the electrode potential makes it possible to isolate various intermediate products which would be destroyed at a higher potential. In the electrolysis of sulphuric acid the yield of persulphuric acid is diminished and that of ozone is increased. Solutions of alcohols in dilute sulphuric acid yield mainly aldehydes instead of acids, which is in accordance with previous observations that with a low anode potential alcohols are oxidised to aldehydes, whereas at higher potential acids are formed. By combining the effect of alternating and direct current in ammonia electrolysis 36 to 40 % current yields of nitrous acid can be obtained, although with direct current only it cannot be detected. In the electrolytic production of ozone experiments were also made with pulsating direct current instead of alternating current. When the pulsating-current was in the same direction as the continuous current it had little effect, but when it was in the opposite direction and of such a magnitude as to temporarily reverse the electrodes, the potential fell and the yield of ozone rose rapidly. This suggests that it is the negative portion of the alternating current which is responsible for its effect on electrolysis. When the frequency of the alternating or pulsating current was very high its action was much less pronounced, probably on account of the displacement of phase caused by the capacity of the electrodes.—W. H. P.

Electrolytic valve action of aluminium; Influence of impurities of the electrolyte upon the ——. G. Schulze. Z. Elektrochem., 1914, 20, 307—310.

The influence of small quantities of certain impurities in a saturated solution of borax upon the formation curve of an aluminium valve-electrode was very marked. Sodium halides, particularly sodium chloride even at a concentration of 0·05 % of that of the borax, exerted a disturbing influence, and electrolytes which give the least cloudiness with silver nitrate should be rejected. Sodium nitrate or potassium permanganate were less detrimental, but should not exceed 1·0 %. Sodium hydroxide was harmless unless present in such considerable quantities as to cause gradual solution of the aluminium. The above results apply also to other electrolytes in which aluminium shows good valve action.—G. F. M.

PATENTS.

Batteries; Electric ——. F. S. B. de Mello, Rio de Janeiro, Brazil. Eng. Pat. 24,471, Oct. 28, 1913. Under Int. Conv., Dec. 4, 1912.

Cuprous sulphide is reduced electrolytically in a solution of an alkali hydroxide, and the finely-divided colloidal copper, which is formed, is partly oxidised to cuprous oxide. On exposure to air at ordinary temperatures it forms a peroxide, suitable as a depolariser, which may be regenerated after use by washing with water and drying in contact with air.—B. N.

Electrode; Storage battery —— and process of manufacturing it. H. C. Hubbell, Newark, N.J. U.S. Pat. 1,094,903, April 28, 1914.

The active material is formed from precipitated ferrous hydroxide, which is filtered, washed, and heated out of contact with air to convert it into ferrous oxide. This is ground with cadmium oxide, and the mixture moulded into tablets suitable for insertion into the pockets of a containing envelope.—B. N.

Fluids [electrically]; Treating ——. H. T. Weston, Cleveland, Ohio. U.S. Pat. 1,094,618, April 28, 1914.

For the treatment of fluids by static discharges, a number of cells supported in a frame is used, each consisting of a pair of flat dielectrics and a flat conductor clamped between and in contact with the sides of the same. The cells are spaced apart by transparent distance pieces to llow the passage of the fluid to be treated. The spacing f the dielectrics is such that a certain intensity of disharge is obtained with a minimum expenditure of electrical energy. Each conductor has an extension projecting outwards beyond the dielectrics, with connectors pivoted to the extensions and loosely engaging with terminal conductors, whereby any of the cells can be disconnected and removed by swinging the connectors out of engagement with the conductors. The discharge may be observed through the transparent distance pieces, which comprise a rack open at two opposite sides for the entry and exit of the fluid.—B. N.

Electric separation of bodies in suspension in insulating fluids and particularly in gases; Process and apparatus for ——. E. Möller. First Addition, dated July 31, 1913 (Under Int. Conv., Aug. 10 and 31, 1912), to Fr. Pat. 449,337, July 31, 1912 (this J., 1913, 495).

The current of impure fluid to be treated is brought into a chamber where the speed is reduced, and it is then divided into several currents which pass through vertical tubes acting as separating elements. Smooth wires, stretched by weights, are arranged axially along the tubes and act as organs of ionisation. An open form of purifier is also described of gradually increasing diameter, so as to diminish the speed of flow of the fluid, and several groups of separating elements are arranged, one following the other. Various forms are given to these groups according to the composition of the fluids to be treated or the bodies in suspension, the various separating elements and organs of ionisation being arranged in a plane parallel to the flow of the fluid. The number of separating elements, mounted in parallel, is greatly increased in the wider part of the apparatus, and the distance between the electrodes is consequently less where the speed of the fluid is diminished. —B. N.

Electric furnaces; Impts. relating to the direction given to the gases in —— with arcs spread magnetically. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 466,109, Dec. 12, 1913. Under Int. Conv., Dec. 16, 1912.

The air or other gas is introduced either at right angles or tangentially to the arc, near to the point where it attains its greatest length, and in a direction opposed to its direction of movement, the gas being withdrawn at a point near to the place of production of the arc. Air or other cooling fluid is admitted through channels in the walls of the furnace, so as to cool the sides and central portions which are most exposed to the heat.—B. N.

Insulator; Electrical ——. J. W. Aylsworth, East Orange, N.J., Assignor to The Halogen Products Co., West Orange, N.J. U.S. Pat. 1,094,829, April 28, 1914.

The liquid insulator, in which electrical apparatus may be submerged, is prepared from a distilled mono-chloronaphthalene free from water, naphthalene, and higher substitution products, by treating it with alkali, removing traces of free alkali from the liquid, and dissolving an anhydride in it.—B. N.

Electrolytes; Purifying ——. F. von Kügelgen and F. von Bidder, Holcombs Rock, Va., and G. O. Seward, East Orange, N.J., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 1,095,609, May 5, 1914.

A salt, such as sodium chloride, is purified by fusing it between electrodes in a crucible formed of the solid salt, and is then subjected to the action of a suitable current, whilst maintaining a pool of sodium over it, until the heavier impurities are precipitated. Direct current is employed, using a molten cathode of heavy metal, to decompose the less electro-positive impurities, the foreign metals being precipitated and absorbed by the molten cathode, and the purified salt is then decomposed by electrolysis.—B. N.

Electrolytic apparatus. W. Thum, Hammond, Ind. U.S. Pat. 1,095,748, May 5, 1914.

The apparatus comprises a framework, which supports a number of compartments, forming suitable tanks of strength sufficient merely to support an electrolyte and anode slimes within the compartments. The sides of the latter carry conductors and insulating bars, upon which rest several electrodes so that they may be easily removed —B. N.

Electric arcs; Process and apparatus for the production of long continuous ——. O. Schönherr, Dresden-Striesen, Germany, and J. Hessberger, Christiansand, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pats. 1,095,425, 1,095,426, and 1,095,427, May 5, 1914.

See Fr. Pat. 410,710 of 1909; this J., 1910, 829.—T. F. B.

Electrodes in electric arc furnaces; Protecting the ——. J. I. Bronn, W. Schemmann and Rombacher Hüttenwerke. Fr. Pat. 466,265, Dec. 17, 1913. Under Int. Conv., Dec. 18, 1912.

See Eng. Pat. 29,259 of 1913; this J., 1914, 555.—B. N.

Cathodes for electric furnaces. Sodium Process Co. Fr. Pat. 466,445, Dec. 20, 1913.

See U.S. Pat. 1,092,178 of 1914; this J., 1914, 555.—B.N.

XII.—FATS; OILS; WAXES.

Fats; Contribution to the study of ——. *Indices of refraction of: (I.) Mixtures of olein, stearin and palmitin; (II.) Mixtures of palmitic, stearic and oleic acids.* P. Pascal. Bull. Soc. Chim., 1914, 15, 360—367, 397—401.

The indices of refraction of a large number of binary and ternary mixtures of olein, stearin and palmitin were determined at 60°, 70° and 80° C. With mixtures of palmitin and stearin the temperature coefficient increased from 0·00025 per 1° C. for palmitin to a maximum of 0·00045 for a mixture of equal proportions of the constituents, and then fell progressively to 0·00028 for stearin. The values for palmitin and stearin were $n_D^{70} = 1·4402$ and 1·4413 respectively. The temperature coefficient for mixtures of palmitin and olein increased regularly with increasing quantities of olein from 0·00026 to 0·00038, the value of n_D^{70} for olein being 1·4523. Mixtures of stearin and olein exhibited, though in a lesser degree than palmitin and stearin, a maximum in the temperature coefficient, which occurred when the quantity of olein present was about 70 %, the value for a mixture containing stearin 27·27 and olein 72·73 % being 0·00043 per 1° C. The values for the indices of refraction of ternary mixtures of olein, stearin and palmitin were plotted on a triangle. With mixtures giving indices below 1·4440 at 70° C. the curve formed an almost straight line, whilst with mixtures giving higher readings the curve became progressively concave. Similar determinations were made with mixtures of oleic, stearic and palmitic acids. The values of n_D^{70} for palmitic and stearic acids were 1·4304 and 1·4335 respectively, the temperature coefficient for mixtures rising regularly with increasing quantities of the latter from 0·00035 to 0·00039 per 1° C. Oleic acid had a refractive index at 70° C. of 1·4415 and when mixed in increasing quantity with palmitic acid the temperature coefficient fell to a minimum of 0·0003 for mixtures containing 50—60 % of the latter, whilst in the case of mixtures of oleic and stearic acids the reverse was the case, the coefficient rising to a maximum of 0·0005 with mixtures containing 20—30 % of the solid acid. The results of observations on ternary mixtures of the three acids were plotted on a triangle. It is suggested that with the knowledge of another property of the mixture, *e.g.*, the iodine value, it would be possible to determine the composition of any mixture of the three glycerides or of the three acids from the given curves.—J. A.

Fatty substances of linen and hemp; Characters of the ——. A. Bianchi and G. Malatesta. Annali Chim. Appl., 1914, 1, 297—302.

The fatty matter of raw linen, extracted by carbon tetrachloride (yield 2—2·5 %), was a brown, brittle waxy substance, sparingly soluble in cold organic solvents but readily soluble in hot benzene and chloroform. Its characters were: sp. gr. 0·9980 at 15° C., m. pt. 68°—70° C., acid value, 23—23·8; iodine value, 17—17·5. The saponification value by the ordinary method was 111·9, but rose to 156—163 on prolonging the treatment up to 6 hours. The unsaponifiable matter (20—23 %), was a brittle brown substance, m. pt. 73°—74° C., sp. gr. 0·986, free from phytosterol, and consisting mainly of hydrocarbons. Hemp yielded 0·5—1·2 % of fatty matter of somewhat similar character to that obtained from linen; m.pt. 66°—67° C., sp. gr. 1·019; acid value, 46—47; iodine value, 22·2—22·8; saponification value (6 hours), 187—192. It contained 11 % of unsaponifiable matter of m. pt. 60° C., sp. gr. 1·0022.—A. S.

Turkey-red oil; Analysis of ——. W. Herbig. Färber-Zeit., 1914, 25, 169—171; 194—196.

The potassium salts of ricinoleic and sulphoricinoleic acids are soluble to a large extent in cold acetone, but the sodium salts are so sparingly soluble that the neutral fat in Turkey-red oils may be separated from the sodium salts almost quantitatively by acetone. From 2 to 5 grms. of the oil, according to the amount of water as determined by Fahrion's method (this J., 1913, 1118), are neutralised with *N*/1 or *N*/10 alkali, evaporated to dryness on the water bath, and the residue dried by Fahrion's method (*loc. cit.*). The dried mass (which must not have been over-heated) is boiled with four successive portions (75 c.c. each) of anhydrous acetone, each extract being cooled with ice and decanted through a filter. The solution is evaporated, the residue of oil weighed, and its acid and saponification values determined. The separated salts are readily soluble in hot water, yielding a solution ranging from faint yellow to deep yellow ("monopol soap"). This solution is treated with boiling hydrochloric acid to liberate combined sulphuric acid and fatty acids, the latter being subsequently extracted with ether and examined. From 66 % ("monopol soap") to 77 % (Turkey-red oil) of the total sulphuric acid was found in the salts insoluble in acetone. The ratios between the percentages of acetone extract and fatty acids were:—"Monopol soap," 1·13; Turkey-red oils, 1·45 and 1·78. The sum of the water and total fat constituted about 90 % of the samples of oil (84 % in the case of "monopol soap"). This affords a practical sorting test. (See also this J., 1914, 32, 266.)—C. A. M.

Changes occurring in oils and paste paints due to autohydrolysis of the glycerides. Gardner. See XIII.

Repeated use of lubricating oil after filtration. Fenno. *See* I.

Patents.

Oil, juice and water or moisture from oil-containing seeds, nuts, fruits, fish and materials or substances generally which contain oil, juice or moisture; Apparatus for expressing ——. G. R. Schueler, Kingston-upon-Hull. Eng. Pat. 9130, Apr. 18, 1913.

The material is forced by one or more rotating sweepers through spaces between vanes or other devices to produce compression, contained in a combined expressing chamber and filter-box. The oil, etc. escapes through holes in plates within the chamber, whilst the residual mass is discharged through an annular opening, the size of which may be regulated, or which may be entirely closed. —C. A. M.

Grain residues; Treatment of —— *after extraction o oil by solvents.* Harburger Eisen- u. Bronzewerk Aktienges. and G. Koeber, Harburg, Germany. Eng Pat. 28,261, Dec. 8, 1913.

The residues in the extractors are moistened and treate with a current of steam at ordinary or reduced pressur in order to remove the remaining solvent. After the steaming, a vacuum is created in the extractors to remove the excess of moisture.—C. A. M.

Cottonseed oil residues; Process of treating and refining ——. C. Epler, Bogorodsk, Russia. U.S. Pat. 1,094,430, Apr. 28, 1914.

The residue (mucilage) is boiled with a solution of caustic soda and common salt, and the resulting precipitated mass bleached with chloride of lime, and treated with sulphuric acid to separate the fatty acids, which are then washed with steam (in the presence of salt) and clarified and dried at 100° C.—C. A. M.

Edible oils; Process and apparatus for treating [hydrogenating] composite ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,095,144, Apr. 28, 1914.

The hot melted fat (*e.g.*, a mixture of edible cottonseed and maize oils) is made to move across the path of a bubbling current of hydrogen in the presence of a catalytic agent.—C. A. M.

Soap; Manufacture and application of a new ——. R. Weiss. 1st Addition, dated Nov. 10, 1913 (under Int. Conv., Nov. 11, 1912), to Fr. Pat. 448,490, Nov. 27, 1912 (this J., 1913, 435).

The soap previously described (*loc. cit.*) is specially suitable as a dressing or finish for linen. The treated linen retains its whiteness on exposure. Its suppleness may be increased by the addition to the soap of substances, such as vaseline or mineral oil, which do not impart odour or colour.—C. A. M.

Floating soaps; Process of manufacturing compact —— *and products thereof.* C. Muller. 1st Addition, dated Nov. 13, 1913, to Fr. Pat. 462,502, Sept. 12, 1913 (this J., 1914, 324).

A certain proportion of sodium silicate with or without a solution of potassium or sodium carbonate or potassium chloride is added after saponification.—C. A. M.

Soap with a basis of petroleum or other hydrocarbons; Process of manufacturing a new ——. P. A. Cattaert. Fr. Pat. 466,151, Feb. 21, 1913.

Oleic or other fatty acids or deglycerinated oils are treated with petroleum or other hydrocarbons (preferably at about 60° C.) in the presence of a trace of a condensation agent, such aluminium chloride, ferric chloride, nitro-derivatives of phenol, etc., and the mass subsequently saponified to obtain a soap which is soluble in water.
—C. A. M.

Soaps; Process of increasing the efficacy and hardness of neutral —— *by mixing them with hydrocarbons.* C. Pleines. Fr. Pat. 466,331, Dec. 17, 1913.

Hydrocarbons are incorporated with neutral soaps within definite limits of temperature.—C. A. M.

Candles; Process of manufacturing composite ——. J. P. Laursen-Schjödt. Fr. Pat. 466,027, Dec. 10, 1913.

Oleine, stearine or analogous substances are dissolved in alcohol, ether, oil of turpentine, chloroform or other readily combustible solvent, the solution treated with alkaline lye in calculated quantity, and the saponified mass mixed with paraffin wax in sufficient proportion to obtain candle material of the desired whiteness and fineness.—C. A. M.

Fats and oils; Process and apparatus for the decomposition of ——. B. E. Reuter, Chicago, U.S.A. Eng. Pat. 10,199, April 30, 1913.

ee U.S.Pat. 1,068,079 of 1913; this J., 1913, 875.—T. F. B.

Lubricating grease; Manufacture of ——. R. Haddan, London. From Chem. Fabr. Troisdorf Dr. Hulsberg und Seiler, Troisdorf, Germany. Eng. Pat. 16,480, July 17, 1913.

See Fr. Pat. 460,418 of 1913; this J., 1914, 90.—T. F. B.

Fatty acids; Bleaching of ——. B. E. Reuter, Chicago, U.S.A. Eng. Pat. 27,867, April 30, 1913.

See Fr. Pat. 457,496 of 1913; this J., 1913, 1020.—T. F. B.

Oils; Process for moistening the residues from the manufacture of —— *and for extracting the solvents by means of steam, with or without a vacuum.* Harburger Eisen und Bronzewerke A.-G. Fr. Pat. 465,641, Dec. 4, 1913.

See Eng. Pat. 28,261 of 1913; preceding.—T. F. B.

Fats, fatty oils, mineral waxes, or mineral oils; Process for solidifying —— *and converting them into dry pulverulent products by means of malt extract or maltodextrin.* M. Hamburg. Fr. Pat. 466,419, Dec. 20, 1913. Under Int. Conv., Dec. 21, 1912.

See Eng. Pat. 29,481 of 1912; this J., 1913, 672.—T. F. B.

Manufacture of oil varnish substitutes from animal oils. Eng. Pat. 21,835. *See* XIII.

Substitute for boiled linseed oil. Ger. Pat. 272,465. *See* XIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Basic lead carbonate; Nature of ——. E. Euston. J. Ind. Eng. Chem., 1914, 6, 382—383.

It was shown previously (this J., 1914, 363) that white lead is probably a mixture of normal lead carbonate with a basic carbonate of the composition, $PbCO_3.Pb(OH)_2$. The lead hydroxide portion of this basic carbonate is soluble in ammonium chloride solution but not in sucrose solution, and the basic salt is regarded as an "adsorption compound." White lead and normal lead carbonate when stirred with a solution of basic lead acetate withdrew lead hydroxide from the solution, yielding, on prolonged treatment, products containing as little as 10·1% CO_2. Basic zinc carbonate, whiting or precipitated calcium carbonate, precipitated barium sulphate, and precipitated barium carbonate behaved in a similar manner, yielding products of approximately the composition, $ZnCO_3.Zn(OH)_2.3Pb(OH)_2$; $2CaCO_3.Pb(OH)_2$; $3BaSO_4.Pb(OH)_2$, and $3BaCO_3.2Pb(OH)_2$ respectively. The lead hydroxide portion of all these compounds was soluble in ammonium chloride solution but not in sucrose solution. The calcium compound and the barium sulphate compound were of no use for paints, but the other two had properties similar to those of white lead. The basic zinc carbonate compound was equal and the barium carbonate compound considerably superior to white lead in regard to being tinted or for covering quality.—A. S.

Oils and paste paints: Changes occurring in —— *due to autohydrolysis of the glycerides.* H. A. Gardner. J. Franklin Inst., 1914, 177, 533—540.

The presence of enzymes in micro-organisms derived from infected seed, etc., appears to be responsible for the granular condition of certain oil paints. A sample of lead paint which had become granular contained lumps from which were separated a liquid fatty acid with neutralisation value of about 180, a solid fatty product with acid value, 84, and a metallic paint in combination with part of the fatty acid as an insoluble soap. A sample of linseed oil which had caused a paint to thicken in 6 to 12 months had the following characters:—Sp. gr. 0·9450; iodine value, 171·3; saponif. value, 133·2; acid value, 4·1; "foots," 9·0%; and moisture and volatile matter, 0·68%. The "foots" had an acid value of 6·9, whilst the oil, after separation from the "foots," showed normal values (iodine value, 177·3; saponif. value, 190·2; acid value, 3·9). Cultures prepared from the "foots" at 37° C. on agar-agar yielded characteristic bacilli resembling the hay bacillus. The paint prepared with this oil showed increased acid value after incubation for a week at 37° C. A sample of cloudy oil upon which moulds readily developed, was mixed with pure linseed oil and a few drops of water containing carbon dioxide. At the end of 48 hours the acid value had increased by 10%. The growth of moulds was not prevented by the addition of small quantities of antiseptics (phenol, cresol, salicylic acid, etc.), but was inhibited by heating the oil to at least 100° C. soon after expression. It is suggested that only oils containing little "foots" and sterilised in this manner should be used for grinding with paint materials. A similar treatment may be found effective for preventing the development of rancidity and malodorous products in fish oils, etc.—C. A. M.

Oil in oil-paints; Determination of ——. F. A. Mazza. Ann. Falsif., 1914, 7, 210—211.

Nicolardot's method (this J., 1913, 202) has the drawback that particles of paint pass through the filter paper with the toluene. This is obviated by heating 2 to 3 grms. of the paint on the water bath with a mixture of alcohol and ether (2 : 3), and collecting the insoluble matter on counterpoised filter papers, which are dried in the oven and weighed. The amount of oil is found by difference.—C. A. M.

Oil of turpentine; Detection and determination of petroleum products in ——. C. Grimaldi and L. Prussia. Annali Chim. Appl., 1914, 1, 324—338.

The method suggested is based on the oxidation of the oil of turpentine by mercuric acetate to products soluble in dilute nitric acid. 75 grms. of mercuric acetate are placed in a graduated 500 c.c. flask, having also graduations of $\frac{1}{5}$ c.c. (from 0 to 10 c.c.) on the neck. 200 c.c. of water, 100 c.c. of glacial acetic acid, and 10 c.c. of the oil under examination are added in the order given, and the whole is heated for 2 hours at 80° C. under a reflux condenser, with frequent agitation. After cooling, nitric acid (2 parts of acid of sp. gr. 1·4 to 1 part of water) is added until the liquid reaches the zero mark, the whole is well shaken, allowed to settle, and the volume of unattacked oil noted. It is possible by this test to detect 6—12% of petroleum benzine, 8—10% of turpentine substitutes (light petroleum) and 10% of petrol in oil of turpentine. Control determinations without oil of turpentine showed that there is an unavoidable loss of 0·5—0·7 c.c. in the case of benzine and 0·35—0·50 c.c. in that of petrol, in carrying out the determination.—A. S.

Wood distillation under diminished pressure. A contribution to the problem of the utilisation of wood waste. Adams and Hilton. *See* IIb.

Determination of the higher lead oxides. I. Iodometric method. Milbauer and Pivnica. *See* VII.

Patents.

Inks for printing machines; Composition of ——. W. E. Heyl and T. T. Baker, London. Eng. Pat. 10,055, April 29, 1913.

About 0·25% of sodium amyl sulphate is added to the ink to increase the rate of drying and thus prevent smearing.—C. A. M.

Lead oxide; Production of —— *and means or apparatus employed therein.* W. Innes, Liverpool. Eng. Pat. 10,387, May 2, 1913. Addition to Eng. Pat. 15,664, July 4, 1912.

Baffle-plates or other deflecting means are placed at one side of the oxide pot of the apparatus claimed in the chief patent (this J., 1913, 1066) to prevent the outlet becoming choked with fine particles of lead or lead oxide. —C. A. M.

Rust-preventive products; Manufacture of ——. Standard Lack- und Farbwerke Zürich-Altstetten. Fr. Pat. 466,304, Dec. 6, 1913. Under Int. Conv., Dec. 7, 1912.

Aqueous solutions of inorganic substances (chromic acid and chromates, alkali carbonates, alkaline-earth hydroxides), which prevent the rusting of iron, are mixed or emulsified with hydrocarbons, fats, oils, resins, powdered clay, chalk or other substances which do not inhibit the rust-preventing action, and the products are used for coating iron and steel.—A. S.

Submarine paints; Use of fluorides and fluorine-compounds for the manufacture of ——. G. Paterno and C. Manuelli. Fr. Pat. 466,368, Dec. 18, 1913.

Fluorides or fluosilicates of aluminium, zinc, lead, or other metals are used in the preparation of submarine paints.—A. S.

Mercury salts; Preparation of solutions of —— *in vegetable or animal oils, fats, waxes, and the like, resistant to water.* Gebr. Avenarius and J. Wolff. Ger. Pat. 272,605, Nov. 7, 1912.

Complex aromatic mercury salts are dissolved in an organic solvent and the solution dissolved in or mixed with oils, waxes, or the like. Or, the organic solvent may be dissolved in or mixed with oils or the like before introducing the mercury salt. The products may be used for the preparation of anti-fouling submarine paints, etc. —A. S.

Oil varnish substitutes from animal oils; Process for the manufacture of ——. W. Kaempfe, Grossenhain, Saxony. Eng. Pat. 21,835, March 15, 1913. Addition to Eng. Pat. 15,012, June 27, 1912.

The fractional hydrolysis of the animal oil as claimed in the chief patent (this J., 1913, 436) may be effected by means of an enzyme such as that of *Ricinus*, the hydrolysed products then being removed as described. (See also Fr. Pat. 445,565 of 1912; this J., 1913, 34).—C. A. M.

Linseed oil; Substitute for boiled ——. E. F. Waentig. Ger. Pat. 272,465, Dec. 17, 1910.

Fish oils, marine animal oils, and the like are heated for a short time at 235°—240° C., then steam superheated to 375°—400° C. is blown through for 25—30 hours, whereby glycerides of saturated fatty acids are hydrolysed and the products of hydrolysis distilled, whilst the glycerides of unsaturated acids are polymerised and remain behind. The drying power of the product is superior to that of linseed oil.—A. S.

Varnish composition; Non-inflammable ——. J. W. Aylsworth, East Orange, N.J., Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,094,830, April 28, 1914.

A mixture of 100 parts of acetylcellulose and 100 parts of a dehydrated phenol resin dissolved in 1000 parts of a water-free volatile solvent, such as acetylene tetrachloride.—B. N.

Sulphite-cellulose extracts; Use of —— *for the preparatio of varnish.* L. Meunier. Fr. Pat. 466,196, Feb. 24 1913.

A varnish giving rapidly drying, uniform coatings i prepared by mixing commercial concentrated sulphite cellulose extract with a substance, especially a solutio of a terpene in a sulphoricinate, which diminishes th surface tension of the product. For example, 4 litres o oil of turpentine are added gradually, with constan agitation, to 25 kilos. of neutral sodium sulphoricinat heated to 60° C., and the resulting thick liquid is inco porated with 25 times its weight of sulphite-cellulo extract of 30° B. (sp. gr. 1·263).—A. S.

Plastic and elastic substances; Manufacture of ——. J. Stockhausen. Fr. Pat. 466,435, Dec. 20, 1913. Under Int. Conv., Dec. 20, 1912.

Plastic substances prepared from glycerin and gelatin are rendered resistant to water, whilst retaining their elasticity, by incorporating with them a resinous condensation product of phenol and formaldehyde. *Example.* A solution of 2·5 kilos. of gelatin in 2·5 kilos. of glycerin is mixed with a solution of 0·5 – 1 kilo. of camphor in acetone, 2—4 kilos. of powdered asbestos, 0·3—1 kilo. of sulphur, 0·5 kilo. of German black ("*noir d'Allemagne*"), and 1—1·5 kilos. of a resinous condensation product of phenol and formaldehyde.—A. S.

Adhesive resinous preparations and process of producing the same. H. Wolff, Assignor to Gebr. Schubert, Berlin. U.S. Pat. 1,095,058, April 28, 1914.

See Eng. Pat. 26,182 of 1912; this J., 1913, 253.—T.F.B.

Linseed oil; Process for rendering soluble the products of oxidation of ——. K. L. F. Friedemann, Forshaga, Sweden. U.S. Pat. 1,095,838, May 5, 1914.

See Ger. Pat. 258,853 of 1912; this J., 1913, 614.—T.F.B.

Coating and impregnating materials; Manufacture of ——. C. Roth, Frankfort on Maine, Germany. U.S. Pat. 1,095,988, May 5, 1914.

See Ger. Pat. 251,710 of 1912; this J., 1912, 1190.—T.F.B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Manihot ——. G. Weber. Tropenpflanzer, 1914, **18**, 274—279.

The author agrees with Frank and Marckwald (this J., 1913, 436) that *Manihot* rubber undoubtedly suffers in nerve and quality generally from the washing and drying process on the plantations. It is recommended that the rubber be marketed in the form of moist balls, containing about 30 % of water. Dry biscuits are superior in nerve to crêpe.—E. W. L.

New processes for the preparation of 1.3-butadiene hydrocarbons. II. Pyrogenetic decomposition of hydroxy-compounds. III. Catalytic dehydration of hydroxy-compounds. Kyriakides. *See* XX.

Patents.

Rubber; Regeneration of ——. Xylos Rubber Co., Ltd. Fr. Pat. 466,243, Dec. 16, 1913. Under Int. Conv., Dec. 20, 1912.

Rubber scrap is heated under pressure with a substance *e.g.*, a solution of caustic alkali, capable of destroying the textile fabric present in the scrap, and a small quantity of an aromatic amino-compound, such as aniline, toluidine, or xylidine, and the regenerated rubber is separated, washed, and dried. The amino-compound acts as a catalytic agent, bringing about the union of the sulphur (both free and combined) of the vulcanised rubber with the alkali.—A. S.

Caoutchouc; Treatment of products resembling or related to ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,816, June 2, 1913.

See Fr. Pat. 463,437 of 1913; this J., 1914, 365.—T. F. B.

Vulcanised rubber; Process for making a product similar to ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Nov. 10, 1913, to Fr. Pat. 446,598, July 27, 1912. Under Int. Conv., Nov. 15 and Dec. 24, 1912, and Jan. 20, 1913.

See Eng. Pat. 11,530 of 1913 and Ger. Pats. 268,387 and 68,947; this J., 1913, 1078; 1914, 269, 365.—T. F. B.

Elastic, solid, refractory, waterproof, and insulating composition. T. D. Kelly. Fr. Pat. 465,417, Nov. 12, 1913.

See Eng. Pat. 23,846 of 1912; this J., 1913, 1120.—T.F.B.

Erratum.

This Journal, May 30, 1914, p. 557, col. 2, delete lines 9—12 from the bottom, and replace by the following:—"R. B. Earle, Assignor to Hood Rubber Co., Boston, U.S. Pat. 1,093,923, April 21, 1914."

XV.—LEATHER; BONE; HORN; GLUE.

[Tanning] Extracts; The colour measurement of ——. H. R. Procter. J. Amer. Leather Chem. Assoc., 1914 **9**, 225—227.

The method of the International Association of Leather Trades Chemists of estimating colour by drumming sheep grain, preserved and delimed in a boro-phenol solution, in very weak liquors is capable of improvement. Split hide or shaved calf skins would probably give better and more even results for sole leather tanners and Seymour-Jones' formic acid mercury treatment is suggested as a preserving method. In the official method the use of ¼ % solution of tanning matter raised to ½ % as tanning proceeds is prescribed but a more practical method would be to commence with 200 c.c. of water and to dissolve in 200 c.c. a quantity of extract about double that required for tannage and add this solution 20 c.c. at a time every five minutes until the whole is given and then carry on the tannage to the end of two hours. The sample should be dried rapidly in the dark or protected from strong light. Oiling and cold drying give brighter shades but drying unoiled and at a higher temperature is the severer test for the extract. Methods in which white broadcloth and gelatinised cotton cloth are substituted for skin will probably never be made sufficiently accurate to serve as a basis of contract. For the direct optical measurement of the colour of the extract, the author (this J., 1910, 663) has suggested a method in which a uniform standard of glasses of 10 units of colour is used, but Kerr has found that recent glasses issued by the Tintometer Company are not strictly comparable in the Schmidt and Haensch colorimeter used, and therefore useless as a standard. Although the optical colour of any one make of extract is fairly proportionate to that which it will produce on leather, it is never satisfactory for the comparison of two different makes as the effect on leather depends not only on the visible colours but on the special tannins which they may contain.—D.J.L.

Tannery practice; A new emulsifying agent and its application to ——. E. D. Van Tassel, jun. J. Amer. Leather Chem. Assoc., 1914, **9**, 236—238.

Amides of the higher fatty acids, such as stearamide and also lecithin and tyrosine are capable of emulsifying large proportions of neutral fats and oils. Stearamide, a white crystalline compound (m. pt. 110° C.), resistant to acids and alkalis, is capable of emulsifying 5—15 times its weight of the oils used in leather manufacture such as neatsfoot oil, moellon degras, fish oil, etc., and will also emulsify substances such as tallow, some mineral oils and paraffin wax. The stearamide is heated to 185°—200° F. (85°—93° C.) in a steam-jacketed vessel and the oil or grease, previously melted, is run in with vigorous stirring. The required amount of water is then added and stirring continued till an even mixture is obtained. In stearamide emulsions animal oils and greases are practically odourless, and the odour of fish oils is considerably diminished. Emulsions of heavy mineral oil produced in this way form very satisfactory fat liquors. Paraffin wax emulsified by stearamide gives a full feel and improved "break" due to its filling action, and the effect is better than that produced by using the melted wax.—D. J. L.

Alkaline sulphides [in lime liquors]; Determination of ——. D. McCandlish and J. A. Wilson. J. Amer. Leather Chem. Assoc., 1914, **9**, 203—207. (See also this J., 1913, 152.)

A method is provisionally suggested which consists in precipitating the sulphides with excess of a standardised solution of cupric sulphate containing sulphuric acid, and determining the excess of copper colorimetrically after addition of ammonia.—D. J. L.

Leather; Determination of acidity of ——. P. Nicolardot. Ann. Falsif., 1914, **7**, 195—202.

The most reliable method of determining the total sulphur in leather is by combustion with oxygen in a bomb under a pressure of 10 atmos. To determine the acidity the leather is freed from fat by extraction with chloroform, boiled for 3 hours with water, and the liquid titrated (with litmus paper as indicator). Sulphuric acid and soluble sulphates are precipitated with barium chloride. As a control a second portion of the sample is boiled for 3 hours with the same quantity of water containing barium carbonate, and the acidity of the filtrate determined as before. After precipitation of dissolved barium by the addition of sulphuric acid, the liquid is filtered and evaporated, and the residue ignited and tested for barium not precipitable by sulphuric acid.—C. A. M.

Patents.

Skins, hides and the like; Method for dressing ——. R. Brooks, Goxhill, Lincolnshire. Eng. Pat. 23,638, Oct. 18, 1913.

The skins are impregnated with an aqueous extract of "brains," then pulled across a sharp board or the like and dried and rendered waterproof by hanging in smoke produced by burning touchwood or the like until they are of a yellowish brown colour throughout.—D. J. L.

Rawhide; Method of treating —— and the product resulting therefrom. A. H. Henderson, Assignor to The Henderson Rubber Co., Baltimore, Md. U.S. Pat. 1,094,853, Apr. 28, 1914.

Rawhide is "expanded" in an aqueous solution of a substance which will produce osmotic pressure in the cells of the hide and a deliquescent polyhydric alcohol, and is then subjected to heat in the presence of an oily vehicle and a fixed oil. Rubber may also be introduced "into the interior of the hide" and subsequently vulcanised. An article of manufacture consisting of a consolidated mass of granules or fragments of rawhide with a deliquescent polyhydric alcohol and vulcanised rubber is also claimed.—D. J. L.

Leather; Drying japanned or varnished ——. A. Genthe, Assignor to C. Heyl, Worms, Germany. U.S. Pat. 1,095,498, May 5, 1914.

See Eng. Pat. 20,795 of 1913; this J., 1914, 95.—T. F. B.

Chrome tanning; Process of ——. F. Hirsch. Fr. Pat. 465,846, Dec. 6, 1913. Under Int. Conv., March 8, 1913.

See Ger. Pat. 271,585 of 1913; this J., 1914, 559.—T. F. B.

XVI.—SOILS; FERTILISERS.

Nitrogen in mixtures of calcium nitrate and cyanamide; Determination of ——. A. Stutzer. Chem.-Zeit., 1914, **38**, 597.

Nitrate and nitrite are first determined by Schlösing's method (reaction with ferrous chloride), and then a portion, rendered free from nitrate, is treated by Kjeldahl's method. By heating 1 grm. with 5 grms. of dry ferrous chloride and 25 c.c. of concentrated hydrochloric acid, under slight pressure (in a flask fitted with a Bunsen valve), the nitrate may be completely eliminated on the water-bath in half an hour. In preparing a mixture of calcium nitrate and cyanamide, for use as a fertiliser, loss of nitrogen is liable to occur if the temperature be raised above 60° C.—F. Sodn.

Patent.

Phosphoric acid; Process of producing available ——. W. S. Landis, Niagara Falls, Ontario, Assignor to American Cyanamid Co., Nashville, Tenn. U.S. Pat. 1,094,857, April 28, 1914.

A finely ground mixture of phosphate rock and a soluble sodium salt, *e.g.*, sodium sulphate, is mixed with water, dried rapidly so as to prevent appreciable crystallisation of the sodium sulphate, and then calcined to convert the tricalcium phosphate into a soluble compound.—A. S.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; Experiments in thinning out ——. A. H. Rosenfeld. Intern. Sugar J., 1914, **16**, 220—221.

Experiments showed that thinning out is not advantageous in the cultivation of the sugar cane, the production of sugar per acre being considerably less than when the ordinary procedure is followed.—J. P. O.

Lime content; Investigations on the —— of [cane] juices. W. E. Cross. Intern. Sugar J., 1914, **16**, 212—220.

Raw cane juices were found to contain from 0·025 to 0·09 grm. CaO in 100 c.c. In applying the carbonatation process, and using more than 1 % of lime, after saturation the clarified juice contained less lime than the original raw juice, so that, *e.g.*, with 2 % of lime so small an amount as 0·03 grm. CaO in 100 c.c. could be obtained. With the defecation-sulphitation process, on the other hand, the greater the initial sulphitation the higher was the lime content of the clarified juice. Sodium carbonate wher added to a clarified juice had only a very slight effect ir diminishing the lime content, as much as 3 lb. per ton o cane, for example, causing a reduction of 28 % only of th original amount of lime present. Phosphoric acid and disodium phosphate also had little effect in diminishing the lime content. In these experiments the lime was determined by titration with standard alcoholic soa solution, the results being controlled by the gravimetri method.—J. P. O.

Sugar house control analyses; Limit of error in certain ——. N. Deerr. Intern. Sugar J., 1914, **16**, 222—223.

Determinations of the water and sugar in mill bagass were made during 24 hours at intervals of 1, 2, and hours respectively, and the arithmetical mean and th probable error of the results were calculated. Th percentage extraction of sugar from the cane calculate from the arithmetical mean of the results was practicall the same whether the samples were taken at intervals 1, 2, or 4 hours, but the probable error was only reduce to reasonable limits when samples were taken eve hour.—J. P. O.

[Sugar.] Vacuum pan; Rate of evaporation in a ——. N. Deerr. Intern. Sugar J., 1914, **16**, 210—211.

Using a lyre coil pan of 2700 cb. ft. strike capacity, a 2455 sq. ft. heating surface, and heating with boiler stea of 90 lb. gauge pressure reduced to 40 lb., it was fou that the maximum rate of evaporation occurs just aft all the heating surface is put into action, and that aft about 10 minutes the rate rapidly falls, decreasi eventually to one-third the maximum rate. The ra per sq. ft. of heating surface is, however, at a maxim during the first hour of operation, and by the time th all the heating surface is in action, the rate per sq.

has already fallen, although the rate of production of vapour increases for at least 10 minutes. With very large pans, owing to the unevenness of the rate of evaporation, "peaked loads" in the rate of steam consumption inevitably occur, but this can be prevented by the distribution of the heating surface over a number of units. It is concluded that there should never be less than 3 units (pans) of equal size, so that a nearly uniform rate of evaporation spread over the different units can be attained.—J. P. O.

Molasses desaccharification; Formation of strontium formate in the waste product from —— by the strontia process. K. Urban. Z. Zuckerind. Böhm., 1914, **38**, 358—363.

In the strontia molasses desaccharification process the strontium bisaccharate separated is allowed to cool, when it decomposes into sugar and crystalline strontium hydroxide, which latter is washed in centrifugals with sweet-water, being afterwards heaped in the open air to be regenerated. After a time the temperature of the mass of so-called "centrifugal salt" gradually rises, commencing at the outside and slowly reaching the centre, 85° C. being sometimes reached. Investigation showed that this is due to the decomposition of the sugar necessarily remaining in the waste product as the result of washing with sweet-water; strontium formate is principally formed at first and later is converted into strontium carbonate.—J. P. O.

Sugars; Resolution of racemic —— by means of optically active amyl-mercaptan, and the properties of some mercaptals. E. Votocek and V. Vesely. Ber., 1914, **47**, 1515—1519.

i-Arabinose was resolved by combination with a pure *d*-amyl-mercaptan and fractional crystallisation of the mixture of mercaptals from alcohol. The method is probably applicable to other aldoses. The amyl alcohol from which the mercaptan was prepared was isolated from fusel oil (20 litres of which yielded 40 grms.) by rectification, saturation with hydrogen chloride, further rectification, combination with 3-nitrophthalic acid, and fractional crystallisation and hydrolysis of the ester (m. pt. 114·8°—115·2° C.). The optical rotation of the pure alcohol was —9·60° in a 200 mm. tube, and the characters of the mercaptan were: b. pt. 119°—121° C. (uncorr.), sp. gr. 0·8415 at 23° C., and $[\alpha]_D = + 3{\cdot}21°$ at 23° C. The melting points of a number of pure *d*-amyl- and isoamyl-mercaptals of aldoses are given.—J. H. L.

Starches; Diverse nature of ——. C. Tanret. Comptes rend., 1914, **158**, 1353—1356.

Starches from a number of different kinds of plants were all found to contain the amylopectin and amyloses of Maquenne and Roux (this J., 1906, 192, 601). The proportions of the constituents varied in the different starches, the amylopectin-content ranging from 67 % in chestnut starch to 79·5 % in banana starch. The amyloses of the different starches were not equally soluble in hot water, and the amylopectin of potato starch, unlike that of other starches, dissolved fairly readily in boiling water. An aqueous solution containing both amylose and amylopectin may be freed from the former by soaking cotton in it. The liquid expressed from the steeped cotton gives with iodine a violet colour characteristic of amylopectin, whilst the cotton gives a blue colour.

—L. E.

Patents.

ugar cane juices; Process of purifying and clarifying raw ——. R. E. Gordon, Wallaceburg, Ontario. U.S. Pat. 1,094,436, April 28, 1914.

HE raw juice is heated to above 90° C., cooled quickly, eed from precipitated impurities, treated with lime nd carbonatated, heated to above 90° C. whilst the lcium carbonate is still present, and again freed from ecipitated impurities, the treatment with lime, etc., ing then repeated.—L. E.

Sugar juices; Process of combined sulphitation within definite limits, for purifying and decolourising ——. J. Weisberg. First Addition, dated Jan. 30, 1913, to Fr. Pat. 455,936, June 5, 1912 (this J., 1913, 955).

The mud precipitated during the second carbonatation contains calcium sulphite, and is added to the raw juice together with the lime used for the first defecation. The amount of lime required is thus diminished, and the clarification of the juice is improved.—L. E.

Sugar juices; Removal of non-sugars from ——. G. Oehlrich. Fr. Pat. 465,580, Dec. 2, 1913. Under Int. Conv., Dec. 4, 1912 and Feb. 17, 1913.

Diffusion juice is treated first with a metallic sulphate, preferably iron sulphate, then with pure milk of lime, and saturated with carbon dioxide or a mixture of this gas and sulphur dioxide until the alkalinity is reduced to say 0·01 %. The treatment with lime and saturation are repeated once or, if necessary, twice, any iron in the juice being removed before the third treatment with lime, by addition of calcium sulphide or polysulphide. The defecated juice is concentrated *in vacuo* to 62°—65° Brix, heated to 100° C., filtered, saturated with sulphur dioxide until slightly acid, made alkaline, nearly neutralised with sulphur dioxide, heated to 90°—100° C., filtered, boiled to massecuite *in vacuo*, and centrifuged. The mother syrup from each operation may be worked up in succeeding operations until sufficiently charged with salts to be suitable for working up into second jet sugar. The waste syrup finally obtained is diluted to about 60° Brix, cooled, and filtered or centrifuged to remove the alkali sulphates; the sulphates remaining in the mother liquor are separated in the form of alums.—L. E.

Sugar beetroots; Preliminary treatment of —— to obtain juice. M. Lindner. Fr. Pat. 466,021, Dec. 10, 1913. Under Int. Conv., Dec. 11, 1912, and Dec. 1, 1913.

The syrups or molasses obtained as described in Ger. Pat. 268,530 of 1912 (this J., 1914, 212), are treated at 70°—80° C. with colloidal alumina and then with diluted milk of lime or lime water, and the mixture is boiled and filtered.

—T. F. B.

Sugar cane and similar saccharine material; Extraction of juice from ——. O. Mengelbier, Berlin. Eng. Pat. 15,070, June 30, 1913. Under Int. Conv., Oct. 19, 1912.

See Ger. Pat. 261,999 of 1912; this J., 1913, 920.—T.F.B.

Sugar from molasses; Process of obtaining ——. A. Grantzdörffer, Assignor to A. List, Magdeburg, Germany. U.S. Pat. 1,095,852, May 5, 1914.

See Fr. Pat. 460,192 of 1913; this J., 1914, 36.—T. F. B.

Process for rendering amylaceous substances soluble. Fr. Pat. 466,275. *See* VI.

XVIII.—FERMENTATION INDUSTRIES.

Yeast preparations; Enzymatic formation of polysaccharides by ——. A. Harden and W. J. Young. Biochem. J., 1913, 7, 630—636.

In the alcoholic fermentation of dextrose and lævulose by Lebedeff's maceration extract of dried yeast, dextrorotatory polysaccharides are formed, the product, in the case of lævulose being of a glycogen-like nature (cp. Cremer, this J., 1899, 777). The difference between the amount of sugar removed and that equivalent to the carbon dioxide evolved during fermentation with yeast juice (this J., 1904, 450) is chiefly due to the formation of these polysaccharides.—L. E.

Yeast fermentation without sugar. XVI. Question of the formation of lactic acid in the fermentation of pyruvic acid by living yeast, and remarks on fermentation processes. C. Neuberg and J. Kerb. Biochem. Zeits., 1914, **62**, 489—497. (See also this J., 1914, 37, 496.)

The fermentation of pyruvic acid by living yeast resembles that of sugar, in that no lactic acid is formed as by-product. For the investigation of the formation of lactic acid in cell-free fermentation, Buchner's pressed juice is preferable to maceration juice, since the latter, especially when prepared from commercial dried yeast, is liable to be infected with acid-forming bacteria (cp. Oppenheimer, this J., 1914, 156). The much greater production of lactic acid from glyceraldehyde than from sugar, observed by Oppenheimer (*loc. cit.*) with respect to cell-free fermentation, is evidence against the assumption that glyceraldehyde, as an intermediate product of fermentation, is the immediate precursor of the lactic acid formed from sugar.—J. H. L.

Phytochemical reductions. II. Transformation of fatty nitro-compounds into amines. III. Transformation of aromatic and fatty-aromatic aldehydes into alcohols. C. Neuberg and E. Welde. *IV. Formation of n-amyl alcohol by yeast. Natural occurrence of n-amyl alcohol.* C. Neuberg and F. F. Nord. Biochem. Zeits., 1914, **62**, 470—488. (See this J., 1914, 434.)

Living yeast in course of fermentation reduces nitroethane and nitromethane to ethylamine and methylamine respectively. In an experiment similar to those carried out with nitrobenzene (*loc. cit.*), about 3 grms. of ethylamine were obtained from 20 grms. of nitroethane. Fermenting yeast, which has already been shown capable of reducing fatty aldehydes and furfural (see Neuberg and Steenbock, this J., 1913, 813 ; Lintner and v. Liebig, this J., 1911, 915 ; 1913, 1081) will also reduce benzaldehyde and phenylacetaldehyde, the yields obtained in the two cases being 20—30% of benzyl alcohol and 65—70% of phenylethyl alcohol. Experiments having shown that *n*-valeraldehyde can be reduced to *n*-amyl alcohol by living yeast, with a yield of 70%, the authors investigated fusel oil (from fermented molasses) for this alcohol and found it present in very small quantities. It is doubtless derived from *n*-aminocaproic acid (norleucin) which, as Abderhalden and Weil have recently shown (Z. physiol. Chem., 1913, **84**, 39 ; **88**, 272), occurs in small quantities as a constituent of some proteins.—J. H. L

Acetaldehyde ; Production of —— during the anaerobic fermentation of dextrose by Bacillus coli communis (Escherich). E. C. Grey. Biochem. J., 1913, **7**, 359—363.

A small quantity of acetaldehyde is formed by the action of *B. coli communis* on dextrose under anaerobic conditions, but much less or none at all is formed by the variety of *B. coli* obtained by growth on agar containing sodium chloroacetate (c.p. Harden and Penfold, this J., 1912 894). Since this variety of *B. coli* produces no gas, and less alcohol and acetic acid than the original organism, the formation of acetaldehyde by the latter is related to the formation of alcohol, carbon dioxide and hydrogen rather than to the other products, and it is suggested that the acetaldehyde is a primary product of the fermentation, a suggestion in accord with Kostytschew's view that acetaldehyde is an intermediate product of alcoholic fermentation (see this J., 1912, 553).—L. E.

Rums ; Composition of ——. Bonis. Ann. Falsif., 1914, **7**, 164—166.

Since 1902 rums distilled from sugar cane juice which has been defecated with lime, have been exported from Martinique to France for blending with molasses rums. The old figures for the non-alcoholic coefficient no longer afford any certain means of distinguishing between the two classes of rums. The ratio of esters to higher alcohols is less than 1 in the case of sugar cane juice rums and some molasses rums. Using the values of this ratio as abscissæ, and the sums of the esters and higher alcohols as ordinates the points of intersection fall within a well-defined zone in the case of pure rums, and above or below this zone respectively in the case of rums containing added essential oil or industrial alcohol in appreciable quantity.—C. A. M.

Assay of digestive ferments. Graber. *See* XX.

Laboratory studies on malt extract. Graber. See XX.

Specific reaction for ethyl alcohol. Method of identifying it in presence of aldehyde, acetone, methyl alcohol, etc. Tominelli. *See* XX.

Patents.

Brewing processes. E. W. Kuhn, Brussels. Eng. Pats. 7456 and 9170, April 18, 1913.

(1) Malt is mashed in water at 10° C., and the extract filtered, the starch separated thereby being added to the mashed malt ; the process is repeated until the enzymes which act on carbohydrates are almost completely extracted, the less soluble proteolytic enzymes remaining in the malt. The malt is then added to water at 50° C., kept at this temperature for several hours to peptonise the albumin, added to boiling water and boiled for one or more hours to gelatinise the starch, cooled to 80° C., treated with the cold extract first obtained, and kept at 80° C., with stirring, to convert the starch paste into soluble dextrins. The peptonisation and dextrinisation may be increased by addition of active pepsin and amylase respectively, and both processes may be accelerated by addition of about 0·15% of phosphoric acid to the malt. (2) Malt is macerated in water at say 10° C., and the extract filtered and treated with about 60 c.c. of phosphoric acid per 100 litres. The macerated malt is added to boiling water, boiled for one hour, cooled to 80° C., treated with the cold extract, and, if necessary, with active amylase, and kept at 80° C. for two hours with stirring. The starch is thus converted into soluble dextrins, whilst the albumin, which is not subjected to proteolytic action at any stage, is coagulated and remains in the dregs.—L. E.

Grape marcs ; Process of treating —— for the extraction of various useful products. E. Disdier. First Addition, dated Nov. 17, 1913, to Fr. Pat. 458,344, May 24, 1913 (this J., 1913, 1081).

If the marc has been partially or completely fermented, the alcohol is recovered either by volatilisation in steam or in the form of low-grade wine by diffusion, the marc then being dried. The oil is extracted from the seeds with say petroleum ether, and the tannin and resins are extracted from the residue with alcohol. The alcoholic extract is distilled ; the residue may be treated with water which dissolves the tannin and the bulk of the colouring matters.—L. F.

Wood ; Process of treating —— with a view to its conversion into carburetted alcohol. G. Boulais and P. E Lefevre. Fr. Pat. 465,534, Feb. 7, 1913.

The process is based on the power of wood charcoa to absorb a large quantity of sulphur dioxide which i almost entirely liberated on heating the charcoal to 100° Wood fibre is placed in layers alternating with layers wood charcoal containing sulphur dioxide, the whol being heated in an autoclave until the fibre is sufficientl disintegrated, and then allowed to cool. The fibre i then saccharified with dilute acid, the product bein fermented and distilled ; the unsaccharified residu which has been reduced to a minimum by the treatme with sulphurous acid, is distilled, the methane, ethylen methyl alcohol and acetone thereby obtained bein utilised for carburetting the ethyl alcohol.—L. E.

Yeast or ferments for use in fermentation and distillation processes. A. Molhant, Mons, Belgium. Eng. Pat. 11,617, May 19, 1913. Under Int. Conv., May 25, 1912.

See Fr. Pat. 455,483 of 1912; this J., 1913, 956.—T. F. B.

Beer free from alcohol; Process for making ——. K. Kroupa and L. Bochmann. Fr. Pat. 466,396, Dec. 19, 1913. Under Int. Conv., Dec. 19, 1912.

See Eng. Pat. 29,314 of 1913; this J., 1914, 497.—T. F. B.

XIXa.—FOODS.

Casein and paracasein compounds; Composition and properties of some —— and their relation to cheese. L. L. van Slyke and A. W. Bosworth. New York Agric. Expt. Stat., Tech. Bull., No. 26, Dec. 1912, pp. 1—32.

Pure casein was prepared from separated milk by repeated precipitation and solution, the final product being then extracted with alcohol and ether and dried over sulphuric acid under reduced pressure; it contained less than 0·1% of ash. A basic calcium caseinate, obtained by decomposing calcium carbonate with casein, or by treating casein with an excess of calcium hydroxide solution and neutralising the excess with hydrochloric acid, contained 1·78% Ca (or 2·50% CaO). Acid or unsaturated caseinates of ammonium, sodium, and potassium were also prepared; these compounds contained: NH_4, 0·20, Na, 0·26, and K, 0·44%, respectively. Two sets of compounds, monobasic and dibasic, may be obtained with casein and calcium, barium, and strontium hydroxides. In the dibasic compounds (containing twice as much base as the monobasic) 100 grms. of casein combine with 0·45 grm. Ca, 0·98 grm. Sr, or 1·54 grm. Ba. On the basis of these results the molecular weight of casein is calculated to be 8888, and its equivalent weight 1111.

Paracasein, obtained by treating separated milk with rennet, yielded a calcium paracaseinate similar in composition and properties to basic calcium caseinate, and also acid compounds containing NH_4, 0·40, Na, 0·52, and K, 0·88%, respectively. The mono- and di-basic calcium, strontium, and barium paracaseinates obtained had properties resembling those of the corresponding caseinates. In both cases, the monobasic compounds were insoluble in water, but soluble in 5% solutions of sodium, ammonium, or potassium chlorides; the dibasic compounds were soluble in water. Paracasein has one-half the molecular weight of casein, and, when casein is treated with rennet-enzyme, it appears to be split up into two mols. of paracasein. During the ripening of cheese (cheddar and many other kinds) a protein is always formed which is insoluble in water, but soluble in a 5% solution of sodium chloride; this protein is identical with mono-calcium paracaseinate.—W. P. S.

Cellulose in flours; Determination of —— to ascertain the degree of grading. L. Lindet. Ann. Falsif., 1914, 7, 169—171.

Ten grms. of the flour are freed from fat by extraction with petroleum spirit or ether, dried, and boiled with 400 c.c. of hydrochloric acid (sp. gr. 1·025) for 30 mins. The liquid is treated with 50 c.c. of a 10% solution of hydrated aluminium sulphate, ammonia is added, and the precipitate of alumina, which retains the cellulose, is separated, washed, and mixed with water and boiled for an hour with 10 grms. of solid sodium hydroxide per 100 c.c. of liquid, to dissolve impurities in the cellulose. After cooling, the liquid is neutralised with hydrochloric acid, and the aluminium hydroxide reprecipitated by ammonia. The alumina in the precipitate containing the pure cellulose is dissolved in hydrochloric acid, the residue of cellulose is dried and weighed, and any ash present deducted. Samples of flour separated into six grades by Pekars' method gave the following percentages of cellulose:—0·30; 0·59; 0·61; 0·69; 0·96 and 1·29. The results obtained with commercial grades sold as 40, 60 and 70% were as follows:—

Grade.	Water.	Fat.	Nitrogenous substances.	Cellulose.	Mineral matter.	Phosphoric acid.
	Per cent.	Per cent.	Per cent.	Per cent	Per cent.	Per cent
40	13·66	0·75	11·20	0·20	0·40	0·19
60	14·08	0·76	11 37	0·42	0·50	0·25
70	13·88	0·80	11·91	0·87	0·53	0·48

—C. A. M.

Flour; Milling of wheat and testing of ——. H. McCormack. J. Ind. Eng. Chem., 1914, 6, 423—428.

A discussion of the methods for the laboratory milling of wheat and chemical examination of flour. The results obtained in different laboratories with a given sample of flour are fairly concordant, but widely varying results are obtained in the case of wheat, this being due chiefly to variations in the laboratory methods of milling. The apparatus used by the author for milling the wheat is described and the adoption of uniform methods is advocated.—A. S.

Patent.

Cacao powder; Process for preparing an easily soluble —— without the use of chemicals. J. Bergmüller, Leipzig-Lindenau, Germany. Eng. Pat. 14,758, June 26, 1913.

See Fr. Pat. 459,675 of 1913; this J., 1913, 1168.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Colloidal matter; Significance of —— in sewage disposal. F. R. O'Shaughnessy. J. Inst. Sanitary Eng., 1914, 18, 19—31.

Additional facts are recorded, mainly in tabular form, relating to the part played by colloids in sewage treatment, based on the author's experience with Birmingham sewage. The colloids originate chiefly from fæces. When fæces is shaken with water, 70% goes into solution and nearly 80% of this dissolved portion is in the colloidal state. In sewage, the colloids are removed with difficulty and only incompletely by precipitants unless used in prohibitive quantities; lime up to 3 parts per 100,000 actually increased the colloids, only at 15 parts or over was much precipitation obtained and even then it was incomplete. Experiments were made on the rate of elimination of the organic matter, corresponding to the colloids, in sewage coming through a long series of tanks and sewers under septic and non-septic conditions. The results obtained were: elimination in sedimentary tanks 0·68 part per hour (septic) and 0·76 part per hour (non-septic); in second tanks 0·2 part and 0·03 part; in five-mile sewer 0·57 part and 0·34 part; in the silt tanks 0·28 part and 0·38 part; in the biological filters 10 parts and 10 parts; total colloids removed during 22 hours, 55% and 50%. Retention in tanks is only effective in removing colloids when a considerable tank surface is exposed to the liquid and the effect then noticed appears due to biological action, for it was observed that in chlorinated and unchlorinated sewage passing through tanks, the organic matter was reduced from 10·75 parts per 100,000 to 9·22 parts in the untreated sewage, but only to 10·72 parts in the chlorinated sewage. Colloids deposit slowly from sewage, and in four different sewages the amount so deposited in 6 days varied from 12·1 to 7·5 parts per 100,000. Effluents from bacteria beds contain a certain amount of colloidal matter, and an instance of the subsequent removal of this is given, in which the effluent was passed through two pools, in the second of which long

grass was grown; in this latter the effluent was rendered brilliantly clear owing to the enormous surface offered by the grass. In sludge, the use of lime in moderate quantities does not effect the separation of the water, and the large quantities added in sludge pressing are necessary because of the attraction between the water and the colloids.
—J. H. J.

Thiosulphate; Oxidation of —— by certain bacteria in pure culture. W. T. Lockett. Proc. Roy. Soc., 1914, B, **87**, 441—444.

It had been found that the effluents from sewage filters containing thiosulphates were completely oxidised by aeration in presence of living organisms (see this J., 1913, 579). Attempts to isolate the organisms concerned in this oxidation failed when ordinary cultivation media were used; but a solid medium prepared from solutions of ammonium sulphate and sodium thiosulphate, and gelatin, gave a growth of slow growing, non-liquefying, bluish white colonies. About 100,000 of these colonies were present per c.c. These organisms when inoculated into a solution containing sodium thiosulphate and other salts produced a white stringy growth at 20° C., and after three weeks the whole of the thiosulphate was oxidised to acid sulphate; no deposition of sulphur nor formation of thionic acids occurred. Prolonged contact with slightly acid solutions impaired the activity and growth of the organism.—J. H. J.

Sulphurous and sulphuric acids in the atmosphere; Damage caused to vegetation by ——. R. R. Tatlock and R. T. Thomson. Analyst, 1914, **39**, 203—210.

Sulphurous and sulphuric acids were determined as sulphates in the acidified aqueous extracts of grass, oak-leaves, bracken, etc., taken from districts with atmospheres ranging from exceptionally pure to exceptionally polluted with smoke. The results, calculated as SO_3 upon the dried substance, showed that it is not justifiable to conclude that plants containing more than a certain proportion of sulphates have been injured by sulphurous or sulphuric acid, unless free acid is also present. For example, grass grown in a fairly pure atmosphere, contains up to 0·3% SO_3, but may contain as much as 1·0%, without injury, in the absence of free acid. Injured bracken contained 0·356% SO_3, or more than double that of an uninjured sample, but there was also free acid. Acid and damaged oak leaves contained only 0·202% SO_3, as against 0·42% in uninjured leaves, whilst healthy birch leaves contained 0·86% as compared with 0·248% in acid and injured leaves. The atmosphere of cities consuming much coal was found to be only exceptionally or locally acid, as for example when coal containing much sulphur (5 to 6%) was burned; but after diffusion of the fumes acidity in the surrounding atmosphere could not be detected.—C. A. M.

Acetylene; Physiological characteristics of —— with respect to its use in mining. E. E. Smith. Internat. Acetylene Assoc., 1913. School of Mines Quart., 1914, **35**, 143—153.

From experiments on the human subject it was concluded that acetylene generated from carbide had no poisonous action, four men having been allowed to remain in an atmosphere containing 2·5% for over two hours without any noticeable effect. With higher proportions the gas merely acted as a narcotic. Flame extinction occurred with an oil lamp at 13% and with an acetylene lamp at 26% of carbon dioxide in a still atmosphere, but at 10% and 17% with moderate motion.—F. Shdn.

Patents.

Water; Means for filtering —— in reservoirs. Puech, Chabal et Cie., and A. Puech, Paris. Eng. Pat. 11,284, May 14, 1913. Addition to Eng. Pat. 24,011 of 1909, dated Nov. 25, 1908.

Compressed air is supplied, through distribution chambers, to perforated concrete pipes supported above the bottom of the filter tank and which in turn support the perforated slabs constituting the false-bottom carrying the filtering material.—W. P. S.

House and town refuse; Treatment of ——. A. D. Furse, Beckenham, Kent. Eng. Pat. 20,232, Sept. 8, 1913.

The refuse is passed through a disintegrator, then between fluted rollers into a perforated cylinder where the mass is subjected to pressure by means of a screw-worm. The compressed refuse is screened to separate fluffy material and the screened material ground to a powder.—W. P. S.

Refuse material; Apparatus for incinerating ——. T. E. Wasley, San Jose, Cal. U.S. Pat. 1,094,503, April 28, 1914.

A drying chamber for the refuse is situated directly over a furnace, sliding plates being provided in the floor of the chamber so that the dried material may be discharged into the furnace. The drying chamber and the furnace each communicate with a condenser, that communicating with the furnace being connected with a stack fitted with a water-spray; the water flowing from the stack is collected in a settling tank.—W. P. S.

Impregnating fabrics with insecticidal substances; Process of ——. W. Wildt. Ger. Pat. 272,822, Aug. 29, 1913.

The fabric (cushions, etc.) is treated first with formaldehyde solution and then with ammonia solution. The formaldehyde acts as an insecticide when applied and then combines with the ammonia to form hexamethylenetetramine, which subsequently is slowly decomposed with re-formation of formaldehyde.—A. S.

Water-softening agents; Manufacture of ——. A. G. Bloxam, London. From Verein. Seidenfärbereien C. A. Langenbeck und T. P. Lohe, Elberfeld, Germany. Eng. Pat. 9755, April 25, 1913.

See Fr. Pat. 463,044 of 1913; this J., 1914, 331.—T. F. B.

Water: Process of purifying —— from germs by means of bromine. M. Riegel, Berlin. U.S. Pat. 1,094,475, April 28, 1914.

See Ger. Pat. 272,271 of 1913; this J., 1914, 564.—T. F. B.

Oxidising process [for treatment of water, etc.]. L. Linden, Brussels. U.S. Pat. 1,094,731, April 28, 1914.

See Eng. Pat. 20,556 of 1911; this J., 1912, 508.—T. F. B.

Waste water; Apparatus for purifying ——. E. Mann and J. Heess, Ebertsheim, Germany. U.S. Pat. 1,095,409, May 5, 1914.

See Fr. Pat. 464,483 of 1913; this J., 1914, 478.—T. F. B.

Sludges extracted from residual waters of all kinds; Process for carrying out the fermentation and agitation of —— and apparatus therefor. Comp. Claricite, Paris. Eng. Pat. 24,726, Oct. 30, 1913. Under Int. Conv., Nov. 25, 1912.

See Fr. Pat. 462,573 of 1912; this J., 1914, 331.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Ipecacuanha root; Alkaloids of true ——. O. Hesse, Annalen, 1914, **405**, 1—57. (See also this J., 1895, 384; 1898, 869; 1901, 500.)

Finely-powdered ipecacuanha root (*Cephaelis ipecacuanha*, Richard) was moistened with cold sodium carbonate solution (1 part of calcined soda to 3 of water), and extracted with a mixture of benzene and petroleum benzine (1 : 5) at 60°—70° C. The alkaloids were removed from the extract by means of $N/10$ sulphuric acid, the acid solution treated with excess of ammonia, and extracted with ether. The ether solution was concentrated and shaken with successive portions of $N/5$ sodium hydroxide till the alkaline solution remained clear on addition of ammonium chloride. The alkaline solution was diluted with an equal volume of water, washed with ether, treated first with a slight excess of hydrochloric acid, then with ammonia, and the precipitated cephaeline dissolved in ether and crystallised. The ether solution of emetine, after washing with sodium hydroxide solution as described, was mixed with an ethereal solution of oxalic acid, added gradually, in small portions, the ether poured off, the precipitate dissolved in warm water, and the emetine converted into hydrobromide by addition of a saturated solution of sodium bromide. From the bromide mother-liquor, a new alkaloid, *ipecamine*, was precipitated by ammonia. When the original sulphuric acid solution of the alkaloids was treated with ammonia and extracted with ether, psychotrine remained dissolved in the ammoniacal solution, imparting to it a blue fluorescence; it was extracted by chloroform. In the purification of the emetine hydrobromide by recrystallisation from water, the mother-liquor was found to contain a fifth alkaloid, *hydroipecamine*, which was separated from emetine by fractional precipitation with sodium bromide. The composition of the five alkaloids is: emetine, $C_{26}H_{27}(OCH_3)_4(OH)N_2$; Cephaeline and hydroipecamine, $C_{25}H_{28}(OCH_3)_3(OH)N_2$; psychotrine and ipecamine, $C_{25}H_{26}(OCH_3)_3(OH)N_2$. ephaeline and hydroipecamine contain a phenolic and the other three alkaloids an alcoholic hydroxy group. Emetine cannot easily be purified by means of its hydrochloride, but its hydrobromide can easily be obtained pure, and should be preferred to any other emetine preparation for medicinal purposes. The proportions of the different alkaloids found in various commercial kinds of ipecacuanha (air-dried) are shown in the following table:—

	Minas.		Matto Grosso	Johore	Carthagena.	
	1	2			1	2
	%	%	%	%	%	%
Emetine	1·31	1·00	1·62	1·03	0·61	1·13
Ipecamine and hydroipecamine	0·53	0·36	0·53	0·25	0·22	0·32
Cephaeline	0·60	0·62	0·52	0·46	0·74	0·81
Psychotrine.........	0·06	0·05	0·06	0·04	0·05	0·06
Total	2·50	2·03	2·73	1·78	1·66	2·32

All of the ipecacuanha alkaloids give a yellow colour reaction with bleaching powder in presence of acid. Emetine, cephaeline and psychotrine dissolve to a colourless and ipecamine and hydroipecamine to a faintly yellowish solution in sulphuric acid of sp. gr. 1·84. On adding a sulphuric acid solution of ammonium molybdate to this solution, emetine gives an emerald-green colour, persistent for several hours, cephaeline gives a brownish-red changing to blue and green and fading in a few hours, psychotrine gives quickly a green coloration, and ipecamine and hydroipecamine gradually a faint olive-green. The reactions are due to reduction of the molybdic acid. A similar reducing action of the alkaloids is the cause of the reaction with potassium ferricyanide and ferric chloride (Allen and Scott-Smith, this J., 1902, 1475).—A. S.

Cinchotoxine; Combination of bromine with ——. G. Rohde and S. Meissner. Ber., 1914, **47**, 1507—1515.

Cinchotoxine dissolved in hydrobromic acid was treated with a solution of bromine in the same acid at 0° C., when wo salts of the composition, $C_{19}H_{22}N_2OBr_2,2HBr$, were produced, which were separated by crystallising from dilute hydrobromic acid. One of these was white and melted at 151° C. when anhydrous. The other was yellow and melted at 162° C. in the anhydrous condition. Both salts were converted into basic salts, $C_{19}H_{22}N_2OBr_2,HBr$, by treatment with pyridine or the calculated amount of sodium carbonate solution. The basic salt obtained from the yellow dihydrobromide was white and melted at 178° C., whilst that from the white hydrobromide melted at about 168° C. The base corresponding to the latter was obtained by treatment with excess of sodium carbonate solution. It was bitertiary as a result of inner alkylation, and crystallised from benzene in rhombohedral crystals, m. pt. 124°—125° C. When the yellow dihydrobromide was treated with excess of sodium carbonate solution, cinchotoxine dibromide was produced, melting at 105° C. after crystallising from ether. When the solution of this base in benzene was boiled, or the chloroform solution was allowed to stand, the basic salt of m. pt. 178° C. was formed.—F. Shdn.

Galega officinalis; An alkaloid from ——. G. Tanret. Comptes rend., 1914, **158**, 1182—1184.

The seeds of *Galega officinalis* were extracted with 60 % alcohol and the extract purified by means of lead acetate and barium hydroxide. The alkaloid was finally separated as the sulphate, $(C_6H_{13}N_3)_2H_2SO_4$, crystallising in fine white needles, m. pt. 227° C. (Maquenne block), and optically inactive. The yield was about 0·5 %. The free base was very hygroscopic and soluble in water but insoluble in ether and chloroform. When crystalline it melted at 60°—65° C. The picrate was prepared by the addition of picric acid to the solution of the sulphate and melted at 180° C.—F. Shdn.

Aporeine and its salts. V. Pavesi. Gaz. chim. ital., 1914, **44**, I., 398—405.

The yield of alkaloids from *Papaver dubium* is much higher if the fresh material be extracted with alcohol than if the dried material be used as described previously (this J., 1907, 1108). Petroleum ether (b. pt. 45°—50° C.) dissolves 11 % of aporeine at the boiling point and only about 3·5 % at 15°—20° C., and the alkaloid can be crystallised from the hot supersaturated solution. It melts at 88°—89° C. (corr.) to a greenish yellow fluorescent liquid, which decomposes when heated in the air but can be distilled in a current of an inert gas such as hydrogen or carbon dioxide. Aporeine is dextro-rotatory, $[\alpha]^{15} = +75·19$ in 95 % alcohol. The petroleum ether extract of the crude alkaloid contains, besides aporeine, a small quantity of another alkaloid, m. pt. 176°—178° C., somewhat less soluble in this solvent. Aporeidine described previously (*loc. cit.*) as an alkaloid accompanying aporeine, is really produced by the action of light and air on the latter or on some other constituent of the crude alkaloid.—A. S.

Homonataloïn and nataloïn; Optical isomerides of ——, and their reciprocal transformation. E. Léger. Comptes rend., 1914, **158**, 1189—1191. (See this J., 1914, 275.)

When the β, γ- and δ-homonataloïns and nataloïns were heated to 105°—110° C. with acetic anhydride and sodium acetate, each yielded a mixture of three acetyl compounds exactly similar to those furnished by the natural aloins. —F. Shdn.

Emetine. I. A. Windaus and L. Hermanns. Ber., 1914, **47**, 1470—1472.

After energetic oxidation with potassium permanganate in aqueous solution, emetine hydrochloride yielded *m*-hemipinic acid and *m*-hemipinicimide.—F. Shdn.

Vanilla in Madagascar; Cultivation of ——. A. Fauchère. J. d'Agric. Trop.; Perfum. and Essent. Oil Rec., 1914, **5**, 152—153.

The variety cultivated in Madagascar is *Vanilla planifolia* introduced from Mexico 40 years ago. It flourishes best on granitic alluvial soil rich in phosphates and potash, in shady situations and with a humid climate. Propagation takes place by means of cuttings which yield a crop in about three years. Fertilisation is done by hand. The ripe pods after gathering are immersed in boiling water for 15—20 seconds, drained, and placed on woollen cloths. They are then exposed to the sun during the day and wrapped up at night for 4—10 days, when they develop a chocolate colour. Drying is effected by laying the pods on open shelves for several weeks. In 1911 the production of vanilla in Madagascar was 52,430 kilos. and in 1912 113,662 kilos. The yield may vary from 600 to 1000 kilos. of green pods per hectare (500—900 lb. per acre).—F. Shdn.

Vanillin; Reactions of ——. E. P. Häussler. Z. anal. Chem., 1914, **53**, 363—371.

Aqueous alcoholic solutions of vanillin when evaporated in an open dish on the water-bath with various organic substances in presence of a little dilute hydrochloric or sulphuric acid yielded very characteristic colour-reactions. Thus, amines, imines and amides gave a yellow and phenols a red or violet coloration. In many cases the subsequent addition of ammonia effected a change or disappearance of the colour. Blank experiments should always be made with the substance in the absence of vanillin before applying such tests. By means of p-phenylenediamine hydrochloride (pink colour) or phloroglucinol (yellow colour) it was possible to detect, respectively, 5×10^{-7} grm. or 5×10^{-6} grm. of vanillin. —J. R.

Tobacco; Chemistry of ——. *The essential oil of tobacco.* W. Halle and E. Pribram. Ber., 1914, **47**, 1394—1398.

An essential oil was isolated from the extract obtained from tobacco by means of warm organic solvents, the yield being 0·047% of the original weight of tobacco. The oil, which had an acid reaction, was treated with sodium carbonate solution and fractionated by distillation which took place between 77° and 133° C. at 26—22 mm. As the fractions developed acidity they were again treated with sodium carbonate, distilled, and their characters determined. There was finally obtained from the lower fractions a hydrocarbon, $C_{10}H_{18}$ or $C_{11}H_{20}$, b. pt. 73°—76° C. at 20 mm. On oxidation with permanganate this yielded terephthalic and isobutylacetic acids. A small quantity of isovaleric acid was separated from the sodium carbonate solution used in treating the original oil.—F. Shdn.

Malt extract; Laboratory studies on ——. H. T. Graber. J. Ind. Eng. Chem., 1914, **6**, 403—404.

Concentrated aqueous glycerin malt extracts darken in colour soon after manufacture and on keeping for a year or more acquire an acid taste and disagreeable odour. Extracts of ages varying from 3 to 12 months were found not to have suffered any diminution of diastatic activity. On keeping for longer periods, however, increasing quantities of lactic acid were formed, and when more than 1% was present, the diastatic activity was considerably weakened. The darkening of the extracts is also attributed to lactic acid.—A. S.

Digestive ferments; Assay of ——. H. T. Graber. J. Ind. Eng. Chem., 1914, **6**, 402—403.

To obtain uniform results in the determination of the diastatic power of pancreatin preparations the starch used should be neutral or very slightly acid to cochineal indicator and the moisture content should not vary greatly. The diluted iodine solution should always be at the same temperature when used.—A. S.

Lavender oil with high ester content. J. C. Umney. Perfum. and Essent. Oil Rec., 1914, **5**, 130.

Oil distilled in April from lavender grown at an altitude of 900 metres in Dalmatia had the following characters: sp. gr. 0·899, optical rotation—8° 30′, esters 61·6%, solubility in 70% alcohol 1 in 4. Oil obtained a year ago from plants grown at the same altitude had an ester percentage of 57·1 as against 43 and 49 for oils distilled from plants grown at 250 and 500 metres respectively. —F. Shdn.

Salol, sulphonal and β-naphthol; Incompatibility of —— [*in pharmaceutical preparations*]. G. Bianchini. Atti R. Accad. dei Lincei, Roma, 1914, **23**, I., 608—615.

Binary and ternary mixtures of salol, sulphonal and β-naphthol were examined by the method of thermal analysis. From fused binary mixtures of sulphonal and β-naphthol and of salol and sulphonal the pure components separate. The sulphonal-β-naphthol eutectic contains 62 mols. % of β-naphthol and melts at 67° C.; the salol-sulphonal eutectic contains 92 mols % of salol and melts at 34° C. In the case of fused mixtures of salol and β-naphthol, a solid solution separates from mixtures containing 80 mols. % or more of β-naphthol; the eutectic contains 85 mols. % of salol and melts at 34·5° C. In mixtures containing the three substances, together, the ternary eutectic melts at 27° C., and is composed of salol 78, β-naphthol 15, and sulphonal 7 mols. %. These results show that it is inadvisable to add sulphonal to mixtures of salol and β-naphthol which are to be packed up in paper or cardboard cases. (See also this J., 1913, 251.)—A. S.

1.3-*Butadiene hydrocarbons; New process for the preparation of* ——. *II. Pyrogenetic decomposition of hydroxy compounds. III. Catalytic dehydration of hydroxy compounds.* L. P. Kyriakides. J. Amer. Chem. Soc., 1914, **36**, 980—1007.

Glycols and unsaturated alcohols can be dehydrated to 1.3-butadiene hydrocarbons by catalysis over kaolin or aluminium phosphate, at temperatures above 350° C., preferably under diminished pressure. Thus β-butyleneglycol was converted into butadiene, the butanediol, $CH_3.CH(OH).CH(CH_3).CH_2OH$, into isoprene, and the pentanediol, $CH_3.CH(OH).CH_2.CH(OH).CH_3$, into piperylene. Ditertiary α-glycols, *e.g.* pinacone, can be dehydrated to 1.3-diolefines in presence of finely divided copper at temperatures above 430° C. The yields in most cases are good. Ditertiary, tertiary-secondary, and disecondary glycols, with the exception of the α-glycols in the last two cases, can be dehydrated to the corresponding 1.3-butadiene hydrocarbons by the catalytic action of small quantities of halogen acids, or their derivatives, particularly the halogen salts of aniline. The process is made continuous by boiling the glycol with the catalyst in a flask, allowing the hydrocarbon to distil off through a fractionating column as it is formed, and running in fresh glycol to take the place of that decomposed. In general hydrobromic acid or aniline hydrobromide were more efficient than hydrochloric acid, and produced a smaller amount of undesirable by-products. Pinacone with 0·2% of hydrobromic acid or 1% of aniline hydrobromide was converted into 2.3-dimethyl-1.3-butadiene with a yield of over 70%. 2-Methyl-2.4-pentadiene, $(CH_3)_2C:CH.CH:CH_2$, was prepared from acetone by condensing it to $(CH_3)_2C(OH).CH_2.CO.CH_3$, reducing this to the glycol and dehydrating with hydrobromic acid; a 50% yield of the hydrocarbon was obtained, and the remainder consisted of the unsaturated alcohol, $(CH_3)_2C:CH.CH(OH).CH_3$, which, by repeating the treatment was eventually entirely dehydrated to the methyl pentadiene. This new hydrocarbon was polymerised by the sodium process to a caoutchouc-like substance. Other unsaturated alcohols, similar to the above, were likewise quantitatively dehydrated, isoprene being obtained, for example, from $(CH_3)_2C(OH).CH:CH_2$. The method is also applicable to the dehydration of tertiary alcohols, thus trimethylethylene was readily obtained from dimethylethylcarbinol by heating with a small quantity of hydriodic acid or of aniline hydrobromide.—G. F. M.

Hydrogenation of liquids; Catalytic —— *under the influence of common metals, at moderate temperature and pressure.* A. Brochet. Comptes rend., 1914, **158**, 1351—1353.

In many cases, the hydrogenation of liquids may be effected by certain common metals, notably nickel, without recourse to high temperature or pressure, and in all cases a much lower temperature may be employed than that adopted in the method of Sabatier and Senderens. The proportion of nickel (obtained by reduction of the oxide at about 300° C.) may be as low as 0·1 to 0·5% of the weight of liquid in some cases. The method is applicable to the hydrogenation or reduction of various organic compounds. A mixture of the active metal and the liquid (the substance to be treated, or its solution or suspension in a suitable liquid) is agitated vigorously in presence of hydrogen at the ordinary or higher pressure. —L. E.

Nitroglycerin [*in pharmaceutical preparations*]*; Determination of* ——. F. W. Heyl and J. F. Staley. Amer. J. Pharm., 1914, **86,** 195—198.

The colorimetric method with phenoldisulphonic acid introduced by Scoville (this J., 1911, 1086) is more suitable for the estimation of minute quantities of nitroglycerin in tablets and other pharmaceutical products than the Kjeldahl method. Analyses by the two methods show close agreement.—O. E. M.

Formic acid; Method of determining ——. V. Hottenroth. Chem.-Zeit., 1914, **38,** 598.

The acid, which may be dissolved in a homologous acid or other indifferent solvent, is treated with acetic anhydride and a drop of concentrated sulphuric acid, as contact substance. There is an immediate evolution of carbon monoxide, in accordance with the equation,

$$(CH_3CO)_2O+H.CO_2H=2CH_3.CO_2H+CO,$$

and the evolved gas is measured. Water, if present, is removed by allowing an excess of acetic anhydride to react before adding the sulphuric acid.—F. Sodn.

Ethyl alcohol; Specific reaction for ——*; Method of identifying it in presence of aldehyde, acetone, methyl alcohol, etc.* A. Toninelli. Ann. Chim. Analyt., 1914, **19,** 169—170.

From 25 to 100 c.c. of the sample is distilled and the fractions between 60° and 80° C. collected in 2 c.c. portions. (Higher alcohols, if present, must be removed before distillation by treating the sample with a 5 per cent. solution of alum and shaking with a small quantity of benzene.) To each 2 c.c. of distillate are added 2 c.c. of iodine solution (12 grms. in 100 c.c. of ether), and after standing 2 mins., 4 c.c. of potassium hydroxide solution (40 grms. in 100 c.c. of water). When the solution is decolourised, 2 c.c. of a solution of 1.2.4-dinitrotoluene (1·5 grms. in 200 c.c. of a mixture of 1 part of carbon bisulphide and 2 parts of ether) are added with brisk agitation. In the presence of ethyl alcohol a play of colours is observed in the upper layer which eventually becomes an intense garnet red. The reaction will detect ethyl alcohol in the distillate at a dilution of 3 per cent., and is not affected by the presence of methyl alchol, acetone, or aldehyde.—G. F. M.

odine tincture; Regeneration of altered ——. F. Roques. J. Pharm. Chim., 1914, **9,** 277—288.

he free hydriodic acid present in altered tincture of odine may be readily decomposed, with regeneration of odine, by shaking for a few minutes with excess of finely ivided iodic acid.—F. Shdn.

Patents.

lkali salts of acidyl-ortho-[*hydr*]*oxyphenylcarboxylic acids; Manufacture of* ——. A. G. Bloxam, London. From J. A. Wülfing, Berlin. Eng. Pat. 9266, April 19, 1913.

he process described in Ger. Pat. 270,326 of 1913 (this J., 14, 439) is extended to include other alkali salts of all idyl-*o*-hydroxyphenylcarboxylic acids. Instead of using phatic esters for moistening the reaction mixture, an phatic alcohol or ketone may be used.—T. F. B.

Ether recovery during the evaporation of ethereal solutions of tannin and other similar solutions; Process for ——. Nitritfabrik Akt.-Ges. Fr. Pat. 465,835, Dec. 6, 1913. Under Int. Conv., Jan. 28, 1913.

The ethereal solution is subjected to suction in a closed chamber, and the mixture of air (or other inert gas) and ether vapour drawn off is led to a refrigerator where part of the ether condenses. The air is afterwards heated and returned to the evaporating chamber. F. Shdn.

Perfumes in enfleurage with fatty bodies; Process for the removal of ——. Lautier Fils. Fr. Pat. 465,941, Sept. 24, 1913.

The perfumes adhering to the fatty base obtained in the enfleurage process are removed by exhaustion (suction). —F. Shdn.

Essential oils, perfumes, etc.; Process for the extraction of ——. J. A. Meunier. Fr. Pat. 466,273, Feb. 26, 1913.

The extraction is carried out by means of steam under reduced pressure in a closed apparatus. For instance, in order to purify oil of almonds, the oil is placed with water in a vessel connected with a condenser and receiver. After exhausting the whole arrangement by means of a pump the vessel is heated. As soon as boiling takes place, the pump is disconnected and the distillation allowed to proceed.—F. Shdn.

Pancreatic extracts; Stable —— *for industrial use.* Lepetit Dollfus & Gansser. Fr. Pat. 466,276, May 29, 1913.

The pancreatic glands are mixed with an equal volume of sugar and the whole disintegrated. The product becomes homogeneous after standing for several days. —F. Shdn.

Dimethylaminooxymethane and dimethylamine; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,493, June 23, 1913.

See Fr. Pat. 460,429 of 1913; this J., 1914, 42.—T. F. B.

Acetylsalicylic acid; Preparing salts of ——. O. Gerngross, Berlin, and H. Kast, Frankfort on Maine, Germany. Eng. Pat. 18,743, Aug. 18, 1913. Under Int. Conv., Oct. 11, 1912.

See Fr. Pat. 464,081 of 1913; this J., 1914, 439.—T. F. B.

Benzyl alcohol; Manufacture of ——. F. W. Klever, Cologne, Germany. Eng. Pat. 20,505, Sept. 10, 1913. Under Int. Conv., Sept. 11, 1912.

See Fr. Pat. 462,438 of 1913; this J., 1914, 277.—T. F. B.

Ketobases and ketodiamines of the formula, $CH_3.CO.CH(R).CH_2.N(R')_2$ and $CH_3.CO.C(R)[CH_2N(R')_2]_2$ *(R=hydrogen or alkyl, R=alkyl); Process for producing* ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,410, Nov. 6, 1913. Under Int. Conv., Nov. 7, 1912. Addition to Eng. Pats. 25,963 of 1912 and 14,231 of 1913.

See Ger. Pat. 267,347 of 1912; this J., 1914, 103.—T. F. B.

Amino- and diamino-ketones; Process for preparing aliphatic ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition dated Nov. 3, 1913, to Fr. Pat. 454,543, Oct. 28, 1912. Under Int. Conv., Nov. 7, 1912.

See Ger. Pat. 267,347 of 1912; this J., 1914, 103.—T. F. B.

1.3-*Butylene-glycol; Process of producing* ——. K. Delbrück and K. Meisenburg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,094,539, April 28, 1914.

See Eng. Pat. 940 of 1913; this J., 1913, 550.—T. F. B.

Isoprene ; Production of ——. A. Heinemann, London. U.S. Pat. 1,095,395, May 5, 1914.

See Eng. Pats. 14,030 and 24,236 of 1910 ; this J., 1911, 909.—T. F. B.

Lactid ; Manufacture of ——. R. Grüter, Charlottenburg, and H. Pohl, Biebrich, Assignors to Chem. Werke vorm. Dr. H. Byk, Lehnitz-Nordbahn, Germany. U.S. Pat. 1,095,205, May 5, 1914.

See Fr. Pat. 456,824 of 1913 ; this J., 1913, 1086.—T. F. B.

Bismuth salt of gallocarboxylic acid. R. Berendes, Elberfeld, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,095,618, May 5, 1914.

See Ger. Pat. 268,932 of 1912 ; this J., 1914, 277.—T. F. B.

Fatty acids containing arsenic and phosphorus ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Nov. 21, 1913, to Fr. Pat. 449,014, Oct. 3, 1912. Under Int. Conv., Dec. 27, 1912, Jan. 2, Jan. 30, and March 25, 1913.

See Eng. Pats. 10,378 and 10,379 of 1913 and Ger. Pat. 271,158 ; this J., 1914, 218, 439, 503.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Method of obtaining a measure of the colour of metals and alloys. Thompson and Sinkinson *See* X.

XXII.—EXPLOSIVES ; MATCHES.

Explosion of a cast iron benzene nitrating apparatus. Pikos. *See* III.

o-Nitro-p-diazonium-phenol and the constitution of the "diazo-phenols." Klemenc. *See* III.

Patents.

Dynamites ; Method of manufacturing safety ——. K. Ohno, Kitasui, Japan. Eng. Pat. 16,978, July 24, 1913. Under Int. Conv., Aug. 7, 1912.

Terpinene is used as a stabiliser. Examples given are : nitroglycerin (73 parts), terpinene (3) and kieselguhr (24 parts) ; and nitroglycerin (86—90 parts), nitrocellulose (6—10) and terpinene (3—4 parts).—G. W McD.

Smokeless powders ; Manufacture of ——. C. Claessen. Third Addition, dated Oct. 17, 1913, to Fr. Pat. 410,239, Dec. 11, 1909. (See this J., 1910, 842, 1239 ; 1911, 448.)

Nitrocellulose (70—80 parts) is gelatinised by a non-volatile nitro-compound, such as di- or trinitrotoluene (20—30 parts), without the aid of a volatile solvent, to form a propellant.—G. W. McD.

Explosive. G. A. Rauzières. Fr. Pat. 465,718, Dec. 1, 1913.

A mixture of potassium chlorate (90 parts) and barium nitrate (10 parts) thoroughly moistened with nitrotoluene. —G. W. McD.

Explosive ; Manufacture of a plastic ——. C. V. A. Herlin. Fr. Pat. 465,771, Dec. 5, 1913. Under Int. Conv., April 14, 1913.

An eutectic mixture of nitroglycerin and a nitrohydrocarbon or mixture of nitrohydrocarbons is used as basis of the explosives. Suitable proportions are comprised within the limits : nitroglycerin (10—20 parts), *o*-nitrotoluene (10—20), nitrobenzene (0—5), together with nitrocellulose (0·5—2·5), sodium nitrate (25—35), ammonium perchlorate (35—45), and woodmeal (0—5 parts). —G. W. McD.

Signal-fusee ; Time-burning railway ——. L. S. Ross, Newtonville, Mass., Assignor to Central Railway Signal Co., Pittsburgh, Pa. U.S. Pat. 1,094,596, April 28, 1914.

A mixture of a metallic nitrate, sulphur, a hydrocarbon, carbon, potassium perchlorate and potassium chlorate, the last not exceeding 5%.—G. W. McD.

Explosive. A. Voigt, Giessen, Germany. U.S. Pat. 1,095,302, May 5, 1914.

See Fr. Pat. 425,550 of 1911 ; this J., 1911, 926.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Thermometer (variable zero), with automatic setting of, M. J. Ruelle ; Report on ——. C. Féry. Bull. Soc. d'Encour., 1914, 121, 405—408.

The quantity of mercury in a delicate thermometer with a variable zero may be easily and exactly regulated by means of the arrangement shown in the figures. The bulb is first warmed till the whole thread is filled as in Fig. 1. The thermometer is then temporarily inverted so that the mercury in the reservoir retains the position shown in Fig. 2, on reverting to the normal position. The temperature of the bulb is then brought to a value equal to the desired zero of the instrument plus a constant which depends on the length ol the capillary and which is marked on each instrument. When the bath has reached this temperature, the thermometer is given a light ta which causes the mercur to fall again and cuts it of from the capillary. Fo very precise use it is o course necessary to hav the value of the degrees o the instrument calibrate for different values of th zero, *i.e.*, for different quantities of mercury in th bulb.—W. H. P.

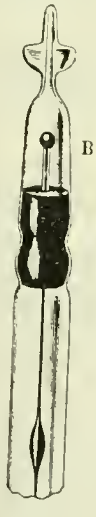


Fig. 1.

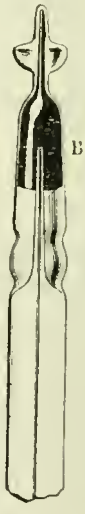


Fig. 2.

Cobalt, nickel, iron, and copper ; Colorimetric determinati of ——. C. Hüttner. Z. anorg. Chem., 1914, 8 341—357.

The colours of chloride solutions in concentrated hydr chloric acid, are matched against those of similar standa solutions of the metal concerned. Cobalt (above 0·1 may be readily detected in nickel or its alloys by the gre tint which it imparts to the otherwise yellow solutio the colour allows of the determination of up to 10% For the determination of iron or copper, the solution shou contain not more than 1 grm. of metal in 10,000 c.c the depth of tint (intense yellow) is influenced by the co centration of the acid. No loss of metal was observed evaporating solutions containing iron with hydrochlo acid on the water bath, and the presence of manganese a small proportion of cobalt or nickel had no disturb effect in the determination of iron. In all cases, nit acid and oxides of nitrogen should be avoided and t chlorine must not be present in determining cobalt. The application of the method to the analysis of commercially pure metals is described. The yellow colour of commercial hydrochloric acid was found to be due chiefly to iron (about 0·03 grm. per litre). —F. SODN.

Titanium; Separation of —— from iron, aluminium and phosphoric acid by means of the ammonium salt of nitrosophenylhydroxylamine ("cupferron"). W. M. Thornton, jun. Amer. J. Sci., 1914, **37**, 407—414. (See also this J., 1914, 279.)

THE solution (about 100 c.c.) is treated with sufficient tartaric acid (at least 4 times the total weight of the four oxides) to prevent precipitation by ammonia, then neutralised with ammonia, acidified with 2 c.c. of sulphuric acid (1 : 1), and the iron reduced by hydrogen sulphide. An excess of ammonia is then added; the ferrous sulphide is filtered off and well washed with water containing ammonium sulphide. The filtrate is acidified with 40 c.c. of sulphuric acid (1 : 1), the hydrogen sulphide boiled off, the solution cooled, diluted to 400 c.c., and a 6% solution of "cupferron" added slowly with constant stirring. The precipitate is allowed to settle and the supernatant liquid tested with a few drops of the reagent. The formation of a yellow turbidity shows the precipitation to be incomplete. The precipitate is filtered off and washed 20 times with dilute hydrochloric acid (1 : 10), the filter placed in a tared platinum crucible, dried at 110° C., ignited very gently at first, then over the blowpipe to constant weight and the residue weighed as TiO_2
—W. R. S.

Beryllium and uranium; Separation [and determination] of ——. M. Wunder and P. Wenger. Z. anal. Chem., 1914, **53**, 371—374.

A SOLUTION containing a mixture of beryllium and uranium chlorides or of beryllium chloride and uranium nitrate was treated with 3% hydrogen peroxide (10 c.c. for 0·16 grm. U_3O_8) on the water-bath. The yellow uranium precipitate was collected on a "double barium filter," washed with dilute hydrogen peroxide or dilute ammonium nitrate solution, ignited in a platinum crucible till the weight became constant and weighed as U_3O_8. The excess of oxygen was expelled from the filtrate by boiling and the beryllium precipitated with ammonia. The precipitate was collected, washed, ignited and weighed as BeO. The results were very accurate. In the presence of a large excess of beryllium the precipitation with hydrogen peroxide should be repeated, as the first precipitate is liable to be contaminated with beryllium.
—J. R.

Sulphurous acid; Volumetric determination of free ——. E. Kedesdy. Chem.-Zeit., 1914, **38**, 601—602.

THE determination of free sulphurous acid in the presence of other mineral acids could not be satisfactorily effected by titration with N/10 caustic alkali, using methyl orange to bisulphite), and phenolphthalein (to neutral salt), as ndicators, as the latter developed colour but slowly nd appeared to be "bleached." When excess of hydrogen eroxide was added after the first titration a sharp colour hange was obtained in the second stage with phenolhthalein. (See also this J., 1914, 442.)—J. L. F.

jeldahl method [of determining nitrogen]; A new modification of the ——. L. Marino and F. Gonnelli. Atti R. Accad. dei Lincei, Roma, 1914, **23**, I., 523—530.

ANADIUM pentoxide, obtained by igniting ammonium etavanadate, is used as catalyst. One grm. of subance is heated with 20—35 c.c. of concentrated sulphuric id, 7 grms. of potassium sulphate, and 0·2 grm. of nadium pentoxide until the colour of the solution anges to emerald green; then 0·2 grm. more of vanadium ntoxide is added, the mixture is heated for ½ hour nger, and the determination completed as usual.—A. S.

Determination of Prussian blue in textile fibres. Williams and Dreaper. *See* VI.

Test for copper on woollen cloth. Elgo. *See* VI.

Determination of arsenic in hydrochloric and sulphuric acids. Tarbell. *See* VII.

Determination of magnesium in calcium salts. Hostetter. *See* VII.

Determination of the higher lead oxides. I. Iodometric method. Milbauer and Pivnica. *See* VII.

Volumetric determination of lead [in ores]. Alder and Coolbaugh. *See* X.

Rapid determination of zinc in ores. Direct application of Frary's method to the analysis of ores. Zublena. *See* X.

Determination of free cyanide in electroplating solutions. Lundell. *See* X.

Analysis of Turkey-red oil. Herbig. *See* XII.

Determination of oil in oil-paints. Mazza. *See* XIII.

Detection and determination of petroleum products in oil of turpentine. Grimaldi and Prussia. *See* XIII.

Colour measurement of [tanning] extracts. Procter. *See* XV.

Determination of alkaline sulphides [in lime liquors]. McCandlish and Wilson. *See* XV.

Determination of the acidity of leather. Nicolardot. *See* XV.

Determination of nitrogen in mixtures of calcium nitrate and cyanamide. Stutzer. *See* XVI.

Limit of error in certain sugar house control analyses. Deerr. *See* XVII.

Determination of cellulose in flours to ascertain the degree of grading. Lindet. *See* XIX.

Reactions of vanillin. Häussler. *See* XX.

Assay of digestive ferments. Graber. *See* XX.

Determination of nitroglycerin in pharmaceutical preparations. Heyl and Staley. *See* XX.

Method of determining formic acid. Hottenroth. *See* XX.

Specific reaction for ethyl alcohol. Method of identifying it in presence of aldehyde, acetone, methyl alcohol, etc. Toninelli. *See* XX.

PATENTS.

Gas-analysis apparatus. E. J. Billings, Assignor to A. D. Little (Incorpd.), Boston, Mass. U.S. Pat. 1,089,390, March 10, 1914.

THE apparatus, of the Orsat type, is provided with means for continuous sampling at predetermined rates. The sampling pipette is connected with an inlet from the flue fitted with a filter for the removal of soot, and with an outlet leading to an aspirator, by means of which flue gases are drawn continuously through the pipette. The upper part of the pipette contains a water-sealed outlet connected through stop-cocks with a sampling tube which is initially filled with mercury. The mercury is allowed to flow from the sampling tube at any desired rate by means of an overflow device connected to the lower end by flexible tubing and lowered gradually by clockwork, thus drawing gases from the sampling pipette into the sampling tube.—A. T. L.

Calorific value of fuels ; Process and apparatus for measuring the ——. H. Junkers. Fr. Pat. 466,280, Oct. 9, 1913. Under Int. Conv., Oct. 16, 1912.

See Eng. Pat. 22,514 of 1913 ; this J., 1914, 105.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Germanium from Vichy water ; Extraction of ——. J. Bardet. Comptes rend., 1914, **158**, 1278—1280.

The residues from the preparation of Vichy salts were heated with water, and the precipitate treated with hydrogen sulphide under special conditions, when a solution of germanium was finally obtained. A yield of 0·060 grm. of pure oxide was obtained from 100 kilos. of the above precipitate, representing 250,000 litres of the mineral water.—F. Shdn.

Butine [Ethylacetylene] ; Preparation of pure ——. M. Picon. Comptes rend., 1914, **158**, 1184—1187. (See this J., 1913, 818.)

Ethyl chloride, bromide or iodide was allowed to act upon a solution of monosodium-acetylene in liquid ammonia. With ethyl iodide reaction took place at —40° C. The gaseous products of the reaction were washed with water and dilute sulphuric acid, dried, and liquefied by cooling to —80° C. Acetylene was removed by exposing the liquid at this temperature to a vacuum. The pure ethylacetylene had an onion-like but slightly ethereal smell and a sweetish taste. It boiled at 8·3° C. at ordinary pressure and after solidification formed a crystalline mass melting at —137° C.
—F. Shdn.

Book Received.

Lehrbuch der Farbenchemie, einschliesslich der Gewinnung und Verarbeitung des Teers sowie der Methoden zur Darstellung der Vor- und Zwischenprodukte. Von Dr. Hans Th. Bucherer, Direktor der Chemischen Fabrik auf Actien (Vorm. E. Schering) in Berlin, Ordentl. Professor a. d. der Technischen Hochschule in Dresden. Otto Spamer's Verlag in Leipzig. 1914. Price M. 20 ; geb. M. 22.

Volume (9½ by 7 ins.), containing 537 pages of subject matter, and an alphabetical index of subjects. The text is classified as follows :—I. Coal tar, its recovery and working up. II. Intermediate products of coal tar distillation. III. The dyestuffs. IV. (i), Theoretical considerations on the connection between colour and constitution. (ii), Introductory remarks on the behaviour of the dyestuffs in dyeing (Methods of dyeing). (iii) Synthetic methods for preparing the coal tar colours. (iv) Natural colours.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Brabbée*, W. : Vereinfachtes Verfahren zur zeichnerischen od. rechnerischen Bestimmung der Rohrleitungen v. Niederdruck-Dampfheizungen. (10 S. m. 1 Tab. u. 1 farb. Taf.) Lex 8°. München, R. Oldenbourg. 1914. M. 2.50.

IIA. *Gmeyner*, E. : Über Braunkohlenbrikettierung. (25 S. m. 25 Fig.) Lex 8°. Wien. 1914. Berlin, Verlag f. Fachliteratur. M. 1.50.

Molnár, L. : Statistik der Steinkohlengaswerke in Ungarn, Kroatien u. Slawonien m. Daten der in selben Städten befindl. Elektrizitätswerke. Mit Vorwort v. Prof. I. Pfeifer. (In ungar. u. deutscher Sprache.) (16 S. m. 1 Karte u. 1 Tab.) gr. 8°. Budapest, M. Dick. 1913. M. 5.

Lindtrop, N., u. S. *Strzetelski* : Die Naphthalagerstätten bei Grosny. (9 S. m. eingedr. Skizzen.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1914. M. 1.

Parish, W. F. : Untersuchungen üb. Schmieröle. (8 S. m. 8 Abbildgn. u. eingedr. Bildnis.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1914. M. 1.50.

IIB. *Pole*, Dr. J. C. : Die Quarzlampe, ihre Entwicklung u. ihr heutiger Stand. (VIII, 84 S. m. 47 Abbildgn.) gr 8°. Berlin, J. Springer. 1914. M. 4.

Weber, C. H. : Die elektrischen Metallfadenglühlampen insbesondere aus Osmium, Tantal, Zirkon u. Wolfram. Ihre Herstellg., Berechng. u. Prüfg. (VII, 453 S. m. 216 Abbildgn.) 8°. Leipzig, Dr. M. Jänecke. 1914. Cloth M. 16.

VII. *Tobiansky d'Altoff*, A. : L'industrie de l'azote atmosphérique, in-8°. Dunod et Pinat. Paris. 1914. 1 fr. 25.

VIII. *Mouliney*, G. : Carrelages et faïences. Technique de la fabrication des carreaux de grès. Manuel du poseur de carreaux céramiques, du poseur de faïences de revêtement, du monteur-faïencier, du monteur de cheminées, 157 fig., 6 pl., in-4°. Dunod et Pinat. Paris. 1914. Bds. 9 fr.

X. *Duponchelle*, J. : Manuel pratique de fonderie, cuivre, bronze, aluminium, alliages divers. 201 fig., in-8°. Dunod et Pinat. Paris. 1914. bds. 6 fr.

Fach, E. : Le minerai de manganèse, in-8°. Dunod et Pinat. Paris. 1914. 3 fr. 75.

Herzig, C. S., and C. W. *Purington* : Mine sampling and valuing ; a discussion of the methods used in sampling and valuing ore deposits ; with especial reference to th work of valuation by the independent engineer ; with chapter on Sampling placer deposits. San Francisco Mining & Scientific Press. c. 163 p. il. forms. 8°. 1914 $2.

Hobbs, W. H. : Simple Directions for the Determinatio of the Common Minerals and Rocks. 8vo. swd. Macmillan. London. 1914. Net 1s.

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Ragno, *S.* : La soudure autogène des métaux. 2e édit fig., in-8°. Dunot et Pinat. Paris. 1914. 2 fr. 50.

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XI. *Herzog*, S.: Theoretische u. praktische Einführung in die allgemeine Elektrotecknik. Handbuch f. das Selbststudium. (VII, 428 S. m. 857 Abbildgn.) Lex 8°. Stuttgart, F. Enke. 1914. Cloth M. 13.40.

XIV. *Scharffenorth, P.*: Die Reparatur v. Automobilpneumatiks. (67 S. m. 124 Abbildgn.) Berlin. gr. 8°. Berlin, Union, Zweigniederlassg. 1914. M. 3.

XV. *Jettmar*, J.: Kombinationsgerbungen der Lohe-, Weiss- u. Sämischgerberei. (VIII. 285 S. m. 6 Fig.) 8°. Berlin, J. Springer. 1914. Cloth M. 8.

XVIII. *Dreyerhoff*. Dr. P.: Brauereiwesen. II. Brauerei. (136 S. m. 35 Abbildgn.) kl. 8°. Berlin, G. J. Goschen. 1914. Cloth 90 Pf.

XIXA. *Franke*, E.: Kakao, Tee und Gewürze. (306 S. m. 25 Abbildgn.) Wien, A. Hartleben. 1914. M. 4.

XIXB. *Gockel*, Prof. A. Die Radioaktivität v. Boden u. Quellen. (V, 108 S. m. 10 Abbildgn.) 8°. Braunschweig, F. Vieweg u. Sohn. 1914. M. 3.

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XX. *Cohn*, Dr. G.: Die organischen Geschmacksstoffe. (XII, 936 S.) gr. 8°. Berlin, F. Siemenroth. 1914. Cloth M. 37.50.

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XXI. *Dillaye*, F.: Les nouveautés photographiques (1913—1914), ill., in 8°. J. Tallandier. Paris. 1914. 2 fr. 50.

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* Compiled by H. Grevel and Co., 33, King Street, Cov Garden, London. W.C., from whom all the works in the preced lists can be obtained.

Journal of the Society of Chemical Industry.

No. 12, Vol. XXXIII. JUNE 30, 1914. No. 12, Vol. XXXIII.

THE SOCIETY OF CHEMICAL INDUSTRY.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDING 31st DECEMBER, 1913.

EXPENDITURE.

		£ s. d.	£ s. d.
To Journal—Editorial and Sundry expenses—			
Editor's Salary		542 16 0	
Do. Expenses		28 15 10	
Do. Assistant		136 10 0	
Abstractors		578 2 3	
Sub-Editor's Salary		150 0 0	
Indexing Journals, &c.		130 8 0	
Foreign Journals, &c.		20 18 10	
Sundry Journals		10 15 3	
French and U.S.A. Patents and Specifications		66 2 0	
Insurance of Stock		7 3 0	
		1671 11 2	
Publishing expenses—			
General	1700 16 7		
Postage on Copies	755 19 6		
		2456 16 1	
			4128 7 3
,, Sectional expenses—			
Birmingham & Midland		22 16 11	
Boston		10 0 0	
Canada		41 15 6	
Liverpool		42 2 9	
London		108 16 9	
Manchester		70 17 5	
Newcastle-on-Tyne		24 3 10	
New York		100 0 0	
Nottingham		23 17 11	
Scotland		4 4 3	
Sydney		9 1 0	
Yorkshire		32 4 7	
			490 0 11
,, Annual Meeting expenses			165 6 10
,, Working expenses—			
Secretary's Salary		300 0 0	
Assistant to Secretary and Editor		250 0 0	
Honorarium to Treasurer's Assistant and for Clerical Assistance		77 10 0	
Rent, Lighting and Cleaning		211 11 1	
Stationery and Binding		62 5 10	
Postages, Bank Charges, Telephone, and Sundry expenses		150 16 4	
			1052 3 3
,, Excess of Income over Expenditure			1285 3 11
			£7121 2 2

INCOME.

£ s. d.		£ s. d.	£ s. d.
	By Entrance Fees		107 8 0
	,, Life Composition Fees		76 5 0
	,, Annual Subscriptions		4993 19 0
	,, Journal Advertisements	322 18 6	
	,, ,, Sales	867 6 6	
			1190 5 0
	,, Collective Index—Subscriptions		0 16 0
	,, Decennial Index—Sales		3 7 0
	,, Dividends and Interest on Investments—		
4476 0 2	Metropolitan 3% Consolidated	126 9 4	
1000 0 0	New Zealand 3% (1945)	28 5 0	
1277 4 8	New South Wales 3% (1035)	36 1 8	
1231 0 10	Consols 2½%	28 19 8	
600 0 0	Gas Light and Coke Co. 3% Debentures	16 10 0	
1084 13 4	North British Rly. 3% Consolidated	28 1 9	
1696 0 0	Midland Rly. 2½% Perpetual Preference and Guaranteed Preference	39 18 6	
1509 0 0	Great Eastern Rly. 4% Irredeemable	56 16 8	
673 0 0	South Eastern Rly. 4½% Preference	28 10 4	
1000 0 0	Metropolitan Water Board 3% B Debentures	28 5 0	
200 0 0	Nottingham Joint Station 3%	5 13 0	
1250 0 0	Great Western Rly. 5% Guaranteed	58 17 1	
800 0 0	Great Northern Rly. 3% Debentures	22 12 0	
450 0 0	Nottingham and Grantham Canal 4½% Consolidated	17 16 0	
724 8 0	India 3½%	23 17 8	
834 9 2	India 3%	23 11 8	
700 0 0	Canadian Pacific 3½% Land Grant Bonds 1938	34 12 2	
	Interest on Deposits	51 5 8	
			659 2 2
			£7121 2 2

London Section.

A TABLE OF SPECIFIC GRAVITIES OF SPIRITS CORRESPONDING TO INDICATIONS OF GLASS HYDROMETERS FOR USE WITH BEDFORD'S CORRECTED SIKES' TABLES.

BY JITENDRA NATH RAKSHIT AND SACHINDRA NATH SINHA, M.A.

(This Journal, March 31, pp. 288—289.)

This paper has been withdrawn by the authors and is cancelled.

New York Section.

Meeting held at Chemists' Building on Friday, May 22nd, 1914.

MR. G. W. THOMPSON IN THE CHAIR.

REFRACTORY MATERIALS.

BY GILBERT RIGG.

The subject of refractory materials to-day presents an enormous field for study. Clay is only one of many heat resisting materials now in regular use. Silica, bauxite, chromite, graphite, carborundum, etc., etc., are all finding increasing application in many directions.

To deal with anything like completeness with such a wide and varied range of material is obviously far beyond the possibilities of a paper like the present one. I propose, therefore, to confine my remarks mainly to refractories composed of clay, and to discuss certain features in the structure and composition of these bodies which I have found to be important factors in their usefulness and durability. Also I wish briefly to draw attention to certain methods of testing which have been shown to give useful indications.

My attitude towards this subject is that of a metallurgist principally concerned with the treatment of zinc ores, and my study of refractories has been influenced by the requirements of this industry. In this connection, I have found that certain types of structure are advantageous, and have worked out certain tests which have proved useful in the identification and standardising of these types. I have also attempted to get at the principles which underlie the empirical relations found between structure, durability and general appropriateness to the purpose in hand.

The following properties are all factors which together condition the utility and durability of firebrick :—1. Refractoriness. 2. Grain and compactness. 3. Burn-

THE SOCIETY OF CHEMICAL INDUSTRY.

BALANCE SHEET, 31st DECEMBER, 1913.

	£	s.	d.	£	s.	d.
To Sundry Creditors................				665	13	11
,, Subscriptions received in advance .				150	1	0
,, Accumulated Fund—						
Balance—31st December, 1912	19,059	0	8			
Add—Excess of Income over Expenditure, 1913	1,285	3	11			
				20,344	4	7
				£21,159	19	6

£	s.	d.		£	s.	d.	£	s.	d.
			By Sundry Debtors (Publishers, &c.) ..				494	6	10
			,, Arrears of Subscriptions				36	5	0
			,, Cash at Bank—						
			On Deposit	500	0	0			
			Current Account	460	5	1			
			,, Cash in hand (Secretary)	20	5	6			
							980	10	7
			,, Investments—						
4476	9	2	Metropolitan 3% Consolidated	4163	2	1			
1000	0	0	New Zealand 3% (1945)	870	0	0			
1277	4	8	New South Wales 3% (1935)	1122	3	1			
1231	0	10	Consols 2½%	1031	15	4			
600	0	0	Gas Light and Coke Co. 3% Debentures	507	0	0			
1084	13	4	North British Rly. 3% Consolidated	900	5	6			
736	0	0	Midland Rly. 2½% Perpetual Preference	1187	4	0			
960	0	0	Midland Rly. 2½% Guaranteed Preference						
1509	0	0	Great Eastern Rly. 4% Irredeemable	1629	14	5			
673	0	0	South Eastern Rly. 4½% Preference .	747	0	7			
1000	0	0	Metropolitan Water Board 3% B Debentures	922	10	0			
200	0	0	Nottingham Joint Station 3%	166	0	0			
1250	0	0	Great Western Rly. 5% Guaranteed ..	1762	10	0			
800	0	0	Great Northern Rly. 3% Debentures ..	696	0	0			
450	0	0	Nottingham and Grantham Canal 4½% Consolidated	495	0	0			
724	8	0	India 3½%........	700	0	0			
834	9	2	India 3%	700	0	0			
700	0	0	Dominion of Canada Canadian Pacific 3½% Land Grant Bonds 1938	697	9	6			
				18,297	14	6			
700	0	0	Canada Stock 4% (1940-1960)	676	8	1			
700	0	0	Dominion of Canada Canadian Pacific 3½% Land Grant Bonds 1938	674	14	6			
			Total Cost				19,648	17	1*
							£21,159	19	6

*Market value on Dec. 31, 1913, £17,349 18 5.

We have examined the above Balance Sheet, dated 31st December, 1913, and have verified the Investments and the balance at the Bank. In our opinion the Balance Sheet shows correctly the position of the Society at 31st December, 1913.

28, Basinghall Street, London, E.C.
23rd March, 1914.

(signed) FEASEY & CO.,
Chartered Accountants.

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4. Porosity. 5. Resistance to penetration, corrosion and chemical change. 6. Truth of surface and dimensions. 7. Conductivity.

(1) *Refractoriness.*—In ordinary furnace practice failure of firebrick through actual fusion is one of the rarest cases. The materials which enter into the body of high-class refractory material usually possess a melting point well in excess of the temperatures met with in furnaces heated by fuel. In electric furnaces, of course, conditions may readily arise which will cause the real fusion of the brick.

In some cases, however, distinct softening may occur, without actual fusion. When the bricks are built into a solid mass of masonry as in a furnace wall, this is hardly likely to cause serious trouble unless very marked. Where, on the other hand, the brick is supported only at the ends, as in the case of a shelf, it will be not unlikely to sag, especially if loaded in the middle. This condition is frequently due to small quantities of fluxes in the clay, which are not sufficiently large to cause actual fusion, but are large enough to bring about a slightly viscous condition, which allows the brick to yield gradually.

It will usually show up more quickly in a brick whose constituents have been finely ground and closely pressed together than in a coarse, loose textured one. In the latter case, however, the trouble is only postponed, unless, indeed, the inherent weakness of such brick causes failure by fracture before softening has time to appear. .

It has been shown by Ries and others that the fineness to which the different constituents of a firebrick have been ground has a strong influence on the point of fusion or softening point; the finer the constituents are ground the lower is the melting point. By grinding a firebrick to powder (100 mesh) and forming the powder into three sided pyramids, like Seger cones, and exposing these to temperature of 100° C. above that at which the brick will have to work, we have a good accelerated test. If the cones stand up under this discipline, the brick will withstand the conditions of service as far as heat alone is concerned.

The resistance to heat due to coarseness of grain and the looseness of texture that goes with it, cannot be considered as permanent. The action of the fluxes still continues, but more slowly, and the brick gives gradually. When destructive vapours or slags are present these soon penetrate a loose textured brick and destroy it.

Where the bricks are exposed to the action of a fusible dust, at a high temperature, as in the case of a firebox in which coal with a low fusion point ash is being burned, apparent fusion, due to the deposition and fusion of the coal ash on the firebrick of the arch, is quite common. This is strictly a case of corrosion and will be dealt with more fully under this head.

(2) *Grain and compactness.*—This subject is one about which some difference of opinion seems to exist. A plastic clay, when worked down with water until its plasticity is thoroughly developed, will after drying and burning yield a fairly homogeneous mass (as far as its solid substance is concerned). In the large majority of cases, however, such clays are unsuited to the production of firebrick when used alone, as the large amount of water taken up by the clay causes excessive shrinkage during drying and burning, and in consequence the bricks are badly cracked and deformed. To remedy this the plastic clay is usually mixed with a non-plastic material, either a non-plastic refractory clay, or with the plastic clay after the latter has been dried and burned. Bricks made in this way constitute a very large percentage of the fireclay refractories used in smelting and when well made give good results.

In the case of a brick made of, for example, 30% of a plastic clay and 70% of a non-plastic and highly refractory flint-clay, the question of what should be the ruling size of the grains of flint-clay is one of extreme importance.

There seems to be some disposition in the trade to regard with suspicion bricks made with a flint-clay or burnt clay (or "grog," as it is commonly called), which has been crushed through an 8-mesh screen, on account of the risk of cracking or spalling with changes of temperature. I believe, however, that this risk has been greatly exaggerated, and I think that this view has been gaining ground considerably during the last few years. For example, a 9 in. brick has been kept at a temperature of 1400° C. for about 6 hours, and then withdrawn and allowed to cool quickly in the open air. The brick is a fine-grained one, fully as fine as the figure quoted, and yet this severe treatment has had no effect on it.

In another place I have made use of a parallel drawn between concrete and firebrick as a guide to the understanding of the physical structure of the latter. In both cases we begin with a collection of separate non-plastic solid fragments imbedded in a plastic mass. The latter subsequently hardens in the case of cement by setting, in the case of the brick by drying and burning, and the final state of both is that of a solid mass composed of grains set in a solid matrix.

The power of cohesion of many plastic clays after drying and burning is quite considerable, figures of 500—600 lb. per square inch being not uncommon. On the other hand, the shrinkage is considerable, and there is a great tendency for the plastic clay to open in minute fissures during burning, especially when the grog is coarse, ¼ in. pieces or over. This fissuring makes the brick weak and crumbling, and opens it up to the entry of destructive gases and slags (Fig. 1). I have found that if the grog be sized, as is done with the stone and sand in concrete, the density and strength of the bricks can be greatly improved, especially if the mass be thoroughly compressed before drying and burning.

In our own work we find that with the flint-clay or grog crushed through an 8 in. mesh screen we have never been troubled with spalling, and the bricks resist the penetration of gases, etc., much better than the coarse-grained masses, and resist also the disrupting adhesion of heavy masses of incrusting material forming on the lower surface of the arches far better.

As a general rule the non-plastic flint-clays are considerably more refractory than the plastic bond-clays. Moreover, as they are not required to exert any binding effect on the mass they can be calcined before use and their fire-shrinkage thereby eliminated, or at any rate greatly reduced. The bond-clay will naturally have considerable shrinkage, owing to the amount of water it has taken up, and, as stated above, it is usually less refractory than the flint.

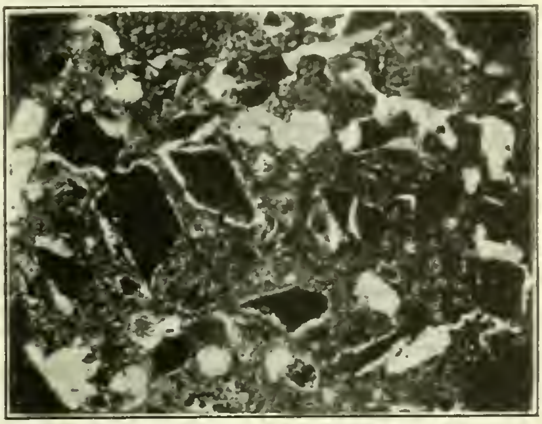

Fig. 1.

Obviously, then, it is essential to cut down the percentage of the bond-clay as low as possible when making up the brick, but if this is overdone the brick is, naturally, weak and crumbling and soon yields to penetration. If the bond-clay is excessive in amount, high porosity is likely to occur.

This is where regulation of the size of the grog comes in. By sizing the grog and then mixing the different sizes in the proper proportions, we have the minimum of space left to be filled up by the bond-clay, and can get the densest and closest mass with the least amount of bond; as stated above, it is very much like mixing concrete.

The question of machine-made *v.* handmade brick is closely tied up with the question of density. I prefer machine-made bricks. They are denser, truer to shape and freer from pores than the handmade. A well-made steam-pressed brick is, in my opinion, the best type of refractory on the market to-day.

The shapes that can be made by machine are much more limited in variety than those that can be made by hand. To engineers, who have to design furnaces, I would say—"Avoid as far as possible complicated shapes. Try to be a cubist. Use rectangular masses wherever possible, and try to keep one dimension as near to a 4½ in. maximum as the design will permit. By doing this you have a chance of getting your brick burned hard to the heart, whereas, if you have all three dimensions running high, it is very difficult to avoid underburning in the middle. As long as you keep your shapes simple you can get them machine made. It is not always possible to avoid complicated shapes, but the more you can do it the more chance the brick manufacturer has to give you satisfaction."

At the Chicago meeting of the American Iron and Steel Institute, held on October 24th, 1913, Mr. Harry W. Croft, President of the Harbison-Walker Refractories Company of Pittsburg, read a paper on "The Use and Development of Refractories in the Iron and Steel Industry," from which I will quote. The paper is an exceedingly interesting one, and the claims of machine-made or steam-pressed brick are done justice to, but the author still seems to have a warm place in his heart for the old hand-made brick.

"*Manufacture of fire clay brick.—Handmade brick.*—The clays mined and properly selected are broken into small lumps, mixed in suitable proportions and ground in the wet pan to the proper degree of fineness. The mass is then moulded into shape, tempered on a hot floor, repressed, thoroughly dried and burned at a temperature of 2600° to 2650° Fahrenheit. This is the old handmade process."

"This brick is open, porous and well adapted to withstand sudden changes of temperature. Many departures from this process have been tried and various machines employed in the different stages of manufacture. In many cases there has been a speedy return to the hand-made process, while in others a better brick has been developed for certain uses."

"*Machine made brick.*—In the high-grade brick, the most noticeable development in the machine-made product is in the manufacture of blast-furnace brick on a steam or other powerful press. The machine-made brick is denser by 7 to 8% than the hand-made one."

"*Uses of fire-clay brick—Blast furnace.*—The introduction of the water-cooled (blast) furnace, with its lining of 12 in. or less, necessitated the use of the highest grade of refractories available, and the blast-furnace operator and the brick manufacturer co-operated in making a brick of more uniform dimensions and of much greater density than heretofore, without sacrifice of refractoriness. This was accomplished by a mixture of clays giving the minimum of shrinkage and by manipulation designed to increase their bond to the maximum. The bricks were finally made into 12-in. blocks on a steam press. The result was a lining that fulfilled the expectations of all concerned."

"The furnace in which this lining was put was blown out after an eight months' run, to make some slight changes in the shell. The lining had taken on a thin coat of carbon which, when chipped off, exposed the face of the brick in many cases with the original skin intact. In making a 12-in. lining of such great density, backed by a water-cooled jacket, there was naturaly some apprehension as to whether it would spall. An examination showed that no spalling occurred. It also resisted the abrasion of the stock and channelling blast, and was practically impermeable to gases. A number of these linings have since been installed."

"At present blast-furnace men are calling for the hand-made and machine-made linings in about equal numbers. The present machine-made lining includes as many as possible of the good points of the first steam-pressed lining referred to, without all of the extra treatment of clays and consequent higher cost. In one point apparently the machine-made brick should be superior, and that is in furnace tops. It is also possible to make it of more regular and uniform dimensions than by the hand-made process, thus insuring better bricklaying."

"*Hot blast stoves.*—In hot blast stoves fire-bricks act merely as a thermal reservoir, yet are subject to widely varying temperatures, to enormous loads, and in many cases to the fluxing action of the flue dust in unwashed gases. Again we note development in the use of brick of greater density and higher refractoriness, with a decided tendency to substitute a higher for a lower gradebrick."

Mr. Ambrose N. Diehl, Superintendent of Blast Furnaces, Carnegie Steel Company, Duquesne, Pa., discussed Mr. Croft's paper from the blast-furnaceman's point of view, and some of his comments are very interesting and much to the point.

"*Machine and hand-pressed brick.*—There was formerly a prevalent opinion that hand-pressing of brick was a necessity, and that machine-pressing turned out a product which was not so durable. This feeling is passing, as the bricks made in machines have a better appearance and are truer to size, besides equalling if not exceeding the hand-pressed ones in durability. A comparison of a hand-pressed 9-in. brick with a 9-in. machine-pressed one made from the same material and manufactured in the same plant is given below. The machine-pressed brick was superior in shape and appearance."

"In examining the relative merits of machine-pressed and hand-pressed fire-brick certain determinations and simple tests are exhibited. First quality 9-in. fire-clay brick were taken as samples. As shown in the following tabulations the apparent specific gravities were compared. Those for hand-pressed brick were found to average 2·01 for five samples, and for steam-pressed brick 2·13 for five samples. Eight of these bricks were tested for spalling when chilled from high temperatures, but none showed any signs of chipping off, either when air cooled, when suddenly immersed in water, or when sprayed. One specimen of each being tested for absorption of water, it was found that each took up 4·12% of its volume or 6·02% by weight for the hand-pressed and 5·76% for the steam-pressed. By these tests it appears that the steam-pressed brick has a density 6% greater than the hand-pressed brick, and that it is just as capable of withstanding sudden changes in temperature."

"From our experience in handling brick in sheds for stock and rehandling for use, reports show a breakage loss of 50% less in the steam-pressed than the hand-pressed ones. This is also true regarding breakage in transit. Considerable money is thus saved to the consumer and the maker. For some purposes, such as irregular shapes, hand-made brick will always be preferable. The cost of laying the machine-made brick, due to its more perfect shape and less breakage in handling, will also be a great factor in its favour."

(3) *Burn.*—The question of "burn" belongs more to the manufacturing part of the subject of refractories. Naturally, the longer the time of burning and the higher the temperature, the more expensive the operation. From the consumer's point of view the burn should be carried far enough to bring out the full strength of the brick, and allow the fire-shrinkage to take place thoroughly.

There is, however, one point to which I would like to draw attention, and that is the burning of the grog or refractory non-plastic flint-clay before mixing with the plastic clay to form the brick. By doing this the fire-shrinkage of the flint-clay is eliminated altogether, and when severe conditions have to be withstood it is of undoubted advantage to do this.

The German Association of Firebrick Manufacturers has recently conducted a series of tests which show that the harder the material to be used for grog is fired, the better will be the quality of the finished brick. Lightly fired grog gives great shrinkage in the bricks.

The relation of dimension to burn has been referred to already.

(4) *Porosity.*—The porosity of a brick is usually determined by drying it, immersing it in water until its weight is constant, and reweighing it. The amount of water absorbed is a measure of the porosity of the brick. This test, however, unless care is taken to interpret it properly, may be exceedingly misleading. Strictly speaking, there is no objection to a brick containing empty spaces, so far as its heat-resisting properties are concerned. In fact, where the object is to retain heat, porosity is an advantage. When, however, the question of resistance to destructive gases, vapours and slags is concerned, porosity becomes of importance at once, and in judging a refractory it is necessary to know whether the openings are such as will admit these matters to the interior of a brick, or not.

Fig. 2 shows two bricks which have been immersed in a solution of glue, coloured by malachite green, for the same length of time, allowed to dry and broken across.

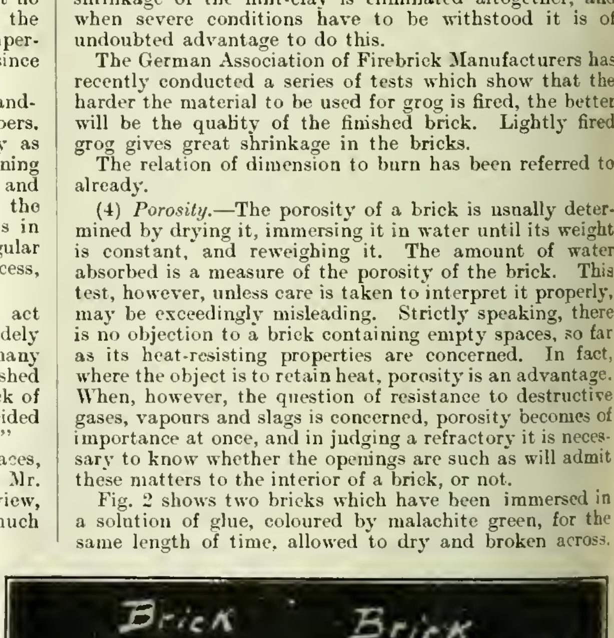

FIG. 2.

In one the glue has barely penetrated below the surface and the specimen appears white with a thin green selvage, showing somewhat deeper penetration at a few spots. In the other brick the glue has sunk well into the brick, somewhat irregularly, and its line of entry is in many places indicated by fissures stained green. Both these bricks would give a fairly high porosity test by the water method, but the behaviour of the two bricks towards a more viscous fluid like the glue solution, is radically distinct. Brick No. 1 is a strongly compressed, well-ground, rather fine-grained mass, the spaces in which are due simply to the evaporation of the water with which the plastic clay was made up and to the shrinkage on burning. Brick No. 2 is a coarse, loosely aggregated mass in which the percentage of bond-clay is insufficient to fill up the spaces between the pieces of grog. In the first case the viscous liquid refused to enter the brick ; in the latter it readily entered the coarser channels within the brick.

The result of this test agrees excellently with the behaviour of the two types in actual service. I shall go further into this branch of my subject when speaking of penetration. For the present I merely reiterate that all porosity tests must be checked by careful inspection of the mass, so that capillary pores which are relatively harmless may be distinguished from coarse openings which allow destructive agents to enter the brick. The glue test referred to above is a useful indication.

(5) *Resistance to penetration, corrosion, and chemical change generally.*—The subject of penetration and corrosion by gases and slags furnishes a series of problems in physical chemistry of a highly interesting order, both from the scientific and technical points of view. Penetration *per se* would be of little importance if unaccompanied by alteration of the clay. This, however, is very unusual. Almost all slags attack fire-clay more or less, and the attack proceeds with greater rapidity, if the corrosive influences can gain entrance into the interior of the refractory mass, than if they are confined to the surface.

In this connection, an item of considerable importance is the skin of the brick. When the plastic mass of clay and grog is submitted to pressure in the mould, the water is forced to the surface, carrying with it a little of the bond-clay. As the brick dries this latter is left on the surface, and during the burning it forms a dense layer over the brick, which forms the first line of defence. The resistance of this skin in a well-made brick is remarkable. In our work we find that it will block the penetration of oxide of zinc in the furnaces so completely that when the incrustation of this compound which forms on the lower surface of the arches is knocked away, or falls off with its own weight, the pattern of the brickwork shows up sharp and clear on the surface of the attachment of the mass. In poorly made brick, where the grains of flint-clay proper show through the skin, the mass of incrustation takes such firm hold of the irregular surface that pieces of brick are torn away when the mass comes down, and the arch is soon destroyed.

I should consider the absence of a good firm skin sufficient cause for rejecting a brick for our work. On the other hand, I should not consider a test for resistance to corrosion a fair one, unless it were carried out on the natural surface or skin of the brick. Tests on a fractured surface are for our purposes misleading.

Consider first the penetration of a brick by a liquid slag, supposing that the brick forms part of a furnace lining which is heated from within. The brick, therefore, will become progressively cooler away from the laboratory of the furnace. Let us further suppose that the brick is of a hard-pressed compact type, presenting only capillary openings. The liquid slag will proceed to enter the pores of the brick and attack the clay. As it absorbs the clay matter its freezing point rises until it solidifies, and in the case of a fine-grained brick the amount of slag that can enter is small and soon saturated. Under these circumstances a glaze forms on the brick, the slag penetrating for a quarter of an inch or so in capillary veinlets. The action will then go no further.

In the case of a brick which shows fissures and cracks the case is very different. The slag gets in at these points in considerable quantity, and by the time it has saturated itself with the clay it has eaten out a considerable hole. Into this more slag can get, and under such circumstances the brick is soon corroded away.

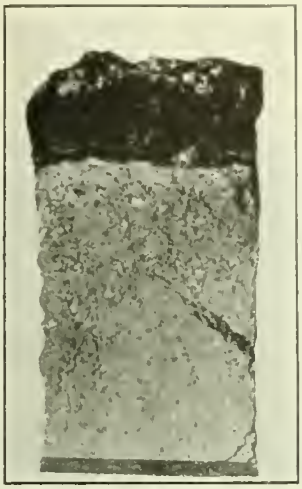

Fig. 3.

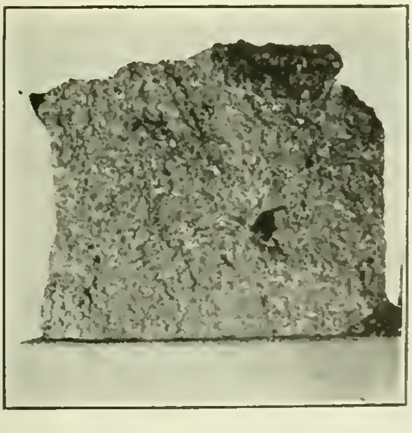

Fig. 4.

The photographs 3 and 4 show these two conditions well. In the first case the slag has failed to penetrate and forms a layer on the surface. In the second it has sunk in and destroyed the surface of the brick.

These considerations have led us to a method of testing which enables us to form a pretty good idea how a given brick will resist a specified slag within specified temperature limits.

A one-half 9 in. brick is a convenient size to handle, and it should be set up with one edge uppermost, as that is the surface which will probably be exposed in the furnace. The natural surface of the brick should always be tested as explained above. The slag, or slag constituents, should be ground to powder and made up into a block about 3 in. by $1\frac{1}{2}$ in. by 1 in. with a little starch, and dried. The slag block is then laid on the brick and the brick is placed in a furnace and brought up to about 100° C. above the working temperature. The slag block melts and flows down over the surface of the brick, attacking it on three faces.

The next two figures (6 and 7) are micro-photographs of a good brick before and after the test. The first one shows the pores with somewhat rounded contours, exaggerated by grinding. The latter shows the pores filled with slag.

An interesting example of the destructive effect of penetration was shown by determination of the melting points of certain refractory masses after various periods of exposure to a slag. After three months' service at a temperature of 1250° to 1350° C. it was found that the fusion point had fallen from 1700° to 1400° C. and failure came soon afterwards.

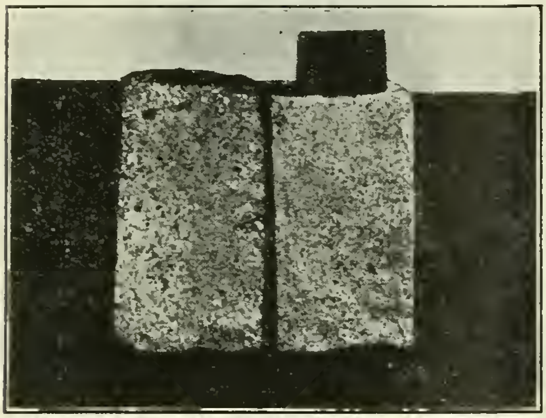

Fig. 5.

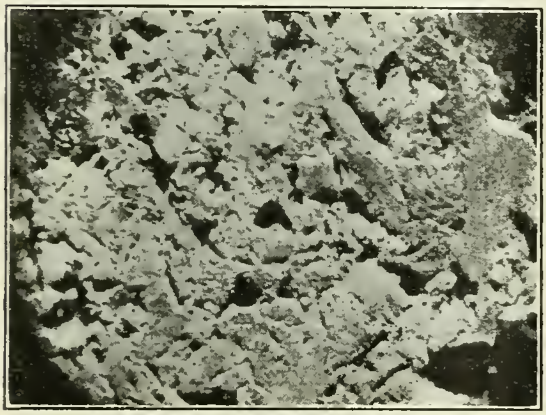

Fig. 6.

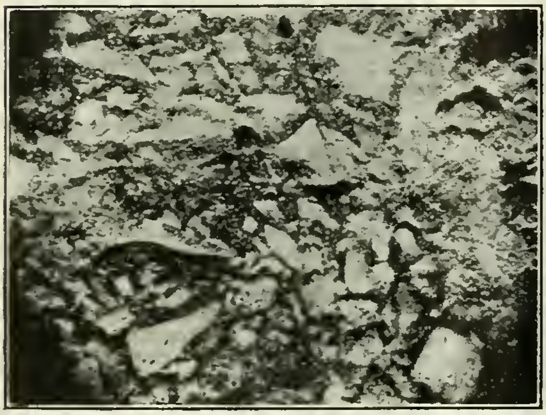

Fig. 7.

Another case is that of a loose-textured brick which has been immersed in molten spelter. The mass is completely impregnated with the metal as shown by the photomicrograph 8.

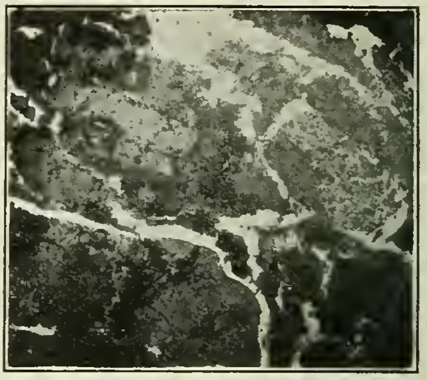

Fig. 8.

The changes that take place in the substance of a spelter retort, due to the action of zinc, constitute, perhaps, one of the most remarkable cases of chemical change in a working refractory known, because they take place at temperatures below the fusion point of the bodies entering into the reaction.

We find that after a spelter retort has been in service for some days it changes in colour from a light buff to a dark blue with white spots, and becomes a good deal denser. These changes are accompanied by a more or less complete chemical decomposition of the clay substance of the retort, the alumina of the clay combining with zinc oxide to form zinc spinel, $ZnO.Al_2O_3$, and the silica of the clay being liberated in the form of tridymite.

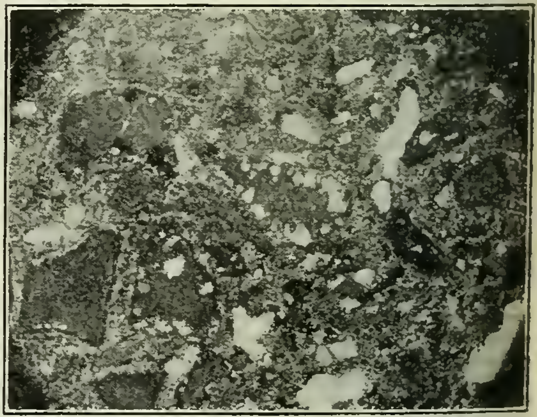

Fig. 9.

Figure 9 shows a micrograph taken from a slice of an old retort. The large grains are the grog, which being denser and more resistant than the bond are largely unaltered as yet. The granular matter is the zinc spinel, which occurs in grains or minute octahedra, and are seen forming fringes around the grog grains, showing that their decomposition is in progress.

In this case we have to deal with an actual change in the chemical composition of the refractory mass from a silicate of alumina to a mixture of zinc aluminate, or spinel, free silica and absorbed slag. Fortunately, however, this change is not accompanied by any deleterious results as far as the fitness of the retort for its particular purpose is concerned.

The longer my acquaintance with refractories becomes, the more I am convinced of the necessity that exists for the study of the relation of the charge to the furnace lining.

The behaviour of alumina in slags is a matter about which there is considerable difference of opinion. Mr. G. E. Johnson, jun., read a paper at the Cleveland meeting of the American Institute of Mining Engineers, in which he stated that he had seen a blast-furnace slag containing 30% of alumina running perfectly freely and giving no trouble. The general consensus of opinion, however, is that alumina causes slags to become viscous and difficult to tap, quantities as low as 6% being objectionable. This latter contention I can endorse from my own experience, mentioning also that I have also had experience of a 12% Al_2O_3 slag which behaved excellently. Of course part of the discrepancy might be explained as being due to differences of temperature, but this did not seem to be the whole of it, so I decided to investigate a little further.

The method used was to form the lime, silica, and alumina, which were all in powdered form, into a cube, with a trace of starch, the cube being formed around a spirally twisted Pt-Ir wire. The cube was about ⅝ in. a side, and was suspended in a crucible in an electric furnace provided with a pyrometer couple and the temperature brought up.

The first sign of fusion is the melting off of the corners of the cube. Shortly afterwards the cube rounds off and slips from the wire. A liquid mobile slag will be run off completely like water. A fairly stiff one will flow off slowly, leaving a thread drawn out behind it, whilst a very stiff one will draw into a pear-shaped mass and be very reluctant to leave the wire.

CaO. SiO₂.			2CaO.SiO₂.		
Al_2O_3%.	Fusion point.	Character.	Al_2O_3%.	Fusion point.	Character.
—	1460° C.	Stiff	—	1382° C.	Stiff
6·8	1318° C.	Fairly liquid	6·8	1422° C.	Very stiff
13·3	1296° C.	Very liquid	13·3	1468° C.	„ „
19·6	1272° C.	„ „	19·6	1453° C.	„ „

We experimented with a large number of mixes, and the results of one set are shown in the accompanying table. It will be noticed that with the metasilicate addition of Al_2O_3 brings down the melting point and liquefies the slag, whilst with the orthosilicate addition of alumina raises the melting point and stiffens the slag. This suggests a possible explanation for some of the differences of opinion referred to above.

Now, I have frequently heard it stated that heavy liming when blowing in a blast furnace tends to prevent scouring and cutting away of the lining, and my own experience confirms it, whilst the figures in the table suggest an explanation. With high lime, as the slag attacks the brick, the tendency will be to form a sticky, difficultly fusible, viscous glaze over the lining, which will collect a defensive covering of small coke, etc., whilst with low liming a thin, readily fusible slag will form, and scour the lining very efficiently.

(6) *Truth of surface and dimensions.*—The accuracy of the dimensions and surface of a brick is of great importance from the penetration point of view. When bricks are warped or untrue to dimension, necessitating wide courses, penetration is liable to occur. The clay grout which is used between the bricks is a poor substitute for brick and should be reduced to a minimum. It is an axiom amounting to a platitude that poor brick-laying, whether caused by lack of truth in the bricks themselves, or careless work on the part of the masons, is as bad for the furnace as a poor brick.

(7) *Conductivity.*—The factors which control the conductivity of refractory masses are getting to be better understood and I expect soon to see more authentic figures than any that are available to-day.

Conductivity appeals to the user in two different ways, according to whether it is required to retain heat inside the space enclosed by the brick or transmit heat through the brick. In the first case insulation is aimed at, and in the second case transmission.

Now, my own experience, and that of several others, indicates that a coarse-grained, loose-textured, porous mass makes for low conductivity, and a fine-grained, close-textured, compact mass, for high conductivity. The checker work in a blast furnace stove is a case in point. Here it is desired to absorb heat into the brick as quickly and completely as possible and return it to the air in the same way, and the tendency to-day is to go over more and more to dense and hard-burned brick for this purpose, as stated by Mr. Croft in the quotation given.

When the object is to retain heat, loosely compacted masses are more effective than close-textured ones. An extreme case of this condition I worked out some time ago. The questions at issue were: How many rings of brick would it be economical to place over a certain furnace arch in order to retain the heat, and what class of brick would be best? Or, could something more effective than brick be used? We started out with 1 in. thickness of firebrick in three rings. Under the third ring and on top of the furnace arch four thermo-couples were placed at different points, and the temperature was noted from day to day, until an average figure was obtained for the temperature on top of the furnace arch. Then the three rings were taken off and other materials were tried. Eventually we found the most economical material was boiler ashes screened through ¼ in. mesh: 3½ in. of this kept the top of the furnace arch as hot as 12 in. of fairly compact firebrick.

The lesson is fairly obvious, yet it is not uncommon to find figures published for the conductivity of firebrick without any mention being made of grind, burn, or porosity. Under these circumstances it is hardly surprising that the figures frequently do not check.

In Havard's book on Refractories and Furnaces the author draws attention to the necessity of knowledge of the burn-temperature of a brick in figuring on the conductivity. On page 280 Havard quotes a table of conductivities, giving amongst others the following relative conductivities:—

Magnesia brick	0·0074
Chromite brick	0·0057
Fire-clay brick	0·0042
Checker brick	0·0039
Gas-retort brick	0·0038
Silica brick	0·0020

Except for the statement that the figures selected are representative of the ordinary commercial grade of refractory materials, we are left in a good deal of doubt as to the nature and history of these samples.

In a later series we have the following:—

Magnesia brick	(burned at 1050)	0·0058
„ „	(burned at 1300)	0·0065
Chromite brick	(burned at 1300)	0·0034
Fire-clay brick	(burned at 1050)	0·0037
„ „	(burned at 1300)	0·0050
Checker brick	(burned)	0·0039
Silica brick	(burned at 1050)	0·0020
	(burned at 1300)	0·0031

These figures show considerable variation amongst themselves, but in general they show that the temperature of burning has a profound influence on the conductivity, particularly in fireclay-brick. I believe that compactness also plays a strong part. For example, the fire-clay brick that was burned at 1050° C. had a porosity of 30·8% of volume, and that burned at 1300° of 24·1%. It is a pity that bricks of a porosity of less than 10% were not tried. My own results suggest that they would have gone still higher.

This last group of figures is due to Wologdine, and is a great advance on anything preceding them, although I think the method used might be improved upon. The specimens tested were only 2 in. thick and were exposed only on one side to the heat. Under these circumstances the heat gradient would be exceedingly steep much more so than under working conditions.

Marshall, in a recent number of "Mechanical and Chemical Engineering," has challenged Wologdine's figure for silica brick, pointing out that these bricks are burned at a temperature considerably over 1300° C., and therefore that it is reasonable to suppose that the conductivity will be still higher.

I am strongly inclined to believe that compactness, grain, and temperature of burning have more to do with the conductivity of a refractory mass than its composition, within limits. Fire-clay and magnesite can be made to overlap, and so probably can fire-clay and silica. Under these circumstances figures like those first given are of little practical value.

In the discussion of Mr. Croft's paper Mr. Diehl concluded by saying that "refractories . . . demand an exhaustive and co-operative study from both the consumer's end, where new materials and progressive practices result in ever-changing demands on the refractory materials, and from the manufacturing end, where the proper material should be adjusted to meet the ever-changing conditions arising from such progression. By a clear understanding of the exact conditions to be met and the concerted efforts of both parties, there is no question but that the present assumed amortisation period can be greatly extended with benefit to all parties concerned."

I want to emphasise in the strongest possible way this need for co-operative study from both the consumer's end and the manufacturing end referred to by Mr. Diehl. If the manufacturers are to meet successfully the changing and increasingly severe conditions that refractories have to face to-day, co-operation on the part of the consumers is essential. When a lining fails, the dead lining needs careful study. Working temperatures, slags, gases, as far as possible every physical and chemical condition to which the bricks are exposed should be known, and the manufacturer fully acquainted with what his product has got to stand. We have tried to act up to this principle and have found that it pays. The more of us that play the game in this way, the easier it will be for us to get what we want, and the man who orders "fire-brick," and uses the contents of the resulting car indiscriminately on several different clases of work, will have himself to blame if the brick fails on some of them.

I believe that the interest in the subject is growing and that the outlook is decidedly hopeful.

SUBSTITUTES FOR AUTOMOBILE GASOLINE.

BY GAIL MERSEREAU.

During the last few years the development of the automobile and the greatly increased use of gasoline in chemical extraction work, combined with the partial exhaustion of the crude petroleums rich in gasoline, has more than doubled the cost value of this product.

During the last year or two there has been a great demand for some cheaper substitute for use in the automobile engine. The publication in the daily papers of offers of prizes for a solution of the problem has spurred on inventors to work out many ingenious possible solutions.

The Diesel type of engine is being used on some motor boats designed for racing and on some trucks, but can never find favour in the ordinary passenger automobile. This is because of the necessity of preheating the vaporiser. The ordinary user of the automobile will never take the trouble in order to save a few cents on his fuel.

Denatured alcohol can be used readily. It is clean, not so dangerous as gasoline, and will give three-fourths as much mileage as gasoline per gallon (and sometimes better); but it costs much more than gasoline and it hardly seems probable that the price will decrease greatly in the future.

Kerosene has been used and is being used more and more in heavy trucking. In order to use it in the ordinary motor it is simply necessary to heat the carburettor by means of the exhaust gases. The motor must be started with gasoline or alcohol. There is no difficulty in this, as it is easy to attach a small supplementary tank.

The great drawback to the use of kerosene is its production of polymerised products in the cylinder and the formation of coke and lampblack from these products. This polymerisation reaction takes place apparently only in the larger globules of the kerosene which enter the cylinder. The outside layer of oil is partially oxydised, with the formation of high boiling polymers. These then condense on the relatively cool sides of the cylinder. Further explosions in the cylinder oxidise and burn off more and more of the hydrogen atoms until the material becomes nearly pure carbon.

Alcohol, injected into the cylinders, while still hot, at the end of the day's work, will clean out the greater proportion of these troublesome products. This is too much trouble for the ordinary automobile owner.

To obviate the difficulties above mentioned, namely, the preheating of the carburettor and the production of coke and lampblack, a great many mixtures have been proposed.

All kinds of low boiling point constituents have been added, so that the carburettor need not be preheated, and all kinds of oxygen containing materials have been added to prevent the dehydrogenation and polymerisation of the molecule.

Many mixtures of kerosene with acetone, other ketones, alcohol, casing-head gasolene, methyl and ethyl ether, etc., have been proposed and tried. Many of these mixtures work very well, but the average owner wants a fuel that can be purchased at any point on his travels. Such mixtures would usually be found only at the larger towns.

The Southey carburettor[*] or rather "gasifier" seems to work very satisfactorily. In this apparatus the kerosene is sprayed into a chamber, where the spray comes into contact with a small amount of air. A partial combustion takes place, just enough air being admitted to cause sufficient combustion to furnish the heat necessary to gasify the oil. This combustion is started by a spark, but after a minute or two the spark may be cut off. The chamber is so arranged that the large globules of oil from the spray drop to the bottom and are returned to the main tank.

The apparatus works very well in practice. It gives practically no trouble from coking or the formation of evil-smelling products of partial combustion. Kerosene of very much the same composition can be bought all over the world. This certainly seems to be a ready solution of the problem.

Many methods[†] for the manufacture of gasoline from heavy oils have been proposed and quite a number patented. The principle on which most of these work is the distillation of the heavy oil under pressure. The first lots of these gasolines to reach the New York market a year or so ago, were straw-coloured, ill-smelling oils. They had been distilled carelessly and contained considerable proportions of very heavy oils, but during the last few months the quality has been much improved. These gasolines made by high pressure distillation are now being manufactured on a very large scale in this country, but the price is maintained very close to that of the natural petroleum product.

THE THEORETICAL PROBLEMS INVOLVED IN THE CRACKING OF OILS.

BY WALTER F. RITTMAN.

Until recently it has been common to consider the so-called tar and petroleum oils as two separate and distinct materials. The present conceptions of organic chemistry, however, avoid any sharp differentiations, such as those between the methane and benzene series. Instead, all hydrocarbons are considered together, and indicated as differing only in their hydrogen content. The latter classification is more fortunate because in the course of a dozen petroleums from different fields nearly all the various hydrocarbon series are represented. Many petroleums contain considerable percentages of the same constituents that are found in oil or water gas tar. In fact, it is possible to find two petroleums which differ as much in composition as certain petroleums differ from so-called tar.

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[*] Southey, Eng. Pat. 27,612, Dec. 8, 1911.

[†] For example, Burton, U.S. Pat. 1,049,667, Jan. 7, 1913; Leffer, Eng. Pat. 2328, Jan. 29, 1912.

In dealing with the technical use of petroleum it can be said that we already know something about its end products; it at least appears that we know more about the end products than we do about the application of the most favourable conditions for obtaining maximum yields of the desired end products. It is known that valuable gasoline and illuminating gas can be obtained by cracking petroleum. What we want to know is how to increase the yields of gasoline or illuminating gas from a given amount of oil. It is questionable how much increase can be obtained by the perfection of the well-known methods now in use. Radical increases can result only from the application of radical scientific principles.

In the production of petroleum end products practically all the variables of chemical reactions are involved. While this fact complicates the problem, it makes the field of research more fertile and greatly enlarges its possibilities. We are dealing with chemistry involving both liquids and gases, and with all the physical and chemical principles which apply to both of them. Mechanism of reaction, duration of temperature, contact surface, catalysis, temperature, pressure, and concentration conditions are all vitally important in the cracking of oils. They are all interesting, but in the time allotted me I shall deal with only the last three: temperature, pressure, and concentration.

The information that endothermic reactions work better at high temperatures while exothermic reactions work better at low temperatures is important, but this information does not become fully valuable until we regard as well the chemical equilibria between the various reacting constituents. The subject of chemical equilibrium is studied by practically all undergraduates, but its application to industrial problems, despite its value wherever applied, is still limited. There are very few experimental data dealing with equilibria between hydrocarbon vapours and gases; the principles affecting equilibria in fields which do not involve hydrocarbons are well known, however. There is no reason why these same principles should not be applied directly to hydrocarbons. Doing so leads to theoretical conclusions which suggest experimental research. Application of the principles indicates that the entire problem of cracking oils revolves about the equilibrium or kinetic conception of reaction.

It has been experimentally determined that when hydrogen iodide (HI) is heated, there is a definite percentage of decomposition to H_2 and I_2, dependent upon the temperature of the system. Only at extremes of temperature do the equilibrium conditions carry the reaction completely in one direction. As the temperature is increased the percentage of decomposition increases. Equilibrium conditions prevail when the square of the partial pressure of HI, divided by the product of the partial pressures of H_2 and I_2, equals a constant.

The equilibrium relationships for hydrocarbon reactions have not been determined, but because of the validity of the equilibrium principles and the reversible nature of all chemical reactions investigated, we are reasonably safe in applying the same principles and reasonings to hydrocarbon reactions. The equilibrium considerations are important whatever end it is desired to reach, whether illuminating gas, gasoline, or some other products are the ones being sought. In some cases it will be found desirable to permit the reaction to reach an equilibrium at a relatively high temperature, whereas in other equally important hydrocarbon reactions the equilibrium of this high temperature would be destructive. In either case the equilibrium equation would serve as an indication of the degree of success that might be expected, as well as of the direction the reaction would take. Unfortunately practically none of the numerical values of the equilibrium constants for hydrocarbon reactions have been experimentally determined.

The application of thermodynamic equilibria to hydrocarbons can be illustrated by one or two simple examples. Let us consider the following reactions and their constants (which are approximate):—

	K_{600}	K_{900}
$C_2H_6 \rightleftarrows C_2H_4 + 2H$	0·0027	1·28
$3C_2H_2 \rightleftarrows C_6H_6$	$9 \cdot 10^{33}$	$1{\cdot}2 \times 10^{13}$
$2CH_4 \rightleftarrows C_2H_4 + 2H_2$	0·0000001	0·0004

Any number of others might be taken. Important mathematical expressions which give approximations for the values of these equilibrium constants for hydrocarbons can be found in works on thermodynamics and physical chemistry.* As soon as more of them are known we shall have a better understanding of temperature conditions as related to other conditions in oil cracking processes.

The application of different pressures in the sphere of reaction of the cracking process has been limited. Numerous patents and articles can be found indicating the use of increased pressure in the production of gasoline and illuminating gas. It has long been known that lubricating oils can be recovered more efficiently by distillation under partial vacuum. The distillation of aniline under diminished pressure through the use of steam is common laboratory practice. In such cases, however, the object of the process is not to crack an oil, but to avoid cracking it. So far, the effect of greatly diminished pressure on oil cracking processes is practically uncovered. For a detailed consideration of this aspect of oil cracking see the articles on "Thermal Reactions in Carburetting Water Gas," by Whitaker and Rittman, Jour. Ind. and Eng. Chem., Vol. 6, pp. 383 and 472. To show the effect of varying the pressure when cracking an oil, consider the general reaction, $A \rightleftarrows 2B$, where equilibrium exists when $KA=B^2$. This equilibrium constant is identical with the ones referred to under temperature, and deals with the relative partial pressures at equilibrium under differing conditions of pressure. For numerical illustration assume the value of K to be equal to 1. From this one finds for partial pressures, when $A=100$, $B=10$, or when $A=0{\cdot}01$, $B=0{\cdot}1$. In the first case the partial pressure of A is ten times as great as that of B; in the second case the partial pressure of A is only one-tenth as large as the partial pressure of B. In other words, by simply changing the total pressure on the system and keeping all other conditions constant, the ratio of A to B for the pressures shown has been divided by 100. This change can also be observed by plotting the parabola, $B^2=KA$, where A and B are variables. From this it becomes evident that diminished pressure increases dissociation or decomposition to the gaseous state, whereas increased pressure decreases dissociation. The manufacture of gas under diminished pressure, as reported in the above-mentioned articles, illustrates the former; the present methods of manufacturing gasoline from heavy oils by heating them under increased pressure illustrates the latter.

In dealing with the influence of concentration changes we are applying one of the common laws of physical chemistry. In the dissociation of HI by heat according to equation, $2HI \rightleftarrows H_2 + I_2$, $K = \frac{P_{H_2}P_{I_2}}{P^2_{HI}}$ it is a well-known fact that less of the HI will dissociate in an atmosphere of H_2 or I_2 than in an atmosphere of nitrogen or any other inert gas. This can be observed from a mathematical consideration of equilibrium conditions, purely aside from the chemistry involved. Since the value of K does not change at any given temperature, if the partial pressure of H_2 is increased, the partial pressure of I_2 necessarily decreases unless the partial pressure of HI is increased simultaneously. Assume that the H_2 of the example cited were in excess to the extent that 50%, instead of 10%, of the resultant mixture were hydrogen; what, in this case, would be the partial pressures of HI and I_2, assuming the total pressure to be equal to 1 atmosphere? $0{\cdot}5=$partial pressure H_2, $x=$partial pressure HI, $0{\cdot}5-x=$ partial pressure I_2.

$$K = \frac{P_{H_2}P_{I_2}}{P^2_{HI}} = \qquad 0{\cdot}0156 = \frac{(0{\cdot}5)\ (0{\cdot}5-x)}{x^2}$$

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* Nernst, Theoretical Chemistry (seventh edition). Jellinek Physikalische Chemie der Gasreaktionen Sackur Thermochemie und Thermodynamik. Morgan, The Elements of Physical Chemistry.

Solving X=0·492 HI. 0·5—X=0·008 I_2, 0·5 H_2. 49·2% HI, 0·8% I_2, 50·0% H_2. Thus, by having a large excess of hydrogen it is possible to eliminate, practically, the uncombined iodine. Or looking at the problem in another way, it is observed that almost none of the HI is dissociated, because of the excess of one of the end products of decomposition. In cracking oil hydrogen and methane are always among the end products.

Drawing an analogy one would expect that cracking petroleum in the presence of an end product, such as hydrogen, would lessen oil decomposition; in ordinary practice some oil decomposition is necessary to produce the hydrogen and other gases required by the equilibrium at that temperature. This decomposition might be avoided by the addition of the necessary hydrogen or other gases from an outside source. In experiments carried out in the laboratory it was found that when oil is cracked in the presence of an excess of hydrogen, not only does none of the hydrogen of the oil split off, but a considerable part of the added hydrogen actually enters into combination. This means that it is not necessary to generate new gaseous end products at the expense of more valuable hydrocarbons.

In conclusion it appears that through the application of physical chemical principles to the cracking of oil, a better control of and greater flexibility in the resultant end products can be expected.

Scottish Section.

Meeting held at Glasgow on Tuesday, 21st April, 1914.

DR. THOMAS EWAN IN THE CHAIR.

DETERMINATION OF NITROGEN IN GUNCOTTON BY MEANS OF THE NITROMETER.

BY E. G. BECKETT, PH.D.

On account of its simplicity, convenience, and speed, Lunge's method of determining nitrogen in nitrocellulose is now in general use throughout the world. In this method the nitrocellulose is shaken up with mercury and sulphuric acid in a nitrometer and the nitric oxide gas, which is formed by reduction of the nitrates and nitrites, is measured.

During the past ten years, several articles dealing with this subject have appeared, which might arouse scepticism as to the analytical value of the results obtained. Thus Newfield and Marx (J. Amer. Chem. Soc., 1906, **28**, 877), Berl and Smith (Ber. 1907, **40**, 903), Poppenborg and Stephan (Z. ges. Schiess u. Sprengstoffw., 1909, **4**, 350), Berl and Jurrissen (Z. angew. Chem., 1910, **23**, 241), and Marqueyrol and Florentin (Bull. Soc. Chim. France, 1911, **9**, 231) mention instances in which slight modifications of the method have led to the detection of considerable impurities in the nitric oxide evolved. Now, the accuracy of the method depends upon the truth of the assumptions that the gas evolved is pure nitric oxide and that all the nitric acid nitrogen is in the form of nitric oxide. The following research was therefore carried out to ascertain the reliability of the method for guncotton by analysis of the gas evolved and of the residual sulphuric acid.

Besides the ordinary nitrometer method as recommended by Lunge, a modification has also been in use, which, according to some chemists gives results which differ from those given by the original method by as much as 0·25 in the percentage of nitrogen found. Although it was known that these differences exist, it was not known which method gives the truer result.

In the original method, subsequently referred to as Method A, the guncotton is shaken up with sulphuric acid and mercury without the addition of water. In the modified method—Method B—one c.c. of water is added to the 15 c.c. of sulphuric acid and guncotton just before the mixture is shaken.

Details of procedure.—Dry guncotton was sifted and mixed and 0·53 grm. was placed in each of six small weighing bottles. These were placed open in a steam bath for two hours, then closed and kept in a desiccator over calcium chloride.

For each determination, one of the bottles was placed in the balance case for about 20 minutes and weighed accurately and the guncotton shaken into the cup of the nitrometer. The empty weighing bottle was placed in the balance case for 10 minutes and weighed. The guncotton was washed down into the nitrometer with successive quantities of 5, 2½, 2½, and 5 c.c. of 96·5% sulphuric acid (made by dilution from 98·2% pure acid). In the determinations by Method B, one c.c. of water was added at this point, before shaking; in Method A, the shaking was proceeded with without the addition of water. In both methods the nitrometer was shaken for 3 minutes, and then shaken again for one minute after allowing the mercury globules to settle. The pressure of the gas was reduced to slightly below atmospheric pressure and the nitrometer allowed to stand for ¼ of an hour in this

Results:—

Method A.

Weight of guncotton grm.	Gas c.c.	Temp. ° C.	Press. m.m.	% N *uncorrected	Gas residue.		Sulphuric acid residue.	
					CO_2+CO c.c.	N_2 c.c.	Ammonia found c.c.	N calcutd. as c.c NO.
0·5203	116·83	20·75	759·0	13·04	0·27	0·63	—	—
0·5166	114·7	15·3	754·0	13·05	0·25	0·65	3·2 N/100	0·70
0·5071	113·35	15·3	748·35	13·04	0·20	0·60	3·6 N/100	0·79
	Mean			13·045	0·24	0·63	3·4 N/100	0·75

"Uncorrected" means that neither the impurities in the nitric oxide nor the nitrogen in the sulphuric acid residue are taken into accoun

Method B.

Weight of guncotton grm.	Gas c.c.	Temp. ° C.	Press. m.m.	% N uncorrected	Gas residue.		Sulphuric acid residue.	
					CO_2+CO c.c.	N_2 c.c.	Ammonia found c.c.	N calculd. as c NO.
0·5133	115 25	17·7	755·25	13·11	0·5	0·6	—	—
0·5167	116·15	16·85	752·0	13·11	0·4	0·55	3·5 N/100	0·77
0·5133	115·8	16·95	749·75	13·11	0·4	0·6	3·6 N/100	0·79
	Mean			13·11	0·43	0·58	3·5 N/100	0·78

condition in order to give the nitric oxide every chance of escaping from the sulphuric acid. The gas was then transferred to a second nitrometer—the measuring nitrometer—where it was allowed to remain for a quarter of an hour before being measured. This measuring nitrometer was surrounded by a water jacket, and had a water pressure gauge for determining accurately when the gas inside the nitrometer was at atmospheric pressure. The sulphuric acid residue was at the same time removed from the first nitrometer—the shaking nitrometer—transferred to a Kjeldahl flask, and the nitrogen determined by Kjeldahl's method as described below.

Analysis of the nitric oxide.—After the nitric oxide had been measured, it was shaken with 20—30 c.c. of concentrated ferrous sulphate solution. The gas residue was then transferred to a small gas burette where it was successively treated with ferrous sulphate, potassium hydroxide, ammoniacal cuprous chloride, in order to determine the carbon dioxide, carbon monoxide and nitrogen. After it had been found that very little carbon dioxide—at the most 0·03 c.c.—was in the residue, the treatment with potassium hydroxide was discontinued and the carbon monoxide and carbon dioxide determined together by absorption in ammoniacal cuprous chloride.

Estimation of nitrogen in the sulphuric acid residues.—The sulphuric acid from the nitrometer determination was placed in a stoppered separating funnel, treated with 5 c.c. of a 1% solution of potassium permanganate in sulphuric acid to oxidise all the nitric oxide to nitric acid and then 2 grms. of salicylic acid was added. The stopper was then inserted and the acids mixed. After standing for half an hour, the mixture was allowed to flow into a round-bottomed Jena flask and the funnel washed with 20 c.c. of sulphuric acid. The mixture was then slightly warmed to nitrate the salicylic acid as far as possible, cooled and 2 grms. of zinc dust added gradually. The mixture was allowed to stand for half an hour, heated over a small flame till all the zinc was dissolved and then boiled vigorously for 15 minutes; 15 grms. of sodium sulphate was then added and the solution boiled until colourless. The ammonia was determined in the usual way. The method was tested with a synthetic solution of concentrated nitric acid in concentrated sulphuric acid and found to yield the following results:—0·947, 0·947, 0·948% of nitrogen instead of 0·956%.

The difference, 0·065%, between the percentage of nitrogen by these two methods was smaller than was expected, for chemists had in former years obtained results differing by as much as 0·25%. The following attempts were therefore made to account for the discrepancy.

Effect of stronger sulphuric acid.—It was thought possible that greater differences might be obtained if sulphuric acid of a higher concentration were used. The following experiments were therefore carried out by Method B with the same guncotton, 98·2% acid being used:—

Weight of Guncotton grm.	Gas c.c.	Temp. ° C.	Press. m.m.	% N. uncorrected.
0·5131	115·5	20·35	762·15	13·14
0·5161	114·95	19·2	765·9	13·2
			Mean	13·13

It will thus be seen that the employment of higher concentrations of acid produces practically no increase in the quantity of gas evolved, due to the addition of water.

Effect of using warm mercury.—An experiment was carried out by Method B with the mercury in the nitrometer heated to 25° or 30° C., but the result 13·10% N did not differ from the others obtained by the same method. The heat evolved on the addition of 1 c.c. of water to 15 c.c. of concentrated sulphuric acid is evidently so great that it is not appreciably increased by warming the mercury.

Equalisation of temperatures inside and outside nitrometer.—It was also thought that the equalisation of temperature between the gas inside the ordinary non-jacketed nitrometer and the atmosphere of the room may not take place within the time recommended for the purpose in the method. The greater heat caused by the addition of the one c.c. of water in Method B might then account for the differences between the above results and those obtained by other chemists.

A dummy nitrometer with a thermometer inside was heated in a steam bath, taken out and allowed to cool in the room. The temperatures inside and outside the nitrometer were observed every 5 minutes.

Time—Min.	Temp. inside.	Temp. outside.	Difference.
0	36·0	15·7	20·3
5	23·0	15·8	7·2
10	18·8	15·5	3·3
15	17·4	16·0	1·4
20	17·0	16·0	1·0
25	16·8	15·6	1·2
30	16·6	15·6	1·0

These results show that after twenty minutes, it is unlikely that a difference of temperature greater than 1° C. would exist between the inside and the outside of the nitrometer, and a difference of 1° C. would account for a difference in the results of only 0·03, making altogether a difference of 0·09 to 0·12 in the percentage of nitrogen found by the two methods.

Thus, all attempts to obtain or account for greater differences than those described above failed, and the only possible explanation left was that the sulphuric acid used in this research was different in purity from that used previously.

Cause of difference in the results by the two methods.—It will be noticed that the difference of 0·065% between the two methods is unaccounted for by the analysis of the gas and of the residual sulphuric acid. The amount of nitrogen left in the sulphuric acid showed no difference whatsoever and it surely would have done so, had the difference of 0·065% been caused by a greater evolution of nitric oxide. It may therefore be assumed that the difference was entirely caused by impurities in the gas. The results obtained, however, accounted for a difference of only 0·2 c.c., which was observed in the quantity of CO, the nitrogen being the same in both methods, whereas, the difference of 0·065% demands a difference of about 0·6 c.c.

It must be remembered that in analysing the nitric oxide, it had been shaken up with 20—30 c.c. of concentrated ferrous sulphate solution, this quantity being necessary for the absorption of over 100 c.c. of nitric oxide. Such a quantity of liquid is liable to absorb not only all the carbon dioxide and sulphur dioxide contained in the nitric oxide, but also some of the carbon monoxide which is soluble in water to the extent of 2·3% at 20° C. It seemed, therefore, desirable to re-determine the carbon monoxide, carbon dioxide and sulphur dioxide by a method in which the use of large volumes of the absorbents were avoided.

As the ferrous sulphate solution had been made with ordinary distilled water, which had been for some time in contact with the air and, as the solubility of nitrogen is only about 1·5% in water and 0·6% in salt solution, it is probable that the figure obtained for the nitrogen content was not far from the truth. No attempt was therefore made to repeat the determination of the nitrogen.

Improved method of determining the impurities in the nitric oxide.—In the following experiments, the nitric oxide, after it had been measured was passed back into the first nitrometer, where it was allowed to remain in contact with 1 c.c. potassium hydroxide solution for about 10—15 minutes, after which it was passed into the measuring nitrometer and measured. The reduction in volume gave the quantity of SO_2+CO_2 in the gas. If the potassium hydroxide solution contained dissolved air, that air would combine with the NO to form NO_2 which would then be absorbed by the potassium hydroxide. The amount of this absorption was determined by treating the nitric oxide which had been freed from CO_2 and SO_2 with a fresh c.c. of the same potassium hydroxide solution and allowing it to remain in contact for 10 minutes as in the actual determination of CO_2 and SO_2. This absorption of NO caused by dissolved air was 0·12 c.c. It was subtracted from the contraction in the actual determination of the CO_2+SO_2.

After the nitric oxide had been freed from CO_2 and SO_2, oxygen was added and the nitrogen peroxide formed was absorbed by 1 c.c. of potassium hydroxide. Care was taken not to add an excess of oxygen. The gas residue of 5—10 c.c. was then passed into a gas burette, where it was treated with a few c.c. of ferrous sulphate solution until free from nitric oxide, measured, treated with ammoniacal cuprous chloride then with dilute hydrochloric acid and measured again. The contraction was taken as CO.

Method A.

Weight of guncotton	Vol. of gas	Temp.	Press.	%N uncorrected.	CO_2+SO_2	CO
grm.	c.c.	° C.	mm.		c.c.	c.c.
0·5045	111·7	17·2	760·57	13·04	0·4	0·25
0·5099	114·9	18·5	748·8	13·01	0·45	—
0·5097	114·85	18·2	749·92	13·04	0·45	0·35
			Mean	13·03	0·43	0·30

Method B.

Weight of guncotton.	Vol. of gas	Temp.	Press.	%N uncorrected.	CO_2+SO_2	CO
grm.	c.c.	° C.	mm.		c.c.	c.c.
0·5081	114·55	15·1	744·3	13·09	—	—
0·5154	117·45	18·2	744·2	13·09	0·55	0·65
0·5117*	115·15	18·05	754·1	13·105	0·7	0·7
			Mean	13·095	0·6	0·65

* Mercury warmed to 25°—30° C.

The total quantity of non-nitrogenous gases, that is of CO_2+SO_2+CO found in the nitric oxide in Method A was 0·73 c.c., whereas in Method B it was 1·25 c.c. The difference, 0·52 c.c., is equivalent to 0·06% in the result for the nitrogen in the guncotton. Thus, the slightly higher values found by Method B were accounted for by an increase in the quantity of CO_2, SO_2 and CO present in the nitric oxide. The increased evolution of these bye-products was entirely due to the heat produced by the mixing of the sulphuric acid with water, for when the acid and water was mixed and cooled before the experiment, no difference could be observed between the results by the two methods, as the following comparative experiments show :—

Method A.

Weight of guncotton	Vol. of Gas	Temp.	Press.	N %.
gm.	c.c.	°C.	mm..	
0·5146	113·85	17·3	760·6	13·03

Method B.

(15 *c.c.* 96·5% *acid mixed with* 1 *c.c. water and cooled before experiment*).

Weight of guncotton	Vol. of Gas.	Temp.	Press.	N %.
grm.	c.c.	° C.	mm.	13·035
0·5189	114·85	17·1	760·22	

The correctness of the results by Method A.—The above experiments show that the 115 c.c. gas evolved from 0·51 grm. guncotton contained 0·73 c.c. non-nitrogenous gas, 0·6 c.c. of nitrogen and that the sulphuric acid residue contained nitrogen equivalent to 0·75 c.c. of nitric oxide.

Thus, the error involved by measuring 0·73 c.c. of $CO_2+CO+SO_2$ was neutralised by the nitrogen equivalent to 0·75 c.c. NO left in the sulphuric acid.

The 0·6 c.c. nitrogen in the nitric oxide was partly derived from the sulphuric acid used, which was found to contain 2·5% by volume of nitrogen gas besides about 0·5% by volume of oxygen gas. Thus, the 15 c.c. of sulphuric acid used for one determination contained 0·4 c.c. of nitrogen. The sulphuric acid after a determination was found to contain only 0·05 c.c. of nitrogen gas, showing that 0·35 c.c. of the 0·6 c.c. nitrogen in the nitric oxide had been derived from the sulphuric acid. The rest of the nitrogen, 0·25 c.c., was probably produced by reduction from the nitric oxide as shown by Marqueyrol (Bull. Soc. Chim. France, 1911, 9, 231). Now, 0·25 c.c. nitrogen or nitrous oxide is equivalent to 0·5 c.c. nitric oxide, and therefore, in this case also, the two errors practically neutralised one another.

Thus, the errors in the determination of nitrogen by Method A balanced one another and the results may be taken as correct.

Solubility of nitrogen in sulphuric acid.—No figures having been found in the literature for the solubility of nitrogen in sulphuric acid, it was thought advisable to ascertain whether the 15 c.c. of sulphuric acid could contain more than 0·4 c.c. of nitrogen to be subsequently evolved during the decomposition of the guncotton. A quantity of the 96·5% sulphuric acid set apart for the determinations was therefore placed in the bottom of a glass-stoppered bottle and shaken for about 6 to 7 hours. After it had been allowed to stand for about 5 days, the 96·5% sulphuric acid, which it could now be said had been brought into equilibrium with the air, was found to contain only 0·22 c.c. of nitrogen per 15 c.c. acid, that is, little more than half the quantity it contained before being shaken.

The original 98·2% acid from which the 96·5% acid was made, was found to contain 0·42 c.c. nitrogen per 15 c.c. acid—a quantity slightly greater than that found in the unshaken 96·5% acid. Thus, it would appear that the 96·5% sulphuric acid has a smaller solubility for nitrogen than the stronger acid, and, hence, was supersaturated with this gas, which was partly given off again when the acid was agitated. These results prove, however, that there is no probability of the 96·5% sulphuric acid containing appreciably more nitrogen gas than it was found to contain above.

The nitrogen in the sulphuric acid residues.—An attempt was also made to ascertain in what form the nitrogen is left behind in the residual sulphuric acid. Only a trace of ammonia could be found and the dissolved gases contained besides carbon monoxide and carbon dioxide 0·25 c.c. of nitric oxide and 0·05 c.c. of nitrogen.

On distilling the sulphuric acid residue left after the determination of dissolved gases with ferrous sulphate solution and sodium chloride, 0·2 c.c. of nitric oxide was further obtained, which may be said to have been derived from undecomposed organic nitrate or nitrite.

The cotton used for the manufacture of guncotton was found by Kjeldahl's method to contain 0·012 and 0·014% of nitrogen. This nitrogen in 0·51 grm. of guncotton is equivalent to 0·05 c.c. nitric oxide and is probably present in the cotton as albuminoid ammonia. Thus, of th nitrogen present in the residual sulphuric acid, which b Kjeldahl's method was found to be equivalent to 0·75 c.c nitric oxide, nitrogen equal to 0·25 c.c. nitric oxide is stil unaccounted for. The determination of the dissolve nitric oxide was conducted with all care, but som authorities declare that it is impossible to remove the las traces of the gas from watery solutions by boiling, an hence the values obtained for the dissolved nitric oxid gas and undecomposed nitrate may be somewhat low Thus, according to Lunge, the volume of the dissolve nitric oxide in 15 c.c. of sulphuric acid should be 0·33 c.c which is rather higher than the value found above.

Summary.—As far as could be ascertained from an exam ination of the gas evolved, of the residual sulphuric aci and of the sulphuric acid used, the ordinary nitromet method (Method A), of determining nitrogen in guncott gives correct results.

The 111—115 c.c. of nitric oxide evolved by this meth from 0·51 grm of guncotton contains about 0·4 c.c.

carbon dioxide + sulphur dioxide, 0·3 c.c. carbon monoxide and 0·6 c.c. of nitrogen. The residual sulphuric acid was found to contain nitrogen equivalent to 0·75 c.c. nitric oxide.

The 15 c.c. of 96·5% sulphuric acid used contained about 0·4 c.c. of nitrogen gas, of which 0·35 c.c. was evolved during the determination of nitrogen in guncotton.

The errors produced by these impurities balance one another, so that if the gas evolved is supposed to be pure nitric oxide and to contain all and only the nitrogen in the guncotton, correct results are obtained.

The method in which 1 c.c. of water is added gives slightly higher results than the above method, the increase in the volume of the gas evolved being caused by the presence of a larger quantity of carbon dioxide + carbon monoxide + sulphur dioxide in the nitric oxide. The greater quantity of these gases is caused solely by the heat evolved on adding one c.c. of water to 15 c.c. of sulphuric acid and is not due to the use of more dilute acid.

I wish to express my indebtedness to Colonel Sir Frederic L. Nathan and Messrs. Nobel's Explosives Coy. for permission to publish this paper.

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, German.

I.—GENERAL PLANT; MACHINERY.

Patents.

Drying grain and other fine materials; Apparatus for ——. Soc. de Constructions Mécaniques d'Alais, France. Eng. Pat. 9489, April 22, 1913. Under Int. Conv., June 21, 1912.

The grain is passed down a tower provided with a number of superposed horizontal partitions each formed of concentric rings, the spaces between the rings of one partition being beneath the rings of the next. The material is transferred from partition to partition by stirrers which are supported by arms projecting from and rotated by a central shaft, and have blades corresponding with the rings. Drying is effected by a current of hot air or gas passed upwards through the tower.—W. H. C.

Dryer; Continuous automatic ——. C. A. Wendell, Joliet, Ill. U.S. Pat. 1,088,754, March 3, 1914.

A centrifugal dryer which can be operated continuously comprises a circular chamber rotating horizontally and carrying a number of pockets at the periphery for the material to be dried. The material is fed to these pockets by a spout which rotates at a slightly different speed from that of the separator, so that the pockets are filled in turn, the time occupied in filling all of them being, say, one minute. The pockets are provided with perforated plates through which the liquid discharged by centrifugal action escapes, and have hinged bottom plates which are periodically opened by a cam carried by the charging spout so as to discharge the dried material just before the fresh charge is introduced.—H. H.

Drying by compressed air; Apparatus for ——. W. E. Hall, Assignor to C. A. Tatum, New York. U.S. Pat. 1,091,215, March 24, 1914.

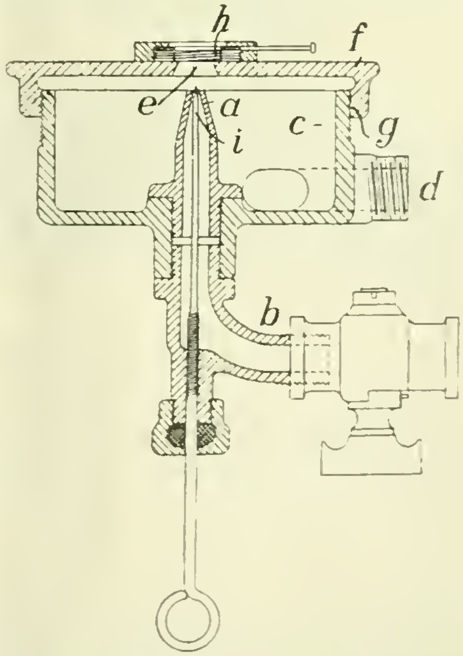
Air is compressed and passed through water-cooled pipes or through a chamber containing baffle-plates whereby the moisture is condensed. The dried air then flows through a reducing valve into a heating chamber, and thence to a chamber where it is used as a drying medium. —H. H.

Drying loose materials. A. Hofmann. Fr. Pat. 465,966, Nov. 20, 1913. Under Int. Conv., Nov. 12, 1912.

The material is dried upon a series of superposed travelling bands within a chamber. It is fed on to one end of the uppermost band and drops from the other end on to the band next below, travelling in the opposite direction, and so on to the bottom where it is discharged. The speed of the bands is decreased from the top downwards to compensate for the shrinkage of the material due to drying. Furnace gases are passed through a series of longitudinal flues below the chamber and air is blown by a fan through a number of transverse flues which pass through the longitudinal flues. The heated air rises up through the chamber and is withdrawn from the top by a fan.—W. H. C.

Spraying or atomising liquids by air or gases; Appliances for ——. E. Samuelson, Banbury, and J. Backhouse, Bootle. Eng. Pat. 9823, April 26, 1913.

The liquid enters the box, *c*, from the pipe, *b*, through the nozzle, *a*, provided with the needle valve, *i*, and the air or gas enters the box tangentially through the pipe, *d*. The cover, *f*, of the box is screwed on as indicated



at *g*, so that the distance between the nozzle, *a*, and the orifice, *c*, through which the mixture of atomised liquid and air escapes can be adjusted. The orifice, *c*, is provided with an iris diaphragm, *h*, by which the size of the aperture can be varied.—W. H. C.

Spraying apparatus for the treating of gases and vapours with liquids. C. H. Fowler and E. A. Medley, Liverpool. Eng. Pat. 10,963, May 9, 1913.

In the apparatus described in Eng. Pat. 23,864 of 1911 (this J., 1912, 1167) in which the washing liquid is sprayed from a number of horizontal discs mounted on a rapidly rotating vertical shaft, a series of vanes or a single cylinder provided with a lip at its lower edge, or a combination of both, is arranged around the shaft below the discs so as to dip into the liquid in the tray beneath. When the shaft is rotating, the vanes or cylinder cause the liquid to rise up until it reaches the level of a series of openings, pierced in the cylindrical support of the discs, through which it escapes and is again sprayed by the discs.—W. H. C.

Air, gas or vapour, and liquids ; Means and apparatus for the treatment of ——. L. Chew, London. Eng. Pat. 24,601, Oct. 29, 1913.

Wire netting is wound tightly round a perforated vertical cylinder which is fixed within a casing: at the top the cylinder makes a gas tight joint with the casing. Washing liquor is supplied at the top, flows downward through the annular coil of netting, and collects in the lower part of the casing, sealing the lower open end of the perforated cylinder. The air or gas to be purified, is delivered horizontally into the casing, passes through the meshes of the netting, thus coming into intimate contact with the washing liquor, and is withdrawn from the interior of the perforated cylinder.—W. H. C.

Spraying pulverulent or other materials with liquids ; Plant or installation and apparatus for ——. C. E. Gardner, Gloucester. Eng. Pat. 10,548, May 5, 1913.

The material to be sprayed by means of a compressed air spraying device on to the pulverulent or other material is contained in two vessels so connected that they may serve alternately to supply the atomiser; or a single vessel may be used in which a constant head is maintained by means of a force pump or a ball valve.—W. H. C.

Furnace ; Regenerative ——. H. Walsh and A. Priestley, Halifax. Eng. Pat. 10,950, May 9, 1913.

The waste gases pass backwards and forwards through horizontal tubes arranged on each side of the producer, and the secondary air for the combustion of the producer gas is preheated by circulating around the tubes in an ascending zigzag direction. The tubes have a rectangular external section and a circular bore, and the secondary air inlet tubes are formed with an open or slotted side. A baffle-plate is fixed between each tier of tubes to lengthen the path traversed by the secondary air.—T. St.

Gas furnaces of the Siemens type ; Reversible regenerative ——. A. Reynolds, London. Eng. Pat. 14,541, June 24, 1913.

To obviate danger of explosion in the flues and stack and to increase the efficiency of the regenerators, separate flues and draught-producing devices are provided for each reversing valve system.—W. H. C.

Filters. H. Sefton-Jones, London. From K. Kiefer, Cincinnati, Ohio, U.S.A., Eng. Pat. 14,136, June 18, 1913.

The filter consists of a wide shallow tray containing a sheet of filtering paper with ridges embossed thereon, the ridges on the bottom running diagonally towards a spout at one corner of the tray, and the ridges on the sides running vertically. The ridges are terminated at a short distance from the folded edges so as to leave an unembossed space around the bottom close to the sides. Some of the uprigh ridges adjacent to the corners are embossed on opposit sides of the paper so that the overlapping portions of pape at the corners are separated by the ridges.—H. H.

Filters. J. H. Carruthers and Co., Ltd., and J. Gourlay C. M. Jackson and G. K. Johnstone, Glasgow. Eng. Pat 14,396, June 21, 1913.

A number of filter elements is arranged within a casing Each element is formed of filtering material stretched o a cylindrical frame constructed of perforated metal rod having a wire threaded helically through the perforation The filter is intended more particularly for the remova of oil or grease from feed water for steam generators. —W. H. C.

Slime cakes ; Process of dislodging ——. *Filtering lea* G. W. Shepherd, New York, Assignor to The Butter Patent Vacuum Filter Co., Me. U.S. Pats. 1,096,13 and 1,096,133, May 12, 1914.

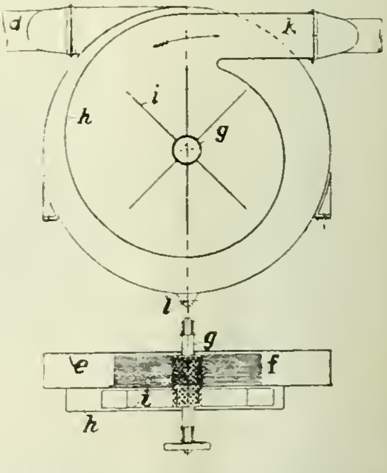
Pipes are provided on each side of the upper edge of th filter-leaf for the purpose of supplying water under pressur between the surface of the filtering medium and the bac of the cake in order to dislodge the latter.—W. H. C.

Separating specifically heavier admixtures from gases an vapours ; Apparatus for ——. E. Kluge, Leipzi Germany. Eng. Pat. 22,646, Oct. 7, 1913. Und Int. Conv., Oct. 8, 1912.

Oil, etc., is separated from steam or other vapours or a by means of baffles built up of alternate non-perforate corrugated plates and flat perforated plates so arrang that the gases flowing between any two adjacent corrugate plates have to pass backwards and forwards through t perforated plate separating them.—H. H.

Gases and liquids ; Apparatus for separating suspend impurities from ——. C. Pfaul, Nachf. von F. Bod Ger. Pat. 272,288, Dec. 10, 1912.

A number of discs, *f*, are mounted close together on hollow, perforated shaft, *g*, within a casing, *e*, adjacent which is the casing, *h*, of a centrifugal fan, *i*. The gas be purified enters at *d*, and the purified gas is drawn throu the perforated hollow shaft and forced out through The impurities are prevented from reaching the holl shaft by the discs, *f*, and are continuously projected o wards by centrifugal force: they accumulate in casing and are removed by the screw, *l*.—A. S.



Centrifugal-machines. J. A. Nordström. Stockho Sweden. Eng. Pat. 22,989, Oct. 11, 1913.

The vertical spindle of the centrifugal machine is journal in both ends of a socket free to oscillate laterally, an engaged between the ends by the screw drive. The socket is retained in position by longitudinal springs which press against its lower end.—W. H. C.

Pulverisers. E. C. R. Marks, London. From Blake Crusher and Pulveriser Co., Pittsburg, Pa., U.S.A. Eng. Pat. 27,162, Nov. 25, 1913.

The material is fed into the crusher from a hopper provided with a rotating screw which is tapered towards its receiving end; the radial length of the blades of the screw is reduced in the direction of the taper.—W. H. C.

Compressed gases; Preventing the freezing of vapour during the discharge of —— from storage vessels. L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploit. des Procédés G. Claude, Paris. Eng. Pat. 746, Jan. 10, 1914. Under Int. Conv., Jan. 14, 1913.

The high-pressure gas chamber is thermally insulated from the expansion chamber by non-conducting material. —W. H. C.

Separating gases from liquids. F. Strohbach, Charlottenburg, Germany, Assignor to General Electric Co. U.S. Pat. 1,095,478, May 5, 1914.

The liquid is introduced from below into a conical chamber having an opening at the apex, where it overflows in a thin film, passing over the outer surface of the cone into a surrounding tank. The occluded gases become separated as the liquid descends, and escape into the upper portion of the tank.—H. H.

Solution, purification and crystallisation of substances which are only slightly soluble in water; Process of —— and apparatus therefor. L. M. Rousseau Fr. Pat. 465,540, Feb. 8, 1913.

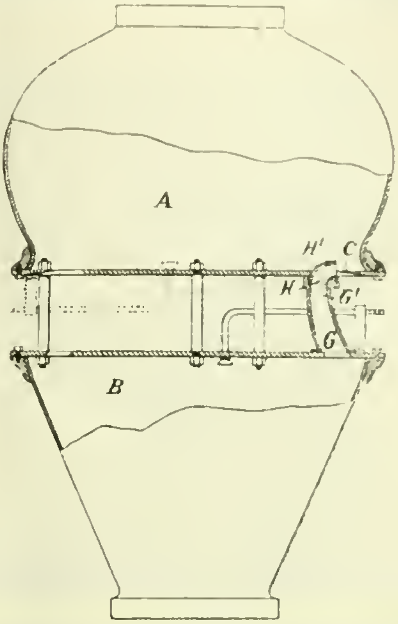
The substances are dissolved at as high a temperature as practicable in an autoclave provided with an agitator. The solutions are purified by filtration in a second autoclave and received in a third in which crystallisation is allowed to take place either rapidly with agitation or slowly without agitation according to the product required.—W. H. C.

Extractor; Cylindrical, vertical ——. Harburger Eisen und Bronzewerke A.-G. Fr. Pat. 465,640, Dec. 4, 1913.

The vertical shaft carrying the agitator blades passes through a stuffing-box in the centre of the bottom of the cylinder. The stuffing-box is sealed by a liquid which is not miscible with the solvent used in the extractor. —W. H. C.

Gaseous mixtures; Process and apparatus for the separation of ——. E. N. Mazza. Ger. Pat. 272,853, Dec. 10, 1912.

The separation is effected by converting the potential energy of the gaseous mixture into kinetic energy by passage through a curved tube of diminishing cross-section from inlet to outlet, whereby the lighter and heavier constituents accumulate respectively nearer to, and more remote from, the centre of curvature of the tube. The apparatus (see Fig.) consists essentially of a chamber, B, to which the gaseous mixture is supplied, another chamber, A, to receive the separated heavier constituent, and between these one or more separating elements, each consisting of two portions, viz., G,G′ in which transformation of the potential energy of the mixture into kinetic energy first takes place, and H,H′, which is the separator proper: the separated heavier constituent is diverted into A by the partition, C. The tubes, G,G′, and H,H′, consist of cylindrical surfaces joined by flat side walls, and are curved in such a manner that together they have substantially the form of an archimedean spiral. The radius of curvature of the tubes diminishes continuously from the inlet to the outlet; the convolution of the portion H,H′, may be twice the length of the mean radius of curvature of this portion, and the convolution of G,G′, is several times as long as that of H,H′.—A. S.



Evaporation; Continuous ——. M. Prager, Berlin. U.S. Pat. 1,096,193, May 12, 1914.

See Fr. Pat. 449,572 of 1912; this J., 1913, 525.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal solvents. L. Vignon. Comptes rend., 1914, **158**, 1421—1424.

The action of alcohol, ether, benzene, toluene, aniline, nitrobenzene and quinoline was investigated. In the case of a bituminous gas coal from the Loire district, aniline dissolved 23·4% and quinoline 47·3% at the boiling-point. With bituminous coal a smaller proportion is soluble. The dissolved substances are precipitable by acid. The soluble part is richer in hydrogen and lower in ash than the insoluble portion. The coke from the former is vesicular and glassy, that from the latter is powdery. —J. L. F.

Electrical ignition of gaseous mixtures. W. M. Thornton. Roy. Soc. Proc., 1914, A, **90**, 272—297. (See also this J., 1913, 935 and 1149).

The results of a comprehensive investigation of the relation between the nature of the combustible gas, the composition of the mixture, the voltage, and the magnitude of the least igniting current (continuous and alternating) are given in numerous diagrams. The current required for ignition diminished very rapidly as the voltage was raised, the curves obtained for continuous current being similar to those which are characteristic of steady arcs. With alternating current the variation with frequency is shown in Fig. 1. In the paraffin series the relation of the least igniting current to the composition of the gas was different for continuous and alternating currents. Continuous currents gave curves (see Fig. 2) the middle portions of which were straight lines all passing through zero or nearly so, showing that the igniting current was proportional to the number of molecules of combustible gas in unit volume of mixture. The same igniting current was required for each most inflammable

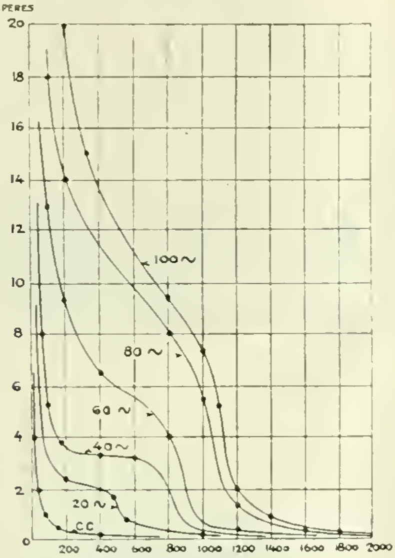


Fig. 1.
Influence of frequency in igniting current in a 9·5 per cent. mixture of methane and air. Iron poles, alternating current.

mixture, and such mixtures contained as a rule a slight excess of air. The slope of the straight portion of the curve was greatly diminished by an increase in the voltage. Alternating currents gave curves which had no straight portion and were almost symmetrical between the limits of inflammability. The minima were at different current values, but the minimum current multiplied by the percentage of inflammable gas in the corresponding mixture was the same for all members of the series. The igniting current was always greater for alternating than for continuous current with the same voltage. The compositions at the minima of the alternating current curves corresponded with combustion to equal proportions of carbon monoxide and dioxide. The alcohols gave curves similar to those for the paraffins. Benzene gave with both currents almost symmetrical curves with no straight portion and the most sensitive mixture corresponded with combustion to carbon monoxide. Carbon bisulphide gave curves with a straight portion for both currents and the minimum corresponded with complete combustion to carbon dioxide. With hydrogen and carbon monoxide both curves (alternating and continuous) had a straight portion, but in the continuous current curve for hydrogen the straight portion was horizontal and in the alternating current curve it was slightly inclined. For carbon

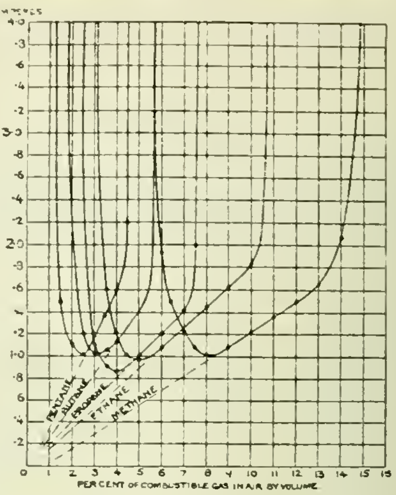


Fig. 2.
Least igniting currents for the paraffin gases in air. Continuous current. Iron poles. 100 volts.

monoxide these conditions were reversed. External ionisation (from X-rays or ultra-violet radiation), which did not itself cause ignition, had no influence on the minimum igniting current.—W. H. P.

Gas; Uses of——. W. A. Bone. Report of Brit. Assoc., 1913, 440—444.

After referring to the industrial applications of coal gas, water-gas, producer gas, and blast-furnace and coke-oven gases (compare this J., 1907, 674; 1908, 1008; 1910, 395; 1911, 1455; 1912, 114; 1913, 1013, 1057), it is stated that at the Skinningrove Ironworks, since October, 1911, blast-furnace gas enriched with coke-oven gas up to 130 B.Th.U. per cb. ft. has been regularly supplied to boilers, power house, and soaking pits, the whole of the steel output of a 275-ton Talbot furnace being converted into finished steel sections without the use of any outside fuel. By supplying the Talbot furnace with an enriched gas of 180 B.Th.U., a saving of 2½—3 cwt of coal per ton of steel was effected.—A. S.

Naphthenic acids from different petroleum distillates. E. Pyhälä. Chem. Rev. Fett Ind., 1914, 21, 128—130.

Commercial naphthenic acids prepared from a series o distillates from Baku petroleum oil had the followin characters :—

Naphthenic acid from	Neutralisation value.	Sp. gr. at 15°/15° C.	Viscosity (Engler) at 30° C.	Iodine value (Hübl-Waller)	Corresponding petroleum fraction.	
					Sp. gr. at 15°/15° C.	Viscosity at 30° C.
Kerosine	310	0·9860	—	—	0·8255	1·05
Do.	255	0·9650	4·23	0·9	0·8250	1·08
Pyronaphtha	186·5	0·9521	8·35	—	0·8640	1·45
Light solar oil	170·0	0·9513	15·00	2·42	0·8818	2·10
Vaseline oil fraction	152·0	0·9471	—	—	0·8894	3·20
Heavy solar oil	136·0	0·9418	18·90	2·50	0·8924	3·40
Spindle oil	108·0	0·9358	34·76	6·17	0·9020	7·12
Machine oil	87·5	0·9350	47·71	7·18	0·9100	16·12
Cylinder oil	32·6	0·9294	97·92	11·36	0·9210	(40° C.) 31·30

The relatively low neutralisation values accompanyir fairly high iodine values were probably due to tl naphthenic acids being partly in combination wit unsaturated hydrocarbons (probably terpenes). Th would account for the difficulty of isolating pu

naphthenic acids of high molecular weight. A fairly pure naphthenic acid was isolated from the ordinary waste lyes from the refining of machine oils. This had sp. gr. 0·9470 at 19·8° 15° C.; neutralisation value, 169·7; and iodine value, 2·54. On fractional distillation it yielded about 13% of eikosinaphthenic acid, $C_{20}H_{38}O_2$, and 63% of eikosipentanaphthenic acid, $C_{25}H_{48}O_2$.
—C. A. M.

Mineral oil industry of the Caucasus. Board of Trade J., May 28, 1914. [T.R.]

It will be seen from the following table that, owing to the large falling-off in the output of the Baku, Chelekon, and Maikop oilfields, the production of petroleum in the Causasus in 1913 showed a decrease of 211,387 tons as compared with the previous year:—

Oilfield.	Production.	
	1912.	1913.
	Tons.	Tons.
Baku	6,758,054	6,290,323
Island of Cheleken	209,677	129,032
Surachani	500,000	629,032
Grozni	1,048,389	1,129,032
Maikop	145,161	96,774
Other sources	662,880	838,581
Total	9,324,161	9,112,771

The decline in Russian production is attributed principally to the strikes at, and the exhaustion of, the wells in the Baku area. The number of feet drilled in 1913 was 219,625 against 192,423 in 1912. Although progress in prospecting on new oil-bearing lands was made during the year, it is too soon yet to arrive at any conclusions as to the possibilities of the two areas which have come under exploitation. Petroleum prospecting work in Gouria was not very successful, but three derricks are being erected preparatory to commencing boring operations. A black thick oil, not heavy, has been met with in the district, and it is possible that now drilling operations are to be taken in hand prospects in this locality may be more promising than they were in 1913. The exploratory work done during the year on the Taman peninsula was not attended with results of a very promising character.

According to a review of the petroleum industry in 1913, published by the Baku Petroleum Association, the following changes took place in the production of crude oil during the year as compared with the figures of 1912. In order to show the leading position Russia held in the oil industry of the world in 1901 the approximate figures of the production of that year are also given.

Country.	1901.	1912.	1913.
	Tons.	Tons.	Tons.
United States	8,951,000	29,161,000	31,984,000
Russia	10,984,000	9,324,000	9,113,000
Mexico	—	2,450,000	2,968,000
Roumania	226,000	1,774,000	1,839,000
Dutch East Indies	613,000	1,452,000	1,645,000
Austria-Hungary	451,000	1,177,000	1,016,000
Other countries	484,000	1,709,000	1,919,000
Total	21,709,000	47 047,000	50,484,000

Patents.

Furnaces and fuel feeding devices therefor. C. J. Greenstreet, St. Louis, Mo., U.S.A. Eng. Pat. 1515, Jan. 18, 1913. Under Int. Conv., Sept. 26, 1912.

Powdered coal is fed from a hopper, through adjustable oors at the bottom, to a feed-box, whence it is transorted by adjustable conveying gear to the blower placed just below, within a casing. The air enters the blower from the casing which is provided with an adjustable damper.—W. H. C.

Combustion of gaseous or vapourous combustibles; Apparatus for the catalytic combustion of ——. L. Schmidt, Düsseldorf, and F. Krieger, Berlin, Germany. Eng. Pat. 9678, April 24, 1913. Under Int. Conv., April 24, 1912.

A burner of the Bunsen type is fitted with a closed hollow extension made of a highly porous refractory material, such as closely woven asbestos, impregnated with a catalytic material such as finely divided platinum. The gases burn on the outer surface of the porous body, no combustion taking place within it.—H. H.

Fuel; Compositions for aiding the combustion of ——. A. Morin, L. Hamon and E. Hess, Montreal, Canada. Eng. Pat. 27,648, Dec. 1, 1913.

The fuel is sprayed with a solution of sodium chlorate or perchlorate and permanganate.—W. H. C.

Coal; Preparation of a solution for economising ——. H. Lewison. Fr. Pat. 465,995, Dec. 8, 1913. Under Int. Conv., Sept. 4, 1913.

An aqueous solution of a mixture of powdered potassium nitrate, 60, calcined sodium carbonate, 32, and potassium permanganate, 8%, is poured over coal for the purpose of securing a more complete combustion thereof.—H. H.

Fuel briquettes. T. H. Peters, sen., Chiswick, T. H. Peters, jun., Brentford, Middlesex, G. L. and C. P. Tuxford, Richmond, Surrey. Eng. Pat. 4757, Feb. 24, 1914.

Powdered fuel is agglomerated into briquettes by means of a mixture of 1 cwt. of Portland cement, 5 oz. of potassium permanganate, and 5 lb. of ochre to each ton of coal, coke, or peat.—H. H.

Coal and lignite; Briquetting —— by means of a mixture of pitch and oils resulting from the distillation of tar oils. V. Moreau. Fr. Pat. 465,530, Dec. 1, 1913. Under Int. Conv., Sept. 23, 1913.

Coal dust, etc. is mixed with powdered pitch, and sufficient tar oil is added to dissolve the pitch, the resulting paste being moulded into briquettes.—H. H.

Briquettes from waste wood: Manufacture of ——. E. Eckstein and C. Wislicki. Fr. Pat. 466,363, Dec. 18, 1913.

Waste wood or sawdust (80 kilos.) is impregnated with rosin (25 kilos.) in a heated vacuum chamber, and the mass is compressed into moulds which have been sprinkled with sawdust to prevent adhesion of the blocks.—H. H.

Agglomerating coal and other powdered materials; Process for ——. H. Steven, Fr. Pat. 466,420, Dec. 20, 1913. Under Int .Conv., Jan. 20, 1913.

A mixture of a powdered material (*e.g.* coal dust) and an agglomerant is subjected in moulds to a series of pressing operations of increasing intensity, air and gases being eliminated in the first, liquids in the second, and consolidation taking place in the third. Any cracks produced by the heavy compression are closed by a final light compression. The apparatus used comprises a circular plate containing the moulds and a series of hydraulic pistons of uniform size at the top for entering the moulds but of varying size at the bottom where they enter a common hydraulic chamber. The varying pressures are thus obtained automatically and the pistons operated by a single hydraulic control. The pistons are withdrawn after each operation and the moulding plate turned to bring the next moulds into position.—H. H.

Waste from coal-mining and from coking installations; Utilisation of —— by mixing with coal sludge. C. Hilgenstock. Ger. Pat. 272,852, Dec. 3, 1912.

THE sludge obtained in coal-washing plants is made to flow upwards through a filtering bed of the dry waste from coal mining or from coking installations.—A. S.

Distillation of coal. J. Stephenson, Salisbury. Eng. Pat. 13,104, June 5, 1913.

THE coal is continuously charged into and the coke discharged from a series of vertical retorts heated by a continuous supply of a predetermined proportion of water-gas from a pair of water-gas generators. The remaining portion of the water-gas is carburetted. The producer gas obtained from the water-gas generators during the "blow" period is burned in a chamber provided with a number of cross flues in which the air used to burn the water-gas is preheated. The hot products of combustion of the producer gas also serve to heat the flue or flues in which the water-gas is carburetted.—W. H. C.

Distilling coal in large charges; Process of —— and apparatus therefor. H. Breuillé. Second Addition, dated Nov. 10, 1913, to Fr. Pat. 435,189, Oct. 13, 1911 (this J., 1912, 323).

BENEATH the retorts is a channel provided with a conveyor for removing the ash so that all manual labour is avoided. —W. H. C.

Coke ovens; Process and apparatus for destroying fumes from —— during discharging and charging. F. J. Collin. Fr. Pat. 466,071, Dec. 11, 1913.

THE gas-outlet pipes of coke ovens are connected by elbow pipes with a channel passing through the masonry above the ovens and leading to the main chimney. This channel is opened when the ovens are being charged; the gases in the ovens are drawn into the channel, and are burnt by air admitted for that purpose.—H. H.

Gas-producers. J. A. Weil, Stockton-on-Tees. Eng. Pat. 4452, Feb. 20, 1914.

THE cylindrical portion of the rotary grate of a gas producer is set obliquely and is formed with a corrugated periphery to crush the ash and facilitate its discharge. —W. H. C.

Gas; Apparatus for use in manufacturing ——. J. E. Cochran, Assignor to The National Gas Process Co., Elkhart, Ind. U.S. Pats. 1,096,223 and 1,096,224, May 12, 1914.

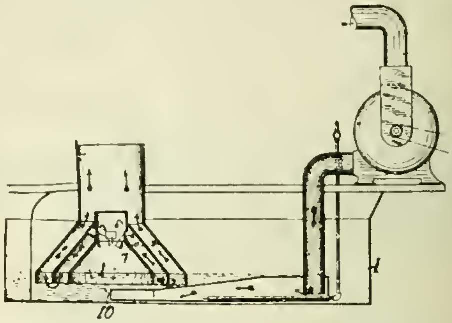
(1) THE gas is passed in succession through a number of compartments formed in a chamber by means of partitions, the first two compartments containing agents for removing impurities and the others, through which cooling tubes pass, serving as condensing chambers. Staggered baffles are arranged in the condenser compartments to force the gases into contact with the cooling tubes. (2) The condensing chambers are replaced by a single chamber provided with hollow shell-like baffles projecting into it so as to form a tortuous and narrow passage for the fluid. A cooling medium is circulated through the baffles.—H. H.

Gas process and product. W. O. Snelling, Pittsburgh, Pa., Assignor to Consolidated Liquid Gas Co., Chicago, Ill. U.S. Pat. 1,096,797, May 12, 1914.

ACETYLENE is forced under pressure into a vessel partly filled with liquefied propane, butane and ethane, and the mixture stored. When the pressure is released, the paraffin hydrocarbons vaporise with the acetylene and escape in admixture therewith.—H. H.

Gas or smoke washer. O. M. Foster, Elkhart, Ind., Assignor to American Smoke Washing Co., Cleveland, Ohio. U.S. Pat. 1,096,501, May 12, 1914.

THE gas or smoke is delivered from the open end of the pipe, 10, beneath a series of concentric hoods, 7, 8, 9, the lower edges of which dip into the washing liquid contained in the vessel, 1. The innermost hood, 7, is open at the top, the next, 8, closed and the third open and connected with the stack. The smoke is thus compelled to bubble twice through the washing liquid.—W. H. C.



Briquettes of coke dust alone or mixed with wood waste. J. Alexander, Altona, Germany. Eng. Pat. 16,838, July 22, 1913.

SEE Fr. Pat. 461,065 of 1913; this J., 1914, 67.—T. F. B.

Briquettes; Manufacture of ——. C. Fohr, Munich, and E. Kleinschmidt, Frankfort on Maine, Germany. Eng. Pat. 17,519, July 30, 1913. Under Int. Conv., Aug. 2, 1912.

SEE Ger. Pat. 263,158 of 1912; this J., 1913, 901.—T.F.B.

Gas-producer. C. Whitfield, Sydenham. U.S. Pat. 1,096,774, May 12, 1914.

SEE Eng. Pat. 1117 of 1913; this J., 1914, 190.—T. F. B.

Gas washer or scrubber. W. J. Fiddes, Tottenham. Eng. Pat. 13,813, June 14, 1913.

SEE U.S. Pat. 1,095,835 of 1914; this J., 1914, 585.—T.F.B.

Generator gas, water gas, and the like; Purifying apparatus for ——. Berlin-Anhaltische Maschinenbau-Akt.-Ges., Berlin. Eng. Pat. 28,389, Dec. 9, 1913. Under Int. Conv., Dec. 11, 1912.

SEE Ger. Pat. 271,122 of 1912; this J., 1914, 472.—T.F.B.

Process of treating sulphur-bearing materials. Eng. Pat. 21,385. *See* VII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

PATENTS.

Acetic acid; Manufacture of —— by the destructive distillation of woody matters. G. Calvert, London. Eng. Pat. 10,687, May 6, 1913.

COFFEE husks or the like are heated in a continuous retort provided with a screw conveyor and the gaseous products of distillation are drawn off and treated for the recovery of acetic acid and then returned to the furnace where they are burned to assist in the heating of the retort.—W. H. C.

Wood; Process for the continuous distillation of ——. E. J. J., B. O. A., and O. A. R. Pampe. Ger. Pat. 272,725, Oct, 24, 1911.

A DEFINITE temperature is maintained in the still by means of a diaphragm-regulator. The regulator is connected with a rectifying column, dephlegmator, and oil separator in such a manner that when the temperature of the distillation gases falls, further heat is applied by means of a closed heating coil, whilst when the temperature rises too high, a quantity of the lighter and lower-boiling oils is run into the still from the oil separator.—T. F. B.

Ammonia from the products of the destructive distillation of coal or the like; Direct recovery of ——. C. Still, Recklinghausen, Germany. Eng. Pat. 28,215, Dec. 8, 1913. Addition to Eng. Pat. 28,072 of 1912, dated Dec. 6, 1911 (this J., 1913, 590).

Between the reheating apparatus in the principal patent (*loc. cit.*) and the intermediate cooler, a gas exhauster is provided, which serves for imparting motion to the gases within the plant, and an additional final cooler is arranged behind the ammonia saturator. A certain volume of the ammonia-freed gases is returned to the main gas current at a point between the cooling and reheating stages, whereby the volume of gases to be reheated is augmented and their capacity for saturation with aqueous vapour enhanced.—O. R.

Heating rotary tubular kilns; Method of ——. W. Engelhardt. Fr. Pat. 466,347, Dec. 18, 1913. Under Int. Conv., Dec. 30, 1912.

Liquid fuel is forced under pressure through parallel or converging jets into the end of the kiln which is obstructed or narrowed at a point somewhat in advance of the nozzles so that the fuel, and the air drawn with it, are thoroughly mixed at this point and a zone of intense combustion produced.—H. H.

III.—TAR AND TAR PRODUCTS.

m-Anisidine and dimethyl-m-anisidine. F. Reverdin and A. de Luc. Ber., 1914, **47**, 1537—1545.

To prepare *m*-anisidine, $C_6H_4(OCH_3).NH_2$, a solution of commercial *m*-aminophenol (110 grms.) in a mixture of water (100 c.c.) and glacial acetic acid (70 c.c.) was shaken with acetic anhydride (100 c.c.) and kept at the temperature of the water-bath for half-an-hour. On cooling, the acetyl derivative separated. This (152 grms.) was dissolved in an aqueous solution (300 c.c.) of sodium hydroxide (50 grms.) and well shaken with methyl sulphate (100 grms.) added in small portions. The yield in each of these two operations was well over 90% of the calculated amount. The resulting acetyl-*m*-anisidine was crystallised from 50% alcohol and hydrolysed by heating for 20 mins. on the water-bath with its own volume of hydrochloric acid (2 : 1). On pouring the product into water and rendering alkaline with ammonia, *m*-anisidine was obtained as an oil of b. pt. 243° C. Several salts and derivatives are described; *m*-anisidine-azo-β-naphthol forms red needles. Dimethyl-*m*-anisidine, $C_6H_4(OCH_3).N(CH_3)_2$, was prepared by gradually adding *m*-anisidine (12 grms.) to methyl sulphate (24 grms.) and subsequently heating for an hour on the water-bath. The product was poured into sodium hydroxide solution and to the separated base was added acetic anhydride (20 c.c.) in small portions to acetylate the primary and secondary base contained in the mixture. After warming for an hour the solution was neutralised with sodium carbonate and distilled with steam. Dimethyl-*m*-anisidine, boiling at 237° C., was thus obtained n a 75% yield. The nitration of this base is described, he chief products being 4.6-dinitrodimethyl-*m*-anisidine and 3-methylnitramino-4.6-dinitro-1-anisol.—J. R.

Cyclic hydrocarbons; Hydrogenation of —— *by means of sodammonium* ——. P. Lebeau and M. Picon. Comptes rend., 1914, **158**, 1514—1517.

odium, (2—10 atoms), was dissolved in a solution of aphthalene in anhydrous liquid ammonia. The action roceeds best under pressure at 15° C. The resulting roducts were sodamide, tetrahydronaphthalene, (90% ield), and a considerable proportion of an unidentified solid compound, $(C_{20}H_{18})$, which boiled with decomposition at 400 C., producing, apparently, a mixture of $C_{10}H_{10}$ and $C_{10}H_{12}$.—J. L. F.

Patents.

Sulphophenol-o-carboxylic acids; Process for producing compounds containing derivatives of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 466,236, Dec. 16, 1913. Under Int. Conv., Feb. 17, 1913.

The sulphochlorides of aromatic *o*-hydroxycarboxylic acids are condensed with ammonia, amines, aminophenols, aminonaphthols, or their sulphonic or carboxylic acids or other derivatives. For example, salicylsulphamide, $HOOC(HO).C_6H_3.SO_2NH_2$, is obtained by the action of aqueous ammonia on the *p*-sulphochloride of salicylic acid. The products may be used in the preparation of dyestuffs.—T F. B.

Anthraquinone-α-nitriles; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 271,790, Feb. 18, 1913.

α-Halogen-anthraquinones are heated with copper cyanide in presence of an indifferent solvent, to produce anthraquinone-α-nitriles.—T. F. B.

4.4′-Diaminodibenzyl sulphide and its derivatives; Process for preparing ——. Chem. Fabr. vorm. Weiler-ter-Meer. Ger. Pat. 272,292, Nov. 1, 1912.

Aromatic amines or their homologues or substitution products with free *p*-position to the amino group or groups (aniline, ethylaniline, *o*- or *m*-toluidine, *o*-chloroaniline, metanilic acid, *m*-phenylenediamine, or α-naphthylamine) are treated with formaldehyde and an alkali thiosulphate in presence of an acid. The products are derivatives of 4.4′-diaminodibenzyl sulphide, $(NH_2.C_6H_4.CH_2)_2S$.
—T. F. B.

Acetoacetanilide-p-carboxylic acid; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 272,530, May 15, 1913.

Acetoacetanilide-*p*-carboxylic acid, which is a valuable azo dyestuff component, is obtained by saponifying its esters with caustic alkalis; no other decomposition of the molecule takes place.—T. F. B.

Acetoacetanilide; Process for preparing derivatives of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 273,321, May 10, 1913.

Acetoacetanilide-*p*-carboxylic acid esters are obtained by heating *p*-aminobenzoic esters with acetoacetic ester, either alone or in presence of a diluent. The yields are good, whereas when the isomeric aminobenzoic esters are used, the reaction is very incomplete.—T. F. B.

Acridine derivatives from aminohydroxynaphthalenesulphonic acids; Process for preparing ——. Farbwerke vorm Meister, Lucius, und Brüning. Ger. Pat. 272,612, Dec. 6. 1912.

1-Aminohydroxynaphthalenesulphonic acids which have a free 2-position or 2-aminohydroxynaphthalenesulphonic acids with a free 1-position are treated with a tertiary aromatic amine and formaldehyde in presence of dilute mineral acid. The properties and composition of the products indicate that they are *p*-dialkylamino-*ms*-phenyldihydroxynaphthacridines.—T. F. B.

Condensation products of the anthraquinone series; Process for preparing nitrogenous ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 272,613, Dec. 14, 1912. Addition to Ger. Pat. 270,790 (see this J., 1914, 475).

α-Halogenanthraquinones or their derivatives or substitution products are heated with salts of aromatic glycines, preferably in presence of substances which combine with acids (acetates), under pressure to a high temperature (*e.g.* 160°—170° C.). The products are identical with those obtained according to Ger. Pat. 270,789 (this J., 1914, 474).—T. F. B.

Condensation products of the anthraquinone series; Process for preparing nitrogenous ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 272,614, Dec. 15, 1912. Addition to Ger. Pat. 265,725 (see this J., 1913, 1060).

α-Arylaminoanthraquinones, or the acridine compounds derived from them, are melted with naphthols and zinc chloride.—T. F. B.

Anthraquinone; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 273,318, Dec. 14, 1912, and 273,319, Feb. 11, 1913.

(1.) Anthracene is oxidised to anthraquinone by means of iron chlorate or a mixture of an alkali chlorate and an iron salt. (2.) The chlorates or salts of other metals which can exist in the bivalent or tervalent form, are used to oxidise anthracene. In this and the previous patent, alkaline-earth chlorates may be used instead of alkali chlorates. —T. F. B.

Anthraquinone-N-1.1′-oxazine; Process for preparing ——. Farbwerke vorm. Meister, Lucuis, und Brüning. Ger. Pat. 273,444, March 20, 1913.

Anthraquinone-N-1.1′-oxazine is prepared by treating with condensing agents the 2-methoxy-1.1′-dianthrimide obtained by the action of 1-chloro-anthraquinone on 1-amino-2-methoxyanthraquinone (see also Ger. Pats. 266,945 and 266,946; this J., 1913, 1151).—T. F. B.

Amino-derivatives of anthraquinone; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 273,810, July 11, 1913. Addition to Ger. Pat. 267,212 (see this J., 1913, 1151).

Anthraquinone-1-sulphonic acid, anthraquinonedisulphonic acids, or derivatives of anthraquinonesulphonic acids are converted into the corresponding amino derivatives by treatment with ammonia in presence of a barium compound which will combine with the free sulphurous acid liberated during the reaction.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Thujin. A. G. Perkin. Chem. Soc. Trans., 1914, **105**, 1408—1413.

Thujin, isolated by Rochleder and Kawalier in 1858 (Wien. Akad. Ber., **29**, 10) from the green portions of the *Arbor vitæ* (*Thuja occidentalis*), is found to consist of quercitrin, with a trace of another glucoside, also probably of the flavonol group, whilst thujetinic acid is composed mainly of quercetin. Thujigenin is not regarded as a definite compound.—F. Sodn.

Santalin; Researches on ——. *Part II.* J. C. Cain, J. L. Simonsen, and C. Smith. Chem. Soc. Trans., 1914, **105**, 1335—1342. (See this J., 1912, 580.)

Molecular weight determinations by Barger's method indicated $C_{30}H_{28}O_{10}$ as the formula of santalin. Ethylcarbonatosantalin, $C_{30}H_{26}O_{10}(COOC_2H_5)_2$, was prepared by treating an alkaline solution of santalin with ethyl chloroformate. After purification by dissolving in ethyl benzoate and precipitating with benzene, it formed a reddish-brown powder, which could be hydrolysed with the production of santalin by warming with dilute potassium hydroxide. It was not acted upon by diazomethane and could not be further methylated. Santalin monomethyl ether, $C_{28}H_{20}O_6(OCH_3)_4$, was formed during the methylation of santalin and melted at 248°—250° C. It was insoluble in alkalis and was not acted upon by the usual hydroxyl reagents. Similarly to the dimethyl ether it gave a mixture of anisic and veratric acids on oxidation with alkaline permanganate solution. Nitrosantalin monomethyl ether, $C_{28}H_{18}O_4(NO_2)_2(OCH_3)_4$, was purified by dissolving in acetic acid and precipitating with water. It was an amorphous brown powder, soluble in alkalis and not melting below 300° C. Oxidation of nitrosantalin dimethyl ether yielded anisic acid, 4-nitro-2.3-dimethoxybenzoic acid and two other acids. It was concluded that the skeleton formula of santalin might be that of a dianthracene derivative. —F. Shdn.

Datiscetin; The constitution of ——. J. Leskiewicz and L. Marchlewski. Ber., 1914, **47**, 1599—1600.

From the products of the oxidation of datiscetin (a colouring matter present in *Datisca Cannabina*) with bromine, bromosalicylic acid, and tetrabromophloroglucinol were isolated. Since the substance is an isomeride of luteolin, and yields tetrabenzoyl and acetyl derivatives, these results are in agreement with the conception of datiscetin as 1.3.1′-trihydroxyflavonol.—G. F. M.

Indigo production in India. Rept. on the Progress of Agriculture in India for 1912–13. [T.R.]

The area under indigo in India in 1912 declined by nearly 20% to 214,500 acres, the output of dye declined by 21% and the price by 5·4%. The reduction of area is probably due to some extent to declining yield as well as to falling prices, the crop having been affected by a condition which seriously reduces the yield of "khoontics" and the production of seed, in the Java plant.

The Bihar Planters' Association having found itself unable to continue its subscription to the maintenance of the Sirseah Research Station, the latter has been closed.

It has been agreed that the most efficient methods of manufacture now in vogue in Bihar certainly extract within 30% of the possible amount of the colouring principle and that the present state of the industry does not justify further search for improved methods which would be likely to promise at best a further 15% of outturn in return for considerable capital expenditure on reorganisation of plant. It has consequently been decided that the improvement of yield by a botanical study of the crop and by selection of the best type of plant offers the best chance of success, and this work is being undertaken at Pusa.

Patents.

Vat [anthracene] colouring matters; Production of —— J. Y. Johnson, London. From Badische Anilin un Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng Pats. 12,817 and 27,010, June 2 and Nov. 24, 1913.

A nitro or amino derivative of normal or *iso*-dibenz anthrone is treated with a "reactive" chloride, viz., alu minium chloride, antimony pentachloride, phosphoru trichloride, or phosphorus pentachloride. The reaction i preferably carried out in presence of nitrobenzene. Th products give grey dyeings which are faster towards hypo chlorite solutions than the dyeings obtained from th known grey dyes of this class. (Reference is directed i pursuance of Sect. 7, Sub-sect. 4, of tho Patents an Designs Act, 1907, to Eng. Pat. 22,519 of 1905; this J 1906, 634.)—T. F. B.

Azo dyes containing an arylsulphonic ester group; Manu facture of ——. Anilinfarben- und Extract-Fabr. vorm J. R. Geigy, Basle, Switzerland. Eng. Pat. 30,05 Dec. 31, 1913. Under Int. Conv., Jan. 2, 1913.

The arylsulphonic esters of aminophenols (other than th of o-aminophenol) are used for the production of monoa or primary or secondary disazo dyestuffs. The dyestu have a great affinity for wool in neutral solutions, t shades produced being fast to milling, whilst the dyein on silk are fast to water. Their lakes are very fast sublimation. For example, orange-red dyestuffs are p duced from the *p*-aminophenyl ester of *p*-toluenesulphon acid after diazotisation and combining with β-naphtho by combining the diazo compound with 1-phenyl-3-methyl-5-pyrazolone, yellowish green dyestuffs are obtained A blue-black dyestuff is obtained by diazotising the *m*-aminophenyl ester of *p*-toluenesulphonic acid, combining with 1.8-aminonaphthol-3.6-disulphonic acid in acid solution, and combining this product in alkaline solution with diazotised *p*-aminophenyl ester of *p*-toluenesulphonic acid.—T. F. B.

Azo dyestuffs; Production of new diazotisable ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 465,794, Dec. 5, 1913. Under Int. Conv., Jan. 7 and June 28, 1913.

Dyestuffs which give yellow shades when developed with β-naphthol are obtained by combining the diazo compounds of nitro-(acetylamino-)arylacidyl derivatives of aromatic diamine-sulphonic or carboxylic acids with the pyrazolones or pyrazolone-carboxylic acids derived from aminothiazoles, *e.g.* dehydrothiotoluidine or Primuline, and afterwards reducing (saponifying) the nitro-(acetylamino-)group. Examples of the first component are nitro-(acetylamino)-benzoylphenylenediamine-sulphonic or -carboxylic acid, or the corresponding derivatives of benzidinesulphonic acid, diaminostilbenedisulphonic acid, etc.—J. B.

Indigoid dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 273,536, Aug. 15, 1912.

Derivatives of 2.3-naphthisatin halogenated in the naphthalene nucleus, and in which the α-keto oxygen is replaced by chlorine or an anilino or similar group, are condensed with components necessary for the formation of indigoid dyestuffs.—T. F. B.

Vat dyestuffs analogous in constitution to indirubin; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 273,537, Aug. 30, 1912.

Halogenated 2.3-naphthisatins are condensed with oxythionaphthene, indoxyl, or analogous compounds containing the group, $CH_2.CO$, or their substitution products.—T. F. B.

Indigo vat; Preparation suitable for the ——. A. Schmidt and A. Steindorff, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,096,060, May 12, 1914.

See Eng. Pat. 17,045 of 1911; this J., 1912, 808.—T.F.B.

Sulphurised dyes and process of making same. H. Heimann, Dessau, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,096,715, May 12, 1914.

See Fr. Pat. 454,782 of 1913; this J., 1913, 863.—T. F. B.

Azo dyestuffs. H. Jordan and W. Neelmeier, Leverkusen. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,097,231, May 19, 1914.

See Fr. Pat. 457,840 of 1913; this J., 1913, 1004.—T. F. B.

Vat [anthracene] dyestuffs; Green —— and process of making same. B. Mayer, Assignor to Soc. of Chem. Industry in Basle, Switzerland. U.S. Pat. 1,097,343, May 19, 1914.

See Ger. Pat. 261,557 of 1912; this J., 1913, 822.—T. F. B.

Azo dyestuffs containing arylsulphonic ester groups; Process for preparing ——. Fabriques de Couleurs d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat. 466,161 Dec. 13, 1913. Under Int. Conv., Jan. 2, 1913.

See Eng. Pat. 30,055 of 1913; preceding.—T. F. B.

Manufacture of pigments. Eng. Pat. 20,106. *See* XIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Paper and paper yarns; Dry and wet strengths of ——. C. Beadle and H. P. Stevens. Chem. News, 1914, **109**, 242—244.

The strongest Swedish "kraft" papers used for the manufacture of paper yarns show a tensile breaking length in the machine direction of over 9 km.; papers made from Hedychium for the same purpose show over 10 km. When thoroughly wetted, the strength of the Swedish papers either disappears altogether or is reduced to a negligible quantity (highest 0·58 km.); the strength of wet Hedychium papers is still considerable (1·58 km.). The modern process of twisting paper yarns from the finished paper, subsequently moistened, results in a decrease of the dry strength, the yarns from the Swedish papers showing an average breaking length of 6·89 km. and those from Hedychium papers 7·37 km. On the other hand, the strength of thoroughly wet paper yarn is very much greater than the strength of the original paper in the wet state. Yarns from the Swedish papers showed a wet strength of 4·18 km. on the average, and yarns from Hedychium, 4·90 km. This increase of wet strength as between paper and paper yarn is due to the twisting of the strips. Yarn made in the old way, by twisting strips without drying and finishing the paper, gave inferior results, both dry and wet. In the manufacture of yarn, the general rule is to produce a paper of a substance of 40—44 grms. per sq. m. and to vary the count of the yarn by varying the width of the strips.—J. F. B.

Sulphite pulp waste lyes; Disposal of ——. Lassar-Cohn. Chem.-Zeit., 1914, **38**, 657—658.

A report on the disposal of the waste lyes from two sulphite pulp mills in the neighbourhood of Königsberg. The effluent from one mill is discharged into the town sewers for irrigating the sewage fields. The admixture of the sulphite lyes with the sewage has produced a beneficial effect upon the crops, the large proportion of non-nitrogenous organic matter introduced by the lyes having an effect similar to that produced by the straw of farm-yard manure when used in conjunction with town-sewage, great bacterial activity being thereby induced. The soluble sulphur compounds probably also play an important part, for it has been shown that electrolytically prepared phosphates are by no means so successful as ordinary superphosphates, owing to the absence of calcium sulphate. The waste lyes from the other mill, situated at the mouth of the river, are carried out into the bay by tank-steamers and gradually discharged on the voyage. Here again, a beneficial result is recorded. The organic matters of the lye encourage the growth of the plankton, which attracts the fish, and the local fishery statistics show considerable increase. The question of profitable or even costless disposal of the lyes still awaits solution. The hygroscopic nature of the solid matters of the lyes makes them unsuitable for fuel briquettes, although small quantities are successfully applied for briquetting blast-furnace dust; the evaporation, however, is a difficult problem. Over 2 million kilos. of waste lyes are produced daily by the German pulp mills alone.—J. F. B.

Pseudo-tannins in sulphite-cellulose extracts. Moeller. *See* XV.

Detection of sulphite-cellulose extract. Gansser. *See* XV.

Patents.

Air-craft; Fabric [conducting electricity] for use in the manufacture of ——. R. Weil, Hanover, Germany. Eng. Pat. 23,932, Oct. 22, 1913. Under Int. Conv., Jan. 16, 1913.

Fabrics are treated with finely powdered graphite or with a mixture of rubber and graphite or with each successively. The conducting material is so applied or

brushed into the fabric that any movement of the latter independent of the conducting powder is impossible.
—J. F. B.

Fur and hair; Process for carotting ——. L. F. Paris, Paris. Eng. Pat. 5409, Mar. 3, 1914. Under Int. Conv., Mar. 5, 1913.

Fur or hair intended for the manufacture of felt is subjected to the action of nitrous anhydride, nitrosyl chloride, and a combination of nitrosyl chloride with a metallic chloride, *e.g.*, $ZnNOCl_3$, or a mixture capable of yielding such substances, together with a small excess of nitric and hydrodrochloric acids. Example: for a yellow carotting fluid, sodium nitrite and nitrate (300 grms. of each) are dissolved in 8 litres of water and 100 c.c. of commercial sodium hypochlorite solution added. A mixture consisting of nitric acid (sp. gr. 1·31), 1800 c.c.; hydrochloric acid, 500 c.c.; zinc chloride solution (sp. gr. 1·42), 350 c.c. is then stirred in and the skins treated in the ordinary way. A neutral salt, *e.g.*, a strontium or barium salt may be added to impart a lustre to the hair and precipitate any sulphuric acid present.—J. F. B.

Acetylcellulose solutions; Manufacture of ——. D. E. Reid. Assignor to Eastman Kodak Co., Rochester, N.Y. U.S. Pat. 1,095,999, May 5, 1914.

Acetylcellulose is dissolved in a solvent of low boiling point, mixed with a transparent non-oleaginous liquid which is not a solvent of cellulose, has a relatively high boiling point, is incapable of combining chemically with the cellulose or the solvent, and is non-inflammable. A solution of acetylcellulose in acetone, containing pentachloroethane in the proportion of 50—100% of the weight of the cellulose, is specified.—J. F. B.

Cellulose esters; Process for preparing ——. Knoll und Co. Ger. Pat. 272,121, Dec. 20, 1911.

Cellulose or an analogous compound is treated with an organic anhydride in presence of a salt of an ester-sulphuric acid. By adjusting the conditions of the reaction, acidylcelluloses soluble in chloroform and insoluble in acetone, or soluble in acetone may be obtained. Salts of the weaker bases are the more active catalysts.—T. F. B.

Pulp stuff; Apparatus for refining —— *for use in the manufacture of paper and the like.* T. H. Nash, St. Paul's Cray, Kent. Eng. Pat. 6876, Mar. 18, 1914.

The stuff is contained in a mixing chest having a well-shaped or semi-circular bottom in order to retain the heavy impurities which settle out; an agitator or zig-zag frame, mounted on a horizontal shaft in bearings situated in the ends of the chest, serves to keep the pulp well mixed. At a point above the lowest level of the chest is a sluice from which the stuff may be discharged in a regulated stream into a shoot, which delivers it down an inclined base, feeding the stuff between the roll and bed-plate of a beating engine. The beating apparatus may consist of one or several rolls, with their respective bed-plates, arranged consecutively on the inclined base. After treatment under the lowest beater-roll the stuff is returned to the mixing chest by a pump.—J. F. B.

Papers; Manufacture of opaque ——. A. D. Daigre and L. P. A. A. Bailleul, Paris. Eng. Pat. 7883, Apr. 3, 1913.

Opaque papers are made by the superposition of two or more layers of paper or partly manufactured moist paper coming from the paper-forming wires, the inner faces of the outside layers being coloured or coated and the whole united in a single sheet by suitable couch or press rolls. Preferably, the opaque or coloured layer is applied in the form of a very fine paper pulp introduced between two outer layers of paper so that under pressure it tends to fill up the pores of the inner surfaces of these layers. This opaque intermediate layer may be composed of a basis of magnesium carbonate with the necessary quantity of colouring matter and a small proportion of finely beaten rag or other stock.—J. F. B.

Paper; Manufacture of a flexible and waterproof material from ——. G. Magnasco, Genoa, Italy. Eng. Pat. 18,836, Aug. 19, 1913.

Sheets of paper are coated or impregnated with a mixture of animal glue, 25 parts; glycerin, 20; albumin, 10; camphor, 8; linseed oil, 10; sulphur, 7; water, 20 parts. The product is then tanned with formaldehyde or tannic acid on one side and a number of superposed sheets are compressed together. Tissues, threads or wires may be interposed between the sheets to strengthen the material. The composite sheet is afterwards again immersed in a tanning solution, dried and coated with paraffin wax or fats.—J. F. B.

Insects [in furs, skins, etc.]: Process of destroying ——. A. Erlenbach, Dessau, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,097,406, May 19, 1914.

See Fr. Pat. 442,719 of 1912; this J., 1912, 1026.—T. F. B.

Producing fermentable sugars [from cellulosic materials] U.S. Pat. 1,096,030. *See* XVII.

Purifying alcohol manufactured by distilling fermented sulphite liquor. U.S. Pat. 1,095,830. *See* XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing of wool; The theory of the ——. *Preliminary investigation of the constitution and dyeing properties of wool.* K. Gebhard. Z. angew. Chem., 1914, **27**, 297—307.

The presence of a primary amino group in wool is evident from the formation by the action of nitrous acid of a diazo compound and not a nitrosamine. In agreement with this is the absence of any reaction between the diazo-compound and phenol and sulphuric acid, also the normal combination of the diazo-compound with a series of azo-components and the fact that any condensation which has the effect of stopping up or removing an amino group has the effect of rendering wool undiazotisable. Treatment of diazotised wool with caustic soda causes a brown coloration and an increase in the acidic properties of the wool (loss of affinity for acid dyes) which suggests the formation of a triazone. The fact that wool has not yet been deamidised by decomposition of the diazo compound. which points to nitrosification rather than diazotisation, may be due either to ring formation between the diazo and the carboxyl groups or reduction to hydrazine. In support of the latter assumption is the violet colour which diazotised and boiled-out wool gives with caustic soda just like the hydrazinesulphonic acid of anthraquinone The hydrazinesulphonic acid of wool gives an orange coloration with zinc chloride, and it is suggested that ring formation takes place. The power of this condensatio product still to fix to a certain extent acid dyestuff suggests the weakly basic properties of a pyrazolone ring Treatment of wool with acetic anhydride seems to lead i the first instance to simple acetylation of the amin group. The wool loses its basic properties and its affinit for acid dyestuffs, whereas its affinity for basic dyestuffs i increased. Further action causes a strong brown coloration of the wool, due to ring (lactone, miacin, pyridone formation. Aldehydes which condense with the amin group, bisulphites which convert it into hydroxyl o sulphinic acid and oxidising agents which convert it int hydroxyl or cause ring (indazole) formation all have th effect of depriving wool of its basic functions as show by loss of affinity for acid dyestuffs and increased affinit for basic colours. Wool also behaves like a primar amine in forming salts, for instance with phosphotungsti acid. This salt formation is prevented by acetylation the wool but is not affected by esterification of the carbox group. The existence of a carbonyl group is shown b the action of hydroxylamine on wool. The affinity fo acid dyestuffs is thereby decreased, that for basic dyestuffs unchanged or increased. These effects can be heightened by inner salt formation, according to whether it takes place between the :C : NOH residue and the amino group or the carboxyl group, phosphotungstic acid furnishing an example of the former and aluminium acetate of the latter. That a carboxyl group is present in wool is shown by the formation of coloured metallic salts and by the fact that esterification with alcohol and sulphuric acid leads to a loss of all the acid properties of the wool. For complete reservation of wool against acid dyestuffs inner complex ring or salt formation involving both the amino and the carbonyl groups appears to be necessary, examples of which are the products of reaction of wool with pyrotartaric acid, urea or methylenedisalicylic acid, or the well-known tannin-stannous chloride reserve. The complex salt wool oxime-phosphotungstic acid is also an example. Of a large number of amino-acids examined in regard to their behaviour towards dyestuffs and mordants, only such as contained an aromatic nucleus, and particularly anthranoylanthranilic acid, approximated in their properties to wool, and it is concluded that a substance analogous to anthranoylanthranilic acid is the chief constituent of wool.—J. B.

Boric acid; The use of —— for souring. R. Weiss. Sealed note, No. 1366, dated Dec. 29, 1902. Report thereon by Th. Stricker. Bull. Soc. Ind. Mulhouse, 1914, **84**, 127—128.

A solution containing 3 grms. of boric acid per litre is used for souring after bleaching. There is not the same risk of tendering as when mineral acids are used, as a solution of boric acid can be dried on the fibre without risk. Ramie is said to be improved in appearance by this process.—J. B.

Barium aluminate as a mordant for cotton; The use of ——. L. Grenot. Sealed note, No. 1365, dated Dec. 25, 1902. Report thereon by M. Battegay. Bull. Soc. Ind. Mulhouse, 1914, **84**, 124—125.

Cotton is impregnated with a solution of barium aluminate and exposed to the air, whereby the salt is decomposed and alumina is deposited on the fibre. The process is applicable to Alizarin dyeing with or without oiling. —J. B.

Reserve; A new —— [under zinc dust and stannous chloride discharges]. A. Lehmann. Sealed note, No. 1381, dated Feb. 23, 1903. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1914, **84**, 125—127.

Precipitated sulphur is proposed as a reserve under zinc dust discharges, and sulphur in the form of hydrosulphite as a reserve under stannous chloride discharges. Hydrosulphite also gives good results in reserve printing under chlorate-prussiate black. The sulphur reserve is now obsolete since zinc and tin-salt have been replaced by hydrosulphite for discharge work, under which the usual reserves are nitrite and other oxidising agents or non-volatile organic acids.—J. B.

Patents.

Bleaching liquor; Process for the regeneration of ——. W. Mathesius and M. Freiberger. Fr. Pat. 466,121, Dec. 12, 1913. Under Int. Conv., April 2, 1913.

Bleaching kier liquor is regenerated by boiling with lime, filtering, treating with an oxidising agent (*e.g.* a hypochlorite), boiling and finally correcting the excess of oxidising agent, with bisulphite, for example.—J. B.

Singeing yarn and fabrics; Process and apparatus for ——. B. Szilard, Paris. Eng. Pat. 15,867, July 9, 1913. Under Int. Conv., July 10, 1912.

A quartz screen is interposed between the flame and the article to be singed.—J. B.

Mercerising yarn; Machines for ——. P. Hahn, Niederlahnstein a/R., Germany. Eng. Pat. 14,702, June 25, 1913.

The mechanism for stretching the yarn in mercerising machines of the type described in Eng. Pat. 22,235 of 1902 (this J., 1903, 993) is modified so as to avoid unnecessary stresses on the wearing parts of the machine during that part of the process in which the yarn is not under tension.—J. B.

Silk: Weighted —— and process of making it. E. Stern, Hanover, Germany. Assignor to Deutsche Gasglühlicht Akt.-Ges. (Auerges.), Berlin. U.S. Pat. 1,095,681, May 5, 1914.

Silk is treated with a solution containing a cerium salt rich in didymium and lanthanum, a zinc salt and a tin salt.—J. B.

Shifting hanks of yarn in dyeing; Apparatus for ——. Niederlahnsteiner Maschinenfabrik G. m. b. H. and P. Hahn, Niederlahnstein-on-the-Rhine, Germany. Eng. Pat. 16,738, July 21, 1913. Addition to Eng. Pat. 13,982 of 1911, dated June 13, 1910 (see Fr. Pat. 421,183; this J., 1911, 486).

A regulating mechanism is incorporated in the machine to enable adjustments to be made before starting, so that the beginning of the period, at which hanks must be turned and displaced on their carriers, can be regulated relatively to the intermediate period during which the hanks are only displaced. The regulation may be varied, according to the nature or the qualities of the yarn to be treated and the dye employed, thus enabling operations previously carried out by hand to be done automatically.—B. N.

[Developed] dyestuffs on the fibre by the one-bath method; Production of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt a/M., Germany. Eng. Pat. 9102, April 9, 1914.

Cotton goods are padded or printed with a caustic soda solution of an arylide of 2.3-hydroxynaphthoic acid and a nitrosamine salt (*e.g.*, that derived from *p*-nitraniline) and developed by passing through a solution of a weak acid or an acid salt, for example acetic acid or sodium bichromate. Brilliant red shades are produced. (See Eng. Pat. 13,766 of 1912; this J., 1912, 915.)—J. B.

Dyeing wool; Process of —— by means of furfural. A. and E. Lederer. Fr. Pat. 466,323, Dec. 17, 1913.

Wool is dyed yellow by treating it with a solution of furfural, the shade changing to a black on exposure or by the action of hydrochloric acid. Hydrochloric acid may be added directly to the bath or the process may be advantageously employed in connection with carbonising. The addition of metallic salts varies the shade and it is also possible to use the condensation products of furfural with phenols or other substances capable of undergoing the Perkin-Claisen condensation.—J. B.

Dyeing furs; Process for ——. L. Cassella und Co. Ger. Pat. 272,736, June 13, 1913.

Fur skins are chrome-tanned and simultaneously or previously treated with formaldehyde, then treated with chlorine and finally dyed with an acid wool dyestuff. The formaldehyde treatment reduces the amount of chloride of lime required to about one-third. If it is not desirable for the skin itself to come in contact with the formaldehyde, the fur alone is treated prior to tanning.—T. F. B.

Printing Alizarins; The preparation of esters of high molecular weight and their application in ——. Mollard and Cumet. Fr. Pat. 466,005, Dec. 10, 1913.

Substances of the ester type are produced by treating fatty acids of high molecular weight and having an alcoholic function (*e.g.*, ricinoleic acid) with acids other than sulphuric or formic, for example phosphoric, acetic, lactic or butyric acids. The new products are stable in the cold but decompose on heating in the presence of water with liberation of the fatty acid, which property enables them to be used for the direct printing of Alizarins without previous oiling.—J. B.

Brown or grey prints on vegetable fibres ; Process for producing fast ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 272,686, March 30, 1913. Addition to Ger. Pat. 271,252 (see this J., 1914, 480).

HEXAMETHYLENETETRAMINE is used in place of formaldehyde in the process described in the princ'pal patent. The printing colours prepared in this way are more stable than those made with formaldehyde.—T. F. B.

Lace and other similar goods, woven or other fabrics ; Coating —— *with metal.* E. A. and B. O. Holland, London. Eng. Pat. 9786, Apr. 25, 1913.

THE lace or other fabric is rendered waterproof by immersion in a solution of shellac or other varnish ; after drying, it is coated successively with a mixture of Oxford ochre and boiled oil, leaf-metal, and two layers of thin varnish or lacquer. The first treatment may be partly replaced by the application of rubber solution and parchment size. —J. F. B.

Hanks of yarn ; Apparatus for treating —— *with a liquid contained in a trough.* H. Hablützel, Zürich, Switzerland. Eng. Pat. 16,858, July 22, 1913.

SEE Fr. Pat. 460,829 of 1913 ; this J., 1914, 73.—T. F. B.

Mercerised cotton ; Production of ——. C. Rumpf, Berlin. Eng. Pat. 24,236, Oct. 25, 1913. Under Int. Conv., Oct. 28, 1912.

SEE Fr. Pat. 464,114 of 1913 ; this J., 1914, 418.—T. F. B.

Cotton ; Process for the treatment of ——. B. Teufer, Chemnitz, Germany. U.S. Pat. 1,097,377, May 19, 1914

SEE Fr. Pat. 463,073 of 1913 ; this J., 1914, 248.—T. F. B.

Printing gallocyanine dyestuffs on cotton ; Resist method of ——. Farbwerke vorm. L. Durand, Huguenin und Co., Basle, Switzerland. Eng. Pat. 8355, April 2, 1914. Under Int. Conv., May 2, 1913.

SEE Ger. Pat. 269,933 of 1913 ; this J., 1914, 418.—T. F. B.

Printing-colours. L. Schütze, Leipzig-Eutritzsch, and R. Fischer, Leipzig-Reudnitz, Germany. U.S. Pat. 1,096,198, May 12, 1914.

SEE Eng. Pat. 12,567 of 1913 ; this J., 1913, 1007.—T. F. B.

Finishing or dressing textile fabrics with soapy preparations. R. Weiss, Kingersheim, Germany. U.S. Pat. 1,097,493, May 19, 1914.

SEE Fr. Pat. 448,490 of 1911 ; this J., 1913 435.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Potassium ferricyanide ; Electrolytic production of ——. G. Grube. Z. Elektrochem., 1914, **20**, 334—344.

IN the electrolysis of potassium ferrocyanide, good current yields of ferricyanide in solution were obtained when the anode and the cathode were separated by a diaphragm and the contents of the anode compartment well stirred. The current yield was best at low anode current densities, and was independent of the nature of the anode (nickel, platinum, iron, copper or lead peroxide). Maximum yield was obtained at about 50° C. ; above this temperature the alkaline solution of ferricyanide in the anode compartment suffered a purely chemical decomposition with formation of iron oxide which produced a non-conducting coat on the anode and thus lowered the efficiency of the cell. For the process to be of industrial value solid ferricyanide must be separated at the anode, since the alkaline liquid which accumulates there could not be evaporated without loss. By keeping the anolyte saturated with ferrocyanide, the ferricyanide was deposited in a pure finely crystalline form. When the anolyte had become so alkaline that oxygen began to be evolved it was regenerated by adding a suitable amount of potassium calcium ferrocyanide and passing in carbon dioxide : $CaK_2Fe(CN)_6+2KOH+CO_2=K_4Fe(CN)_6+CaCO_3+H_2O$. When nickel electrodes were used in the electrolysis it was necessary to exclude chloride from the electrolyte.—W. H. P.

Aluminium nitride ; The preparation of —— *from its elements.* J. Wolf. Z. anorg. Chem., 1914, **87**, 120—128.

PURE aluminium heated quickly to 2000° C. in a current of nitrogen and kept at this temperature for 60 mins. gave a product containing 33·9% N (theoretical 34·08%). Aluminium nitride dissociates in nitrogen at atmospheric pressure at about 1850° C. When heated in nitrogen at a pressure of 4·3 atmospheres, it melts at about 2150°—2200° C. It appears to exist only in the crystalline form.—T. ST.

Nitrides ; Dissociation pressures of some ——. R. E. Slade and G. I. Higson. Report of Brit. Assoc., 1913, 451.

VANADIUM, tantalum, or boron was heated in an unglazed porcelain boat *in vacuo*, nitrogen was admitted and allowed to react until the dissociation pressure of the nitride was attained, then some nitrogen was pumped off, and equilibrium established from the other side. The results obtained were :—

	Temperature.	Pressure.
	° C.	mm.
Vanadium	1203	Not greater than 0·2
„	1271	„ „ „ 1·5
Tantalum	1170	„ „ „ 0·4
Boron	1222	„ „ „ 9·4

—A. S.

Nitric oxide ; The compounds of —— *with ferrous and copper salts.* W. Manchot. Ber., 1914, **47**, 1601—1614. (See also this J., 1910, 563 and 1202.)

ON account of the reversibility of the reaction $FeSO_4+NO \rightleftharpoons FeSO_4\cdot NO$, only a portion of the iron in aqueous solutions of ferrous sulphate is combined with nitric oxide. In alcoholic solution, however, the absorption proceeds to completion, and by the addition of ammonium phosphate, potassium ferrocyanide, borax, or sodium arsenate, the insoluble ferrous-nitric oxide salt is precipitated, free from admixed ferrous salt. The product precipitated with ammonium phosphate had the composition $Fe(NO)HPO_4$ and formed a crystalline mass melting at 16° C. The ability of copper salts to combine with nitric oxide is limited to the bromide, chloride, and sulphate. In each case only 1 mol. NO is absorbed per atom Cu, and the products are extremely sensitive to water. The view previously put forward that the brown iron compounds are analogous to the basic ferric salts ($HO\cdot Fe:SO_4$, $NO\cdot Fe:SO_4$) is confirmed by the isolation of the phosphate above, and by the fact that a brown $(FeNO)^{\cdot\cdot}$ ion wanders to the cathode during electrolysis. In the previously described green compounds a (FeNO) group exists in the anion. The red iron-nitric-oxide compounds, and all the copper compounds gave negative results on electrolysis. Iron in stable complexes as the ferrocyanides or the tri-*a,a*-dipyridyl iron compounds is unable to combine with nitric oxide (or carbon monoxide, which is of importance with regard to hæmoglobin), but if one of the co-ordinated groups is less firmly bound, *e.g.* in $Na_3Fe(CN)_5NH_3$, the loosely bound group can be displaced. It is probable that in every case the nitric oxide first combines with the whole molecule by subsidiary valencies, since all condition-favouring diminution of dissociation favour the combination with nitric oxide. In dissociating solvents ion formation may then occur, the brown compounds being the limiting case.—G. F. M.

Ferrous-nitric oxide compounds; Lecture experiments with ——. W. Manchot. Ber., 1914, **47**, 1614—1616.

The reversibility of chemical action can be readily demonstrated by means of the reaction $FeSO_4+NO \rightleftarrows FeSO_4 \cdot NO$ (see preceding abstract). The displacement of the equilibrium to the right is shown by the complete absorption of nitric oxide by a concentrated ferrous sulphate solution in a nitrometer, and the reverse reaction by leading first nitric oxide, and then hydrogen into a dilute ferrous sulphate solution in a wash-bottle, when the intense brown colour first produced will, after 3—4 mins., have completely disappeared. Coloration and decolorisation can be effected in a similar manner, and still more rapidly, if a dilute alcoholic solution of cupric chloride be substituted for the iron solution.—G. F. M.

Radium preparations and mesothorium preparations of different ages; Distinguishing —— by the aid of their γ-radiation. O. Hahn. Strahlentherapie, 1914, **4**, 154—174. Chem. Zentr., 1914, I, 1779—1780.

If a solution of a radioactive salt be heated for several hours on the water-bath, with occasional boiling, the penetrating radiation falls to practically nil in the case of a radium salt, since the active deposit decomposes and the emanation is prevented from accumulating. If mesothorium be present, the penetrating radiation diminishes by an amount corresponding to the proportion of radium present. In freshly-prepared mesothorium products a radium-content corresponding to 25% of the total γ-radiation was found. In the following table the penetrating powers of the γ-rays from various radium and mesothorium preparations are shown, the figures representing the proportions of the total radiation passing layers of lead of increasing thickness, the portion passing a layer 3·3 mm. thick being taken as 100.

Thickness of lead, in mm.	Pure radium bromide.	Commercial mesothorium bromide.		Mesothorium bromide free from radium.	Radio-thorium.
		Freshly prepared.	About 2 years old.		
3·3	100	100	100	100	100
5	84·5	86·7	85·5	87·3	86·8
10	57·6	60·7	60·1	60·8	63·1
15	41·9	44	44·6	43·2	47·1
20	31·5	32·1	33·2	31·5	36·8
25	24·2	23·7	25·2	22·8	29·1
30	18·6	17·7	19·4	16·7	23·3
35	14·3	13·4	15·1	12·2	18·8
40	11·3	9·9	11·8	9·2	15·3
45	9·9	7·5	9·1	6·8	17·4

Curves plotted from results such as these afford a ready means of characterising various radioactive preparations. Attention is drawn to the great influence of the material of the electroscope: the action of the γ-rays was considerably greater in an electroscope made of lead than in one of aluminium or zinc, thus affording proof of the very strong secondary radiation of lead.—A. S.

Determination of ferrocyanides by oxidation with an alkali bromate. De Koninck and Joassart. *See* XXIII.

Patents.

Acid-resisting pipes and vessels for use in sulphuric acid concentration; Process of manufacturing ——. W. Strzoda, Schoppinitz, Germany. Eng. Pat. 26,732, Nov. 20, 1913.

An inner, acid-proof lining is separated from an outer, iron shell by a porous, acid-resisting cement, which is capable of reacting with iron and sulphuric acid, at places where leaks may occur, to form acid- and heat-resisting seals. Such a cement may be composed of fossil earth, barium sulphate, and sodium silicate, with or without the addition of iron powder.—O. R.

Drying liquids, gases and vapours [nitric acid]; Process of ——. Norsk-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 465,504, Nov. 29, 1913. Under Int. Conv., Nov. 30, 1912.

The weak nitric acid is vaporised and the vapours passed up a tower supplied with concentrated sulphuric acid, so that only practically dry nitric acid vapour escapes from the top. To avoid irregular working due to the heat evolved by the absorption of water by the sulphuric acid, a portion of the latter is withdrawn from the lower part of the tower, passed through a cooler and returned higher up. The diluted sulphuric acid from the bottom of the tower is concentrated for use again but is first passed through an apparatus in which the nitric acid is expelled by a current of air, the vapours of nitric acid carried away being passed up the first tower.—W. H. C.

Hydrosulphites; Manufacture of anhydrous ——. J. Y. Johnson, London. From Kinzlberger und Co., Prague, Austria. Eng. Pat. 11,010, May 9, 1913.

Anhydrous hydrosulphites are prepared by heating sodium formate with sodium bisulphite or sodium pyrosulphite to 65°—70° C. in the presence of alcohol, of 70—90% strength, preferably with addition of sulphur dioxide or formic acid, or both.—O. R.

Sulphur-bearing materials; Process of treating ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 21,385, Sept. 22, 1913.

Sulphur-bearing materials, especially the residues from the purification of coal-gas, are passed continuously through a container, in which they are subjected to the action of steam and gases, heated to a temperature below that at which sulphur volatilises. The issuing gases are drawn through a saturator, for the absorption of the ammonia (which is formed and evolved in the container), and forced through a superheater back into the container. The object of the process is to remove organic matter, etc., from the material and render it more suitable for the production of sulphur dioxide for use in the manufacture of sulphuric acid.—O. R.

Aluminium nitride; Method of obtaining —— by heating alumina or aluminous materials and carbon in an atmosphere containing nitrogen. Soc. Générale des Nitrures, Paris. Eng. Pat. 23,740, Oct. 20, 1913. Under Int. Conv., Nov. 22, 1912.

A mixture of aluminous substances and carbon is blown, dropped, or passed in a state of suspension through a graphite tube, several metres high and 12 cm. in diameter, which is heated electrically to about 2000° C.—O. R.

Aluminium nitride; Preparation of —— in electric furnaces heated by the electric arc. Aluminium Industrie Akt.-Ges. Fr. Pat. 465,807, Dec. 6, 1913. Under Int. Conv., Dec. 7, 1912.

A mixture containing alumina and carbon is heated by the electric arc, and a plentiful supply of nitrogen or gas containing nitrogen is led directly into the flame through hollow electrodes, or is passed between the arc and the mixture, leaving the furnace at a somewhat lower level. The furnace (preferably of the shaft type) is provided with a cover, and the wall is pierced at about the level of the electrodes by channels directed downwards and normally closed, which communicate with a spherical cavity in the charge, formed around the electrodes during working. The channels serve for recharging and permit of working the charge, so that the reaction product (relatively pure aluminium nitride) may be regularly withdrawn through an opening at the bottom of the furnace.—F. Sodn.

Nitrogen compounds of aluminium and alkali or alkaline-earth metals; Manufacture of double ——. D. Peniakoff. Fr. Pat. 465,679, Feb. 11, 1913.

An alkali or alkaline-earth aluminate (or substance yielding such on heating), mixed with an amount of carbon equivalent to the combined oxygen present, is heated in a current of nitrogen or gas containing nitrogen, which is readily absorbed at a relatively low temperature. The double nitride thus obtained is treated for the production of ammonia or other nitrogen compound, with simultaneous recovery of aluminate, or of pure alumina and alkali or alkaline-earth compounds.—F. Sodn.

Zinc lyes; Treatment of ——. W. Buddeus, Charlottenburg, Germany. Eng. Pat. 25,967, Nov. 12, 1913. Under Int. Conv., Dec. 11, 1912.

Zinc lyes containing ferrous iron are treated with sufficient slaked lime to precipitate all the zinc and all the ferrous iron, the precipitate is dried by means of air, which oxidises all the ferrous to ferric hydroxide, and the dried mass is treated with sufficient acid to form the corresponding zinc salt only, all the zinc hydroxide being dissolved before the ferric hydroxide is attacked.—O. R.

Hydrogen peroxide; [Electrolytic] Manufacture of ——. H. Wade, London. From Henkel und Co., Düsseldorf, Germany. Eng. Pat. 754, Jan. 10, 1914.

In the electrolytic production of hydrogen peroxide, as described in Eng. Pat. 8582 of 1913 (this J., 1913, 791), the amalgamated gold cathodes are replaced by cathodes composed of silver or copper amalgam.—O. R.

Calcium cyanamide; Process and means for producing continuously ——. Dettifoss Power Co., Ltd., and J. H. Lidholm, London. Eng. Pat. 3546, Feb. 11, 1914. Under Int. Conv., Feb. 18, 1913.

Calcium carbide is fed continuously through an electrically heated, inclined, rotary tube furnace, into which nitrogen is injected under pressure. The furnace contains, in addition to a main channel, one or more longitudinal channels, and is provided with a system of injectors, which produce a circulation of the nitrogen, the flow of the gas in the main channel being in counter-current to the passage of the carbide, which moves from a hopper at the feed end, through the zone of highest temperature, to a collecting chamber at the delivery end.—O. R.

Nitrogen compounds derived from carbides [calcium cyanamide]; Manufacture of ——. J. H. Lidholm and Dettifoss Power Co., Ltd. Fr. Pat. 465,473, Nov. 28, 1913. Under Int. Conv., Feb. 24, 1913.

Nitrogen is supplied to a closed (preferably bell-shaped) furnace chamber, fitted with a movable hearth which may be lowered from the furnace and removed on rails. The charge is not allowed to come into contact with the walls of the chamber, but is introduced into a receiver on the hearth, before this is moved into position, or is fed in gradually through a device in the roof of the chamber. A second charge is introduced into the heated furnace, on a new hearth, as soon as the first has been withdrawn.—F. Sodn.

Aluminium-bearing materials; Treatment of ——. H. P. Bassett, Catonsville, Md. U.S. Pat. 1,095,306, May 5, 1914.

Clay, felspar, or the like, is heated with an equal weight of a mixture of sodium carbonate, 3, and sodium chloride, 2 parts, the soluble portion of the treated mass is extracted with water, carbonated, and the aluminous precipitate is separated. Caustic alkali is added to the remaining solution, to convert sodium and potassium bicarbonates into carbonates, and the solution sufficiently evaporated to separate sodium carbonate and chloride.—O. R.

Antimony oxide; Method of manufacturing ——. A. L. Stark, Assignor to The Enamel Company of America, Elyria, Ohio. U.S. Pat. 1,096,468, May 12, 1914.

A combustible mixture of air and hydrocarbon holding powdered antimony sulphide in suspension, is discharged into a chamber where it is ignited, the mixture of antimony oxide and sulphur dioxide produced is immediately cooled so as to prevent the formation of antimonic oxide, and the antimony oxide separated, *e.g.*, by passing the combustion products through a settling chamber and dust collector.—F. Sodn.

Radium, radioactive emanations, and other radioactive substances; Process of extraction, isolation, and concentration of ——. E. Ebler. First Addition, dated Dec. 4, 1913, to Fr. Pat. 440,236, Feb. 16, 1912 (this J., 1912, 723). Under Int. Conv., Dec. 11, 1912.

Adsorption is effected by means of hydrated manganese peroxide which may be formed *in situ* by reducing permanganate (preferably with manganese chloride), and the radioactive salt, extracted from the adsorption product, is redissolved, and the treatment repeated until the desired concentration of radium (with respect to barium, for instance) is effected.—F. Sodn.

Radioactive preparation. Radiogen-Ges. m. b. H. Fr. Pat. 466,015, Dec. 10, 1913. Under Int. Conv., Dec. 13, 1913.

A radioactive substance, of such a nature that its first decomposition product is the mother-substance of the emanation of the radioactive matter, is incorporated in a porous, inert vehicle. For example, radio-thorium, the first product of which, thorium X, gives rise to thorium emanation, may be used.—O. R.

Sodium chloride; Process of decomposition of ——. A. Helbronner. Fr. Pat. 465,350, Feb. 3, 1913.

Sodium chloride is subjected to the combined action of carbon and steam (or their reaction products) in the presence of metallic oxides (such as ferric oxide or alumina) which react with the sodium hydroxide formed to give such compounds as ferrites, aluminates, etc.—F. Sodn.

Ammonium nitrate; Manufacture of ——. Wulfing Dahl and Co. Fr. Pat. 465,683, Nov. 18, 1913.

Sodium nitrate (1 mol.), or a mixture containing alkali nitrate and other alkali or ammonium salts, is treated in aqueous solution with sufficient ammonium sulphate (at least 1 mol.), to convert all the alkali metal into alkali ammonium sulphate, and the ammonium nitrate formed is separated by fractional crystallisation from the less soluble double salt, or the solution is concentrated and extracted with alcohol or other solvent. Or, sodium nitrate and ammonium sulphate are allowed to interact in equivalent proportions, the double salt destroyed by heating (*e.g.*, to 119° C.), the solution concentrated until most of the sodium sulphate has separated, and the mother liquor, after adding more ammonium sulphate to convert the remaining sodium sulphate into double salt, is treated as above.—F. Sodn.

Separation of particles easily condensed or absorbed from those which are not easily condensed or absorbed, from mixtures of hot compressed gases. [Ammonia from hydrogen and nitrogen.] B. Lepsius. Fr. Pat. 466,102, Dec. 12, 1913. Under Int. Conv., Dec. 13, 1912.

The hot mixture of ammonia with the residual hydrogen and nitrogen coming from the contact apparatus is passed into the cylinder of a compressing pump where it expands and is cooled, at the same time doing work. The cooled mixture of gases is then passed through an absorbing or condensing apparatus and the ammonia separated. The residual hydrogen and nitrogen pass back into the othe end of the cylinder and are compressed, whereby the are raised to a suitable temperature and pressure for us again in the contact apparatus. Fresh supplies of hydrogen and nitrogen may be added to the residual gases and any deficiency of power is supplied from external sources.—W. H. C.

Ammonia ; Process for the catalytic production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 466,303, Dec. 5, 1913. Under Int. Conv., Feb. 26, 1913.

In the synthesis of ammonia from nitrogen and hydrogen under pressure, the contact mass is cooled, *e.g.* by embedding in the mass a spiral cooler, through which a current of cold, compressed gases circulates.—O. R.

Ammonium sulphate from calcium carbonate muds containing it ; Extraction of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 466,302, Dec. 5, 1913. Under Int. Conv., Feb. 26, 1913.

Calcium carbonate slimes containing ammonium sulphate are filtered in an "immersion suction filter," comprising a number of submerged filtering elements, each consisting of two filtering surfaces mounted on a frame, and separated by a space from which conduits lead to a suction device.—O. R.

Nitrous gases ; Process for the absorption of ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 465,740, Dec. 4, 1913.

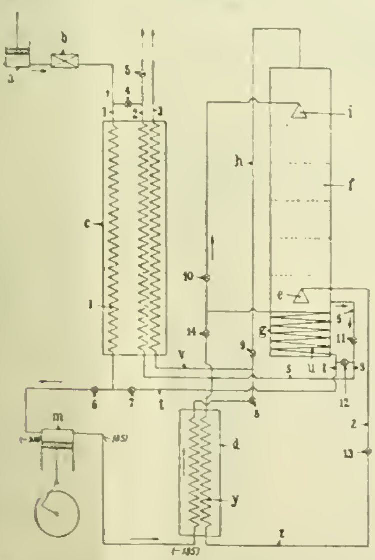
Dilute acid produced by absorption of nitrous gases is alternately neutralised (by limestone, for example) and employed for absorbing further quantities of the gases until any desired concentration of calcium nitrate is reached.—F. Sodn.

Colloidal silicic acid ; Process for the purification of liquids containing ——. H. W. de Stucklé. Fr. Pat. 465,817, Dec. 6, 1913. Under Int. Conv., Dec. 7, 1912.

Hydrofluosilicic acid, or one of its salts, is used to precipitate silica completely from its colloidal solutions, the separation taking place instantaneously at boiling temperature. A portion of the silica present may be converted into hydrofluosilicic acid by addition of a fluoride and a mineral acid, and used to precipitate the remainder.—O. R.

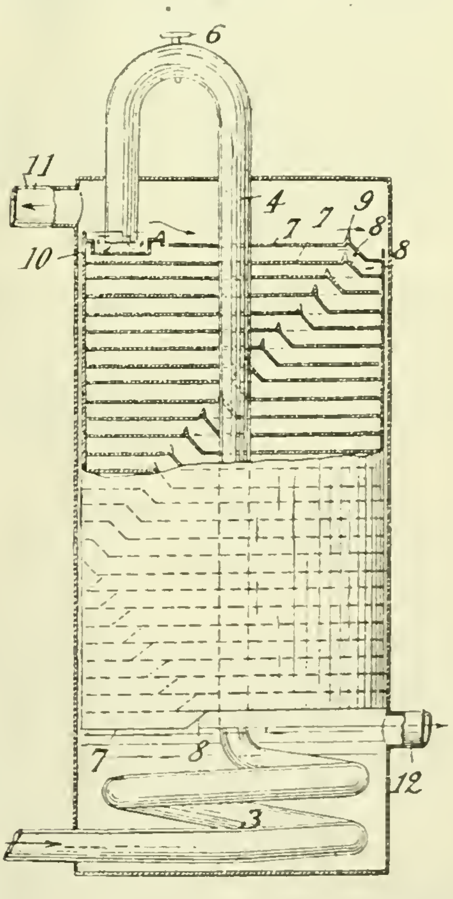
Liquefaction of air, with a view to its separation into its constituent elements ; Process and apparatus for the ——. G. F. Jaubert. Fr. Pat. 465,822, Feb. 14, 1913.

First phase : Air at about 25 atmospheres pressure is forced by the pump, *a*, (see Fig.), through the purifier, *b*, into the worms, 1, and 2, of the interchanger, *c*, the tap, 4, being open, and the tap, 5, closed. Passing downwards through 1, and by way of the open tap, 6 (tap, 7, being closed), into the expansion motor, *m*, which it enters and leaves at temperatures of about —100 C. and —185° C. respectively, the air passes into the liquefier, *d*, and through the open tap, 8, by way of the tube, *v*, into the worm, 3, of the interchanger. Taking the other course down the worm, 2, the air passes through the tap, 12, into the coils, *u*, of the vaporiser, *g*, where it is cooled by a shower of liquid air issuing from the rose, *e*. Leaving *u*, the air, now liquefied, passes by way of the tap, 14, into the worm, *y*, of the liquefier, *d*, and through *z* to the rose, *e*. The spray of liquid air falling on the coils, *u*, undergoes partial vaporisation, gaseous nitrogen ascending the column, *f*, and liquid oxygen collecting at its foot at *g*. *Second phase :* When the coils, *u*, are entirely submerged in liquid oxygen, which reaches nearly to *e*, the motor, *m*, is stopped, the taps, 4, 6, 12, 13, and 14, are closed, and the taps, 5, 7, 9, and 11, are opened. Air now passes down the worm, 1, only, through the tap, 7, and tube, *t*, into the coils, *u*, where it is liquefied, passing out to be expanded at 10, into the rose, *i*, from which it flows down and is rectified in the column, *f*. Nitrogen escapes at the top and passes through *h*, and 9, into the worm, 3, whilst oxygen flows through *s*, and 11, into the worm, 2, of the interchanger.—O. R.



Oxygen and nitrogen ; Process and apparatus for the separation of liquid air, by distillation only, into ——. Comp. Internationale de l'Oxygène. Fr. Pat. 466,315, Dec. 16, 1913. Under Int. Conv., Dec. 2, 1913.

Strongly cooled, compressed air passes upwards through the tube, 3, 4, and expansion-valve, 6, whereby it is liquefied. The liquid air overflows from the well, 10, and flows down over a spiral staircase, the surfaces, 7, of which communicate with one another by way of the inclined steps, 8, and are provided with rims, 9. The surfaces, 7



are of very thin, heat-conducting material, and the thin layers of liquid air, the thicknesses of which are determined by the rims, 9, are evaporated by the heat, which is furnished by the air ascending in 4 ; gaseous nitrogen rises upwards to escape at 11, and liquid oxygen descends and is collected at 12.—O. R.

Distilling acids ; Method of and means for ——. W. Ilof, Frankfort, Germany. Eng. Pat. 21,291, Sept. 20, 1913. Under Int. Conv., Sept. 20, 1912.

See Fr. Pat. 463,208 of 1913 ; this J., 1914, 421.—T. F. B.

Ammonium chloride ; Manufacture of ——. Berlin-Anhaltische Maschinenbau-A.-G. Abteilung Köln-Bayenthal, Germany. Eng. Pat. 11,312, May 14, 1913. Under Int. Conv., May 30, 1912.

See Fr. Pat. 457,681 of 1913 ; this J., 1913, 1009.—T. F. B.

Ammonium sulphate ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,979, June 4, 1913.

See Fr. Pat. 462,487 of 1913 ; this J., 1914, 483.—T. F. B.

Hydrogen peroxide ; Process of producing ——. A. Pietzsch and G. Adolph, München, Germany. Eng. Pat. 13,544, June 11, 1913.

See U.S. Pat. 1,083,888 of 1914 ; this J., 1914, 200.—T. F. B.

Refractory fibrous material [silicon oxycarbide] and process of making the same. British Thomson-Houston Co., Ltd., London. From General Electric Co. Schenectady, N.Y., U.S.A. Eng. Pat. 16,299, July 15, 1913.

See U.S.Pat.1,094,352 of 1914 ; this J.,1914, 594.—T. F. B.

Nitrogen simultaneously with oxides of nitrogen ; Process of producing ——. M. Rohmer, Gersthofen, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pats. 1,096,392 and 1,096,393, May 12, 1914.

See Fr. Pat. 453,845 and Eng. Pat. 28,737 of 1913 ; this J., 1913, 791 ; 1914, 483.—T. F. B.

Lead salts of acetic acid ; Manufacture of ——. F. J. Kalkow, Offenbach on Maine, Germany. U.S. Pat. 1,097,099, May 19, 1914.

See Eng. Pat. 29,048 of 1913 ; this J., 1914, 256.—T. F. B.

Manufacture of acetic acid by the destructive distillation of woody matters. Eng. Pat. 10,687. *See* IIb.

VIII.—GLASS ; CERAMICS.

Eye-preserving glass for spectacles ; Preparation of ——. Sir W. Crookes. Phil. Trans. Roy. Soc., 1914 [A. 509], 1—25.

The main object of the research was to prepare a glass which would cut off those rays from highly heated molten glass which damage the eyes of workmen, without obscuring too much light or materially affecting colours of objects seen through spectacles made of the glass. The screening properties of glass plates for ultra-violet, luminous, and infra-red radiations were investigated. Photo-spectrographs were taken, with exposures varying up to 3 hours, of the radiations from a glass tank in actual practice, the temperature at the melting end being 1500° C., and at the working end 1200° C. Infra-red rays being found in far greater abundance than ultra-violet, it is inferred that glassworkers' cataract must be ascribed principally to heat rays. A series of glasses was made by adding pure metallic oxides and earths as colouring or absorbing materials to a soda flux. Absence of striæ was obtained by repeated stirring with a platinum rod ; and freedom from air-bubbles, by leaving the glass in perfect repose for 1½ hours at the maximum temperature. After cooling for 12 hours, plates were cut, ground and polished to a thickness of 2 mm. By superposing on the radiation from a Nernst lamp the light from a high-tension discharge between poles of pure metallic uranium, a practically continuous beam extending from λ 2000 to λ 8000 was obtained, and the absorption of the glass plates recorded on a spectograph. Biotite (black mica) from Norway and "black amber" mica from Africa were found most effective in obstructing light while transmitting heat rays. Athermancy of various glasses by the readings of a thermometer bulb corresponded with the results obtained from a radiometer balance. The prepared plates were first tested in the spectrum apparatus to ascertain the upper limit of transmission of ultra-violet rays. They were next put into the radiometer balance, then tested in an opacity balance to ascertain the percentage of luminous rays transmitted, and finally their colour was registered in a Lovibond tintometer. The composition of the glasses selected for practical use, in percentages by weight, is as follows :—**150** : fused flux 90·00, cerium borate 8·13, $NiSO_4,7H_2O$ 0·07, U_3O_8 1·80 ; **158** : fused flux 89·75, cerium borate 8·13, Fe_3O_4 2·03, Cr_2O_3 0·09 ; **165** : raw flux 87·56, cerium borate 8·00, $FeSO_4,7H_2O$ 3·00, UO_3 0·55, NiO 0·09, Cr_2O_3 0·80 ; **187** : fused flux 83·0, $Ce(NO_3)_3,6H_2O$ 17·0 ; **197** : fused flux 79·00, $Ce(NO_3)_3,6H_2O$ 20·50, $NiSO_4,7H_2O$ 0·30, $CoSO_4,7H_2O$ 0·05, U_3O_8 0·15 ; **202** : flux 95·15, Fe_2O_3 4·75, $CoSO_4,7H_2O$ 0·10 ; **210** : fused flux 89·0, $FeSO_4,7H_2O$ 8·9, Cr_2O_3 1·3, carbon in fine powder 0·8 ; **217** : fused flux 96·80, Fe_3O_4 2·85, C 0·35 ; **221** : fused flux 80·0, $Ce(NO_3)_3,6H_2O$ 13·4, U_3O_8 6·6 ; **238** : raw flux 77·0, $Ce(NO_3)_3,6H_2O$ 23·0 ; **240** : raw flux 90, $FeC_2O_4,2H_2O$ 10 ; **246** : as 240 with a small quantity of red tartar and powdered wood charcoal to prevent oxidation ; **247** : raw flux 92·00, cerium borate 6·30, NiO 0·04, Fe_2O_3 1·60, Cr_2O_3 0·06 ; **248** : fused flux 94·60, $Ce(NO_3)_3,6H_2O$ 4·72, UO_3 0·30, NiO 0·30, $CoSO_4,7H_2O$ 0·08 ; **249** : fused flux 88·47, Fe_2O_3 1·50, $CoSO_4,7H_2O$ 0·03, $Ce(NO_3)_3,6H_2O$ 10·00 ; **250** : raw flux 88·00, cerium borate 5·00, $FeSO_4,7H_2O$ 4·15, U_3O_8 2·75, Cr_2O_3 0·10 ; **251** : raw flux 92·0, $FeSO_4,7H_2O$ 8·0 ; **252** : raw flux 72·60, $Ce(NO_3)_3,6H_2O$ 24·90, $CuSO_4,5H_2O$ 2·10, NiO 0·40 ; **253** : raw flux 88·5, fused black biotite 11·5. The last-mentioned glass has properties contrary to what might be expected from its biotite content ; it offers almost complete obstruction to heat rays. The transmissive powers of biotite itself appears to be due to iron protoxide. In the foregoing recipes the flux used has the composition : sand 61·00, anhydrous sodium carbonate 25·50, recrystallised sodium nitrate 5·00, precipitated calcium carbonate 7·20, borax 0·75, arsenic trioxide 0·55%. The optical properties of the glasses are shown in the following table :—

No.	Heat rays absorbed.	Absorbs violet and ultra-violet rays of wave length shorter than :	Luminous rays transmitted.	Colour.
	%		%	
150	37	3620	73	Pale yellow.
158	63	3700	54	Pale greenish yellow
165	38	3680	42	Pale yellowish green.
187	27	3650	99	Practically colourless
197	41	3800	45	Pale neutral tint.
202	83	3830	25	Neutral tint.
210	87	3620	30	Bluish green.
217	96	3550	40	Bluish green tinge.
221	39	3685	60	Faint yellow.
238	34	3610	71	——
240	88	3950	36	Smoky green.
246	98	3800	27·6	Sage green.
247	29	3620	71	Faint green.
248	47	3550	30	Neutral tint.
249	51	3550	63	Pale blue.
250	25	3685	74	Yellow, green tinge.
251	37	3550	89	Faint yellow.
252	47	3680	45	Faint bluish green.
253	94	3610	30	Sage green

Glasses Nos. 246, 217, 253, 240, 210, and 158 are most effective for cutting off heat rays, Nos. 240, 202, 246, 197, 158, 221, and 150 for absorbing ultra-violet rays, Nos. 187, 251, 250, 150, 247, and 238 for transmitting luminous rays, and Nos. 249, 197, 252, 165, 210, and 248 for reducing glare (of sun on chalk, snow, or sea).—H. H. S.

[*Zirconia crucibles*]. *Researches in the field of high temperatures. IV.* O. Ruff and G. Lauschke. Z. anorg. Chem., 1914, **87,** 198—208. (See also this J., 1914, 262, 593.)

Three grades of zirconium oxide were formed into crucibles, baked at temperatures varying from 1500° to 2400° C., and the shrinkage, loss of weight, and porosity determined. One grade consisted of the natural oxide and contained ZrO_2 83·53, SiO_2 11·48, Al_2O_3 0·58, Fe_2O_3 4·65%; the other two were obtained by precipitation and contained ZrO_2 98·73, SiO_2 0·95, Fe_2O_3 0·27 %. The first of these was ignited at 900°—1000° C., and the second for 10 hours at about 1400° C. The natural oxide gave good crucibles when baked below 1900° C. Above this temperature silica was volatilised and blisters were formed. The more strongly ignited prepared oxide was less plastic than the other and required an agglutinant, the best results being obtained with about 1% of dry starch; the addition of starch increased the porosity. The less strongly ignited oxide gave the greater shrinkage and the lower porosity. —T. St.

Enamel glazes free from lead and tin. A. Berge. Sprechsaal, 1914, **47,** 339—341. (See also this J., 1913, 142.)

Antimony compounds as a substitute for the costly tin oxide in producing opacity have not yet been unanimously condemned as poisonous. The following molecular formulæ are given for glazes fired at cone 010 with an addition of 7·5% Sb_2O_3, and found after ten weeks to be free from crazes :—

	1	2	3	4	5
SiO_2	2·8	2·0	3·0	3·2	3·0
Al_2O_3	0·25	0·2	0·3	0·1	0·2
B_2O_3	0·30	0·5	0·46	0·6	0·5
K_2O	0·5	0·2	0·3	0·1	0·2
CaO	0·5	—	0·27	0·2	0·15
Na_2O	—	0·25	0·2	0·3	0·25
MgO	—	0·1	—	0·23	—
BaO	—	0·45	—	—	0·1
SrO	—	—	0·3	0·2	0·3

—H. H. S.

Enamels ; Covering power of clouding agents for ——. R. Vondracek. Sprechsaal, 1914, **47,** 341—342.

A new class of substances for producing opacity in glazes has appeared in water- and alkali-containing forms of the usual reagents, the oxides of tin, zirconium and titanium. The increased power of the new products, which may contain for example 3% Na_2O and 10% H_2O, cannot be explained on chemical grounds alone, but is probably due to the oxide being in the colloidal state of a gel, the water being absorbed. This hypothesis explains also the fact that the presence of alkali may be injurious to the covering power of tin oxide, when the latter has been "dead burnt," in which case it loses its power of absorption and gel formation.—H. H S.

Patents.

Glass furnace. P. Bourdu. First Addition, dated Nov. 11, 1913, to Fr. Pat. 418,482. July 21, 1910 (this J., 1911, 87).

In place of separate wells to receive the molten glass in case of breakage of a pot, as described in the chief patent, a circular gallery with the bottom sloping downwards to the middle is provided.—H. H. S.

Ceramic materials ; Manufacture of ——. W. J. Mellersh-Jackson, London. From H. H. Randolph, Chicago. Eng. Pat. 8748, April 14, 1913.

See Fr. Pat. 456,837 of 1913 ; this J., 1913, 1069 —T. F. B.

[*Packing material for*] *Electric batteries and accumulators.* Eng. Pat. 16,681. *See* XI.

IX.—BUILDING MATERIALS.

Portland cement ; The presence of combined nitrogen in ——. V. Kratochvil and G. Weissenberger. Oesterr. Chem.-Zeit., 1914, **17,** 116—118.

Portland cement was boiled for half an hour with a 30% solution of caustic alkali, and the evolved ammonia determined. An average of 0·00025% of combined nitrogen was found, and control determinations with powdered granite, to which were added aluminium nitride, calcium cyanamide, and calcium cyanide, indicated that aluminium nitride was the most probable source of the combined nitrogen.—O. R.

Cements ; Influence of common salt on various ——. A. O. Passow. Tonind.-Zeit., 1914, **38,** 995—997.

Cement made from granulated, vitreous blast furnace slag with Portland cement, and Passow's cement (a mixture of vitreous and devitrified slag) were found to be improved by the addition of common salt (0·5—1%) or by immersion, after gauging, in a solution of salt, greater strength being developed, especially during the early stages of hardening. The effect is attributed to the increased solubility of lime in salt solution. Mortar made with ordinary Portland cement and sand was little affected by salt.—F. Sodn.

Patents.

Paving or building blocks [*and iron*] ; *Process for treating fusible domestic and other refuse for obtaining* ——. H. Becker and H. Unger, Berlin, Germany. Eng. Pat. 10,281, May 1, 1913.

The fine material obtained by sifting the refuse is made into briquettes and fused with an excess of coke (in a blast-furnace), so as to produce metallic iron and slag, which latter is drawn off separately and poured into moulds. The product is granular in structure.—F. Sodn.

Artificial marble ; Manufacture of ——. E. Douzal, Paris. Eng. Pat. 22,297, Oct. 3, 1913. Under Int. Conv., May 10, 1913.

Vaseline oil is mixed with a pasty mass, composed of calcium carbonate (preferably crystalline), an oxide and halide or basic halide of a divalent metal (having a "non-coloured" oxide), and water ; lead acetate solution is added, and the mixture cast in moulds, which are coated with a solution of gum lac in sodium borate to render polishing unnecessary. Suitable proportions are—chloride of divalent metal 100, oxide of divalent metal 500, water 150, vaseline oil 75, calcium carbonate 950, and lead acetate 60 grms. Quartz and fluorspar may be added, if desired, and metallic oxides to impart colour. The product is very hard and resists both heat and moisture.—F. Sodn.

Lithographic stones ; Manufacture of artificial ——. V. Hereng, Brussels. Eng. Pat. 5859, March 7, 1914. Under Int. Conv., March 7, 1913. Addition to Eng. Pat. 12,640 of 1913, dated May 30, 1912 (this J, 1913, 82).

One part by weight of white sand is added in making the mixture previously specified.—F. Sodn.

Cementitious compound. D. J. Morris, Assignor to J. E. Carroll, Seattle, Wash. U.S. Pat. 1,096,384, May 12, 1914.

A mixture of 3 parts of magnesia and 1 part of calcium hydroxide.—O. R.

Wood; Impregnation of ——. Hülsberg und Co., Ges. m. b. H. Fr. Pat. 466,263, Dec. 17, 1913. Under Int. Conv., May 8, 1913.

The wood after being subjected to the action of a vacuum, is treated first with steam, then with compressed air; it is next impregnated by liquid under pressure in the usual manner, and again subjected to the action of a vacuum. The wood may also be subjected to the action of a vacuum between the treatments with steam and with compressed air respectively.—H. H. S.

Wear-resisting body [sintered alumina] and method of making the same. C. Dantsizen, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,096,688, May 12, 1914.

See Eng. Pat. 4887 of 1912; this J., 1913, 363.—T. F. B.

Production of fat lime for viticulture, agriculture generally, and building purposes. Fr. Pat. 465,851. *See* XVI.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron and steel: Advances in the metallurgy of ——. Sir Robt. Hadfield. Presidential Address, Faraday Soc., June 11, 1914. [Advance proof.] (Pamphlet of 40 pages.)

The following are the subjects of this address consecutively arranged:—(i.) Early metallurgy and alloys of iron and steel. (ii.) Ancient iron and the Delhi Pillar. (iii.) Faraday's experiments in 1822. (iv.) Early workers in scientific metallurgy. (v.) French metallurgy in the 18th and 19th centuries. (vi.) Value of research. (vii.) The author's research work. (viii.) Metallurgy in the middle of last century. (ix.) Steel alloys research. (x.) Science and practice working together. (xi.) Development of research during the last fifty years. (xii.) Special steel alloys. (xiii.) Effect of carbon upon iron. (xiv.) The author's experiments on alloy tool steel. (xv.) Tool steel of lower carbon percentage. (xvi.) The great work of Ledebur. (xvii.) Allotropic theory. (xviii.) The author's papers on alloys of iron. (xix.) Thermal treatment. (xx.) Low temperature experiments in Great Britain and America. (xxi.) Field for research. (xxii.) The non-magnetic and magnetic conditions of manganese steel. (xxiii.) Melting points. (xxiv.) Microscopy (Sorby's work as the originator of metallography). (xxv.) Percy's work. (xxvi.) The art of scientific discovery. (xxvii.) Why research work is so valuable. (xxviii.) The work of the National Physical Laboratory. (xxix.) Past progress in metallurgy. (xxx.) The scope of the University. (xxxi.) The Faraday Society.

Iron ores; Experiments on the reducibility of —— *by flowing gases.* L. Mathesius. Stahl u. Eisen, 1914, **34**, 866—873.

Various raw and calcined ores and briquettes were heated for 5 hours in a current of coal gas at 450°—900° C., and the amounts of metallic iron and ferrous oxide formed determined. Calcined spathose ore was easily reduced; the reducibility of other ores was smaller and roughly proportional to their porosity. The FeO-content of magnetite was hardly affected by the treatment, the ferric oxide being more easily reduced. Ore and flue-dust briquettes were much more easily reduced than ores, over 80% of the iron being reduced to metal at 900° C. Sintering caused an increase in ferrous oxide and decrease in the reduction to metal.—W. R. S.

Cyanidation; Filtering slimes in ——. H. A. Megraw. Eng. and Min. J., 1914, **97**, 1057—1061.

Filtration becomes very difficult when more than 20—30% of colloidal slime is present, and it becomes necessary to add sand. Vacuum or pressure filtration is more economical than the ordinary filter-press. In the movable leaf filter (such as the Moore), a series of leaves is immersed in the tank, and when the cake is formed, the leaves are removed to other tanks for washing. In the stationary leaf type, filtration and washing is effected in the same tank. The Merrill plate-and-frame press, in use at the Homestake mill, has a sluicing bar through the bottom of each frame; after the cake has been made and washed, it is sluiced out by a stream of water. In the Oliver vacuum filter the filtering medium constitutes the face of a drum which revolves in the suspended slime. As the cake emerges it is dewatered by the vacuum and washed by sprays from nozzles attached to the drum. The cake is then detached by reversing the air current. In the continuous decantation process the pulp passes through a series of Dorr thickeners. The thickened pulp is thinned in each case with washing solution, and transferred to another thickener. Where the solution is relatively poor in metal values, final filtration may not be required in this process.—W. R. S.

Silver-silver sulphide; The system ——. C. C. Bissett. Chem. Soc. Trans., 1914, **105**, 1223—1228.

The addition of silver sulphide to silver caused a gradual lowering of the freezing point from 961° C. to 903° C. at about 17% Ag_2S; between 17 and 94% Ag_2S the freezing point was constant (903° C.), practically pure silver separating from the mixtures until a liquid containing 94% Ag_2S remained. Above 94% the freezing point gradually fell to 804° C. at 99% Ag_2S (the mixtures being homogeneous when solidified) and then rose to that of pure silver sulphide (815° C.). No indication was obtained of the existence of any sulphide other than Ag_2S.—W. E. F. P.

Copper; Influence of temperature and pressure on the oxidation of ——. E. Berger. Comptes rend., 1914, **158**, 1502—1505.

Copper oxidises in comparatively dry oxygen at 15° C.; the velocity slowly increases until a certain temperature is reached, when its rise becomes rapid. This temperature depends upon the physical state of the copper, varying from 163° C. in the case of turnings to 71° C. in the case of metal obtained by reducing cupric oxide at 130° C. The experiments were conducted in a V-shaped tube, one limb of which constituted a manometer, the other, containing the copper, being heated by the vapour of a suitable boiling liquid. The velocity is tripled for a 10° C. rise in temperature in the neighbourhood of 170° C. (Cu turnings), and seems to be directly related to the concentration of the film of gas, (pressure), condensed on the metallic surface.—J. L. F.

Copper; Rapid electrolytic separation of —— *from arsenic.* A. Sieverts and W. Wippelmann. Z. anorg. Chem., 1914, **87**, 169—174.

The copper-arsenic alloy is dissolved in nitric acid, the solution evaporated, and the residue, with 2·5 grms. of ammonium nitrate, dissolved in 125 c.c. of 5% ammonia solution. Using concentric gauze-electrodes, the following conditions give a quantitative arsenic-free deposit of 0·3 grm. Cu in 15 minutes at 90° C. from solutions containing 0·22 grm. As:—speed of glass stirrer 500—550 revs. per minute; current density 7·5 amps. per sq. dm. The cathode is washed without breaking the current, dried, and weighed. The arsenic is not reduced and can be determined directly by precipitation by magnesia mixture. It is essential that no trivalent arsenic be present during electrolysis.—T. St.

Aluminium and silicon; The alloys of ——. C. E. Roberts. Chem. Soc. Trans., 1914, **105**, 1383—1386.

Results obtained by the method of thermal analysis and microscopic examination confirmed the conclusions of Fraenkel (this J., 1908, 1023), viz., that the alloys of aluminium and silicon form only a simple eutectic series The eutectic contains about 10% Si and melts at abou 76° C.—W. E. F. P.

Thorium, uranium, zirconium and titanium; Preparation of the elements ——. D. Lely, jun., and L. Hamburger. Z. anorg. Chem., 1914, **87**, 209—228.

The metals were obtained by reduction of the chlorides with sodium in a cylindrical steel bomb, which was exhausted and then heated to 500° C. In the case of titanium the bomb was cooled with alcohol and solid carbon dioxide during exhaustion.

Thorium. The anhydrous chloride was prepared by passing a stream of chlorine and sulphur chloride vapour over the pure oxide at 670° C., and purified by sublimation in a vacuum. Metallic thorium was obtained in grains of different sizes, the largest containing Th 99·9 and O 0·1%. The metal was lead-gray, very ductile, and rubbed down in an agate mortar to a mirror. It could be melted and completely vaporised in a high vacuum on a tungsten support. In the coarse form the metal was unattacked by water, alkali solutions and nitric acid. Warm hydrochloric acid attacked it, and *aqua regia* oxidised it to ThO_2. It oxidised very slowly in the air at the ordinary temperature. The powder had the sp. gr. 11·2. A rod formed by pressure out of grains of about the same size, then rendered conducting by heating for 30 mins. in a vacuum at 1100° C., and sintered by an alternating current in a high vacuum, was exceedingly ductile, even in the cold. *Uranium.* The tetrachloride was prepared by heating the oxide in a stream of sulphur chloride vapour at about 500° C., and purified by sublimation in a porcelain tube at 650°—750° C. in a current of chlorine with which was mixed a little sulphur chloride vapour. The larger metallic grains obtained contained U 99·5 and O 0·5%. The metal was darker in colour and less ductile than thorium; it was not attacked at the ordinary temperature by water, alkali solutions or acetic acid; it dissolved in dilute hydrochloric acid forming UCl_4, and in concentrated hydrochloric acid forming violet UCl_3 which oxidised later to the green UCl_4; nitric acid dissolved it giving yellow $UO_2(NO_3)_2$; the metal became brown in the air. A rod formed by pressure became conducting after heating for half an hour in a vacuum at 1400° C. and could then be sintered into a solid metallic rod. *Zirconium.* The chloride was obtained in a compact crystalline form by passing a very slow stream of chlorine containing carbon tetrachloride vapour (one to two bubbles per second) over the oxide heated to about 800° C. The chloride sublimed to the cooler parts of the tube, kept at about 140° C. The metal was very ductile and was easily obtained in the compact form. It resisted the action of concentrated hydrochloric and nitric acids. Hot *aqua regia*, hot concentrated sulphuric acid, and cold hydrofluoric acid attacked it quickly. *Titanium.* The chloride was obtained by heating 62% ferrotitanium to 400°—500° C. in a current of chlorine, and carefully fractionating the product to a colourless liquid. The metal was less ductile than thorium, zirconium or uranium, and was obtained in rod-form only with special precautions, owing to its ready oxidisability.—T. St.

Reduction of oxides by carbon; Equilibria of ——. R. E. Slade and G. I. Higson. Report of Brit. Assoc., 1913, 450—451.

Vanadium, tantalum, chromium, or tin was heated in an unglazed porcelain boat *in vacuo*, and carbon monoxide was admitted and allowed to react with the metal until the pressure fell to that of equilibrium. Some carbon monoxide was then pumped out and equilibrium attained from the other side. The reactions taking place are of the type: $MO+C \rightleftarrows CO+M$ or $2MO+3C=M_2C+2CO$. The results obtained were:—

	Temperature.	Pressure.
	° C.	mm.
Vanadium	1340	1·5
Tantalum	1270	<0·1
Chromium	1292	6·2
,,	1339	9·2
Tin	750	>760
Tin in presence of SiO_2	753	670

A. S.

Metals and intermetallic compounds; The capacity for heat of —— between 18°—600° C. P. Schubel. Z. anorg. Chem., 1914, **87**, 81—119.

The specific heats of Mg, Al, Cr, Fe, Ni, Co, Sb, Pb, Bi, Cu, Zn, Ag, Sn; Cu_2Mg, Cu_3Al, $CuAl$, $CuAl_2$, Cu_3Sb, Cu_2Sb, $AgMg$, Ag_3Al, Ag_2Al, Ag_3Sb, $MgZn_2$, Ni_2Mg, Ni_3Sn, Co_2Sn, $FeSi$, Ni_2Si, $NiSi$, and Mg_2Si were determined at intervals of 100° C. between 18° and 600° C. From the mean experimental values the true specific heats were obtained graphically. The change of atomic heat with temperature was in general nearly linear above 100° C., both for the pure metals and the compounds. The experimental values for the compounds agreed well with those calculated from the specific heats of the component metals by the rule of Neumann and Kopp.—T. St.

Palladium hydrogen alloys; The specific electrical conductivity and density of ——. G. Wolf. Z. physik. Chem., 1914, **87**, 575—588.

Palladium wire was used alternately as anode and cathode in dilute sulphuric acid for a short time, and then for a longer period as anode. After this treatment it absorbed hydrogen very readily. The conductivity fell progressively with the occlusion of hydrogen, reaching about half its original value at saturation. The curve connecting the conductivity with the hydrogen absorbed consisted of three parts. In the first the diminution was directly proportional to the hydrogen dissolved. In the second the conductivity diminished asymptotically, corresponding to the formation of PdH_2, while in the third, where hydrogen was dissolving in the PdH_2, the diminution again became linear. The density of the alloys diminished with increasing hydrogen content, the curve consisting of two parts. In the first part the gradient was steep and the form of the curve was hyperbolic. In the second the gradient was much smaller and the curve became a straight line.—W. H. P.

Dissociation pressures of some nitrides. Slade and Higson. *See* VII.

Patents.

Steel; Manufacture of ——. G. H. Benjamin, New York. U.S. Pat. 1,095,184, May 5, 1914.

Acid steel obtained by removing silicon and most of the carbon from iron in a converter is refined with a basic slag in a mixer and then treated at a high temperature in a furnace with metallic oxides in an atmosphere of carbon dioxide and nitrogen.—W. E. F. P.

Tool-steel; High-speed ——. R. Furness, Jenkintown, Pa. U.S. Pat. 1,095,842, May 5, 1914.

A steel containing V 1—2 (preferably 1·5), Co 3—7 (4), Cr 2·5—4 (3) and W 16·5—20 (17·5) %.—W. E. F. P.

Iron and steel; Process of treating ——. D. Lamon, Denver, Colo. U.S. Pat. 1,096,006, May 5, 1914.

A mixture of potassium cyanide 1, boric acid 1, and aluminium sulphate ½ part, is used for hardening and toughening iron and steel.—W. E. F. P.

Tin ores; Dressing of ——. W. M. Martin, Redruth. Eng. Pat. 19,514, Aug. 28, 1913.

Carbon dioxide is forced through tin-ore pulp, concentrate, etc., whereby any gelatinous silica present is removed as a lighter product than the gangue, and a better separation of the tin oxide is obtained. The separated gelatinous material is heated to render the silica insoluble, pulverised, and again treated on concentrating tables to recover any tin present. In many cases a better extraction is effected by adding alkali with or after the carbon dioxide.—T. St.

Aluminium alloy and method of producing the same. W. A. McAdams, Bay Shore, N.Y. U.S. Pat. 1,095,653, May 5, 1914.

An alloy of Al 70, Zn 22, Cu 3 and Sb 5, parts by weight. A portion of the aluminium is heated to a high temperature, the copper and then the remainder of the aluminium added, the temperature lowered, the zinc and antimony added, and the mixture agitated.—W. E. F. P.

Filtration of flue dust, fume, and like fine solid impurities from furnace gases. G. Rigg, Palmerton, Pa., Assignor to New Jersey Zinc Co., New York. U.S. Pat. 1,095,676, May 5, 1914.

The gases are passed upwards through a layer of coarse material until an efficient filter is formed by accretion of the solid impurities, after which the conditions are maintained constant by the periodic removal from below of the layers of coarse material which tend to become clogged and by the addition of fresh coarse material at the upper side of the filter.—H. H.

Copper alloys containing a small amount of tin; Process of hardening ——. H. Bryda, Blackstone, Mass. U.S. Pat. 1,095,804, May 5, 1914.

The alloy is filed on the surface while hot, then placed upon a layer of loam "which has not been allowed to come into contact with water or sunshine," allowed to remain until the filed surface becomes bluish, and cooled in a dry place.—W. E. F. P.

Platinum [-tungsten] alloy. E. Weintraub, Lynn, Mass., Assignor to General Electric Co. U.S. Pat. 1,096,655, May 12, 1914.

The malleable alloy, permanent in air and more refractory and harder than platinum, contains Pt 20 to 60 and W 40 to 80%.—B. N.

Furnace; Electric —— with an electric arc or arcs for melting and extraction of metal from ore. P. Krefting, Christiania, Norway. U.S. Pat. 1,097,336, May 19, 1914.

The furnace has a closed melting chamber into which several electrodes project, and a vertical charging shaft above. A flue leads from the melting chamber through the descending charge in the shaft. Several extensions from the shaft communicate with charging apertures, normally closed by the charging material, and conveyers located in the extensions charge the material from the shaft into the melting chamber.—B. N.

Iron; Manufacture of electrolytic ——. Soc. Anon. "Le Fer," Grenoble, France. Eng. Pat. 16,565, July 18, 1913. Under Int. Conv., Aug. 2, 1912.

See Fr. Pat. 458,294 of 1912; this J., 1913, 1115.—T. F. B.

Steel; Purifying ——. E. Humbert, Barleduc, France. Eng. Pat. 18,856, Aug. 19, 1913.

See U.S. Pat. 1,081,532 of 1913; this J., 1914, 86.—T. F. B.

Tool-steel; High-speed ——. R. Becker, Crefeld, Germany. U.S. Pat. 1,096,669, May 12, 1914.

See Eng. Pat. 27,838 of 1912; this J., 1913, 430.—T. F. B.

Zinc and zinc oxide; Apparatus for the manufacture of ——. P. Ferrere, Paris. Eng. Pats. 3965, Feb. 15, 1913, and 9368 of 1914, date of appl., Feb. 15, 1913. Under Int. Conv., Feb. 17, 1912.

See Fr. Pat. 451,680 of 1912; this J., 1913, 663.—T. F. B.

Metal furnace. I. Hall, Birmingham. Eng. Pat. 29,525, May 21, 1913.

See Fr. Pat. 462,568 of 1913; this J., 1914, 320.—T. F. B.

Agglomerating fine ores or metalliferous products; Process of ——. E. A. Preteeille, Nantes, France, Assignor to Metallurgische Ges. A.-G., Frankfort, Germany. U.S. Pat. 1,096,054, May 12, 1914.

See Fr. Pat. 419,526 of 1909; this J., 1911, 136.—T. F. B.

Metallising the surface of cast-iron, wood, gypsum, paper, and other porous substances or articles; Process of superficially ——. P. Marino, London. U.S. Pat. 1,096,177, May 12, 1914.

See Eng. Pat. 20,012 of 1911; this J., 1912, 193.—T. F. B.

Refractory metals and alloys; Process for the manufacture of bodies of ——. P. Schwarzkopf and S. Burgstaller, Assignors to Wolfram Laboratorium Dr. P. Schwarzkopf G. m. b. H., Berlin. U.S. Pat. 1,096,464, May 12, 1914.

See Fr. Pat. 448,229 of 1912; this J., 1913, 431.—T. F. B.

Treating fusible domestic or other refuse for obtaining paving or building blocks [and iron]. Eng. Pat. 10,281. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Electrical ignition of gaseous mixtures. Thornton. *See* IIa.

Electrolytic production of potassium ferricyanide. Grube. *See* VII.

Electrolysis of molten salts of the fatty acids. Petersen. *See* XX.

Patents.

Resistance materials: Production of electrical ——. Resisto-Electrical Manufacturing Co., Ltd., London, and C. Ruzicka, Gravesend, Kent. Eng. Pat. 11,975, May 22, 1913.

A carbide of a metal or metalloid, such as boron, having a comparatively high specific electrical resistance and a melting point above 1500° C., is mixed with a carbide of a metal, such as iron, having a relatively lower specific resistance and a melting point between 800° and 1500° C., and a permanent inert substance, such as felspar, which acts as a conductor of the second class, is relatively neutral to the other substances, and has a melting point below those of the carbides employed. The powdered mixture is fused in a furnace, whilst surrounded by a neutral or reducing gas, at a temperature sufficient to melt the carbide of the metal of lower melting point.—B. N.

Batteries and accumulators; [Packing material for] Electric ——. F. Sablon. Eng. Pat. 16,684, July 21, 1913.

A mixture of a double silicate of magnesium and calcium, such as asbestos, and a trisilicate of magnesium, such as steatite, is baked, and the ceramic mass crushed to fragments about 1 mm. in diameter, these being used for packing primary and secondary batteries to prevent movement of the electrolyte or the plates.—B. N.

Electrode for electric furnaces. A. T. Hinckley, Niagara Falls, N.Y., Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,097,227, May 19, 1914.

The electrode is composed of two parts, one of which has, in one end, a longitudinal hole provided with an annular enlarging groove, with two holes leading from it to the outer surface of the electrode. The second portion has an integral pin, smaller in diameter than the electrode, which fills the hole, and the pin is also provided with an annular groove. A cement ring of conducting material embraces the pin and fills up the grooves.—B. N.

Ozone; Apparatus for the production of ——. J. Steynis. Fr. Pat. 466,029, Dec. 10, 1913. Under Int. Conv., Oct. 27, 1913.

In the apparatus described in U.S. Pat. 1,066,674 of 1913 (this J., 1913, 796) the hollow, cylindrical electrodes and dielectric tubes are so arranged as to be easily removable, and are provided with means for centering and withdrawal in case of breakage. To that end, the top of the outer electrode is provided with a flange, which rests on the casing of the apparatus, and the bottom of the electrode carries a framework fitted with inclined arms, on which the dielectric tube rests and centres itself. A vertical branch extends upwards from the centre of the framework and terminates in an insulating cone, which penetrates and centres the internal electrode.—O. R.

Lead accumulator cells; Solution for use in ——. P. Rabbidge, Neutral Bay, New South Wales. Eng. Pat. 19,782, Sept. 1, 1913. Under Int. Conv, Sept 2, 1912.

See Fr. Pat. 462,663 of 1913; this J., 1914, 322.—T. F. B.

Secondary batteries; Negative electrode for alkaline ——. H. P. R. L. Pörscke and J. A. E. Achenbach, Hamburg. U.S. Pat. 1,096,751, May 12, 1914.

See Eng. Pat. 29,848 of 1912; this J., 1913, 664.—T. F. B.

Electrolytic process and apparatus [for treating alkali salts]. C. White, London. U.S. Pat. 1,096,085, May 12, 1914.

See Eng. Pat. 1935 of 1913; this J., 1914, 206.—T. F. B.

Furnace; Electric —— [for treating lamp filaments]. W. D. Coolidge, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 1,096,414, May 12, 1914.

See Eng. Pat. 282 of 1909; this J., 1910, 163.—T. F. B.

Insulating material. J. L. R. Hayden, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,096,839, May 19, 1914.

See Eng. Pat. 13,946 of 1910; this J., 1911, 905.—T. F. B.

[Electrolytic] Manufacture of hydrogen peroxide. Eng. Pat. 754. *See* VII.

Process of and apparatus for treating water. U.S. Pat. 1,095,893. *See* XIXb.

XII.—FATS; OILS; WAXES.

Mowrah fat; The unsaponifiable constituents of —— and the detection of mowrah fat in animal and vegetable fats. P. Berg and J. Angerhausen. Z. Unters. Nahr. Genussm., 1914, **27**, 723—731.

Mowrah fat yields about 2% of unsaponifiable matter having $[\alpha]_D = +27{\cdot}1°$. When the unsaponifiable matter obtained from 100 grms. of the fat is dissolved in 5 c.c. of ether and the solution poured into 100 c.c. of absolute alcohol about 0·3% (calculated on the fat) of a white, amorphous, optically inactive precipitate is obtained. The portion of the unsaponifiable matter soluble in alcohol has the rotatory power $[\alpha]_D = +34°$. The rotations are best observed in chloroform solution. The optical properties of the unsaponifiable matter of mowrah fat may be used for its detection in other fats and oils. The rotatory power of the unsaponifiable matter of lard, for instance, is $[\alpha]_D = -19{\cdot}6°$, whilst that of lard containing 10% of mowrah fat is $[\alpha]_D = +11{\cdot}5°$. The unsaponifiable matter of mowrah fat contains only a very small quantity of phytosterol (recognised by precipitation with digitonin), and Bömer's phytosteryl acetate test yields a negative result. In the case of other fats yielding optically active unsaponifiable constituents, these may be removed by precipitation with digitonin (this J., 1913, 1118) previous to the separation and determination of the optical properties of the remaining substances. A preliminary test for the detection of mowrah fat in lard depends on the partial insolubility of the unsaponifiable matter of the former in alcohol. The unsaponifiable matter is dissolved in a small quantity of ether and the solution is diluted with alcohol; in the case of lard, the mixture remains clear, whilst with lard containing more than 10% of mowrah fat a turbid solution is obtained.—W. P. S.

Jatropha curcas [purging nut] seeds; Toxicity of ——. J. Felke. Landw. Vers.-Stat., 1913, **82**, 427—463. Chem. Zentr., 1914, **1**, 1958—1959.

Curcas (purging nut) oil was separated by treatment with alcohol into a non-poisonous insoluble and a poisonous soluble part. The toxic constituent, *curanolic acid*, was isolated from the soluble portion by stirring with a hot saturated solution of baryta, washing the resulting paste with cold water, drying, extracting with ether, evaporating the ether solution, extracting the residue with absolute alcohol, and treating the alcoholic solution with sulphuric acid. It set to a jelly at about 10° C.

Curcin, the toxic principle isolated from fat-free curcas seeds by extraction with physiological sodium chloride solution, was very sensitive to acid, and had a retarding influence on the coagulation of blood.—A. S.

Cholesterol in fats; Determination of ——. M. Klostermann and H. Opitz. Z. Unters. Nahr. Genussm., 1914, **27**, 713—723.

Whilst about one-half of the cholesterol occurring in blubber oils is present in the form of esters, practically all animal fats are free from cholesteryl esters, the cholesterol being present in the free state, and there is, consequently, no necessity to saponify the fat before the cholesterol is precipitated by means of digitonin (this J., 1913, 1118). In vegetable oils, the greater part of the phytosterol is present in the form of esters and saponification is essential before the whole of the phytosterol can be precipitated by digitonin. Previous saponification is, therefore, also necessary when it is desired to detect vegetable oils in animal fats by means of the phytosteryl acetate test.—W. P. S.

Rice oil and rice fat. J. Davidsohn. Seifenfabrikant, 1914, **34**, 178—179. Chem. Zentr., 1914, **1**, 1788.

On keeping, a solid fat, m.pt. 46° C., separated from rice oil. The characters of the residual liquid oil (water 0·32%) andof the solid fat (water 0·43%) were as follows:—

	Sp. gr. at 15° C.	Butyro-refractometer reading.	Acid value.	Saponif. value.	Iodine value.	Saponifiable matter.
						%
Oil	0·918	67·8 (25° C.)	98·56	198·44	108·5	99·47
Fat	0·924	44·7 (50° C.)	124·30	197·21	74·11	99·43

The oil is suitable for the manufacture of soft, and the fat (the mixed acids from which melt at 39·6° C.) for the manufacture of hard soaps.—A. S.

Beeswax; Use of ozonised air to whiten ——. Times, June 5, 1914. [T.R.]

A plant has been built for the Eparchical Candle Works at St. Petersburg for bleaching beeswax by ozonised air, for use in making church candles. The air is cooled to about 0° C. and passed through a bank of nine ozonisers, each having an electrode area of 40 sq. ft., and supplied with high-tension current at 7000 to 9000 volts by means of three transformers. Each ozonizer takes from 300 to

600 watts, according to the voltage of the secondar current, and the whole plant, which is able to treat one ton of beeswax in a day of 10 hours, requires 10 kw., including the power for the blower and refrigerator.

With energy at 0·6d. per unit the working costs for treating a ton of beeswax are about 5s., exclusive of interest on capital and costs of maintenance, whereas it is stated that with the bichromate method commonly employed for bleaching wax the cost per ton is about £3 15s. The loss of material is said to be practically negligible, and the wax is harder than that bleached by other methods.

Patents.

Oil from seeds and the like ; Apparatus for the extraction of —— by means of a solvent. J. E. McCoid, Kingston-upon-Hull. Eng. Pat. 11,059, May 10, 1913.

Means are provided for tilting the extraction vessels or pots so as to discharge the spent grains, etc. on to a platform. Any material requiring further extraction is then returned to the pots, whilst the remainder is made to fall through a trap-door on to an endless belt or screw conveyor. —C. A. M.

Fats and oils ; Process for improving the odour and taste of vegetable and animal ——. F. Gössel. Ger. Pat. 273,069, May 12, 1912.

Milk, *e.g.*, skim milk, buttermilk, or the like, which has been soured by the bacteriological method, is mixed with the fat or oil and the mixture heated until the water is evaporated and the acid constituents of the milk acquire a brown colour. A portion of the water may be evaporated from the milk, before or after souring, before mixing with the oil or fat. Cocoanut oil treated in this way acquires the odour and taste of freshly rendered lard.—A. S.

Fats and oils ; Process of treating —— in the manufacture of fatty acids and glycerine. E. Twitchell, Wyoming, U.S.A. Eng. Pat. 9160, April 18, 1913.

See Fr. Pat. 456,956 of 1913 ; this J., 1913, 1119.—T. F. B.

Fatty acids and their glycerides ; Process for the reduction of unsaturated ——. W. Fuchs, Vienna. Eng. Pat. 11,543, May 17, 1913. Under Int. Conv., May 18, 1912.

See Fr. Pat. 458,445 of 1913 ; this J., 1913, 1119.—T. F. B.

Oil and like extractors. O. Wilhelm, Stralsund, Germany. Eng. Pat. 25,026, Nov. 3, 1913. Under Int. Conv., Dec. 31, 1912.

See Fr. Pat. 457,057 of 1913 ; this J., 1913, 1095.—T. F. B.

Oils ; Process of introducing water-insoluble —— into emulsions or water-soluble bodies. J. H. Smith, La Garenne-Colombes, France. U.S. Pat. 1,096,465, May 12, 1914.

See Fr. Pat. 446,570 of 1911 ; this J., 1913, 150.—T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Red lead ; Analysis and composition of ——. A. P. West. Philippine J. Sci., 1913, 8A, 429—437.

An analysis of commercial red lead which is generally regarded as a mixture of Pb_3O_4 and PbO showed a discrepancy of 3·69% Pb between the total Pb found by direct estimation and the Pb calculated from the amounts of free PbO found by leaching out with lead acetate solution, and of Pb_3O_4 obtained by decomposing with nitric acid and weighing the resulting PbO_2. The author considers that red lead consists of PbO in admixture with Pb_3O_4 and Pb_4O_5 and recommends the following methods of analysis. (A) *Insoluble matter* (Baucher's method. Petit, Monit. Pharm., **47**, 2651). 2 grms. are boiled with 100 c.c. of 10% nitric acid for a few minutes, the insoluble PbO_2 formed is reduced with sucrose solution and dissolved in nitric acid, and the insoluble matter is weighed in a Gooch crucible. (B) *Free PbO.* This is best estimated by Lowe's method (Lowe, Dingl. poly. J., 1889, **271**, 472). 0·5 grm. is digested on water-bath for about one hour with 10% lead nitrate solution, boiled for 10 mins., diluted with 2 vols. of hot water, the residue collected and weighed in a Gooch crucible. (C) *(PbO_2+insoluble matter) and (free PbO+combined PbO).* 0·5 grm. of sample is heated with 100 c.c. of 10% nitric acid, the PbO_2 formed+insoluble matter is collected in a Gooch crucible and weighed. The lead in the filtrate is estimated as sulphate in the usual manner and indicates the combined and free PbO in the sample, as Pb_3O_4 and Pb_4O_5 are decomposed by nitric acid in a similar way :—

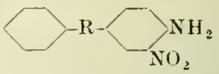
$$Pb_3O_4+4HNO_3 \rightarrow PbO_2+2Pb(NO_3)_2+2H_2O.$$

The amount of free PbO being already known the combined PbO can be calculated. The percentage of PbO_2+combined PbO indicates the percentage of red lead present in the sample. A table is given showing the amount of combined PbO in mixtures of Po_3O_4 and Pb_4O_5 from which the relative percentages of these oxides can be readily found. The total lead in the sample may be determined as sulphate and corresponds very closely with the total lead calculated from the PbO, Pb_3O_4 and Pb_4O_5 as determined by the methods described. For rapid approximate work, it is sufficient to estimate insoluble matter and free PbO ; % red lead=100—(free PbO+insoluble matter). —R. G. P.

Patents.

Pigments ; Manufacture of ——. J. Y. Johnson, London From Badische Anilin und Soda Fabrik, Ludwigshafer on Rhine, Germany. Eng. Pat. 20,106, Sept. 5, 1913.

Compounds of the general formula,



where R represents CO or SO_2, or derivatives of thes compounds substituted in either or both of the benzen nuclei, are mixed with a substratum such as alumina barium sulphate, or china clay to form pigments of clea yellow shades of good colouring power and fast to ligh water, lime, and alcohol. They do not sublime, and, wit few exceptions, are insoluble in oil. They may be used fo colouring paper, or as oil paints, or for lithographic other printing. The preparation of pigments for vario purposes from different sulphobenzide and benzophenoı derivatives is described in detail.—T. F. B.

Paints [for the inside of boiler tubes]. W. Chadd, Wilke Barre, Pa., U.S.A. Eng. Pat. 25,185, Nov. 4, 1913.

Litharge and plaster of Paris (say, equal parts) are inco porated with, say, one-third of their quantity, of rosi and with the desired amounts of boiled linseed oil, drie and pigment, to obtain a paint which is not affected "sulphur water" or strong brine.—C. A. M.

Iron ; Composition for application to —— for the purp of acting as a preservative. A. C. Aglioubz and G. Howkins, Manchester. Eng. Pat. 27,698, Dec. 1913.

A mixture of tar containing creosote oil 40, benzine terebene 1½, turpentine 2, pints, black-lead 2 oz., and desired, "patent driers" ½ lb.—T. St.

Paint ; Method of producing a weatherproof and r preventing ——. M. Brenneisen, Bern, Switzerla Eng. Pat. 4113, Feb. 17, 1914. Under Int. Co Feb. 19, 1913.

Linseed oil varnish (140 grms.) is made into a paste w zinc powder (1 kilo.), and the mass stirred with conc trated hydrochloric acid (180 grms.) and subseque diluted with linseed oil varnish (320 grms.) and turpentine (100 grms.), or the like.—C. A. M.

Resinous products; Manufacture of ——. J. P. A. McCoy, Wilkinsburg, Pa., U.S.A. Eng. Pat. 13,657, June 12, 1913.

See Fr. Pat. 458,904 of 1913; this J., 1913, 1163.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Insoluble constituent of raw ——, *its isolation and characterisation.* D. Spence and G. D. Kratz. Kolloid-Zeits., 1914, 14, 262—277.

If a small quantity of acid be added to a rubber solution, the viscosity is lowered almost to that of the pure solvent, and from the resulting solution the insoluble nitrogenous constituent of the rubber can be easily separated. The reduction of viscosity is accelerated by sunlight and by heat. The insoluble constituent was separated from a number of different kinds of rubber by a method based on this fact. 100 grms. of washed and dried rubber were treated with 1 litre of benzene containing 0·3—0·5% of trichloroacetic acid and the mixture exposed to sunlight or warmed gently on the water-bath. After about 48 hours, with occasional vigorous agitation, the mixture was allowed to settle, the clear liquid poured off, the insoluble matter extracted twice for several hours with 500 c.c. of benzene containing trichloroacetic acid, then washed with pure benzene, dried, powdered, extracted with benzene to remove the last traces of rubber, washed with alcohol and dried. The insoluble constituent separated in this way from four samples of plantation Para rubber contained: N 9·83, 10·90, 11·58 and 12·08% respectively. It was soluble in a 1% solution of sodium hydroxide, and reprecipitated by dilute acetic or hydrochloric acid. It agreed in nitrogen content and reactions with the glucoproteins. The insoluble constituent from three samples of "hard cure" Para rubber contained: N 7·75, 9·6 and 10·3% respectively. It resembled generally that from plantation Para rubber, but gave reactions for proteins and carbohydrates only after being dissolved in dilute alkali. The insoluble constituent (N about 5%) of balata and specimens of protein (N 9·5 and 11·5%) isolated from *Funtumia elastica* latex also possessed the characters of a complex of protein and carbohydrate. The authors' results, which differ essentially from those of Schmitz (this J., 1913, 499), establish the fact that the nitrogenous constituent of rubber is not a simple protein but a complex of protein and carbohydrate, probably a glucoprotein. The factor 6·25 usually employed for calculating the percentage of insoluble nitrogenous constituent in rubber from its nitrogen-content, gives incorrect results. For Para and plantation Para rubbers a factor of about 10 should be used.—A. S.

Rubber; Vulcanisation of solutions of —— *by means of ultra-violet rays.* A. Helbronner and G. Bernstein. Comptes rend., 1914, 158, 1343—1345.

When a solution of rubber containing sulphur is exposed to the action of ultra-violet light vulcanisation takes place, and a gel is formed the stability of which is so great that not a trace of precipitation occurs on standing for several months, nor on heating for 18 hours at 80° C. On evaporation, however, an insoluble pellicle of vulcanised rubber is left behind. Examination by means of the ultramicroscope shows that there is very little difference in size between the particles present in the vulcanised solution and those in the unvulcanised solution; if anything the latter are slightly smaller and more numerous than the former. Smits and Wiegand have observed that ultraviolet light converts soluble sulphur into the colloidal form which is then precipitated from solution. Since no precipitate or even cloudiness is produced in the presence of rubber, it would appear that it is the insoluble variety of sulphur which in a nascent condition combines with or is adsorbed by the rubber. No vulcanisation takes place unless the sulphur is in solution. The vulcanised material is characterised by the low percentage of combined sulphur (0·6%) necessary for a good product, a fact which recalls the polymerising action of 0·2% of sulphur in the preparation of synthetic caoutchouc from isoprene.—E. W. L.

Rubber; Action of copper and other metals on ——. *I. Cable insulation.* F. Frank and E. Marckwald. Gummi-Zeit., 1914, **28**, 1280—1282.

The destructive action of copper is largely attributed to the wandering of colloidal copper sulphide (cf. Lewis and Waumsley, this J., 1912, 518) due to insufficient vulcanisation, as shown by analyses of cables which had and had not perished: in the former case a very high acetone extract was found. To avoid this effect cable wires should be provided with a good and homogeneous tin coating and the rubber insulating composition should be vulcanised at a high temperature, preferably using basic accelerators, so that the wire inside will not be overheated during the short period required for complete vulcanisation. Under-vulcanisation followed by after-vulcanisation is inadvisable.—H. E. P.

Patents.

Rubber latex; Apparatus for smoking ——. J. S. Cardwell-Quinn, Bello-Horizonte, Brazil. Eng. Pat. 11,424, May 16, 1913.

Latex is supplied to an endless travelling band, on which it is spread uniformly in a thin layer by means of a spreading knife or "doctor" provided with side guides. The endless band passes into the horizontal exit flue of a smoke-generating apparatus where the thin layer of latex is smoked and coagulated, and is afterwards subjected to the pressure of a roller in order to remove excessive moisture. The endless band is supported, where engaged by the spreading knife, between two rollers, by means of an endless rubber apron mounted on these two rollers.
—E. W. L.

Caoutchouc; Process for producing products similar to vulcanised ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,209, May 13, 1913.

See Ger. Pats. 266,619, 267,945, 268,387, 268,947, and 269,512; this J., 1914, 93, 94, 269, 365.—T. F. B.

Elastic and plastic substance; Production of an —— J. Stockhausen, Crefeld, Germany. Eng. Pat. 27,663, Dec. 1, 1913. Addition to Eng. Pat. 9264 of 1911, dated April 16, 1910.

See Fr. Pat. 465,306 of 1913; this J., 1914, 558.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Hides and skins; Second report of the International Commission for the preservation, cure and disinfection of ——. A. Seymour-Jones. Collegium, 1914, 267—277.

Preservation.—The "*Association française pour la destruction du Varron*" have found that one drop of iodine, injected into the tumour caused by the larva of the warble fly, killed the larva, acted as an aseptic and was a more effective method than the old method of squeezing out the larva with the fingers. A more simple method is to pierce the larva with a heated lancet or knitting needle. Birch oil, applied to the sides of the cattle before leaving the sheds for the pastures was effective in preventing the attacks of the warble fly. The removal of larvæ from warbled cattle was always followed by a considerable increase of weight. Fellmongers gathering limes are a great source of trouble to tanners and could advantageously be replaced by clean water to which "Beta-lysol" or "Arasol" had been added. Such materials form no chemical compound with the pelt, arrest all decay and can be completely washed out of the pelt before putting into work. It is suggested that butchers should spray all hides and skins with such a solution after flaying and before salting.

Cure—The successful results obtained by Becker in the laboratory in curing hides with a mixture of salt and soda have been confirmed on the large scale. Many stains are described as salt stains which are of quite a different origin. It is probable that the decomposition products of the albumin form new compounds with the impurities in the salt. Abt has isolated a bacterium which produces a brown colour in the medium on which it is grown and the colour becomes darker as the medium becomes more alkaline by the production of ammonia. The colouring matter is precipitated by iron salts, redissolved by ammonia and contains less nitrogen than peptone. The colouring matter is carried down by gelatinous precipitated phosphate of calcium and if the bacterium is sown on a Petri dish and in other parts a precipitate of calcium phosphate is produced the greater part of the colouring matter is attracted to the precipitate. In the formation of a salt stain the brown colouring matter produced by the bacteria would be fixed by the calcium phosphate produced from calcium sulphate in the salt; in other cases it would be precipitated by the iron salts derived from the hæmoglobin, etc. Abt has also isolated a streptothrix, a variety of *Actinomyces chromogenes* Gasperini, which produces a colouring matter of similar nature. All bacteria which colour culture media without being coloured themselves, are capable of producing salt stains. "Pir-holes" are of quite a different origin from salt stains and are produced by the crystallisation of salt in the grain thereby breaking it. Salt stains are less common when sea salt is used than when rock salt is used; the latter contains calcium sulphate. A process in which the grains of calcium sulphate were allowed to settle to the bottom of the brine gave the fewest stains. No better results were obtained by adding 4% of sodium carbonate to the salt. The use of salt of 99·9% purity, which has lately come into commerce, is recommended.

Disinfection.—Abt found that chlorine was not a satisfactory disinfectant and sterilisation was never obtained with mustard oil. Seymour Jones' formic mercury process gave good results and the Schattenfroh-Kohnstein method was efficient, but was harmful to the skin. As a preventative treatment to be applied to all dried skins the Seymour-Jones' method is recommended provided that depilation is carried out with pure lime, with lime and arsenic sulphide or with concentrated sodium sulphide solution. Yocum condemns the official methods of the U.S. Government on account of inefficiency or destruction of hide substance. Disinfection with carbolic acid, sulphur dioxide and mercuric chloride are condemned for the same reasons. Röhm has patented the use of solutions of copper salts, containing the metal in the form of complex ions, as a method of disinfection.—D. J. L.

Tannins; Pseudo —— in sulphite cellulose extracts. W. Moeller. Collegium, 1914, **5**, 319—324.

Wood pulp liquor produced as a by product in the manufacture of cellulose by the soda process has quite different properties from that from the sulphite process. The liquor from the latter process contains much lime and sulphurous acid, which must be removed before it can be used as a tanning material; all wood pulp extracts produced in Germany are of this variety. Liquors from the soda process only require to be neutralised with a weak acid before use. All cellulose extracts have about 15% of ash and this is included in the total soluble matter. They also contain quantities of non-tannins such as resin, sugar, etc., which must also be reckoned as useless when the cost price is calculated. All these non-tannins remain in the liquors when cellulose extract is used mixed with other materials and accumulate in the suspender liquors to such an extent that they can only be run away. Molasses, cane sugar and glucose are much cheaper to use for weighting leather than cellulose extract. Even when used as a weighting material only, scarcely 50% of the total soluble matter of cellulose extract is utilised.—D. J. L.

Sulphite cellulose extract; Detection of ——. A. Gansser. Collegium, 1914, **5**, 324—325.

Moeller (this J., 1914, 365) and Loveland (this J., 1913, 373) have been unable to confirm the author's results in the detection of cellulose extract in the extract from leathers on which it has been used (Collegium, 1912, 482). It must be assumed that there are some cellulose extracts which do not give the Procter-Hirst reaction (this J., 1909, 293) and Becker has shown that such extracts may be produced. Quebracho wood which is kept away from light and air and under the action of mould growths will give the Procter-Hirst reaction.—D. J. L.

Leather liming control; Light ——. J. T. Wood. Collegium, 1914, 305—311.

A report of further work done on the subject since the last report presented at the London Conference of the I.A.L.T.C. in 1912 (this J., 1912, 446). Giusiana (this J., 1912, 1192) states that the addition of magnesium and ammonium salts to the lime liquor results in a fine grain and suggests the following composition of a lime liquor where it is not desirable to swell the skin: Na_2S, 5; $CaCl_2$ (cryst.) 8·7; $MgCl_2$ 8·05, NH_4Cl 2·1 and $BaCl_2$ 9·65 kilos. per 100 litres. From the preliminary report by the author and D. J. Law (*loc. cit.*) it was found that the greatest amount of nitrogen is dissolved out of the goods in the first draw and that there is a definite amount of nitrogenous substance which the limes are capable of extracting from the skin. Nitrogen in a lime liquor up to 0·2 grm. per litre is not detrimental but it depends upon other factors such as temperature, degree of breaking down of the proteins and number of proteolytic bacteria present, so each case must be judged on its merits. R. F. Innes has found as much as 14% CaO in a fully limed goat skin but no regular curves of absorption of lime could be obtained; the ash usually contained 65—75% CaO. The author has found, in the case of sheep skins that have been over-limed, that in the early stages of liming the hyaline layer is not attacked by tryptic enzymes even by long exposure to their action but, after a certain time in lime, these enzymes are capable of attacking this layer. Stiasny made experiments with the stalagmometer on old lime liquors, the number of drops falling showing the surface tension (σ) and the time required for emptying the tube showing the viscosity (η). Peptones and glycocoll (as representative of amino acids) diminished the surface tension but did not increase the viscosity. Inorganic substances (lime, sulphide, etc.) had no influence on either the surface tension or the viscosity. Gelatin slightly increased the surface tension, very dilute solutions being relatively more effective than strong ones, and considerably increased the viscosity. Mixtures of Witte peptone and gelatin showed also the great influence of peptones on the surface tension and their small influence on the viscosity, and the small influence of gelatin on the surface tension and its great influence on the viscosity. Measurements of σ and η for old and medium limes are given.—D. J. L.

Patents.

Chrome-leather; Method of treating —— to render it strong and resistant to water. O. Walter. Ger. Pat. 272,534, March 23, 1913.

The leather is treated with a colloidal solution, *e.g.* of glue, gelatin, agar-agar or the like, and with formaldehyde, then strongly compressed at a temperature above atmospheric, dried, and treated at about 90° C., under diminished pressure, with a composition consisting of wool-fat, asphaltum, pitch, gutta-percha, and the like.—A. S.

Formaldehyde-leather; Manufacture of ——. K. Evler. Ger. Pat. 272,678, Oct. 11, 1912.

Tanning with an emulsion containing formaldehyde, a fat or oil, and magnesium silicate is preceded or followed by tanning (and if desired colouring) according to one of the usual processes.—A. S.

Horny or leathery materials from leather or leather refuse; Process for the production of ——. P. P. Damgaard, Frederiksberg, Denmark. Eng. Pat. 22,644, Oct. 7, 1913. Under Int. Conv., Oct. 17, 1912.

See Fr. Pat. 463,596 of 1913; this J., 1914, 432.—T. F. B.

XVI.—SOILS; FERTILISERS.

Phosphates in soil extracts; Determination of ——. J. A. Prescott. J. Agric. Sci., 1914, **6**, 111—120.

A measured volume of soil extract containing 5—10 mgrms. P_2O_5 is evaporated to dryness and the residue ignited at a dull red heat for 15 mins., or if much silica is present for two hours at 120°—160° C. It is then digested for half an hour on a sand bath with 50 c.c. of 10% sulphuric acid, the extract diluted, and filtered, and the residue washed with hot water. The solution is treated with 25 c.c. of concentrated ammonium nitrate (500 grms. per litre), warmed to 55° C., 25 c.c. of ammonium molybdate (150 grms. in 1 litre of water poured into 1 litre of nitric acid of sp. gr. 1·2) at the same temperature added and the mixture allowed to cool. After two hours the precipitate is washed several times by decantation with 2% sodium nitrate solution, filtered off, dissolved in excess of standard (*N*/10) alkali and the excess titrated back with standard acid. The best factor is 1 c.c. of *N*/10 alkali = 0·0003004 grm. P_2O_5. It is important to remove all silica and to avoid too high a temperature for precipitation. The method is quicker and more accurate than the lead molybdate method of Brearley and Ibbotson ("*Anal. of Steel Works Materials*").—W. H. P.

Sulphites, thiosulphates and sulphur present in soil; Influence of —— on the growth of the plant. W. Thalau. Landwirtsch. Versuchsst., 1913, **82**, 161—209. Biedermann's Zentr., 1914, **43**, 228—231.

Ammonium sulphite is equal to ammonium sulphate as a manure on loamy soils. On sandy soils it is not quite so good, while on peaty soils it is considerably less effective. In water cultures it is harmful even in very small quantities: at concentrations higher than 0·4% it retards germination, and at 1% it prevents germination entirely, while 1% ammonium sulphate has no harmful action at all. Ammonium sulphite is readily oxidised to sulphate when exposed to air, the oxidation being more rapid in solution and still more rapid when the salt is mixed with soil. Calcium sulphite is harmless in loamy and sandy soils. On peaty soils it has a slight retarding effect; and n water cultures increasing quantities of calcium sulphite roduce a progressive decrease in the yield. Sodium hiosulphate appears to have no harmful action on plant growth. Flowers of sulphur is somewhat variable in its effects, but it does not usually increase growth or yield. —W. H. P.

Preparation and composition of lime-sulphur sprays. Ramsay. *See* XIXb.

Further observations on the fungicidal action of Bordeaux mixture. Barker and Gimingham. *See* XIXb.

Patents.

alcium cyanamide powder; Process for the agglomeration of ——. A. Goris and C. Vischniac. Fr. Pat. 465,514, Nov. 29, 1913.

he powder is treated with a dilute solution of sodium, uminium, or other sulphate, and the resulting mass crushed to a dense, granular, non-caustic material, free from carbide. A mixed fertiliser is produced by employing potassium sulphate in the process.—F. Sodn.

Lime for viticulture, agriculture generally, and building purposes; Process and apparatus for the production of fat ——. P. A. M. Filleux. Fr. Pat. 465,851, Dec. 6, 1913.

Quicklime is slaked with solutions containing a small quantity of an antiseptic and/or a dyestuff, such as picric acid, methylene blue, potassium permanganate, or the like; the slaked lime is tempered (in a silo, in trucks, or otherwise), graded in a separator, and may finally be mixed with powdered sulphur or copper sulphate.—O. R.

Process of dissolving organic substances of animal origin and the fixation of their nitrogen in the form of soluble compounds. Fr. Pat. 466,150. *See* XIXa.

Treating fish to obtain dried fish and fish guano. Fr. Pat. 466,392. *See* XIXa.

XVII.—SUGARS; STARCHES; GUMS.

Cane sugar factory; Studies in the ——. [*Analyses of sugar canes, cane juices, the ash of cane juice and cane syrup, incrustations of juice-heaters and defecators.*] C. Fribourg. Bull. Assoc. Chim. Sucr., 1914, **31**, 778—802.

Louzier cane.—An average sample of this variety, which is almost exclusively worked in Brazil, contained: fibre, 10·50; sucrose, 15·42; non-sugar, 3·44; and water, 70·64%. *Juice of Louzier cane.*—Juice obtained by dry crushing in a laboratory 3-roller mill, gave the following figures in grms. per 100 c.c for (a) the apparent and (b) the true analysis: Sucrose, (a) 20·04, (b) 20·31; reducing sugars, (a) 1·16, (b) 1·31; ash, (a) 0·35, (b) 0·34; organic matter, (a) 1·38, (b) 0·64; Brix degree, (a) 22·93, (b) 22·60; purity, (a) 87·40, (b) 89·80; saline coefficient, (a) 57·20, (b) 59·70; glucose ratio, (a) 5·80, (b) 6·40; ratio of ash to organic matter, (a) 3·94, (b) 1·88. *Ash of the Louzier cane.*—SiO_2, 25·96; Al_2O_3, 0·02; Fe_2O_3, 1·02; Mn_2O_3 0·68; CaO, 7·64; MgO, 9·19; K_2O, 36·17; Na_2O, 1·39; CO_2, 6·91; SO_3, 3·21; P_2O_5, 7·18; Cl, 0·81. *Composition of Louzier and Ribbon canes according to their height.*—Results confirming in a general way those of other workers were obtained, these indicating that the density of the juice is lowest near the root, at its maximum in the middle of the stalk, and gradually diminishes towards the top; the purity of the juice is highest near the root, and gradually diminishes towards the top; the sucrose content is practically the same for three-quarters of the height, but is distinctly lower in the top quarter; the reducing sugars, ash, and acids are lowest near the root, and highest at the top; while the fibre content is highest at the root end. *Composition of the ash of mill juice and clarified syrup.*—The raw juice was sulphited to an acidity of 0·75 grm. per litre, limed to neutrality in the cold, heated to 60° C. in reheaters, and allowed to settle in the usual way, the clear juice being separated from the top scums and the bottom muddy juice. Analysis of the ash of (a) the raw unsulphited mill juice, and (b) the clarified syrup after evaporation, gave the following values, expressed in parts per 1000 of sucrose: SiO_2, (a) 1·99, (b) 0·88; Al_2O_3, (a) 0·05, (b) 0·01; Fe_2O_3, (a) 0·43, (b) 0·14; Mn_2O_3, (a) 0·12, (b) 0·03; CaO, (a) 1·12, (b) 5·47; MgO, (a) 1·37, (b) 1·89; K_2O, (a) 15·36, (b) 16·02; Na_2O, (a) 0·68, (b) 0·38; CO_2, (a) 4·86, (b) 8·93; SO_3, (a) 0·97, (b) 2·10; P_2O_5, (a) 2·07, (b) 0·30; Cl, (a) 0·48, (b) 0·60. The total amount of ash per 1000 of sugar had increased, owing to the introduction of sulphites and sulphates in sulphitation, and of lime and magnesia in defecation; while the silica, oxides of iron and alumina, and phosphoric acid had diminished, having passed into the scums. *Incrustation from limed juice-heater.*—Water (at 100° C.), 1·86; organic matter (including bagasse) and combined water, 26·65; sand, 0·18;

silica, 0·12 ; calcium sulphate, 6·56 ; calcium phosphate, 51·13, magnesia, 0·36, ferric oxide, 1·46 ; lime combined with organic acids, 4·90 ; alkalis, carbonic acid, and undetermined matter, 6·78%. *Incrustation from raw juice defecator.*—Water, 8·54 ; organic matter (including a large proportion of bagasse), 33·55 ; sand and silica, 0·45 ; calcium sulphate, 2·82 ; calcium phosphate, 48·38 ; and undetermined substances, 6·26%. *Incrustations from triple effect evaporators.*—The deposit from the first body has a similar composition to those found in the limed juice re-heater and the defecators ; calcium sulphate is present mostly in the first and least in the third body ; on the contrary, calcium oxalate, which is not met with in the deposits of re-heaters and defecators, nor in the first body of the triple effect, appears in considerable amount in the second, and to an even greater extent in the third body ; combined silica is principally deposited in the last body.—J. P. O.

Clarification of Louisiana cane juices ; Sulphitation and carbonatation processes for the ——. W. E. Cross. Agric. Expt. Station, Louisiana State Univ., Bull. 144, 1914, 39 pages.

Sulphitation.—The Java method of liming before sulphitation is not suited to Louisiana juices, owing to risk of the decomposition by lime of the reducing sugars, which are high in Louisiana juices. For white sugar manufacture, the maximum limit to which the raw juice may be sulphited in most factories in the State is such that 8 c.c. of $N/10$ sodium hydroxide solution are required to render 10 c.c. of the juice neutral to phenolphthalein ; under these conditions a hard filter-press cake and light mobile juices are obtained. After the sulphitation of the raw juice, a precipitate containing : moisture, 4·07 ; fat and wax, 32·57 ; proteins, 23·63 ; ash, 9·48 ; crude fibre, 8·05 ; and gums, etc., 22·20% separated. A sensible increase in the purity of the raw juice was effected by the removal of this precipitate, and although in the factory its filtration was impracticable, promising results were obtained by centrifugal separation. In "liming back" Louisiana juices, which on the average contain 10% of sucrose and 1·5% of reducing sugars, the most suitable point was found to be neutrality to litmus, corresponding to 0·8—1·0 c.c. of $N/10$ sodium hydroxide solution per 10 c.c. of juice, using phenolphthalein as indicator; at this stage the muddy juice settled well, and there was no danger of it becoming alkaline on boiling. Before evaporation in the effect, this acidity could be increased with advantage regarding the colour of the syrup subsequently obtained ; in factory trials no measurable amount of inversion occurred with an acidity corresponding to 1·0 c.c. of $N/10$ sodium hydroxide solution per 10 c.c. of juice, but there was a distinct risk if it was increased to 1·5 c.c. It is of much importance in making white sugar that the clarified juice be free from all suspended matter when taken into the effect, and the use of mechanical filters in addition to settling is advocated.

Carbonatation.—In Louisiana the carbonatation process, successfully used in Java, has not made much progress, owing to the high glucose content of the juices, but the results of the past three grinding seasons have shown that it can be applied, provided the juices be not heated above 40°—50° C., when the products of the decomposition of the reducing sugars are neither dark-coloured nor melassigenic. Either single or double carbonatation may be applied, the alkalinity of the first saturation in double carbonatation being stopped at a point corresponding to 1·2—1·8 c.c. of $N/10$ acid per 10 c.c. of juice, and the temperature of filtration never rising higher than 50° C. Harloff's acid thin juice process (this J., 1913, 1035) may be applied to Louisiana juices with success, though the need of filtering at 70° C., necessitates the use of a large amount of lime in single carbonatation, viz., 1·2—2·5%.

Syrup treatment.—Sulphitation syrups did not filter readily, and it was best to heat them to 70° C., add 1—2 parts of sodium phosphate per 100,000 parts, and allow to settle ; treatment with sulphurous or phosphoric acids was also often helpful. Carbonatation syrups were usually easy to filter, and with these also improvement was effected by addition of sulphurous or phosphoric acids, the amount depending upon the original acidity of the clarified juice.—J. P. O.

[*Sugar.*] *Diffusion ; Temperature at which* —— *should be operated.* A. Herzfeld and L. Kuntze. Deut. Zuckerind., 1914, 39, 289—291.

According to Herzfeld, a temperature above 40°—50° C. is preferable in operating the ordinary process of diffusion, and when the Pfeiffer-Bergreen or other method of returning the residuary waters to the battery (this J., 1906, 328 ; 1907, 704 ; and 1913, 954) is applied, about 70° C. should be maintained throughout, in order to inhibit the action of micro-organisms, and prevent the formation of gas. Such methods of "hot" diffusion produce a pulp of better keeping qualities, either in the open air or in the silo than "cold" diffusion. Kuntze obtained satisfactory results when filtering the residuary diffusion and press waters, and using them in place of fresh water throughout the campaign, by working at the following temperatures in a 9-cell battery : in the first, freshly charged, 38°—40° ; in the second, 60° ; in the third to the seventh, 82° ; in the eighth, 75° ; and in the last, 40°—50° C. The essential conditions for successful working with residuary waters are great rapidity and the avoidance of any stoppage. Provided the pulp is siloed immediately after being discharged, and well covered with earth, it keeps well.—J. P. O.

Intermediate [*beet*] *juice ; Analysis of a precipitate from the sulphitation of* ——. A. Kiroff. Deut. Zuckerind., 1914, 39, 419.

On sulphiting the intermediate juice in a Russian beet factory, difficulty was subsequently experienced in passing it through the cloths of a mechanical filter owing to the slimy nature of the precipitate, analysis of which gave the following figures : water, 4·09 ; insoluble in hydrochloric acid, 4·59 ; sugar from the intermediate juice, 19·30 ; non-sugar, 1·57 ; calcium sulphite, 44·94 ; calcium sulphate, 1·31 ; calcium salts of organic acids, 19·00 ; calcium otherwise combined, iron and alumina, 2·12 ; fat, 1·38%.—J. P. O.

Nipa palm ; The —— *as a commercial source of sugar* D. S. Pratt, R. R. Williams and H. D. Gibbs. Philippine J. Sci., 1913, 8, A, 377—398.

The nipa palm, *Nipa fruticans* Wurmb., is abundant in swamps in the Philippine Islands and other parts of the tropics. The juice obtained from the flower stalk is used on a large scale as a commercial source of alcohol, and the authors' experiments have led to the conclusion that the nipa palm should furnish a cheap supply of sugar. The nipa palm produces about 40 litres of sap per tree in an average season, and at a conservative estimate a yield of about 30,000 litres of sap pér hectare per year should be obtained. The sap is available in sufficient quantity for the supply of sugar mills for about six months in the year; contains on an average about 15% of sucrose and has an apparent purity of not less than 85 ; traces of invert sugar are present and about 0·5% of sodium chloride, but waxes, acids, and pectins are absent. The chief difficulty is the presence in the sap of enzymes of the invertase and peroxidase types which cause inversion and decomposition of the sugar with great rapidity ; by placing a small amount of lime cream and sulphite in the collecting vessel—which should be fitted with a funnel to cause the sap to mix thoroughly with the lime cream—the enzyme action can be inhibited and the sap will then keep without decomposition for several hours. The sulphite also renders further bleaching at the sugar mill unnecessary It is estimated that sap can be delivered to the sugar mills at about 1·5 dollars (U.S.A. currency) per 1000 litres from which 115 kilos. of commercial white sugar polarising 99°—99·5° can be obtained. About 9000 litres of sap would be required to produce 1 metric ton of 96° sugar a 10-ton mill would require therefore 90,000 litres of sap daily, or the produce of about 450 hectares of nipa swamp

—R. G. P.

Lactose and dextrose, Determination of —— by the copper-iodide method. S. W. Cole. Biochem. J., 1914, **8**, 134—142.

A rigorously standardised modification of Schoorl's method (this J., 1899, 791), similar to one described by Peters (J. Amer. Chem. Soc., 1912, **34**, 928), in which the cuprous oxide is filtered off before the unreduced copper is titrated. A table is given for lactose, corresponding to that for dextrose given in Peters' paper.—J. H. L.

Lævulose; Simple qualitative and quantitative tests for —— in presence of other sugars. E. Pinoff and K. Gude. Chem.-Zeit., 1914, **38**, 625—626.

The following qualitative test is more satisfactory than that previously described (this J., 1905, 1192):—6 grms. of finely powdered ammonium molybdate dissolved in 5 c.c. of boiling water, are cooled to 40° C. and mixed with 5 c.c. of the liquid to be tested (containing 0·03—1 grm. of sugar) which must contain no free acid. The mixture, kept at 40° C. for 15 mins., becomes blue if lævulose is present. The only other sugar which reacts in this way is dextrose, but the colour produced by 1 grm. of the latter is only equal in intensity to that produced by 0·03 grm. of lævulose.

The diphenylamine colour test may be applied quantitatively as follows:—2·5 c.c. of the liquid to be tested (containing not more than 20% of sugar) are mixed with 2·5 c.c. of 96% alcohol, 10 c.c. of a mixture of alcohol with sulphuric acid (750 c.c. of 96% alcohol and 200 c.c. of concentrated acid), and 0·1 grm. of diphenylamine, and the mixture is heated to 70° C. in 15 mins. under a reflux condenser, maintained in ebullition for 3 mins., quickly cooled, poured into a Hehner colorimeter vessel (or a measuring cylinder of 3 cm. width) and the colour observed through a spectrometer. If the original sugar solution contains lævulose, the liquid after heating is blue and shows a broad absorption band ($\lambda = 500$—550). The band is only just distinctly visible when the original solution contains 0·036% of lævulose and larger quantities are estimated by ascertaining the extent to which the final liquid must be diluted (with alcohol) to reduce the intensity of the band to correspond with this quantity of lævulose.—J. H. L.

Maltose: Action of dilute solutions of barium and other hydroxides on ——. L. Kolb. Biochem. Zeits., 1914, **63**, 1—57.

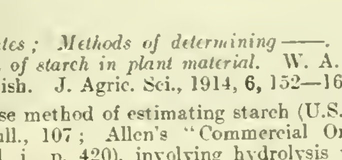
Maltose was decomposed by the hydroxides of lead, magnesium, calcium, strontium, and barium to an extent which depended on the degree of dissociation of the hydroxide; of the alkaline-earth hydroxides, barium hydroxide acted most strongly. The decomposition, as indicated by the fall in optical activity of the solution, was accelerated by rise of temperature, but was characterised at all temperatures by an initial rapid phase followed by a slow phase; the solution could be rendered quite inactive if a sufficient quantity of hydroxide was employed. In the course of decomposition, the solution always became more or less intensely brown. Barium hydroxide first converted maltose into dextrose, a rapid reaction which corresponded to the initial rapid fall in optical activity. The dextrose was slowly converted into an inactive mixture of lævulose, mannose, dextrose (cp. Lobry de Bruyn and van Eckenstein, this J., 1896, 210) and glutose (?), these changes corresponding to the slow fall in optical activity. Organic acids were also formed. —L. E.

Sucrose; Inversion of —— by acids in water-alcohol solutions. G. J. Burrows. Chem. Soc. Trans., 1914, **105**, 1260—1270.

The rate of inversion of sucrose by hydrochloric or sulphuric acid in mixtures of water and ethyl alcohol up to 75% of the latter falls to a minimum as the proportion of alcohol is increased to 45—50% and then increases again. Since the conductivity of the acid is a function of its dissociation and of the mobility of the ions (and therefore of the fluidity of the solution), the values obtained by dividing the inversion velocity constants by the conductivities of the corresponding solutions, represent the influence of the solvent on the activity of the catalyst. These values show that the catalytic activity of the hydrogen ions is greater in alcoholic than in aqueous solutions. The activity of *N*/2 hydrochloric acid relative to that of *N*/2 sulphuric acid is greater in mixtures of alcohol and water than in water alone.—L. E.

Glucoses; Partially methylated ——. III. Monomethylglucose. J. C. Irvine and T. P. Hogg. Chem. Soc. Trans., 1914, **105**, 1386—1396.

Monomethylglucose (m. pt. 160·5°—161° C.) is obtained by hydrolysis of monomethylglucosediacetone which is formed by the action of methyl iodide and silver oxide on glucosediacetone. Since monomethylglucose yields, on strong oxidation with nitric acid, not a dibasic acid but monomethylgluconolactone, and also gives the same phenylosazone as is obtained from monomethylfructose, its constitution is:—



$$CH_3\cdot O\cdot CH_2\cdot \overset{H}{\underset{OH}{C}}\cdot \overset{H}{C}\cdot \overset{OH}{\underset{H}{C}}\cdot \overset{H}{\underset{OH}{C}}—CHOH$$

The α- and β-forms of the sugar exhibited mutarotation, the initial rotatory powers being $[\alpha]_D = +107{\cdot}6$ and $+24{\cdot}4$ and the permanent rotations 68·5° and 68·3° respectively.—L. E.

Carbohydrates; Methods of determining ——. II. Determination of starch in plant material. W. A. Davis and A. J. Daish. J. Agric. Sci., 1914, **6**, 152—168.

The Sachsse method of estimating starch (U.S. Bureau of Chem., Bull., 107; Allen's "Commercial Org. Anal.," 4 Ed., Vol. i., p. 420), involving hydrolysis with dilute hydrochloric acid, is unreliable in the presence of plant material. The tissues invariably contain pentosans which yield pentoses that count as dextrose, and actual destruction of dextrose takes place during the prolonged treatment with dilute acid. O'Sullivan's method (Chem. Soc. Trans., 1884, **45**, 1; also this J., 1904, 137), involving the use of diastase, gives low results owing to the loss of dextrin which takes place on purifying the solution by the precipitation method after the conversion. The use of Taka-diastase avoids this objection as it yields only dextrose and maltose (free from dextrin) and no loss of these sugars occurs when the solution is treated with clearing agents such as lead acetate. In the preparation of the plant material it is necessary to destroy all enzymes immediately the sample is taken. This is done by dropping the leaf or other material into boiling 95% alcohol containing a little ammonia. The sugars are removed by extraction with boiling alcohol. If necessary gums, etc., are removed by extraction with water, as their optical activity would lead to an error in the subsequent starch estimation. The extracted material is usually preserved in a bottle and great care must be taken in subsequent sampling, owing to the tendency for starchy matter to accumulate at the bottom. About 10 grms. of the oven-dried extracted material are dried *in vacuo* at 100°—110° C. for 24 hours or longer, and then gelatinised with 200 c.c. of water. After cooling to 38° C., 0·1 grm. of Taka-diastase and 2 c.c. of toluene are added and the mixture left for 24 hours. It is then heated to boiling, filtered, washed, and the filtrate together with a sufficient quantity of basic lead acetate is made up to 500 c.c., and again filtered. In 100 c.c. of filtrate the slight excess of lead is precipitated by sodium carbonate, the solution made up to 110 c.c., and filtered. 50 c.c. of the filtrate are used for reduction and another portion is polarised in a 400 mm. tube. From the reduction and polarimetric data the dextrose and maltose and hence the original starch can be calculated. —W. H. P.

The Charpentier thermal ozoniser, and its application in the distillery and sugar factory. Sidersky. *See* XIXb.

Patents.

Sugar-containing juice; Process of purifying raw ——. J. Carniol, Vienna. U.S. Pat. 1,095,189, May 5, 1914.

The sliced material containing the juice is treated with powdered limestone, and the juice is heated to about 70° C., mixed with powdered limestone and sufficient lime to produce an alkalinity of 0·3% on saturation, and filtered.—J. H. L.

Sugars; Process of producing fermentable —— [from cellulosic materials]. F. E. Gallagher, Newton, and H. S. Mork, Boston, Mass., Assignors to Standard Alcohol Co., New York. U.S. Pat. 1,096,030, May 12, 1914.

As one step in the production of sugars from lignocellulose or other cellulosic material, the mass is digested under pressure with a dilute solution of sulphuric acid and a soluble metallic chloride (*e.g.*, sodium chloride).—J. H. L.

Betaine or its salts; Manufacture of —— from molasses, exhausted molasses, or other residues of the beet sugar factory. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 2813, Feb. 3, 1914. Under Int. Conv., May 7, 1913.

The exhausted molasses or other raw material is freed as far as possible from water by evaporation in a vacuum and the residue is mixed with concentrated hydrochloric acid under such conditions that a temperature favourable to the formation of humic substances is not reached (*e.g.*, the temperature should not exceed 50° or 60° C.). When the mass is cooled, practically the whole of the betaine separates in the form of hydrochloride mixed with alkali chlorides, which are separated by the usual methods, such as by crystallising from methyl alcohol and recrystallising from water.—T. F. B.

Sugars; Process for producing fermentable ——. F. E. Gallagher, Troy, N.Y., U.S.A. Eng. Pat. 14,937, June 28, 1913. Under Int. Conv., July 15, 1912.

See U.S. Pat. 1,056,161 of 1913; this J., 1913, 441.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Wort; Assimilable nitrogen in —— and its relation to the yeast and fermentation. F. Schönfeld. Woch. Brau., 1914, **31**, 197—199.

Of the soluble nitrogenous matter in beer wort, 45—65% is assimilable by yeast, but owing to the conditions of fermentation, only 15—30% is actually assimilated. In the determination of assimilable nitrogen in wort by fermentation, the wort is much diluted, treated with a considerable quantity of sugar and a very large quantity of fresh distillery yeast, and fermented at a high temperature with vigorous aeration and stirring; the assimilable nitrogen is thus removed in 5—6 hours. The results tend to be rather low since nitrogenous matter may diffuse into, and remain in the wort, but the error thus introduced is not serious. During fermentation, beer worts of high nitrogen-content lose less nitrogen, absolutely as well as relatively, than worts poor in nitrogen, since the yeast "breaks" much more readily in the former case and thus loses much of its power to assimilate nitrogen. The loss of much nitrogen, characteristic of worts poor in nitrogen, accompanies a high attenuation. The amount of assimilable nitrogen in Berlin "Weissbier" wort does not exceed 45%, but almost all of this is assimilated, and the final attenuation is attained in the primary fermentation.—L. E.

Sucrase; Thermoregeneration of ——. G. Bertrand and M. Rosenblatt. Comptes rend., 1914, **158,** 1455—1458.

The authors confirmed a recent observation of Durieux (this J., 1914, 561), that if dried yeast is macerated in water and portions of the mash are heated for 1 min. at various temperatures and subsequently filtered, the filtrates which have been heated at 90° or 100° C. exhibit greater inverting activity towards sucrose than those heated at 70° or 80° C. This "thermoregeneration," was observed with different kinds of yeast, and appears to be a consequence of autolysis, for it is the more marked the more slowly the yeast is dried prior to maceration. Thus, it was not shown by fresh baker's yeast after grinding with sand or killing by successive treatments with alcohol and ether, whereas the same kind of yeast dried slowly at 35° C. (48 hours or longer) and then macerated for 2 hours, and heated for 1 min. at the temperatures indicated, gave the following values for the relative invertase activities of the filtered juices:—not heated, 3·377; heated at 50°, 3·292; heated at 70°, 0·068; heated at 80°, 0·150; heated at 90°, 2·446; heated at 100° C., 3·430. A sample of yeast killed by acetone and dried, behaved similarly, but in a less marked degree. —J. H. L.

Yeast; Enzymes of washed zymin and dried —— (v. Lebedeff). I. Carboxylase. A. Harden. *II. Reductase.* A. Harden and R. V. Norris. Biochem. J., 1913, **7**, 214—217; 1914, **8**, 100—106.

Zymin and dried yeast (prepared by v. Lebedeff's method) after being freed from co-enzyme by washing, and thus rendered incapable of fermenting dextrose (see Euler and Backström, this J., 1912, 404), readily decompose pyruvic acid into carbon dioxide and acetaldehyde (cp. Neuberg and others, this J., 1911, 379, 1179) provided that the acidity of the solution is kept low. If therefore the decomposition of pyruvic acid actually be a stage in the alcoholic fermentation of dextrose, the soluble co-enzyme must be required for some stage precedent to the production of pyruvic acid.

The presence of a fermentable sugar favours the reduction of sodium selenite by living yeast, but has little influence on the reducing power of zymin unless the sugar is present in high concentration, when inhibition occurs (cp. Palladin, this J., 1908, 870). Sodium selenite at a concentration of 0·5% almost totally inhibits the fermentation of dextrose by zymin and dried yeast (10 grms. per 100 c.c. of 10% dextrose solution), an effect much greater than can be explained by Lvoff's hypothesis (see this J., 1913, 955, 1167). When dried yeast or zymin is washed with cold water until incapable of fermenting sugar, it loses its power of reducing methylene blue and sodium selenite. Such washed preparations reduce methylene blue in presence of many aldehydes (not, however, formaldehyde or acetaldehyde) or of bouillon, but these do not restore the power of producing alcoholic fermentation. Addition of the boiled washings to the washed preparations restores both the power of fermenting sugar and reducing methylene blue.—J. H. L.

Port wine; Substitutes for genuine ——. So-called Spanish (Tarragona), Grecian, Californian, and Cape port wines. A. Kickton and R. Murdfield. Z. Unters. Nahr. Genussm., 1914, **27**, 617—676. (See this J., 1913, 670.)

Imitation port wines are generally made from completely or almost completely fermented red and white wines which are sweetened by addition of boiled or fortified wine must, and rendered stable by addition of alcohol. Of nearly 600 samples examined by the authors, only three corresponded in composition with normal genuine port wine. On the other hand, some genuine port wines possess a slightly abnormal composition. Imitation port wines seldom contain more than 14·5 grms. of alcohol or less than 0·5 grm. of acid per 100 c.c., and fairly frequently contain 2·5—3 grms. of sugar-free extract per 100 c.c. These values differ appreciably from those previously given for genuine port wines (*loc. cit.*) Further, the imitation wines frequently contain less lævulose than dextrose, the reverse being the case with the genuine samples.—L. E.

The Charpentier thermal ozoniser and its application in the distillery and sugar factory. Sidersky. *See* XIXb.

Patents.

Fermented beverages; Manufacture of ——. E. W. Kuhn, Brussels. Eng. Pat. 11,124, May 10, 1913.

The process described in Eng. Pat. 4622 of 1908 (see this J., 1908, 826) is modified in that the steel container is not completely filled with the liquid to be fermented, the free space being filled with carbon dioxide or other suitable gas under a pressure of 6 atmospheres or more. Part of the requisite gaseous pressure may be produced by forcing additional liquid into the container.—L. E.

Beer containing iron; Preparation of ——. P. Narjes. Hanover, Germany. Eng. Pat. 14,972, June 28, 1913.

Wort containing a high proportion of sugar is fermented in an open vat at 8°—9° C., by about ¾% of thick pasty yeast added in small quantities at intervals during 7—8 days, until about 60% of the extract has been fermented and considerable quantities of lactic acid have been formed. The yeast is then removed and the wort transferred to storage vessels where it is mixed with an excess of iron hydroxide and again treated with small quantities of yeast until all the sugar is fermented and the lactic acid has combined with the iron. Finally the beer is allowed to ferment in closed vessels.—J. H. L.

Wort; Apparatus for extracting ——. W. T. Ramsden, London. Eng. Pat. 18,237, Aug. 11, 1913.

A long perforated rotatable drum, mounted horizontally or nearly so above a trough, serves as a draining and sparging vessel for the mash, which is fed into it at one end and conveyed along it by means of inclined blades or screws fixed to a shaft passing axially through the drum. this shaft rotates in a direction opposite to that of the drum, and is hollow to serve as a duct for the sparge water. At certain enlarged sections of the drum, the mash is thoroughly stirred by the interplay of rods fixed respectively to the drum and the shaft, and the sparge water is injected into the mash at these places, through perforations in the shaft. The drum may be replaced by a perforated trough, in which case an oscillatory angular motion is imparted to the hollow axial shaft.—J. H. L.

Mash-filters; Process for washing the press-cakes in ——. W. Hofmann. Ger. Pat. 272,600, April 5, 1911.

The wash-liquor is passed through a number of press-cakes in succession, and to allow of this being done without using an excessively high initial working pressure, a force pump or other pressure-increasing device is interposed between successive chambers containing the press-cakes. —A. S.

Brewing liquor; Treatment of ——. A. E. Berry and A. Boake Roberts and Co., Ltd., Stratford, Essex. Eng. Pat. 20,712, Sept. 13, 1913.

The brewing water is treated with lactic acid, *e.g.*, about 0·01—0·02% in excess of the quantity required to combine with the alkaline salts present.—J. H. L.

Hops; Process and apparatus for the production of extracts from ——. L. A. von Horst, London. Eng. Pat. 24,813, Oct. 31, 1913.

The hop oil is first extracted by passage of steam through the disintegrated hops, and recovered by condensation; and the dried hops are afterwards enclosed in bags and extracted by boiling once or twice with alcohol and finally with water. The apparatus used for the steaming of the hops comprises a closed vessel communicating with a condenser, and provided with a perforated steam coil at the bottom, above which is a grid supporting a fibre matting to serve as a couch for the hops.—J. H. L.

Malt extracts; Process for removing the bitter taste and burnt smell from ——. E. Cantor, Nurnberg, Germany. Eng. Pat. 5025, Feb. 26, 1914. Under Int. Conv., March 6, 1913.

Steam is passed through the extract, in particular high-dried malt extract, high-dried malt wort, "colour beer," etc., in order to remove bitter or empyreumatic substances. —L. E.

Alcohol manufactured by distilling fermented sulphite liquor; Method of purifying ——. G. Ekström, Harnäs, Sweden. U.S. Pat. 1,095,830, May 5, 1914.

During the distillation the alcoholic vapours are treated with basic substances (*e.g.*, soda solution) capable of binding the sulphurous acid and decomposing the aldehydic compounds present.—J. H. L.

Alcohol; Process of making ——. F. Thatcher, El Paso, Tex., Assignor to L. M. Stiles, Hachita, N. Mex. U.S. Pat. 1,096,965, May 19, 1914.

A mixture of comminuted cacti and water is stirred and treated with superheated steam at 250°—275° F. (121°—135° C.), in a digester. The steam is then blown off, carrying with it formic acid extracted from the cacti. The liquid is expressed from the mass, and treated with ammonium phosphate and with a yeast capable of producing alcoholic fermentation in presence of the remaining traces of formic acid, the fermented liquid being distilled. —L. E.

Fungus; A new —— *and its use in the saccharification of starch and the production of alcohol.* H. Boulard, Paris. Eng. Pat. 25,406, Nov. 6, 1913.

See Fr. Pat. 464,601 of 1913; this J., 1914, 497.—T. F. B.

Producing fermentable sugars [*from cellulosic materials*]. U.S. Pat. 1,096,030. *See* XVII.

Method of utilising and treating the lighter portion of sewage solids. Fr. Pat. 466,387. *See* XIXb.

XIXa.—FOODS.

Cheese ripening: Biochemistry of ——. *Occurrence of p-hydroxyphenylethylamine in normal cheese and its formation by lactic acid bacteria.* F. Ehrlich and F. Lange. Biochem. Zeits., 1914, **63**, 156—169.

All cheeses contain a quantity of *p*-hydroxyphenylethylamine which is produced by the action of micro-organisms on tyrosine; the amine is a normal constituent of cheese and is produced before actual decomposition of the latter takes place. A Swiss cheese, containing 35% of water, yielded 0·06% of the amine. The organisms which produce the substance have been separated: they bear a great similarity to the *Bac. casei* α-, *Freudenreich*, with which they are probably identical. Alcohols and hydroxy acids, such as *p*-hydroxyphenylethyl alcohol and *p*-hydroxyphenyllactic acid, which may be produced by the action of yeasts on tyrosine, are only present in traces, if at all, in ripened cheese.—W. P. S.

Creatine [*e.g., in meat extracts*]; *Colorimetric determination of* ——. E. Baur and G. Trümpler. Z. Unters. Nahr. Genussm., 1914, **27**, 697—713.

The authors investigated the conditions governing the determination of creatine by Jaffé's method, particularly the influence of time, temperature, acid-concentration, etc., on the conversion of creatine into creatinine, and they recommend the following modified method for the determination of creatine in meat extracts: *Creatinine.* Ten grms. of the extract are dissolved in 100 c.c. of water, and

5 c.c. of this solution are mixed with 15 c.c. of a 1·2% picric acid solution and 5 c.c. of 10% sodium hydroxide solution; after 7 mins. the mixture is diluted to 500 c.c. with water at 17° C. and the coloration compared with that shown by a definite depth of $N/2$ potassium bichromate solution. *Creatinine and creatine.* Ten grms. of the extract are dissolved in 100 c.c. of $N/1$ hydrochloric acid, the solution heated for 4 hours to 97° C., diluted to 500 c.c., and 10 c.c., after neutralisation, treated with 15 c.c. of picric acid solution and 5 c.c. of sodium hydroxide solution. The coloration is compared as before, the difference between the two estimations giving the quantity of creatine present. Liebig's extract was found to contain from 0·76 to 5·65% of creatinine and from 1·38 to 5·58% of creatine. Meat extracts prepared by the authors yielded from 7·5 to 8·9% of creatinine *plus* creatine. (See also this J., 1907, 709; 1908, 87; 1909, 737).—W. P. S.

Phytin; Investigation of ——. R. H. A. Plimmer and H. J. Page. Biochem. J., 1913, 7, 157—174.

A *resumé* of previous work is given (see Winterstein, this J., 1897, 1051; Hart and Andrews, 1904, 33; Patten and Hart, 1904, 618; Suzuki and Yoshimura, 1907, 1061; Geys, 1910, 970; Anderson, 1912, 701; Collison, 1912, 742; Contardi, 1912, 1006). The inorganic phosphorus in phytin can be readily determined by precipitation with ammonium molybdate in $N/2$ nitric acid at ordinary temperatures; precipitation is complete in 1—2 days, when the yellow liquid has become colourless, and no hydrolysis of the phytin is to be feared. The calcium cannot be determined by precipitation as oxalate, but accurate results are obtained by precipitation as calcium sulphate in presence of alcohol after oxidation with nitric and sulphuric acids. The magnesium in the filtrate can be estimated subsequently as pyrophosphate. The following figures represent the limits of composition of 8 samples of commercial phytin:—total phosphorus 17·74—20·04, inorganic phosphorus 0·89—0·98, calcium 12·1—12·82, magnesium 0·44—0·81, and loss at 110° C. 6·81—8·52%. It appears that phytin is a calcium salt, the small quantity of magnesium being present as impurity. There is great difficulty in removing the calcium from phytin in the preparation of phytic acid. The yield of inositol obtained when phytic acid is hydrolysed by acids is not quantitative (for inositol hexaphosphate) and the authors consider that another organic constituent may be present. (See also this J., 1914, 371, 436).—J. H. L.

Canadian pure food regulations. Chem. Trade J., June 6, 1914. [T.R.]

A Canadian Order-in-Council, dated April 4 last, lays down certain regulations made in accordance with the provisions of Section 26 of the Adulteration of Food Act. The regulations governing the employment of preservatives apply to foods intended for domestic consumption. Foods intended for export may contain certain preservatives provided that, both in specific character and in amount, such preservatives do not conflict with regulations in force in the country to which export is made.

It is forbidden to add any preservative whatever to milk, or any other preservatives than the following to foods especially intended for the use of infants or invalids: Common salt, saltpetre, wood smoke, vinegar, acetic acid, spices, or alcohol. These preservatives, which are included in Class I, may be used without declaration of their presence provided that such use does not conflict with any other statutory regulations.

Class II. refers to preservatives which may be used until further notice, provided that no more than one kind of preservative substance, named in the list, shall be added to any one kind of food, or to any mixture of two or more kinds of food, that the amount of preservative shall not exceed the maximum amount named, and that the presence of the preservative shall be declared on the label.

Toleration of the use of this class of preservative is dependent upon the fact that available evidence concerning their physiological action is not considered sufficient to prove that under the prescribed regulations they are harmful to health in such a degree as to bring them under Section 3 (*f*) of the Adulteration Act, which reads as follows: "Food shall be deemed to be adulterated within the meaning of this Act if it contains any added poisonous ingredient, or any ingredient which may render such an article injurious to the health of the persons or cattle consuming it." Should satisfactory evidence of the harmfulness to health of any of the preservatives named in Class II. be forthcoming, such preservatives would immediately fall under the condemnation of the Adulteration Act, and foods containing such preservatives would be declared to be adulterated.

(1) Boric acid (boracic acid) or borax. Limit: 1 part in 400 in cream; 1 part in 200 in butter and other foods. (2) Benzoic acid (benzoate of soda). Limit: 1 part in 1,000 parts. (3) Salicylic acid. Limit: 1 part in 5,000 parts. (4) Sulphurous acid (bisulphite of soda, potash, or lime). Limit: 1 part in 10,000 parts in beverages; 1 part in 2,000 parts in solid foods. (5) Saccharin. Limit: 1 part in 1,500 parts in beverages; 1 part in 700 parts in solid foods. (This substance shall not be used to take the place of sugar in any food in which sugar is employed as a source of nutriment, or for its feeding value. Where sugar is used only as a sweetener, saccharin may replace it under the conditions defined above.)

The following preservative substances, included in Class III., are prohibited from use in foods: Formaldehyde (formalin), beta-naphthol, abrastol (asaprol), hydrofluoric acid, fluorides, fluo-borates, fluo-silicates, or other fluorine compounds.

Unsaponifiable constituents of mowrah fat, and detection of mowrah fat in animal and vegetable fats. Berg and Angerhausen. *See* XII.

Patents.

Bread, biscuits and the like; Manufacture of ——. R. W. Dunham, Little Ilford, Essex. Eng. Pat. 2682, Feb. 1, 1913.

Wheaten bran is moistened with an infusion of hops which has been boiled and strained, and when cooled to about 85° F. (29° C.) a quantity of a "sponge" prepared from wheaten flour, water and yeast, is added and the whole well worked together, and left in a warm place for 24 hours. It is then broken up, dried by exposure to air, the bran and fibrous particles removed by means of a sieve, and the screened product used as a yeast food, instead of potatoes, in the manufacture of bread, or alone, as a ferment in the manufacture of biscuits. Or, the kneaded mass may be diluted with water and filtered, and the extract mixed with pure flour by spraying or otherwise. The yeast food, as thus prepared contains an extract from the cerealin cells, on the inner side of the bran, which is of importance for the nutrition of the nervous system.
—E. W. L.

Malt [food] preparations. F. Hoffmann and C. Meerwein, Basle, Switzerland. Eng. Pat. 5001, Feb. 26, 1914. Under Int. Conv., March 3, 1913.

Non-hygroscopic food-preparations are made by mixing calcium caseinate with extract of malt, either in the dry state or in solutions to be subsequently evaporated.
—J. H. L.

Cacao beans; Process of treating —— *applicable to the manufacture of chocolate, cocoa, and cocoa preparations.* L. E. G. Vignes. Fr. Pat. 465,487, Nov. 29, 1913.

Cacao beans are roasted under reduced pressure and the volatile products are condensed and mixed with ground cocoa. Acrid substances which are given off at the commencement of the roasting may be allowed to escape before the subsequent vapours are condensed, or the condensed liquid may be heated to expel these acrid substances.—W. P. S.

Organic substances of animal origin ; Process of dissolving —— and the fixation of their nitrogen in the form of soluble compounds. J. Sloan and E. Bohon. Fr. Pat. 466,150, Feb. 21, 1913.

The organic substance (flesh, etc.) is dissolved in a solution of potassium or sodium hydroxides, the mixture is neutralised with a mineral acid, filtered, and concentrated. Products suitable for use as foodstuffs or as fertilisers are obtained.—W. P. S.

Fish ; Process of treating —— to obtain dried fish and fish guano. E. Bodin, H. Dupont, and M. Riom. Fr. Pat. 466,392, Dec. 19, 1913. Under Int. Conv., Dec. 20, 1912.

Fish are treated with air containing formaldehyde vapour, under pressure at 30° to 100° C., then dried in a current of air at 50° C. The fish may be passed through a disintegrator before being dried, and then ground to a powder. To obtain a fish guano, the treatment with formaldehyde is carried out at above 100° C.—W. P. S.

Milk ; Manufacture of desiccated ——. J. D. Davis, Bridgeport, Conn., U.S.A. Eng. Pat. 21,295, Sept. 20, 1913. Under Int. Conv., Oct. 7, 1912.

See U.S. Pat. 1,070,781 of 1913 ; this J., 1913, 921.—T. F. B.

Flour ; Method of maturing and bleaching ——. J. A. Wesener, Chicago. U.S. Pat. 1,096,480, May 12, 1914.

See Fr. Pat. 465,300 of 1913 ; this J., 1914, 498.—T. F. B.

Process for improving the odour and taste of vegetable and animal fats and oils. Ger. Pat. 273,069. *See* XII.

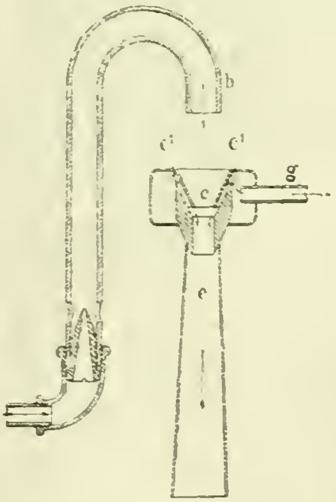
XIXB.—WATER PURIFICATION ; SANITATION.

Lead and copper in drinking water ; Two reliable colorimetric methods of determining ——. C. Reese and J. Drost. Z. angew. Chem., 1914, **27**, 307—312.

A litre of the water is taken, the bottle rinsed with hot distilled water and 2 c.c. of concentrated hydrochloric acid, and the whole evaporated until it can be made up to its original volume with distilled water. Any cloudiness due to ferric oxide must be brought into solution. Finally the hydrochloric acid is neutralised by 4 grms. of crystallised sodium acetate. A standard water of the same colour as the sample but free from lead is treated in exactly the same way and from this a scale is prepared by adding various amounts of standard lead nitrate solution (1 c.c.= 0·1 mgrm. Pb). To 100 c.c. of the water in the colorimeter tube 3 c.c. of acetic acid (10%) are added and freshly prepared hydrogen sulphide solution, or better, sodium sulphide as used by Winkler (this J., 1913, 157). The sample is then compared with the scale in the colorimeter as usual. Copper when present is estimated by the following modification of Winkler's method (*loc. cit.*) using the scale and standard water as above. To 100 c.c. of the water in the colorimeter tube 10 c.c. of a solution containing 100 grms. NH_4Cl and 10 c.c. of pure acetic acid in 500 c.c. are added and, with agitation, 10 c.c. of hydrogen sulphide solution. The total lead and copper is thus estimated. To 100 c.c. of the water are then added 2 drops of 10% potassium cyanide, and, after standing 2 to 3 mins. to allow the copper and ferrous salts to form complex compounds, 10 c.c. of hydrogen sulphide are added and colorimetric comparison made with the scale as before. This reading gives the quantity of lead. The method can only be applied in the absence of ferric oxide, which gives a coloration with cyanide. The above method gave results agreeing within 0·1 mgrm. Pb or Cu per litre. The second method avoids the disadvantage of using a standard ead-free water. It is necessary to use solutions which ave been carefully freed from heavy metals and filtered hrough pure asbestos. The bottle is rinsed out, etc. as n the first method and 20 to 25 c.c. of purified sodium acetate solution (1 : 3), 5 c.c. of glacial acetic acid, a few crystals of sodium sulphide and a little purified asbestos added. If the sample is drawn directly from the tap it is only necessary to add 5 c.c. of glacial acetic acid, 20 c.c. of ammonium nitrate solution (1 : 2), sodium sulphide crystals and asbestos. After standing overnight the precipitate is collected on asbestos, washed with hydrogen sulphide water, dissolved from the filter and from the sides of the flask by means of 20 c.c. of not nitric acid (1 part of acid of sp. gr. 1·4 and 1 of water) and the solution made up to 90 to 100 c.c. with the washing water and evaporated with the addition of 3 drops of concentrated sulphuric acid until free from nitric acid. The lead sulphate is then filtered off on a double paper, washed with dilute sulphuric acid (2 : 100), and dissolved from the filter and the evaporating basin by means of 40 c.c. of hot sodium acetate (1 : 3) solution. 20 c.c. of this solution (corresponding to 100 c.c. of the original water) are made up to 100 c.c. in the colorimeter tube, 2 drops of potassium cyanide solution (10%) added and after shaking well allowed to stand 2 to 3 minutes. Another tube is charged with a corresponding pure sodium acetate solution and treated in the same way, lead having been added to it for the preparation of the scale in the usual way. The copper in the filtrate is also determined colorimetrically. The scale is prepared by adding known amounts of copper sulphate to a solution made to correspond to the filtrate by mixing 3 drops of concentrated sulphuric acid, 40 c.c. of dilute sulphuric acid (2 : 100) and 3 c.c. of concentrated ammonia in 200 c.c. In each case 20 c.c. of solution are made up to 100 c.c. in the tube, 5 c.c. of ammonium chloride solution (10%) added and, after shaking well, 10 c.c. of hydrogen sulphide water. The greatest errors observed were 0·1 mgrm. Pb and 0·11 mgrm. Cu per litre.—J. B.

Ozoniser ; The Charpentier thermal ——, and its application in the distillery and sugar factory. D. Sidersky. Bull. Assoc. Chim. Sucr., 1914, **31**, 747—750.

A gas or alcohol flame is drawn from *b* into the funnel, *c*, by the injector action of compressed air forced in through the pipe, *g*, and annular space, *c′*. The hot gases from the flame are cooled suddenly by admixture with the large volume of air, and the mixed gases leaving *e* are said to contain up to 1 grm. of ozone per cb. metre. Water under pressure may be used instead of air to produce a jet of ozonised water. A portable apparatus on this principle is stated to give good results in sterilising fermentation vats, diffusion discharge waters, etc.—J. P. O.



Water ; Colorimetric determination of iron in ——. F. Gothe. Z. Unters. Nahr. Genussm., 1914, **27**, 676—683.

Contrary to the statement of Heilig (Inaug. Diss. med. Fakult. Heidelberg, 1913), the author finds that in the colorimetric determination of iron with thiocyanate accurate results may be obtained whether the preliminary oxidation be effected with hydrochloric acid and potassium chlorate or with nitric acid, provided the acidity of the solution be low and equal to that of the standard solution, and a large and equal quantity of thiocyanate be added in each case. If 95 c.c. of the iron solution, containing 1 c.c. of hydrochloric acid of sp. gr. 1·125, are treated with 5 c.c. of a 10% solution of potassium thiocyanate, 0·02 mgrm. of iron per litre of water may be determined.—L. E.

Formaldehyde ; Content of methyl alcohol in the vapours produced in the different methods of disinfecting rooms with ——. G. Lockemann and F. Croner. Z. Hyg. u. Infekt.-Krankh., 1914, **77**, 257—281. Chem. Zentr., 1914, **1**, 1772—1773.

On distilling off four-fifths of the volume of a 16% formalin solution, 78·2% of the formaldehyde and 99·5% of the methyl alcohol originally present were volatilised. In the formalin-permanganate process, without lime, 38·3% of the formaldehyde and 79·3% of the methyl alcohol were recovered on distillation. In presence of lime only 12·4% of the formaldehyde was recovered and the quantity of methyl alcohol recovered amounted to 169·1% of that present originally. In the "Autan" process 20% of the paraform used was volatilised as formaldehyde and at least 14·8% was converted into formic acid and methyl alcohol; with paraform and permanganate but no lime, the corresponding figures were 42 and 8·7%, and with paraform, permanganate and lime, 8·6 and 72·3%.—A. S.

Disinfection ; Relations of the phenols and their derivatives to proteins. A contribution to our knowledge of the mechanism of ——. *II. Comparative study of the effects of various factors upon the germicidal and protein-precipitating powers of the phenols. III. Chemical action of quinone upon proteins.* E. A. Cooper. Biochem. J., 1913, **7**, 175—185, 186—196.

The germicidal and protein precipitating powers of phenol are, in general, similarly affected by the entrance of various chemical groups into its molecule, *e.g.*, diminished by hydroxyl groups and increased by nitro groups or by the amino group. The monohydric phenols are superior to the alcohols, both as germicides and as protein-precipitants. Sodium chloride increases the germicidal and protein-precipitating action of phenol, by increasing its solubility in proteins (cp. Reichel, this J., 1910, 107), whilst alcohol has the opposite effect. Solutions of phenol in absolute alcohol or in oil exert no germicidal action upon spores and have no visible precipitating action on gelatin. Very small quantities of alkali inhibit the precipitating power of phenol upon proteins, and moderately low concentrations of alkali effect a measurable decrease in its germicidal power. The precipitating action of phenol is increased by the addition of acids. It is concluded that the absorption of phenols by bacteria is merely the initial stage in the process of disinfection, and that the germicidal action which follows is due, not to a typical chemical union of the phenols with the bacterial protoplasm, as appears to be the case with formaldehyde, but to a de-emulsifying action upon the colloidal suspension of some constituent protein or proteins essential for the vitality of the organisms.

Aqueous solutions of quinone give a red coloration with many proteins, proteoses, amino-acids and imino-compounds. In the case of proteins this reaction appears to be preceded by solution of the quinone in the colloid; no coloration is produced in presence of absolute alcohol, which on account of its great solvent power for quinone would diminish the absorption of the latter by the protein. Formaldehyde, when present in sufficient quantity, completely inhibits the colour reaction (but not in the case of gelatin, aniline or ammonia) probably by combining itself with the amino and imino groups. Acetone differs from quinone in acting as a protein-precipitant. There is some evidence that the germicidal power of quinone is due to its chemical action upon some protein or proteins of the bacterium, and that the superiority of quinone as a germicide, to phenol, quinol and acetone, is explained by its reactivity towards protein at much lower concentrations. —J. H. L.

Lime-sulphur sprays ; Preparation and composition of ——. A. A. Ramsay. J. Agric. Sci., 1914, **6**, 194—202.

The recipes for lime-sulphur washes adopted in various localities vary very greatly (*e.g.*, from 0·88 to 2·08 parts of sulphur and from 10 to 111 parts of water to 1 part of lime by weight). Using the lime and sulphur in different proportions and calculating the amounts entering into solution, the author concludes that the best ratio of lime to sulphur is about 1 to 1·95, and it is suggested that 100 galls. water to 50 lb. of lime with about the above quantity of sulphur will be the most economical recipe. The solution produced on boiling appears to consist of calcium hydroxyhydrosulphide, calcium thiosulphate, and calcium sulphate with sulphur held in solution. —W. H. P.

Bordeaux mixtures ; Further observations on the fungicidal action of ——. B. T. P. Barker and C. T. Gimingham. J. Agric. Sci., 1914, **6**, 220—232.

The authors adduce further evidence in favour of their view of the action of Bordeaux mixture (this J., 1911, 760) which has been opposed by Pickering (this J., 1912, 196). Living cells with readily permeable walls of the unchanged cellulose type are able to render soluble and subsequently absorb copper from insoluble compounds such as the basic sulphates. The effect on the organism depends on the connection between its rate of growth and the rate of absorption of copper. If a fungus is well established and growing rapidly, spraying may fail to check its growth. Cells with walls of an impermeable character have no solvent power. In the case of vigorous apple leaves there is no injury except when the cuticle has been recently injured. Under certain conditions cells with normally impermeable walls may become permeable and absorb copper compounds. Autumn apple foliage for instance is damaged by Bordeaux mixture owing to this cause. The hairs on the under surface of apple leaves, which are decadent cells, will absorb copper even in summer when the epidermal cells (which are full of life) are untouched. It is therefore evident that the nature of the cell is the determining feature in the action of Bordeaux mixture.—W. H. P.

Patents.

Chemical treatment of large quantities of liquid [*water*]. J. J. Lassen and V. F. Hjort, London. Eng. Pat. 13,974, June 17, 1913.

To control the supply of chemicals to a stream of water, a weir is formed in the channel through which the water flows, so that the level of the water above the weir varies with the quantity flowing. A portion of the water above the weir is diverted to a plant where the necessary chemicals are added to it and is then returned to the main stream by a pump which delivers it into a vessel provided with a return overflow to maintain a constant level. The solution flows from this vessel through a valve the size of the opening of which is controlled by float gear from the channel above the weir.—W. H. C.

Water ; Apparatus for removing air from ——. W. Kieser, Berlin, Assignor to General Electric Co. U.S. Pat. 1,095,463, May 5, 1914.

The water passes upwards through a pipe into the lower part of a small chamber, the portion of the pipe in the chamber being expanded into the form of a funnel with walls curving outwards, so that the water is delivered horizontally into the chamber. Separate outlets are provided for the air and the de-aerated water.—W. P. S.

Water; Process of and apparatus for treating ——. C. P. Landreth, Philadelphia, Pa. U.S. Pat. 1,095,893, May 5, 1914.

The water is passed under pressure through a chamber fitted with a series of rotating aluminium electrodes to which alternating and direct currents of electricity are supplied simultaneously.—W. P. S.

Distilled water; Apparatus for the production of ——. B. Bleicken. Fr. Pat. 466,162, Dec. 13, 1913.

An apparatus for the production of distilled water from sea-water consists of a tubular boiler arranged above a furnace, the steam evolved being superheated by the waste gases from the furnace before it enters the condenser. Evaporation is carried out under slightly reduced pressure, and by means of an external return tube, a constant circulation of the water in the tubular boiler is effected. This circulation is aided by the introduction of water from the condenser, a portion of which is admitted to the supply pipe entering the bottom of the tubular boiler whilst another portion is injected into the return tube.—W. P. S.

Water; Process of purifying and clarifying [removing iron and manganese from] ——, particularly potable and industrial waters. O. Vollmar. Fr. Pat. 466,177, Dec. 15, 1913 Under Int. Conv., Dec. 17, 1912, and Sept. 1, 1913.

The water is filtered through material containing algal growths such as *Syderocapsa Dresdensis, S. Treubii, Clonothrix Fusca, Crenothrix Polyspora, Leptothrix Ochracea,* etc.—W. P. S.

Water; Process and apparatus for cooling drinking ——. M. P. Otto and A. Postel-Vinay. Fr. Pat. 466,220, Dec. 16, 1913.

A portion of the water is passed in the form of a spray into a chamber where it is brought into contact with dry air under reduced pressure; the water thus cooled is collected in a vessel containing a coil through which the main volume of the water is circulated. The coil may be constructed of porous material, in which case it is cooled by the current of dry air which is brought into contact with its outer surface.—W. P. S.

Waste-liquids; Purification of —— and extraction of water from sludges. Richter und Richter. First Addition, dated Nov. 11, 1913, to Fr. Pat. 443,789, May 14, 1912 (this J., 1912, 1005). Under Int. Conv., Nov. 15, 1912.

The process described (*loc. cit.*) may be applied to the purification, etc., of oily residues, vinasses, viscous substances, peaty sludges, paper sludges, etc.—W. P. S.

Sewage solids; Method of utilising and treating the lighter portion of ——. J. de la Fresnaye. Fr. Pat. 466,387, Dec. 19, 1913.

The lighter portion of the insoluble substances contained in sewage, and particularly in the waste-water from towns having wood-paved streets, is separated, washed, and hydrolysed by treatment with a mineral or organic acid; the cellulose present is thus converted into dextrins, sugars, etc., which are submitted to fermentation in order to produce alcohol.—W. P. S.

Incinerator for town refuse. P. Auvergne. Fr. Pat. 465,959, Nov. 10, 1913.

The refuse is discharged periodically from a hopper on to rollers situated above a furnace in a closed chamber; while on the rollers, the refuse is dried, and the steam and other gases are conducted round the hopper (containing a fresh charge of refuse) and thence to a condenser. The material falls from the rollers into the furnace and the combustible gases produced are mixed with hot air and conducted to a combustion chamber, the heat from which is utilised to supply a current of hot air to the furnace, etc., or to heat a boiler.—W. P. S.

Smoke, vapours or gases suitable for use in the treatment [sterilisation, etc.] of various materials; Apparatus for the production and treatment of ——. T. G. Marlow, Streatham, and The Pulsometer Engineering Co., Ltd., Reading. Eng. Pat. 9872, April 26, 1913.

The chamber in which smoke or the like is produced by dropping a suitable substance on to a hot band or otherwise, is separated by a movable screen from the chamber in which the material is treated with the smoke. The smoke is carried into the treating chamber by a current of air, for example, as described in Eng. Pat. 16,299 of 1911 (this J., 1912, 909).—W. H. C.

Sterilising liquids and gases by means of ultra-violet rays in vacuum-tubes. E. O. Scheidt. Ger. Pat. 272,772, April 2, 1912.

Tubes of opaque quartz are used which hinder the passage of the inactive visible rays but allow the free passage of the chemically active invisible rays.—A. S.

Vermin; Combustible for destroying ——. A. Lang, Karlsruhe, Germany. Eng. Pat. 20,395, Sept. 9, 1913. Under Int. Conv., Sept. 9, 1912.

Three parts of a mixture of aluminium powder, 9, and sulphur, 16 parts, are added to 1 part of a mixture of charcoal, 3, sulphur, 4, and barium nitrate, 33 parts; shellac solution is then added so as to form a thin paste which is applied to strips of wood or strands of fabric, and dried. The matches thus obtained are ignited in places where it is desired to destroy such vermin as mice, rats, wasps, etc.—W. P. S.

Water; Process for removing oxygen from ——. R. Gans, Grünewald-Berlin, Germany. Eng. Pat. 20,465, Sept. 10, 1913. Under Int. Conv., Sept. 11, 1912.

See Fr. Pat. 462,446 of 1913; this J., 1914, 331.—T. F. B.

Disinfectants; Process for the production of ——. P. Flemming, Hamburg, Germany. U.S. Pat. 1,096,361, May 12, 1914.

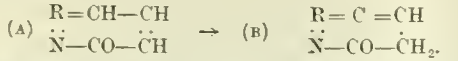
See Eng. Pat. 4838 of 1912; this J., 1913, 305.—T. F. B.

Treating fusible domestic and other refuse for obtaining paving or building blocks [and iron]. Eng. Pat. 10,281. *See* IX.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

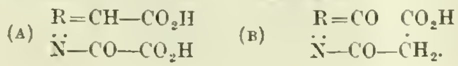
Acetylstrychninolone; Oxidation of ——, and preparation of an isomeric strychninolone. H. Leuchs and G. Schwaebel. Ber., 1914, 47, 1552—1560.

Strychninolic acid upon treatment with $N/1$-sodium hydroxide yielded strychninolone, corresponding to brucinolone from brucinolic acid. Acetylstrychninolone when oxidised in acetone solution with permanganate gave rise to a single acid, of which the barium salt, $C_{21}H_{18}O_8N_2Ba$, was isolated. This corresponds to the acid, $C_{23}H_{24}O_{10}N_2$, obtained in small quantities under similar conditions from acetylated crude brucinolone: whence the original strychninolone is held to be analogous to the isomeride of brucinolone present in small amount in crude brucinolone. By treatment with ammonia the original strychninolone changed into an isomeric form. It is concluded that brucinolic acid when treated with alkali yields first an (a) form of brucinolone, which, under the influence of the alkali, changes rapidly into an isomeric (B) form :—



$$\text{(A)}\ \begin{matrix}\text{R=CH—CH}\\ \vdots\qquad\ \vdots\\ \text{N—CO—CH}\end{matrix}\ \rightarrow\ \text{(B)}\ \begin{matrix}\text{R=C=CH}\\ \vdots\qquad\ \dot{}\\ \text{N—CO—CH}_2.\end{matrix}$$

In the case of strychninolone, however, the primary (A) form is the more stable : but in both cases the conversion of (A) into (B) is effected rapidly in presence of ammonia. The above-mentioned acids, $C_{23}H_{24}O_{10}N_2$ and $C_{21}H_{20}O_8N_2$, would thus be derived from the (A) forms ; while the so-called acetylbrucinolic acid, $C_{23}H_{24}O_9N_2$, would be given by the stable (B) form of brucinolone. The acids derived from the two forms differ as shown below :—



$$\text{(A)}\ \begin{matrix}\text{R=CH—CO}_2\text{H}\\ \vdots\\ \text{N—CO—CO}_2\text{H}\end{matrix}\qquad \text{(B)}\ \begin{matrix}\text{R=CO}\quad\text{CO}_2\text{H}\\ \vdots\qquad\quad \dot{}\\ \text{N—CO—CH}_2.\end{matrix}$$

—J. R.

Galegine : Constitution of ——. G. Tanret. Comptes rend., 1914, **158**, 1426—1429. (See this J., 1914, 611.)

Galegine, $C_6H_{13}N_3$, is unsaturated and contains no asymmetric carbon atom. On dry distillation it yields methyl - 3 - pyrrolidine. Benzoylgalegine, $C_5H_9N : C(NH.CO.C_6H_5)_2$ melts at 95°—96° C. Galegine bicarbonate readily condenses with ethyl oxalate to form oxalylgalegine melting at 203°—206° C. When heated with baryta water at 100° C. galegine is quantitatively hydrolysed into methylpyrrolidine and urea.—F. Shdn.

Adonis vernalis ; Constituents of ——. L. Mercier. Nouv. Rem., Jan. 8, 1914, 1 ; Pharm. J., 1914, **92**, 713.

The aqueous extract was treated with lead acetate, filtered, the filtrate treated with basic lead acetate and the precipitate consisting of lead adonidate was suspended in water and treated with hydrogen sulphide. The solid which remained suspended in the liquid was filtered off and extracted with hot alcohol to remove the adonidic acid. The alcoholic extract was evaporated with sufficient hydrochloric acid. The filtrate from the lead adonidate was treated with sulphuric acid, the filtrate neutralised with sodium carbonate and treated with tannic acid solution. The adonidin tannate was then treated with zinc hydroxide and alcohol, evaporated to dryness at 40°—50° C., and the residue extracted with absolute alcohol in a Soxhlet apparatus. Adonidin was obtained by evaporating the alcoholic solution with hydrochloric acid, any adonidic acid separating being filtered off. Adonidic acid gives no colour reaction with sulphuric acid, reduces Fehling's solution and is precipitated and decomposed by bromine water.—F. Shdn.

Squill ; The toxic principle of the ——. W. Kopaczewski. Comptes rend., 1914, **158**, 1520—1522.

Three substances have been isolated from *Scilla maritima.* One has diuretic properties, a second is a polysaccharide, and the third is bitter and extremely poisonous. The last is a light, yellowish non-crystalline powder of distinctive odour, probably a non-nitrogenous glucoside of the formula $C_{17}H_{25}O_6$. It is soluble in aliphatic alcohols, in acetone and in acetic acid and slightly in water. It melts at 152°—154° C.—J. L. F.

Acetylcholine, a new active principle of ergot. A. J. Ewins. Biochem J., 1914, **8**, 44—49.

An active principle of ergot, recognisable by its inhibitor action on the heart and its stimulant action on intestinal muscle, was isolated and identified as acetylcholine.

—J. H. L.

Ephedrine and pseudoephedrine. E. Schmidt. Arch. Pharm., 1914, **252**, 89—138.

Both ephedrine and pseudoephedrine yielded benzaldehyde and methylamine when oxidised with potassium ferricyanide in potassium hydroxide solution. A condensation product, benzalephedrine was formed as a by-product and melted at 72°—73° C. after crystallising from ether. The corresponding benzalpseudoephedrine was not found amongst the oxidation products but was prepared by the interaction of benzaldehyde and pseudoephedrine in the presence of alkali and melted at 65° C. Heating to 205° C. had no effect on either ephedrine or pseudoephedrine hydrochloride. Both hydrochlorides when heated alone to about 240° C. yielded ethylphenylketone (semicarbazone m.pt. 172°—173° C.), methylamine, trimethylamine, and ammonia. When warmed with phosphorus pentabromide, both hydrochlorides yielded the hydrobromide of phenylmethylaminobromopropane, $C_6H_5.CHBr.CH(NHCH_3).CH_3,HBr$, melting at 174·5° C. after crystallising from alcohol and ether, and with $[\alpha]_D = -92{\cdot}79°$ in absolute alcohol. The acetyl compound of this base melted at 175° C. and had $[\alpha]_D = +80{\cdot}0°$ in water. After reduction with zinc and hydrochloric acid, the above hydrobromide gave phenylmethylaminopropane, the hydrochloride of which melted at 172° C. and had $[\alpha]_D = +19{\cdot}14°$ in aqueous solution. Both ephedrine and pseudoephedrine when dissolved in concentrated sulphuric acid and the solution diluted with water after 15 minutes, yielded a substance, $C_{10}H_{15}NO.SO_3$, melting at 244° C., and with $[\alpha]_D = +109{\cdot}02°$. When a solution of ephedrine in chloroform was treated with bromine, ephedrine hydrobromide separated. Pseudoephedrine hydrobromide was also formed in the same way. The two substances are probably optical isomerides.—F. Shdn.

Crocetin. F. Decker. Arch. Pharm., 1914, **252**, 139—160.

Crocetin, $C_{10}H_{14}O_2$, contains one hydroxyl group, the hydrogen of which can be readily replaced so as to form salts with potassium, aniline, etc. It takes up two atoms of bromine with the formation of a yellowish crystalline substance, melting at 103°—104° C. Acetylcrocetin forms red needles melting at about 174° C. A crystalline compound, $C_7H_{10}Br_2O_2$, is obtained by treating an alkaline solution of crocetin with bromine.—F. Shdn.

Phosphorus compounds ; Hydrolysis of organic —— by dilute acid and by dilute alkali. R. H. A. Plimmer. Biochem. J., 1913, **7**, 72—80.

The esters of phosphoric acid are very resistant towards the hydrolytic action of alkalis. Glycerophosphoric acid is completely hydrolysed within 10 days by $N/4$ sulphuric acid at 92° C., phytic acid is not completely hydrolysed in 17 days by $2N$ nitric acid at 75° C., and ethylphosphoric acid is hydrolysed only to the extent of 50% by heating with $N/1$ hydrochloric acid for 20 days at 75° C. These esters undergo hydrolysis more slowly when heated alone in aqueous solution, but they are not appreciably attacked by very prolonged heating with $N/1$ or $2N$ caustic alkali. Hexosephosphate and phosphoprotein differ so markedly from them in their behaviour towards alkalis, as to indicate a different constitution. Hexosephosphate is completely hydrolysed in 24 hours by $1{\cdot}5N$ sodium hydroxide at 75° C., and in 3—5 days by $N/1$ hydrochloric acid at the same temperature, whilst phosphoprotein (see Plimmer and Scott, Chem. Soc. Trans., 1908, **93**, 1699) is distinguished from all other animal organic phosphorus compounds in yielding the whole of its phosphorus as inorganic phosphate when warmed for 24 hours at 37° C. with a 1% solution of sodium hydroxide. In its behaviour towards dilute acids and alkalis, nucleic acid occupies a position intermediate between the stable esters and the very unstable hexosephosphate.—J. H. L.

Lime-juice ; Nitrogenous constituents of ——. C. Fnnk. Biochem. J., 1913, **7**, 81—86.

In an investigation of commercial lime-juice for antiscorbutic substances, the author found small quantities of a crystalline compound, $C_{13}H_{24}O_3$, belonging to the terpene group and melting at 97°—100° C., and relatively minute quantities of three nitrogenous compounds precipitated by phosphotungstic acid, *viz.*, one, $C_6H_7O_2N_5,H_2O$, belonging to the purine group, another, C[illegible]$H_{15}O_6N_2$, belonging to the pyrimidine group, and a third which gave a platinichloride, $(C_8H_{15}O_2N,HCl)_2PtCl_4$

possibly identical with that of the methylpiperidylacetobetaine described by Braun (Ber., 1908, **41**, 2129). No antiscorbutic substance was found.—J. H. L.

Dacryodes hexandra; Oil of ——. Schimmel's Rep., April, 1914, 50—52.

By the fractionation of a large quantity of oil, obtained by steam distillation of the resin of *Dacryodes hexandra*, the presence therein of *l*-sylvestrene, yielding a hydrochloride, m. pt. 68° C., $[\alpha]_D = -21{\cdot}3^\circ$ (in ether solution) has been proved. (See also More, this J., 1899, 718.)—R. G. P.

Frankincense oil. Schimmel's Rep., April, 1914, 62—63.

Frankincense (olibanum) oils at present found in commerce are dextro-rotatory, $\alpha_D = +17^\circ$ to $+29^\circ\ 41'$; formerly the oils were lævo-rotatory, $\alpha_D = -11^\circ$ to -17°. A sample of oil gave the following results:—Sp. gr. at 15° C., 0·8775; $\alpha_D = +19^\circ\ 18'$; $n^{20}_D = 1{\cdot}47245$; acid value, 1·8; ester value, 7·5; after acetylation, 106; soluble in up to 2 vols. of 90% alcohol, solution clear at first but turbid after adding more than 2 vols. of alcohol. The terpene fractions of the oil consisted of nearly 99% of α-pinene and camphene with about 1% of dipentene and *p*-cymene; phellandrene, β-pinene and terpinene could not be detected.—R. G. P.

Neroli oil. Schimmel's Rep., April, 1914, 70—71.

Farnesol, b. pt. 140°—141° C. at 3 to 4 mm. pressure; sp. gr. at 15° C., 0·8934; $\alpha_D = 0^\circ$; $n^{20}_D = 1{\cdot}48991$; was isolated from those fractions of neroli oil boiling above 127° C. at 4 to 5 mm. pressure; the amount of farnesol probably does not exceed 2%.—R. G. P.

Pagsainguin oil. Schimmel's Rep., April, 1914, 73—74.

This oil is derived from *Canarium villosum*, F. Vill. and has been stated by Bacon (Phillipine J. Science, 1910, **5**, 257) to contain *d*-α-pinene, dipentene and formic acid. The sample of oil examined consisted chiefly of *l*-β-pinene, together with *p*-cymene and probably camphene.—R. G. P.

Peru balsam oil. Schimmel's Rep., April, 1914, 80—82. (See also this J., 1914, 565.)

A sample of Peru balsam oil gave the following results: sp. gr. at 15° C., 1·1200; $\alpha_D = +0^\circ\ 55'$; $n^{20}_D = 1{\cdot}57177$; acid value, 36·4; ester value, 228·2; soluble in 0·5 vol. of 90% alcohol. On saponification with alcoholic potash and subsequent steam distillation, benzyl alcohol was obtained at first, and towards the end of the distillation a light oil with a characteristic balsamic odour. After repeated fractionation this gave the following results: b. pt. 125°—127° C. (4 mm. pressure); sp. gr. at 15° C., 0·8987; $\alpha_D = +12^\circ\ 22'$; $n^{20}_D = 1{\cdot}48982$. It was found to be a sesquiterpene alcohol, $C_{15}H_{26}O$, identical with Hesse and Zeitschel's nerolidol (this J., 1903, 162) and with the nerolidol isolated from neroli oil. The peruviol, $C_{13}H_{22}O$, isolated by Thoms (Arch. Pharm. 1899, **237**, 274) from Peru balsam probably consisted of nerolidol, at any rate in part.—R. G. P.

Terpenes; Chemistry of ——. *Action of hypochlorous acid on camphene.* G. G. Henderson, I. M. Heilbron, and M. Howie. Chem. Soc. Trans., 1914, **105**, 1367—1372.

When camphene was treated in the cold with a dilute aqueous solution of hypochlorous acid it was converted almost quantitatively into camphenechlorohydrin, $C_{10}H_{16}Cl.OH$, a colourless crystalline solid, m.pt. 93° C. Treatment with potassium hydroxide or silver oxide converted this into *iso*camphenilanaldehyde, and phosphorus pentachloride converted it into camphene dichloride, m. pt. 139°—140° C. The sole product after heating with zinc and alcohol was *iso*borneol, indicating camphenechlorohydrin to beta-chloroisoborneol. Chromium trioxide dissolved in acetic acid oxidised the chlorohydrin to a chloroketone (chlorocamphor), m. pt. 132° C., which gave an oxime, m. pt. 142°—143° C., and a semicarbazone, m. pt. 220°—221° C.—F. Sodn.

Thymol-menthol emulsoid in glycerin; A ——. J. Don. Kolloid-Zeits., 1914, **14**, 253—255.

Thymol and menthol when mixed together form a liquid at the ordinary temperature unless a very large excess of one component is present. The cryohydric point is —9° C. for a mixture of 2 parts of menthol and 1 of thymol. If a mixture of 100 grms. of glycerin with 5 grms. of thymol and 2·5 grms. of menthol at 80° C. be shaken vigorously and allowed to stand, an upper layer consisting of a liquid mixture of thymol and menthol is formed above a milky liquid composed of an emulsoid of globules of the thymol-menthol mixture (of size ranging from 0·1 mm. downwards) suspended in a solution of thymol (2%) in glycerin; most of the suspended particles are of colloidal dimensions. This milky liquid keeps apparently unaltered for months. Its viscosity is greater than that of glycerin.—A. S.

Cyclohexane; Mercury derivatives of ——. G. Grüttner. Ber., 1914, **47**, 1651—1656.

Cyclohexylmercuric chloride and bromide were prepared by the interaction of cyclohexylmagnesium halide and excess of mercuric chloride or bromide: either of these substances when treated with alcoholic potassium iodide yielded cyclohexylmercuric iodide. By employing about 6 times the theoretically requisite amount of cyclohexylmagnesium bromide, reaction occurred with mercuric bromide with formation of mercury dicyclohexyl, which was freed from cyclohexylmercuric bromide by separation from supersaturated ethereal solutions at 0° C. All these derivatives are much more soluble and far less stable than the corresponding phenyl compounds, and they exhibit strong reducing properties.—J. R.

Glycerylphosphates; Constitution of the ——. *Synthesis of α- and β-glycerylphosphates.* H. King and F. L. Pyman. Chem. Soc. Trans., 1914, **105**, 1238—1259.

The pure sodium, calcium, barium, brucine, and quinine salts of α- and β-glycerylphosphoric acids were prepared synthetically and are described. The commercial crystallised sodium salt, introduced by Poulenc (this J., 1907, 716), is sodium β-glycerylphosphate, whilst the acid prepared by esterifying glycerol with phosphoric acid at 100° C. is mainly the α-compound. The quinine salts of the two acids are readily distinguished by their melting points, the α-salt becoming transparent at 155°—156° C. and only forming a meniscus at higher temperatures, whilst the β-salt melts sharply at 178°—180° C. The brucine salts, however, resemble one another closely, differing only in crystalline form; when dried at 100°—105° C., they are similar as to melting point, sintering at 150° C., becoming transparent at 158°—160° C., and flowing to form a meniscus between 180° and 195° C. Arguments as to the constitution of glycerylphosphates which have been based upon the m. pt. or water of crystallisation of the brucine salt (Paolini, Carré; this J., 1912, 203, 1053) are regarded as valueless.—F. Sodn.

Ethyl acetoacetate; Manufacture of ——. A. Cobenzl. Chem.-Zeit., 1914, **38**, 665—666.

The reaction is carried out in a hemispherical copper vessel of 100 litres capacity provided with a lid and manhole and heated by an oil bath. An upright tube connects the lid with a copper reflux condenser, and a small vessel provided with stopcocks is set between these so that fresh ethyl acetate can be added during the reaction if necessary. The latter should boil at 78°—79° C. and should have no action on clean sodium after two hours' contact at the ordinary temperature. A charge of 5 kilos. of sodium (cut into shavings under xylene) and 40 kilos. of ethyl acetate is placed in the cold copper vessel, the whole mixed with wooden stirrers, and the oil bath slowly heated to 100°—105° C. As soon as the temperature of the contents reaches 45°—50° C., the oil bath is cooled to 55°—60° C. After 30—45 minutes heat is again applied till distillation recommences and is kept up for 5—6 hours. The contents are rapidly transferred to a leaden vessel provided with a stirrer, and mixed with 35 litres of water and the calculated amount of acetic acid. The crude ethyl acetoacetate is then separated and purified by distillation under ordinary or reduced pressure. With careful working the yield is almost quantitative.—F. Shdn.

Niton [radium emanation] as a therapeutic agent. W. Ramsay. Lancet, 1914, **186**, 1481—1483.

For therapeutic purposes the use of niton possesses the advantage that there is no risk of loss of the valuable radium salt. The radiating power of niton is 75% of that of the radium from which it is derived, and its "strength" at any given time can be read from a curve representing its rate of decay. An apparatus for filling with niton, tubes, bulbs or hollow discs of iron or nickel, preferably the latter, is described and illustrated (see Fig. 1). The reservoir, A, from which the air has been previously expelled through M and E, by mercury from B, is placed in communication with the bulbs, H, containing a solution of radium bromide, and the air which passes from the bulbs into A is expelled as before. These operations are repeated three or four times and air is exhausted in a similar manner from the hollow disc or the like, J, which is to be filled with niton. Then after, say, 24 hours the gases (3·6 c.c. from 500 mgrms. of radium bromide) which have accumulated in H are drawn into A, and after raising B, a spark is passed between wires sealed in at D. After exploding, about 0·5 c.c. of hydrogen, carrying the niton, is left and this is allowed to pass into J by turning the tap, G. The vertical tube from J is preferably of thin lead so that it can be sealed by pinching with a pair of pliers. Any gas left above G is drawn back into A by lowering B. If the amount of gas be too large, for example, for filling very fine glass capillary tubes, a small quantity of oxygen (about half the volume of the residual hydrogen) from the tube, K, is trapped by means of mercury in the inverted siphon, E, drawn into A, and a spark again passed, the minute residue then being forced into the capillary tube to be filled, in the manner described above. To recover residual niton from a hollow disc or the like after it has been used, the apparatus shown in Fig. 2 is used, wherein *a* is the piece of rubber tubing shown at I in Fig. 1, *d* is the thin lead tube projecting from the hollow disc, J (Fig. 1), and *b* is a piece of steel with a sharp cutting edge. After exhausting the air by manipulating the mercury reservoir, B, *b* is pushed in so as to cut the tube, *d*, whereupon the niton passes into the reservoir, A. Glass capillaries are introduced into the tube, *c*, and broken by shaking. If gas be "drawn" from 500 mgrms. of radium bromide after 24 hours, 3·6 c.c. are obtained, containing 0·15 of the total amount of niton in equilibrium with this quantity of radium, and as the efficiency of the niton is 75 per cent. of that of the radium, this quantity at the time of "drawing" would be equivalent to 500 × 0·15 × 0·75 = 56 mgrms. of radium bromide. If gas be "drawn" at the end of 12 hours, 1·8 c.c. are obtained containing 0·08 of the total amount of niton in equilibrium with the radium, and hence equivalent to 500 × 0·08 × 0·75 = 30 mgrms. of radium bromide. It is therefore advantageous to make frequent "drawings" of niton from the radium bromide, and this is an argument in favour of a central institution where a large supply of radium could be kept.—A. S.

Fig. 1.

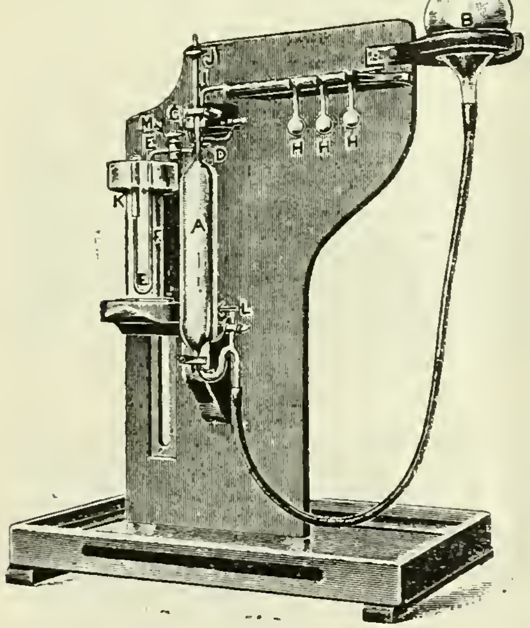
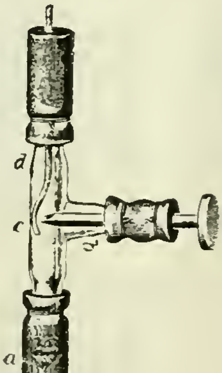


Fig. 2.



Salts of the fatty acids; Electrolysis of molten ——. J. Petersen. Z. Elektrochem., 1914, **20**, 328—323.

When molten lead, zinc, and sodium salts of fatty acids were electrolysed the products at the anode were similar to those obtained from aqueous solutions, but much smaller in amount. The secondary decomposition of the anode radical was however much more complex and the gases evolved contained (in addition to carbon dioxide) carbon monoxide, hydrogen, olefines, and usually more than one saturated hydrocarbon. The saturated hydrocarbons were mainly ethane and methane. On heating the anhydrous lead salts of the fatty acids with sulphur, the volatile portion consisted of small quantities of gas as above, and a liquid consisting almost entirely of the corresponding fatty acid, together with a trace of the ester (methyl acetate, ethyl propionate, etc.).—W. H. P.

Patents.

Vaccines, cultures, and the like, and the preparation thereof. C. J. H. Nicolle, Paris. Eng. Pat. 26,535, Nov. 19, 1913.

Soluble fluorine compounds are used to "stabilise" vaccines from bacterial cultures or killed virus. The bacteria may be suspended or emulsified in a 0·7% solution of sodium fluoride, centrifuged rapidly, and separated from the solution; the separated mass is again suspended in sodium fluoride solution and centrifuged, and the deposited matter emulsified and diluted to produce the vaccine. The fluorine compound may be rendered insoluble at the time of using, if desired, by adding barium chloride or a salt of lead or calcium.—T. F. B.

Ethyl acetate from acetaldehyde; Preparation of ——. Consortium f. Elektrochem. Industrie, Ges. m. b. H., Nürnberg, Germany. Eng. Pats. 26,825 and 26,826, Nov. 21, 1913. Under Int. Conv., Nov. 27, 1912, and Feb. 21, 1913.

(1.) Acetaldehyde is converted almost quantitatively into ethyl acetate by means of small amounts of aluminium alkyl oxides (alcoholates) in presence of catalytic agents, particularly halides or halogen compounds, such as those of tin, aluminium, and silicon, which are not by themselves capable of forming acetic ester from acetaldehyde. For example, 6 parts of aluminium ethoxide, containing about 10% of aluminium chloride, is added gradually to 135 parts of aldehyde ; after standing for ten hours, the acetic ester (123 parts) is separated by distillation. (2.) Instead of using an aluminium alkyl oxide and another catalyst, the product obtained by treating aluminium alkyl oxide with water or a substance containing water, may be used to convert acetaldehyde into ethyl acetate. The most active of the products of this class appear to be those containing from 16 to 25% Al.—T. F. B.

Halogen derivatives ; Transformation of —— [into aldehydes]. Fabriques de Produits de Chimie Organique de Laire. First Addition, dated Feb. 11, 1913, to Fr. Pat. 452,537, March 7, 1912 (see this J., 1913, 673).

A number of new aldehydes have been prepared by the action of urotropine on monohalogen derivatives, as described in the principal patent ; among them are *m*- and *p*-toluic aldehyde, 3.4-, 2.4-, and 2.5-dimethylbenzaldehyde, *p*-ethyl-, *p*-propyl-, *p*-butyl-, *p*-isoamyl-, and *p*-cyclohexylbenzaldehyde, and methylethyl-, methylpropyl-, and methylbutylbenzaldehyde. The mixed phenol carbonates, such as $C_2H_5O.CO.OC_6H_4.CH_2Cl$, may also be used for the preparation of hydroxyaldehydes.—T. F. B.

Hydroxylamine nitrite and other salts of hydroxylamine ; Process for preparing ——. Toelle und vom Hofe, and J. Kronen. Fr. Pat. 466,070, Dec. 11, 1913.

A solution of a nitrite is mixed with ammonia or an ammonium salt and reduced by means of zinc dust. Preferably 4 parts of sodium nitrite and 3·1 parts of ammonium chloride are dissolved in 50 parts of water, and 3 to 4 parts of zinc dust is slowly added, with stirring : a solution of hydroxylamine nitrite is obtained.—T. F. B.

Glycerol-halogenhydrins and polyhydroxy-fatty acid esters ; Process for preparing ——. A. Grün. Ger. Pat. 272,337, July 23, 1912.

Triglycerides of hydroxy-fatty acids are treated with the calculated quantity or with excess of hydrohalogen acid in the gaseous form or dissolved in alcohol, under pressure; the glycerides may be used in the form of a solution. The principal products from castor oil are glycerol mono- and dichlorhydrins and esters of polyricinoleic acids. The yields of chlorhydrins amount to 90 to 98%, whilst the polyricinoleic acids are obtained in theoretical quantity.—T. F. B.

Albumin with alkaline-earth or heavy metal phosphates, sulphates, and silicates ; Process for preparing compounds of —— soluble in alkali. W. Wolff und Co. G. m. b. H. Ger. Pat. 272,517, July 18, 1912. Addition to Ger. Pat. 253,839 (see this J., 1913, 47).

Albuminoids, albumoses, peptones, or their halogen substitution products are treated in aqueous alkaline solution with an alkali phosphate, sulphate, or silicate and a soluble salt of an alkaline-earth metal (other than calcium) or of aluminium, chromium, zinc, lead, bismuth, copper, silver, or tin ; the complex albumin compound is separated from the resulting solution by neutralising with a small quantity of acid, by adding ammonium sulphate or sodium chloride, or by precipitation with alcohol or acetone.—T. F. B.

Arylcarbamic acid esters ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 272,529, Jan. 9, 1913.

Alkylamines are treated with derivatives of arylcarbamic acids, or aliphatic amines are treated with halogenalkyl esters of arylcarbamic acids. The products are powerful anæsthetics.—T. F. B.

Halogenated CC-dialkylbarbituric acids ; Process for preparing ——. A. Einhorn. Ger. Pat. 272,611, Nov. 27, 1912.

CC-Dialkylbarbituric acids are heated with halogens under pressure, preferably in presence of an indifferent organic diluent. The resulting halogen compounds contain the halogen in the alkyl groups. They are soluble in dilute alkali carbonates and in ammonia, and may be used for the preparation of soporific agents.—T. F. B.

Mercury paranucleinate with alkalis ; Process for preparing compounds of ——. Knoll und Co. Ger. Pat. 272,687, Jan. 21, 1913.

Mercury *p*-nucleinate is dissolved in alkali and the solution treated with alcohol, or *p*-nucleinic acid is neutralised with an alkali and the solution is treated with mercuric chloride and alcohol. The products are easily soluble in water, giving neutral solutions suitable for therapeutic injection.—T. F. B.

Mercury paranucleinate with tannin ; Process for preparing compounds of ——. Knoll und Co. Ger. Pat. 272,688, Jan. 21, 1913.

Compounds of mercury *p*-nucleinate with tannin are obtained by treating the mercury salt with a solution of tannin, or by dissolving mercury *p*-nucleinate in alkali and treating with a solution of tannin, or by treating sodium *p*-nucleinate with mercuric chloride solution and tannin solution.—T. F. B.

Dihydroxybenzene-arsinic acid ; Process for preparing a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 272,690, Dec. 14, 1912.

m-Dihydroxybenzene-arsinic acid is obtained by heating resorcinol with arsenic acid.—T. F. B.

Cyanhydrins of aldehydes and ketones ; Process for preparing derivatives of ——. A. Albert. Ger. Pat. 273,073, July 30, 1912. Addition to Ger. Pat. 259,502 (see this J., 1913, 673).

Selenium compounds, analogous to the sulphur compounds described in the principal patent, are obtained by treating acylated cyanhydrins with hydrogen selenide. They may be used in medicine.—T. F. B.

Acetic anhydride ; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 273,101, Jan. 16, 1912.

A good yield of acetic anhydride is obtained by passing chlorine into a mixture of an acetate and a chlorine compound of sulphur ; the temperature should not be allowed to rise above about 20° C.—T. F. B.

p-Aminophenyl ester of salicylic acid ; Process for preparing derivatives of —— containing sulphur. J. Abelin, E. Bürgi, and M. Perelstein. Ger. Pat. 273,221, May 18, 1913. Addition to Ger. Pat. 268,174 (see this J., 1914, 220).

The *p*-aminophenyl ester of salicylic acid is treated with an alkali or ammonium salt of ω-methyl-, ethyl- or propylsulphonic acid in presence of methyl or ethyl alcohol ; it is preferable to add a condensing agent, such as sodium acetate. The alkylsulphonates are obtained in almost quantitative yield and in a state of purity.—T. F. B.

Salts of lower fatty acids ; Process for preparing a mixture of ——. J. Ederer. Ger. Pat. 273,271, May 27, 1913. Addition to Ger. Pat. 272,036 (see this J., 1914, 568).

Vegetable matter other than wood, such as dry fallen leaves, nut-shells, etc., are extracted with dilute alkaline solutions, either at the ordinary temperature or at higher temperatures and pressures, in a diffusion battery, and the liquor is evaporated. The yields of lower fatty acids obtainable from beech leaves and hay by this process amount to 4% of the weight of the air-dry material. —T. F. B.

Cupric salt of cholic acid ; Process for preparing the ——. Knoll und Co. Ger. Pat. 273,317, April 18, 1913.

SOLUTIONS of cupric salts are treated with sodium cholate in presence of methyl or ethyl alcohol ; cupric cholate is obtained in a pure, compact form, which can easily be dried, whereas when the reaction is carried out in aqueous solution the product is obtained as a voluminous, gelatinous mass which it is difficult to dry.—T. F. B.

Bromodialkylacetamide ; Process for preparing derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 273,320, April 18, 1913.

BROMODIALKYLACETAMIDES are treated with formaldehyde in presence of a condensing agent, to produce N-methylol compounds, of the composition, $RR_1CBr.CO.NH.CH_2OH$, where R and R_1 represent alkyl groups. The products possess strong hypnotic and sedative properties.—T. F. B.

Alkyl- and arylaminomethylalkyl ethers ; Process for preparing ——. E. Merck. Ger. Pat. 273,323, Jan. 23, 1913.

ONE mol. of a halogenmethylalkylether is brought to reaction with two mols. of an aliphatic or fatty-aromatic primary or secondary amine, preferably in presence of an indifferent organic solvent. The products have the general formula, $alkyl.O.CH_2.NRR_1$, where R represents alkyl or aralkyl and R_1 hydrogen or alkyl : they may be used in the preparation of medicinal products, such as hydrastinine. —T. F. B.

Panama bark ; Treatment of —— for preventing the production or separation of dust therefrom. R. Mandelbaum, and Dr. A. Kauffmann und Co., Asperg, Germany. Eng. Pat. 21,862, Sept. 27, 1913. Under Int. Conv., Sept. 27, 1912.

SEE Ger. Pat. 264,163 of 1912 ; this J., 1913, 1031.—T. F. B.

Chlorinated aromatic or cyclic compounds ; Manufacture of ——. Fabriques de Produits de Chimie Organique de Laire, Issy les Moulineaux, France. Eng. Pat. 30,068, Dec. 31, 1913. Under Int. Conv., Jan. 17, 1913.

SEE Fr. Pat. 464,645 of 1913 ; this J., 1914, 503.—T. F. B.

Acetaldehyde ; Process of preparing ——. E. Baum and M. Mugdan, Assignors to Consortium f. Elektrochem. Industrie G. m. b. H., Nuremberg, Germany. U.S. Pat. 1,096,667, May 12, 1914.

SEE Fr. Pat. 455,370 of 1913 ; this J., 1913, 959.—T. F. B.

Ethyl acetate from acetaldehyde ; Process for preparing ——. Consortium f. Elektrochem. Industrie G. m. b. H. Fr. Pat. 465,965, Nov. 20, 1913.

SEE Eng. Pats. 26,825 and 26,826 of 1913 ; preceding. —T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver bromide-gelatin plates ; The simultaneous development and fixation of ——. C. Otsuki and T. Sudzuki. Mem. Coll. Sci. and Eng., Kyoto Imp. Univ., 1914, 6, 25—28.

THE combined developing and fixing solution proposed by Crémier (Phot. Rev., 1911, 170), containing 1 grm. of amidol and 2·5 grms. of thiosulphate in 100 c.c. of water, does not give images of sufficient density, and requires from 37 to 40 minutes to act completely. The authors tried to prepare an amidol solution which would work more rapidly, by increasing the amounts of amidol and thiosulphate, but the images were still too thin. Similarly with metoquinone and sodium sulphite and carbonate it was impossible to obtain sufficient density. However, it was found that the use of caustic soda instead of carbonate resulted in a rapidly acting solution which gave satisfactory images. The best formula is, metoquinone, 0·6 grm. ; anhydrous sodium sulphite, 3 grms. ; caustic soda, 0·5 grm. ; sodium thiosulphate, 6 grms. ; water, 100 c.c. In this solution the image is completely developed in 60 to 90 seconds at a temperature of 18° to 22° C. It is best to make the metoquinone and sulphite into one solution and the caustic soda and thiosulphate into another, and to mix the two at the time of using.—T. F. B.

PATENT.

Tellurium toning bath for photographic silver images. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 272,162, Jan. 1, 1913. Addition to Ger. Pat. 271,041 (see this J., 1914, 503).

DEVELOPED and fixed "gas-light" prints are toned pleasing bluish-grey shades by using solutions of tellurium in alkali sulphite.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosion ; Circumstances attending an ——, which occurred on Feb. 20, 1914, in an incorporating house in the factory of Nobel's Explosives Co., Ltd., at Ardeer, Ayr. Major. A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 7396.]

EIGHT men were killed as the result of an explosion of 4180 lb. of blasting gelatin and gelignite in a building, 43 ft. by 25 ft., constructed of wood, in which were eight incorporating machines. The machines had two vertical revolving gunmetal spindles, each carrying 12 horizontal blades, in three sets of 4, the blades of one spindle being about ½ inch below the corresponding blades of the other. There was ample clearance between the ends of the blades and the sides of the pan containing the explosive. In the Inspector's opinion the accident was probably due to some action on the part of one of the men engaged in charging the machines, and the only loose article which could possibly fall into the machines, during the operation of loading, would seem to be a thin sheet-lead apron employed to prevent spillage during the transference of the thin jelly from the box to the pan. Three "runners" were among those killed. The erection of a simple form of shelter against the outer slope of the mound and clear of the tunnel would be an additional factor of safety for "runners." Attention is drawn to the probable advisability of isolating incorporating machines in separate compartments, divided by concrete walls, but the Inspector is not prepared to make a definite recommendation on this point. The incorporating machines were driven by a line of shafting level with the ceiling. In the present case one portion of this shafting, 21 ft. in length, was found half buried in the ground, and another piece, 15 ft. long, was dug out of the mound protecting a danger building. This source of danger would be obviated by the use of two separate shafts, one on each side, situated outside the building and sunk level with, or below the level of, the floor.—G. W. McD.

Smokeless powders ; Experiments upon the ignition of large quantities of —— at the Russian Powder Factory at Schlüsselburg. A. Saposchnikow. Z. ges. Schiess- und Sprengstoffw., 1914, 10, 187—190, 217—219.

NITROCELLULOSE powder, either in the form of strip or tube from 2 to 3·6 mm. in thickness or diameter, was

ignited electrically by the aid of a fuse of fine grain gunpowder contained in a cylinder of gelatinised nitrocellulose. There were no actual explosions of the powder in the following instances. A heap of one ton lying in the open, when ignited from the outside, took 25 secs. to burn out completely, and there was a flame from 20—25 m. high. A similar heap when ignited in the middle took 22 secs. to burn out. 1½ tons laid out in a train 18—20 m. long and 50 cm. high, and ignited at the windward end, took 49 secs., and when ignited at the opposite end 103 secs. to burn out. 1½ tons placed in a large box burnt at about double the rate of the same powder when ignited in the open. One ton of powder was sealed up in 5 cases and these were placed in a strong wooden box with 1½ tons of loose powder lying round the cases. From 5—10 secs. after ignition of the loose powder the whole was blazing very fiercely with a flame about 40 m. high. About ½ min. later, when the flame from the loose powder had died down, one of the cases burst into flame, and, later, two others. Two of the cases were recovered with the whole of the powder in them, but it showed very marked signs of decomposition. 10 tons of powder were placed in a wooden house on tables about one metre apart. The layer of powder on the tables was 75 cm. thick. Four secs. after ignition the flames attained a height of 130 m. and the whole burnt out in 33 secs. The rate of burning was about 12 times that in the open. In the following instances the smokeless powder actually exploded instead of burning. When open cases of black powder and smokeless powder were placed together and ignited. When black powder was present and the sealed lining of cases containing smokeless powder was defective. When a shell containing 5 lb. of trinitrotoluene was detonated on top of a case of smokeless powder. The explosion was communicated to adjoining cases.
—G. W. McD.

Patent.

Explosive substances. C. Claessen, Berlin. Eng. Pat. 24,839, Oct. 31, 1913.

See Fr. Pat. 463,714 of 1913; this J., 1914, 376.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Ferrocyanides; Determination of —— by oxidation with an alkali bromate. L. L. de Koninck and N. Joassart. Bull. Soc. Chim. Belg., 1914, **28**, 144—148.

Under specified conditions ferrocyanides can be quantitatively oxidised by bromates in acid solution:

$$6K_4Fe(CN)_6+KBrO_3+6HCl=$$
$$6K_3Fe(CN)_6+KBr+6KCl+3H_2O,$$

and the method can be utilised for the determination of ferrocyanides using iron alum as external indicator. The solution is acidified with hydrochloric acid and at the end of the titration the concentration of free acid should be about $N/1$; variations from this strength greater than 10—15% render the results too high. The method gives accurate results agreeing with those obtained by using permanganate as oxidising agent; and no ions capable of precipitating the unchanged ferrocyanide are introduced into the solution, as is the case with permanganate.
—G. F. M.

Rapid electrolytic separation of copper from arsenic. Sieverts and Wippelmann. *See* X.

Unsaponifiable constituents of mowrah fat, and the detection of mowrah fat in animal and vegetable fats. Berg and Angerhausen. *See* XII.

Determination of cholesterol [and phytosterol] in fats. Klostermann and Opitz. *See* XII.

Analysis and composition of red lead. West. *See* XIII.

Detection of sulphite-cellulose extract. Gansser. *See* XV.

Determination of phosphates in soil extracts. Prescott. *See* XVI.

Qualitative and quantitative tests for lævulose in presence of other sugars. Pinoff and Gude. *See* XVII.

Determination of lactose and dextrose by the copper-iodide method. Cole. *See* XVII.

Methods of determining carbohydrates. II. Determination of starch in plant materials. Davis and Daish. *See* XVII.

Colorimetric determination of creatine [e.g., in meat extracts.]. Baur and Trümpler. *See* XIXa.

Colorimetric determination of lead and copper in drinking water. Reese and Drost. *See* XIXb.

Colorimetric determination of iron in water. Gothe. *See* XIXb.

Fluorine in soft waters. Gautier and Clausmann. *See* XXIV.

Patents.

Pyrometers. H. L. Heathcote and Rudge-Whitworth, Ltd. Fr. Pat. 465,898, Dec. 8, 1913. Under Int. Conv., June 16, 1913.

The object the temperature of which is to be judged is viewed through a layer of coloured liquid contained in a vessel having transparent ends and a flexible body, and held between two annular plates kept apart by a spiral spring. The flexible body allows the distance between the plates to be varied without altering the capacity.
—W. H. C.

Liquids; Apparatus for the continuous examination of ——. O. Friese, Berlin, and F. Graafen, Erfurt, Assignors to Hydro-Apparatebauanstalt J. von Geldern und Co., Düsseldorf, Germany. U.S. Pat. 1,096,832, May 19, 1914.

See Ger. Pat. 233,529 of 1910; this J., 1911, 714.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Fluorine in soft waters. A. Gautier and P. Clausmann. Comptes rend., 1914, **158**, 1389—1395. (See also this J., 1914, 280.)

A method capable of determining less than 0·1 mgrm. F. per litre consists, essentially, in carrying down the fluoride by the precipitation of barium sulphate, which is subsequently treated with sulphuric acid, the fluorine being finally converted into lead fluoride, and the lead determined colorimetrically as colloidal lead sulphide. The results of the examination of a number of natural waters by this method show that their fluorine content varies from 0·6 mgrm. per litre in the case of the R. Vilaine, draining plutonic and metamorphic rocks, to 0·01 mgrm. for the Lake of Geneva, whose waters are partly calcareous, serving to precipitate the fluoride in the presence of soluble phosphates.—J. L. F.

Boron in mineral waters. H. Fonzes-Diacon and Fabre. Comptes rend., 1914, **158**, 1541—1542.

The boron-content of various mineral waters was investigated by the colorimetric method of Bertrand and Agulhon (see this J., 1914, 105, 273). It seems to depend, to some extent, upon the temperature, varying from 0·05—0·07 mgrm. per litre for the Royat group, and rather less for the Vichy group, to less than 0·005 mgrm. in cold mineral waters.—J. L. F.

Dispersoid [colloidal] solutions; Processes which occur on shaking —— with liquid and solid substances practically insoluble in the dispersion-medium. P. von Weimarn and A. Alexejew. J. Russ. Phys.-Chem. Ges., 1914, **46**, 133—135. Chem. Zentr., 1914, **1**, 1627.

Contrary to the statements of Salbom (Kollo'dchem. Beihefte, 1911, **2**, 79) and Zsigmondy (Kolloid-Zeits., 1913, **13**, 105), it was found that all colloids in aqueous media, even those with a negative electric charge, are coagulated by sufficiently prolonged shaking with liquids insoluble in water. An aqueous colloidal gold solution was coagulated by toluene, bromobenzene, oil of turpentine, salol, diphenylamine, brucine, iodoform, copper oleate, acetic anhydride, ether, petroleum spirit, chloroform, and petroleum; a colloidal gold solution in glycerin by toluene, chloroform, and petroleum spirit; an aqueous alcoholic colloidal barium sulphate solution by toluene and oil of turpentine, and an aqueous colloidal ferric hydroxide solution by oil of turpentine.—A. S.

Books Received.

The Fixation of Atmospheric Nitrogen. By Joseph Knox, D.Sc., Lecturer on Inorganic Chemistry, University of Aberdeen. Gurney and Jackson, 33, Paternoster Row, London, E.C. 1914. Price 2s. net.

Volume (7½ ins. by 5 ins.), containing 103 pages of subject-matter, 6 of bibliography, and an alphabetical index. There are seven illustrations. The text is classified as follows:—I. Fixation of atmospheric nitrogen as nitric and nitrous acids, or as their salts. II. Synthesis of ammonia and ammonium compounds from atmospheric nitrogen. III. Conversion of atmospheric nitrogen into compounds which readily yield ammonia.

Instructions for Rearing Mulberry Silk-Worms. [Agricultural Research Institute, Pusa.] Bulletin No. 39, 1914. By M. N. De. Member of the Sericulture Assoc., Japan, etc. Calcutta: Superintendent Govt. Printing, India. 1914. Price 4 annas, or 5d.

Pamphlet (9¾ ins. by 7¼ ins.), containing 25 pages of subject-matter with 8 illustrations. The text is classified thus:—(I.) Introduction. II. Appliances for rearing. III. Eggs. IV. Rearing. V. Temperature and humidity. VI. Silk-worm diseases. VII. Pasteur system of selecting disease-free eggs. VIII. Grasserie. IX. Facherie. X. Muscardine (all three, diseases). XI. Reeling. XII. Mulberry, and its diseases, etc. XIII. Silk washing. XIV. Silk dyeing, with acid colours, basic colours, alizarin colours, and vegetable colours. XV. Weaving. XVI. Advice and information.

Lectures on Explosives. By William Macnab. [The Institute of Chemistry of Great Britain and Ireland.] 30, Bloomsbury Square, London, W.C. 1914. Price 2s. 6d.

Two lectures delivered before the Institute, the first on February 26th, 1914, and the second on March 26th, 1914. They fill 67 pages, and contain 19 illustrations. The classification of matter is as follows:—I. Historical sketch of manufacture and use of explosives. II. Detonators, and their use and scope. III. Character of explosive decompositions. IV. Two modes of explosion:—(*a*) Combustion or deflagration. (*b*) Detonation. V. Velocity of explosion wave in detonated explosions. VI. Conditions for foreseeing explosions, and interferences necessitating experiment, also experimental limitations. VII. Heat developed, etc. VIII. Explosion heats; attempts at measurement. IX. Sensitiveness, etc. X. Qualities explosives should possess. XI. Testing explosives. XII. Governmental rules and regulations (Home Office) for construction and working of factories. XIII. Processes and plant. XIV. Military propellants. XV. Sporting powders. XVI. Fiery coal mines and explosives (Home Office). XVII. Filling for shells. XVIII. Novel application of explosives. XIX. Scope of chemists' work with explosives.

The Gas Chemists' Summary, 1913. By A. V. Hendrickson, Chemist to the South Suburban Gas Company, etc. Walter King, 11, Bolt Court, Fleet Street, London, E.C. 1914. Price 3s. 6d.

Volume (8½ by 5½ ins.), containing 107 pages of subject matter, with Bibliography of 8 pages, and an alphabetical index, also a few illustrations. The classification of subjects is as follows:—I. Carbonisation. II. Condensation, washing, purification, and naphthalene extraction. III. Tar and ammonia. IV. Oil gas and carburetted water-gas. V. Photometry and calorimetry. VI. Gaseous heating and ventilation. VII. Gas analysis. VIII. Tests. IX. Miscellaneous.

[Monographs on Biochemistry.] Alcoholic Fermentation. By Arthur Harden, Ph.D., D.Sc., F.R.S., Professor of Biochemistry, London University, etc. [2nd edit.]. Longmans, Green & Co., 39, Paternoster Row, London; Fourth Avenue and 30th Street, New York; Bombay, Calcutta, and Madras. 1914. Price 4s. net.

Volume (9⅝ by 6¼ ins.), containing 135 pages of subject matter, with 7 illustrations, 19 pages of Bibliography, and an alphabetical index of subjects. These monographs are edited by R. H. A. Plimmer, D.Sc., and F. G. Hopkins, D.Sc., F.R.S., and the present volume contains a general preface by the editors. The classification of the matter is as follows:—I. Historical introduction. II. Zymase and its properties. III. The function of phosphates in alcoholic fermentation. IV. The Co-enzyme of yeast-juice. V. Action of some inhibiting and accelerating agents on the enzymes of yeast-juice. VI. Carboxylase. VII. The by-products of alcoholic fermentation. VIII. The chemical changes involved in fermentation. IX. The mechanism of fermentation.

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Birmingham Section.

Meeting held at Birmingham University on Thursday, May 7th, 1914.

MR. H. T. PINNOCK IN THE CHAIR.

DISCUSSION ON FUEL—GASEOUS, LIQUID, AND SOLID.

Professor John W. Cobb (Leeds), in opening the discussion, said that when such a fuel as coal was burned completely, the same amount of carbonic acid and water was always formed, and the same amount of heat generated, but the amount of heat utilised depended on a number of considerations, and called for skill in the design and use of apparatus. Moreover, coal was not simply a potential source of so many heat units but was a chemical substance capable of yielding other chemical substances of considerable commercial value on its way to carbon di-oxide and water if the process were controlled. That was the reason for the existence of many fuel problems, and, particularly, modern fuel problems. If coal were burned in one stage the smoke problem had to be faced. The existence of the smoke nuisance might be said briefly to be due to this particular fact: that although distillation and oxidation of coal could both go on at low temperatures the distillation reached a high velocity at a comparatively low temperature, at which combustion was very slow. Another problem arose from the difficulty of using large quantities of fine dust coal. The dust below ground was a danger, and the most effective means of securing that it should be brought out was to make its economical use possible. Dust-firing for boilers and furnaces was fortunately making some headway.

A practical method of dealing with the smoke problem was to effect the combustion of coal in more than one stage; in one, the coal was gasified, in the other, the gas was burned. A blast of air used below a deep layer of glowing coal half-burned it to what was known as producer gas, which could be taken away and burned completely where desired; it contained the nitrogen of the air-blast and so was called low-grade gas. If the coal were only heated, without contact with air, as in gas retorts, or coke ovens, the gas contained very little nitrogen and was a high-grade gas. The advantage of producer gas was made obvious to certain industries by the introduction of the important principle, for fuel users, of regeneration. As soon as gaseous fuel was used it became possible to design apparatus in such a way that some of the heat leaving furnaces in the products of combustion, was restored to the gas and air entering. Thus the open hearth steel process became a commercial possibility. A higher point of efficiency was attained and the use of higher temperatures became feasible. The process of regeneration was necessary for high temperatures with producer gas, but ceased to be of the same importance with high-grade gas. The significance of that was best understood when one attempted to design a small scale apparatus using the regenerative principle.

There was also the difficulty in applying the regenerative principle to small furnaces that the expense of construction would be prohibitive, and the cost of renewal of complicated working parts too great. The possibilities of producer gas were much increased as soon as another disadvantage was removed. For delicate work there should be a proper control of the flow of gas and air, and the regenerators, ports and passages should remain unfused, and be free from dust. A considerable step was made in the development of producer-gas engineering and furnaces when it became economical, on a large scale, to wash producer gas. That was effected successfully by the introduction of a plant the primary purpose of which was the recovery of ammonia.

Dr. Mond found that by the use of a large quantity of steam it was possible to get half of the nitrogen—a proportion since increased—as ammonia. Under that process about 2½ lb. of steam were required for every pound of coal, and a considerable amount of that steam went through the producer undecomposed, so that to establish a high degree of thermal efficiency it became necessary to recover the latent heat of the large quantity of steam escaping through the producer. It was this which led to the system of washing towers, by which the gas was sent away washed and cooled. It could then be controlled and distributed in small pipes; and the most delicate ware could be exposed, if necessary, to the full action of the gas without danger from coal ash. A claim had recently been made that the same high ammonia results could be obtained with a smaller quantity of steam in the blast essentially by water-jacketing the top of the producer; but he thought that those who had had much to do with the ammonia recovery process would require a stricter and narrower definition of the claim made before accepting its probable validity.

Ammonia recovery introduced a new problem since ammonia, when it was recovered in producer-gas, coal-gas or coke-oven practice as ammonium sulphate, required that sulphuric acid should be brought to it, and that had to be bought or made. Interest, therefore, attached to any process which would do away with the necessity of providing sulphuric acid, especially in plants erected in somewhat inaccessible places abroad. The sulphur was in the coal. The ammonium sulphide was in the gas, and by the simple addition of oxygen one got ammonium sulphate. The addition of the oxygen was not a process as simple as it appeared, but several processes were on trial for doing it.

If no oxygen were used in gasifying coal most of the carbon remained as coke, the rest going forward with other constituents as permanent gas, and as vapours. Until recently there were two established methods for working that sort of process. If town gas were required it was made in retorts; if coke were the primary product desired it was made in a coke oven. Modern developments were tending to unify the science and practice of carbonisation to this extent—that it would be more necessary in the future to consider carefully local conditions and markets, and decide what modification of plants, or what combination of them, was most effective. The old horizontal retort was being, to some extent, replaced by the vertical retort, in which gravitation was used to save labour, and continuous vertical retorts were another development. Processes were also being tried and worked in which the temperature and the conditions of carbonisation were even further altered from the normal. One object was to make a coke which ignited easily and burned cheerfully. If a low temperature of carbonisation was used only a portion of the volatile matter was driven off from the coke—the part most likely to produce smoke, such a substance was coalite. A disadvantage of low-temperature coke was that it was rather soft for carriage, and there was a difficulty in controlling the distribution of temperature in a retort working at low temperatures; it was apt to be irregular. In low-temperature carbonisation it was not only the coke which was altered, but the gas was richer, and the tars and oils which came out and condensed were lighter. This was now a point of great importance, because of the large and increasing use of motor traffic and internal combustion engines generally. The demand had arisen for an increased supply of an oil or spirit which was easily and completely volatilised in a current of cool air, and could be used in a carburettor. One way of meeting the difficulty was to design a new carburettor working on a less volatile oil. Another way was to work out a process by which a mixture of oils of different densities, such as a crude petroleum, could be altered in chemical nature so as to contain a much higher proportion of volatile oils. Work in both these directions was being prosecuted vigorously. A third way which would increase the supply although not to the extent sometimes stated was to carbonise coal so as to yield a large supply of light oils. In the coalite process that was done by using a lower temperature, but processes were also being tried using higher and lower pressures. It was not of course correct to say that high benzene yields resulted from low temperatures; as a matter of fact, the volatile oils produced were more like petrol itself.

Whether coke or gas, or both, were burned, we should be freed from the smoke nuisance; but the gas industry was handicapped by a system of selling gas at a price too far above that of its manufacture and distribution. That policy had been defended as a definite means of indirect municipal taxation. It was a tax placed upon the home-manufactured article, and the competitor, raw coal, was out of reach of the imposer. In effect, it placed a premium upon the wasteful use of fuel and pollution of the atmosphere.

Dr. W. B. **Davidson** said he was strongly in agreement with Professor Cobb in suggesting that coal should be brought into disuse as much as possible, in favour of coke and gas. From eight years' personal experience he could say that it was quite an easy matter entirely to displace coal in one's house. If he were on the City Council he would make it his business to bring forward a resolution that a byelaw be made prohibiting the use of coal unless it could be burned without smoke. Something drastic was necessary. The great objection to ordinary good gas coke was the difficulty of ignition because it contained only one or two per cent. of volatile matter. With a coke of 5 or 6 per cent. there was no difficulty in ignition. He was glad that Professor Cobb hit out against municipalities who contributed to the rates from the gas profits. It was a great mistake not to reduce the price of gas to the lowest point. There was, he added, a tremendous wastage of fuel even in gas works where huge quantities of coal were dealt with. In Birmingham the amount required in heating the retorts was 100,000 tons and that amount could be cut down by the simple device of controlling the primary air as by Brooke's air regulator. At one of the city gas works the fuel consumed had been reduced from 25,000 tons to 16,000 tons per annum—a saving of 9,000 tons, or an equivalent of £5,000. If that were done in the whole of the Birmingham gas works there would be a saving of 35,000 tons, or nearly £20,000 per annum

Mr. **Cooper** stated that the production of metallurgical coke was about 11 million tons per annum, of which not more than 65 to 70 per cent. was produced in a scientific way. Taking a coal which had 30 per cent. of volatile matter from this coal when carbonised in the modern coke oven the yield of coke would be approximately 70 per cent. With the same amount of coal utilised in the old type of oven there would probably not be more than 55 to 60 per cent. of coke. In addition with the bye-product oven one got 5,500 cubic feet of surplus gas, about 30 lb. of sulphate of ammonia, 10 gallons of tar and 2½ gallons of benzol. In the case of the beehive oven one got nothing but the coke. It will be seen, therefore, that if all the coke were made in bye-product ovens there would be an enormous saving amounting to some millions of pounds per annum. In Germany greater progress had been made in this respect than in this country, as was shown by the figures for the production of sulphate of ammonia. The rapid increase in production was due to the total adoption of bye-product coke ovens in place of those of the beehive type. There were over 3,000 beehive ovens in Yorkshire, over 4,000 beehive ovens in Durham and several others in other parts of the country. He thought it could be safely said that every class of coal which was coked at all could be dealt with in bye-product ovens. This was especially important also from the point of view of the production of gaseous fuel.

Birmingham had taken the lead in another development, namely, the adoption of chamber ovens for gas production, and these had led to a big saving of fuel on account of the fact that the ovens were heated by producer gas which could be made from inferior fuel and the nitrogen could be recovered from these in the form of sulphate of ammonia. He was very sceptical as to the claims made in relation to the results of low temperature carbonisation. An interesting development of this system of carbonisation which was to be worked on a Yorkshire Colliery was a combination of the Coalite process with gasification of the resulting coke in gas producers. The private Company working this scheme had realised the difficulty they might be faced with when it came to getting rid of the smokeless fuel and they had, therefore, adopted the idea of gasifying this in producers and recovering the ammonia. The surplus gas was to be sold to an electric power company for the production of electricity. On a coke oven plant the surplus gas was used for boiler firing purposes and in some cases in gas engines. Its value on the colliery for boiler firing purposes as compared with coal on the calorific value basis was about 2d. per thousand cubic feet.

Mr. H. T. **Pinnock** pointed out that it was the application of the regenerative and recuperative principle that brought prominence and position to producer gas. This principle was easily applied, and it was that circumstance which made it possible for producer gas to compete with higher power calorific gas for high temperature furnace use. As to the question of abstracting the sulphur from producer gas he agreed that such a course was most desirable both from the point of view of making sulphuric acid and to facilitate certain kinds of work in which sulphur was injurious. Finality had not been reached in regard to producer gas and he thought it was likely to develop to that end on the lines of reduced steam consumption for making ammonia. He thought there would be difficulty, if it was a producer of large size—of from 10 ft. to 11 ft. diameter—to cool the interior of it sufficiently, merely by outside water jacketing. Another way in which producer plants might be expected to improve was in the more centralised extraction of tar. That was the bugbear of many plants which had to work in limited places. The tar had to be extracted at various places in cooling, and the colouring matter therefrom often found its way into the canals and drains, and caused conflict with the local authorities. As to the firing of coal dust, the Bettington boiler struck him as ideal from the point of view of fuel consumption. He did not altogether like the idea of small and long tubes working at high rates, owing to scaling, which often meant the scrapping of the tubes. If such tubes were employed the proper softening of the water had to be very carefully attended to.

Mr. W. J. **Rees** was of opinion that progress must be along the lines of the recovery of the by-products, particularly in gas-producer work. The serious question presented was the immense capital expenditure necessary in laying down recovery plants with works using large quantities of coal. It was also necessary to aim at the further removal of dust and of sulphur from producer gas; and if that could be economically achieved without resort to by-product recovery the advantage would be considerable to many industries, and to the glass industry in particular. With some fuels it was possible to keep some of the sulphur out of the producer gas by sprinkling the fuel with milk of lime, but this method was not really satisfactory in any way. As to the coal-dust problem it was possible that much of the dust could be used by mixing with tar, and using in briquetted form.

The London County Council insisted upon purchasin coal only on a calorific value basis. There were adopte four standards—calorific value, moisture, ash content, an price. Deductions were made *pro rata* if the fuel wer below the standards agreed to in the contracts, an correspondnig bonuses paid if the fuel were above th standards.

Mr. E. J. **Guild** (Leek) stated that his firm, who we paper manufacturers in North Staffordshire, were relucta to adopt mechanical stokers or patent furnaces. In ord to avoid smoke they insisted on sending up an excess of ai and he asked if low temperature coke would be of use them. He also mentioned that his firm would not co sider the use of oil or gas as fuels. His difficulty along had been to induce them to use coal in a more economical way.

Dr. W. B. **Davidson** stated that not the least difficulty would be experienced in burning coke in a Lancashire boiler—and, of course, there was no smoke.

Mr. W. B. **Parker** commented strongly on the fact that there was no recognised standard of purity for coal washed and sold for boiler purposes. The ash approximated from 10 per cent. to 25 per cent. It seemed to him that the consideration, prior to that of the scientific utilisation of fuel, was whether efforts should not be directed to secure that colliery owners would supply fuel of higher quality. He suggested that what was necessary was a central authority for the fixing of a quality standard for each pit. A reasonable specification as to percentage of ash was wanted.

Mr. E. W. **Smith** (Birmingham), said it was startling to hear that coal gas could be produced even at a colliery at 2d. per 1000 cubic feet. No doubt it could be made in the retort house at that figure, but then all the charges for carriage, coal handling and purifying the gas, and for distribution, must be added. Birmingham prices were extremely low, having regard to the rates in many other towns, so that manufacturers had the advantage. The aim must be to obtain the highest efficiencies in securing the greatest amount of heat from the original fuel, and also from the apparatus in which it is to be used. Until recent years it had not been possible to obtain economical results in heating processes, but now, as a result of improvements in the design of furnaces, the cost compared favourably with that of solid fuel furnaces and oil furnaces. He had no faith in the claims made for "surface combustion" at high temperature, nor with the results obtained. Although he had seen large apparatus working under the so-called new process, he had seen nothing, either in boilers or furnaces, practicable, or likely, efficiently, to last. The scientific explanations given with regard to surface combustion—in which there was nothing new either in the form of combustion or the type of furnace employed—were unnecessary and unsatisfactory. Interest would centre on an experiment, shortly to be made on the lines of low temperature carbonisation, by a large firm of continuous vertical retort makers. They were about to install a plant in the Midlands for experiments on those lines mainly with a view to producing hard coke and large volatile oil yields. In the Birmingham Gasworks fuel was being used in what appeared to be an ideal way. The volatile matter was driven off from the coal; the coke was then put into producers and was gasified, and gas was made from this product with which the retorts were heated. This method gave the further advantage of enabling them to obtain by-products in sulphate. A drawback in the use of producer gas for industrial purposes lay in the fact that it contained a large amount of sulphur compounds. That was an almost insuperable stumbling-block in many processes. In the new Corporation plant experience showed that the tar was materially reduced by the centrifugal extractors before the sawdust scrubbers were reached. He did not see why it should not be possible to use coal dust when low in ash in coke ovens compressed with water. The coke would be useful for small furnace work f the ash content was not too high. A coke of high porosity burned much more easily than ordinary gas coke, and ignited immediately from chips.

Mr. F. R. **O'Shaughnessy** stated that he was interested n two of the by-products of the gas industry, viz., nitrogen and tar. The nitrogen in coal had an interesting biological ignificance, for its presence there instanced in a most triking manner the extraordinary stability of certain kinds of nitrogenous organic matter when subjected o destructive putrefaction. If one considered that he vegetable matter from which this nitrogen came nderwent decay for an indefinitely long time when the emperature at the earth's surface was probably much igher than now, the presence of so much residual nitrogen n the coal now was almost startling. In promoting estructive putrefaction of similar organic matter on the arge scale which was present in sewage sludge he was ruck very much by the resistant character of the nitrogenous bodies, and next to mineral matters they were the most resistant normal constituents of the sludge.

He would like to recommend this fact to the notice of enthusiasts who lamented the loss to agriculture entailed by our present methods of sewage disposal. The loss was not nearly so great as they imagined, for the bulk of the nitrogen was not available, and in fact the only way to make it available was to subject the dried sludge, like coal, to destructive distillation. By co-operation with the local gas officials experiments were to be made by him and them on making "producer" gas from the dried sludge with recovery of the nitrogen as ammonium sulphate. The other by-product to which he referred, viz., tar, had a melancholy interest for him as a sewage expert. Certain portions of the tar were until recently not commercially recoverable as they existed in the form of an emulsion, and not infrequently this aqueous residue found its way into the sewers and produced disastrous effects if allowed to enter the sludge digestion tanks. He was very pleased indeed to hear that this useless by-product might be used for making briquettes, etc., and he hoped the gas experts would be able to recover the whole of this tar and prevent it exerting its baneful influence on the biological operations at the sewage purification works.

Professor **Cobb**, in reply, said as regarded tar extraction and ammonia recovery in producer-gas plant, centralisation would simplify the cooling process, but he was doubtful as to air-condensers being applicable to large plants. The difficulty of cooling depended upon the fact that the thermal capacity was so enormously increased by the latent heat of the steam present. Calculations he had made on surface cooling gave discouraging results for a plant of any size. He agreed that a careful choice or treatment or both of water for such a boiler as the Bellington would be necessary. One difficulty of using coke oven gas in regenerative furnaces was the considerable loss in actual heating power, when the gas passed through the regenerator, on account of the decomposition of hydrocarbons. Mixing with blast-furnace gas was reported to be successful. He agreed that the coke oven process might deal satisfactorily with dust of certain qualities. Ash could not be determined accurately without very careful sampling because so much was concentrated in the smaller coal, and, particularly, the dust. He agreed that the question of purchasing coal, on standardised lines, would assume greater importance in the future.

London Section.

Meeting held at Burlington House on Monday, June 8th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

SOME STUDIES ON THE REDUCTION OF URANIUM OXIDE.

BY ERIC K. RIDEAL, PH.D., B.A.

Within the last two years several investigators have published papers drawing attention to the constant accumulation of uranium salts as by-products of the radium industry. The general idea of all is to draw attention to the necessity of finding (in the near future) some technical applications for uranium or its salts.

The use of the oxide to produce a yellow glaze in ceramics, and also a yellow opalescent glass, has long been known; and although this glass is of an expensive nature, up to 20% of uranium oxide being frequently added to produce a good colour, the consumption of uranium by these industries is not enough to absorb all the oxides at present available. It must be remembered that about one ton of pitchblende yields less than 0·2 grm. of radium, and the market for uranium colours is not expanding. Photographic work also consumes a certain amount of the supply. The uranous salts are effective reducing agents.

but appear to be more expensive to work with than the titanous compounds which have been extensively used in the trades.

Metallic uranium and uranium carbide have not been well investigated on account of the difficulties of preparation. It would appear, however, that if a method of manufacture were devised which produced this metal as economically as the more easily reducible tungsten, chromium or molybdenum it would prove an asset if not a valuable adjunct in many industrial processes. In an anonymous article in the Oest. Zeit. f. Berg. u. Huttenwesen, 1909, we are informed that uranium increases the tenacity of steel, and, although not quite as good as vanadium, chromium, nickel, or tungsten for general purposes, it is specially suitable for cannon metal, and armour plates. Frank L. Hess (U.S. Geol. Survey, 1911) records that uranium steel is very similar to tungsten steel but at the present time very much more expensive. Further investigation is needed to confirm these statements. Uranium carbide mixed with oxides has been used for the cores of arc electrodes as a source of ultra-violet light, while the metal and carbide are said to have been used in the production of gas mantles and electric filaments, although on account of the relatively low melting point of the metal the utility of the latter is not at once obvious. Possibly the carbide or an alloy of uranium and iron would be used as a substitute for "cereisen" in automatic pipe lighters and so on. Moreover, it furnishes a direct method of conversion of coal and probably gas coke into the more useful liquid hydrocarbons; but at the present time the method has no more than a scientific significance. The finely divided metal is even more efficient than osmium as a catalyst for the conversion of hydrogen and nitrogen gas mixtures into ammonia.

The following is an account of an investigation into the various methods of producing uranium from its salts; these methods are divisible into two classes.

1. Production from uranous salts.
2. Production from the black-green uranium oxide U_3O_8.

1. *Production of uranium from uranous salts.*

(a) Preparation of dry uranium tetrachloride.

Many methods have been suggested for the preparation of this salt from the oxide.* The following method gives good results.

Uranium oxide and sugar are heated together in absence of air to form an intimate mixture of carbon and the oxide, which is then heated to a low red heat in a current of chlorine saturated with carbon tetrachloride vapour. Crystals of the salt mixed with pentachloride sublime on to the cooler parts of the tube. Copper salts exert a little catalytic activity, but are removed by sublimation of crystals of a double salt UCl_42CuCl in the form of long golden brown needles. On redistilling the mixed chlorides in a current of dry CO_2, the tetrachloride is obtained in a state of purity.

(β) *Preparation of the metal from the chloride.*

According to Zimmermann [Ber. XV., 1182, Ann. 216, XIV. (1883)] uranium may be obtained as a black powder and as solid metal by reduction of the tetrachloride by sodium in the presence of sodium chloride. These experiments were repeated in a steel cylinder of the form shown in Fig. 1.

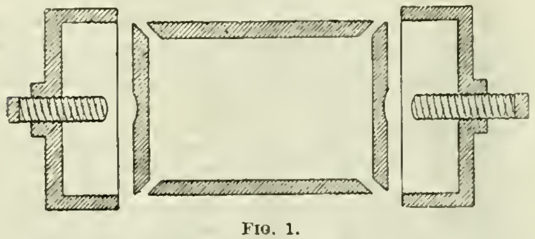

FIG. 1.

A mixture of 10 grms. UCl_4 with 4 grms. sodium and 4 grms. NaCl are heated to 800° C. in a resistance furnace for 45 minutes. The cylinder is subsequently cooled in oil, opened and washed out with alcohol and water; a brown powder containing 99·3% of uranium is obtained. Zimmermann's statement that melted uranium is obtained by this method has not been confirmed. The method has been investigated since these experiments were made in greater detail by A. Roderburg [Zeit. Anorg. Chem. LXXXI. (1913)], who has shown that the steel cylinder under the action of the sodium contributes varying amounts of iron to the uranium, and that uranium is not obtained molten under these conditions. Substitution of magnesium for sodium and of uranium tetrafluoride for the tetrachloride yielded less satisfactory results.

Electrolysis of uranium tetrachloride solutions. According to Ferée (Bull. Soc. Chim. [3], 622) uranium amalgam can be obtained by the electrolysis of an aqueous solution of uranium tetrachloride using a mercury cathode. The uranium is obtained by distilling off the mercury in vacuo. I repeated this method with a 5% UCl_4 solution and obtained a red liquid containing UCl_3 (Loebel, Ueber Halogenverbindungen des Urans. Dissert., Berlin, 1907), and a black deposit which contained both mercury and uranium. Only a very small quantity of uranium was recovered from the mercury; alterations in the current density, temperature, and concentration of the solutions did not markedly affect the result.

As a general conclusion the preparation of uranium from uranium salts does not appear feasible from the industrial point of view.

2. *Production of uranium from urano-uranic oxide* (U_3O_8).

This oxide is the usual article of commerce, and is therefore the most suitable for use as a raw material for direct reduction. With A. Fischer (Zeit. Anorg. Chem. LXXXI., 170, 1913) I have shown that pressed urano uranic oxide possesses a distinct electrical conductivity its sp. resistance at 18° C. lying between 2702 Ohms/cm and 2705 Ohms/cm.

The following curves showing the relationship betwee current, temperature and applied electromotive forc indicate that the conductivity is pseudo-metallic at lo

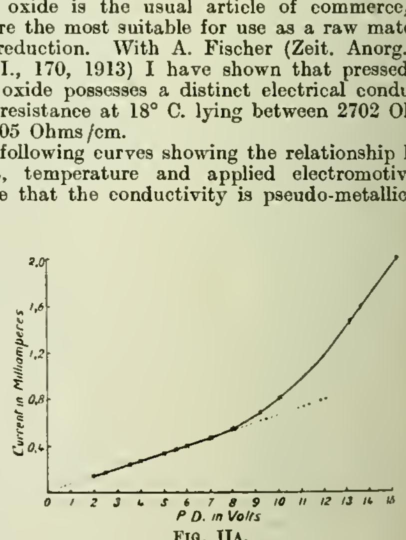

FIG. IIA.

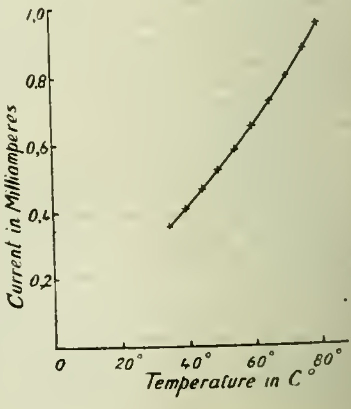

FIG. IIB.

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* Zimmermann, Ber. 1938 (1881). Lothar Meyer, Ber. 181 (1887). Camboulevis C.R. 150, 175. A. Colani, Ann. Chem. Phys. (8) 12, (1907).

E.M.F.'s and afterwards electrolytic in character, a somewhat remarkable phenomenon in a coloured powder.

The decomposition voltage between platinum electrodes is 7·0 volts. The rapid increase of the conductivity with the temperature suggests the possibility of electrolysis in the solid state in an atmosphere of hydrogen, the liberated oxygen being removed as fast as it is formed. The form of apparatus is evident from the appended figure.

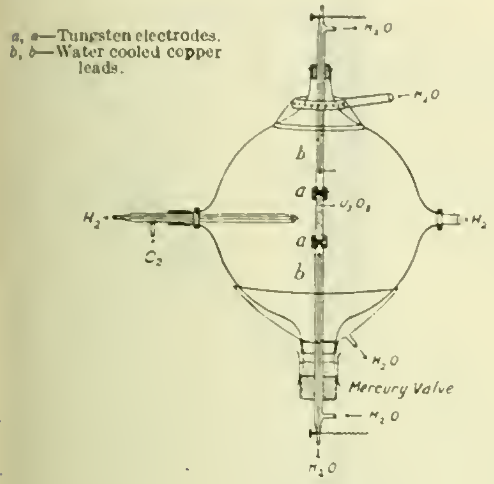


FIG. III.

Tungsten electrodes must be used, since when carbon ones are used much carbide is formed. The pressed oxide in the form of a rod mounted between the tungsten electrodes is heated by the oxy-hydrogen flame: when warm the oxygen was burned off and the heating continued for one hour at a temperature of 1200° C. by means of the current in a hydrogen atmosphere. Analysis of the resulting product yields: U 89·5%; UO_2 contains 88·2%.

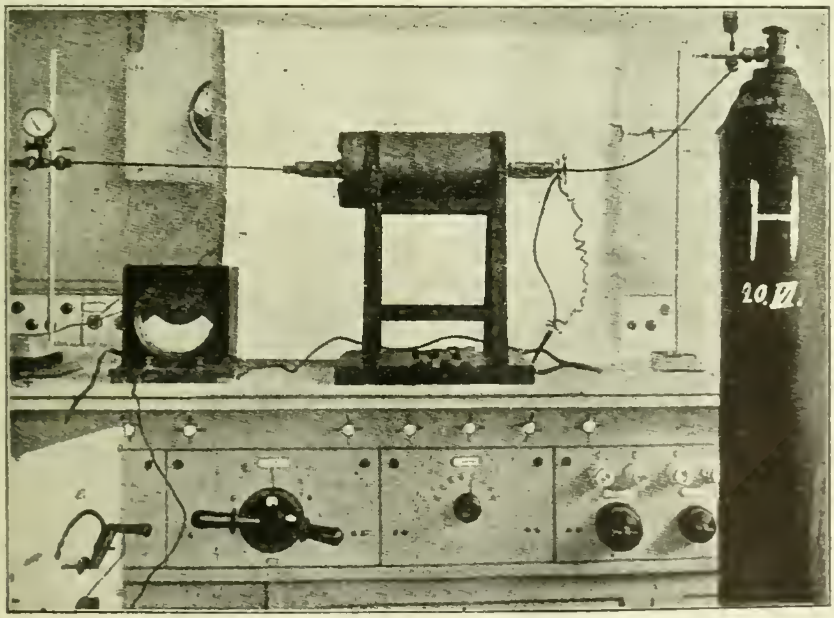


FIG. IV

The product is black, of a well-defined crystalline character, and easily soluble in strong nitric acid with the evolution of nitric oxide fumes.

Since indications have been obtained of reduction by means of hydrogen under normal pressures it seemed worth while to attempt the reduction by this gas under pressure.

Accordingly a special furnace was designed and constructed for the purpose.

The furnace consisted of an iron shell 100 mm. internal and 178 mm. external diameter 300 mm. long turned out of the solid. One end of this cylinder was an integral part of the whole, while the lid, 39 mm. thick, was attached by 8 screws, each 17·5 mm. in diameter. A gas-tight joint between cylinder and lid was obtained by means of a copper asbestos ring. The inside was lined with asbestos paper.

The heater was constructed of a porous porcelain cylinder wrapped with platinum wire, which was embedded in a paste of a mixture of precipitated alumina with a trace of magnesia. When the paste had set it was covered with asbestos paper and iron sheathing. Thick platinum leads insulated by quartz tubes and asbestos discs were brought through the lid of the furnace, the asbestos discs being tightly compressed by cone-shaped check nuts. The leads for a pyrometer were brought through in a similar manner. By this artifice the heating unit could be taken out at will for repairs or replacement.

Admission and escape for the hydrogen was provided by weldless copper tubing brought through the lid and end of the furnace respectively. With a current of 10 amperes at 220 volts, a temperature of 1000° C. could be maintained for prolonged periods, while a slow current of hydrogen, controlled by Desaga valves, at 100 atmospheres pressure was continually passing through the apparatus The oxide U_3O_8 however could not be reduced further than UO_2 under these conditions.

Experiments were then made on the possibilities of applying the "Thermite" process to this reaction. According to Aloy (Bull. Soc. Chim. 25, 344) and Stavenhagen (Ber. 32, 1899) magnesium or aluminium powder will reduce the oxide U_3O_8 to metal of 96%—97% purity. On repeating Stavenhagen's experiments only a regulus of magnesia or alumina with uranium dioxide and metallic magnesium was obtained. It appeared that the temperature of the mixture did not rise high enough to complete the process of reduction unless sufficient air was present, which of course permitted the uranium metal to re-oxidise.

Finally an electro-thermal thermite process was adopted which yielded excellent results :—

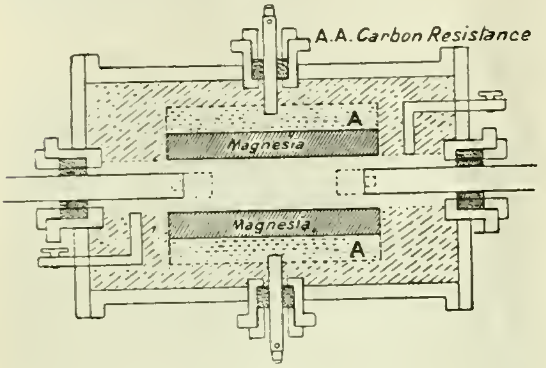


FIG. V.

Briefly the apparatus consisted of a resistance combined with an arc furnace. The granular carbon resister was used to heat up a tube of pure magnesia which contained a mixture of 80% U_3O_8 and 20% magnesium powder pressed into the form of solid rods by means of an oil press. The ends of the rods in the magnesia tube were placed in contact with carbon electrodes, and a current of hydrogen was passed through the apparatus. When hot enough they became conducting and the main electrodes were connected to the 110 volt mains which caused an arc (at a current of 30—40 amperes) of magnesium vapour to play in the centre of the magnesia tube. The magnesium vapour effectively reduced the uranium oxide to metal.

The hydrogen had to be displaced by carbon dioxide before the finely divided "uranium black" could be exposed, since the fresh metal spontaneously ignites in the air. The magnesia could be separated by washing with dilute acetic acid; this did not seriously diminish the yield of uranium. Analysis yielded 98—99% metal.

Reduction of the oxide may also be brought about by magnesium powder and sodium in the presence of calcium chloride as a catalyst.

A mixture of 50% U_3O_8, 15% $CaCl_2$, 15% Mg. 20% Na, was heated in a small steel cylinder to a bright red heat. After being cooled in oil the cylinder was opened and washed out with alcohol, weak acetic acid, and water; the product was a powder grey black in colour and contained 99·4 to 99·6% metal with traces of iron.

Reduction with carbon.

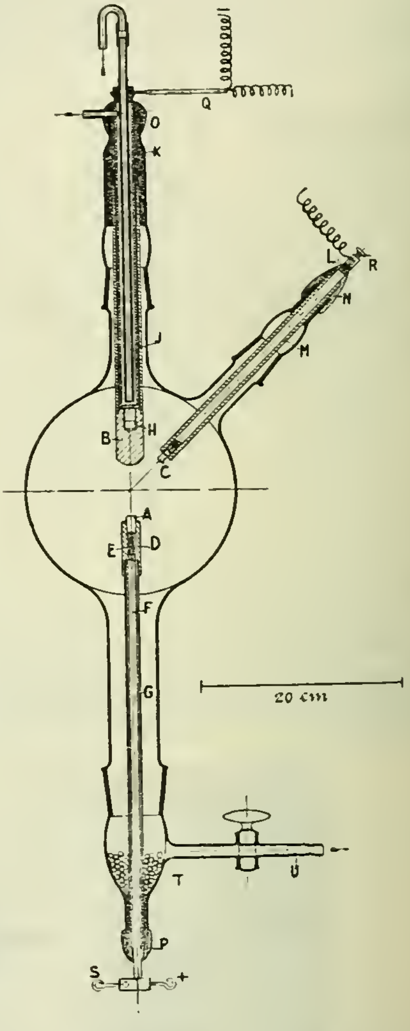
According to Moissan [C.R. 122 (1896), 1088] and Moxter [Zeit. Anorg. Chem., 78, 231, (1912)] uranium oxide is reducible to metal of varying purity by carbon in the arc furnace, when proper precautions were taken. Uranium is technically made by this method and varies in purity between 96 and 98% metal (0·1% deficiency is equivalent to roughly 1% uranium carbide as carbon).

On a small scale it was found that even this state of purity could not be obtained. Professor Hodgkinson's method of using calcium carbide might yield more favourable results.

Fusion in vacuo.

The m.pt. of uranium containing 0·4% carbon lies between 1300° and 1400° (uncorrected). The apparatus used was Roderburg's modification of Wartenberg's vacuum furnace (Ber. 40, 3287, and Zeit. Anorg. Chem., LXXXI., 1913), which, as it probably has a future in industrial chemistry, is described below.

The apparatus consists of a glass globe of about 3 litres capacity with three carefully ground-in tubular attachments. The lower one holds the anode A, a short rod of tungsten metal surrounded by a magnesia tube D and a quartz tube B; the rod is attached to the lead F, a brass rod fixed in the end of the tubular attachment by means of sealing wax. The upper tube is water cooled and carries a massive tungsten cathode B coated with the oxides of barium and calcium. The small electrode C serves as an auxiliary electrode.



The apparatus is evacuated to 0·01 mm. of mercury and an alternating current is sent through B and C (th voltage necessary varies between 2000 and 4000). Th electrode B emits white hot particles which permit direct current of only 100 volts pressure between th electrodes A and B to arc across.

The main drop of potential and consequently th maximum heat formation occurs at the surface of the smal anode A which shortly begins to melt. The point of fusio is determined by an optical pyrometer.

It is evident that A may consist of any metal provide it is in the form of a short conducting rod.

The author devised a modification of the apparatu for the fusion of powders or non-conducting solids.

The small tungsten electrode A is replaced by a annular one containing a small magnesia crucible fitte with a magnesia block lid. An apparatus of this siz can be made to take a crucible of about 2 c.c. capacit

A similar apparatus can be constructed of metal (*e.g* copper) provided that due precautions are taken f insulation. By setting the electrodes A B horizont instead of vertical, and feeding the electrode A by mea of a worm as required, considerable amounts of metal fuse in vacuo may be obtained.

New York Section.

Meeting held on Friday, January 23rd, 1914.

MR. G. W. THOMPSON IN THE CHAIR.

THE INVENTION OF CELLULOID.

The following remarks were made by Prof. C. F. Chandler on the occasion of the presentation of the Perkin Medal to Mr. Hyatt (see this J., March 16, 1914, pp. 225—229), and were omitted from the published report :—

I should not take up your time by enlarging further on the history of celluloid were it not that in one of our most important and most recent works on applied chemistry I find it stated as follows under the head of celluloid :—

"The substance was first produced by Daniel Spill of Hackney, England, and came into commerce under the name of Xylonite.

"Spill's method of converting the nitrocellulose has been followed for more than forty years."

I have had occasion, in connection with celluloid and nitrocellulose litigation, to study most carefully the history of the pyroxylin industry, and there is no logical ground for making the above statement. Celluloid was invented by the brothers Hyatt, and not by anyone else. This whole matter has been thrashed out in the Federal Courts as long ago as 1886, and the Hyatt patents have been sustained, although everything that had been patented or published was carefully studied and discussed during the litigation.

It is quite true that many other experimenters sought to prepare useful plastic compounds with the aid of pyroxylin prior to the Hyatt invention of celluloid. Most prominent among these experimenters we find Alexander Parkes and Daniel Spill, but neither one of them ever suggests the essential features of the Hyatt method for manufacturing celluloid. Parkes' patents relate to the following points :—(1) Making liquid solutions by the use of various solvents, rendering the material less inflammable by adding chloride of zinc or tungstate of soda or gelatin dissolved in acetic acid. (2) Making sheets by pouring the solution on glass and allowing it to evaporate. (3) Dehydrating wood alcohol or naphtha as a solvent by distilling over chloride of calcium. (4) Adding castor or cottonseed oil, gums or resins, or oil previously treated with chloride of sulphur to the solvents. (5) Introducing nitrobenzene or glacial acetic acid or hydrocarbon solvents.

In one patent he proposed to remove the solvent from the solution of pyroxylin by adding water, mineral naphtha, or other liquids. In another patent he gives compositions to be used as varnish.

There is nothing whatever in any one of these patents that anticipates Hyatt.

As for Daniel Spill, his patent 2666 of 1867 suggests as substitutes for dehydrating alcohol or wood naphtha as a solvent for pyroxylin, fish, vegetable oils, essential oils, resins, gum resins, spirits of turpentine, fats, light oils and naphtha from coal and mineral naphthas.

One example of a suitable solvent contains 80 per cent. alcohol and 20 per cent. of rosin. Another contains 60 per cent. of alcohol, 3 of castor oil, 1 of essential oil of lavender, 3 of resin and 34 of coal naphtha or benzol.

The Spill patent 3984 of 1868 claims the production of compounds of Xyloidine by the employment of non-volatile solvents, mentioning animal, fish, vegetable, or mineral oils, as mineral tar, lard oil, cod liver oil, camphor oil, or liquid camphor, linseed oil or heavy coal oils or mixtures of the same. He further states that the following substances may be added: paraffin, camphor, resins, fat, wax, india rubber, gutta percha or balata gum or mixtures of the same. He gives the following example :—

Camphor, camphor oil, or liquid camphor	20 parts by weight.
Oil, such, for example, as castor or linseed oil, either before or after such oils have been oxidised or boiled	40 parts by weight.
Xyloidine..............................	40 parts by weight.

The claim of the patent is for the production of compounds of Xyloidine by the employment of non-volatile solvents.

This is also the essential feature of the claims of Spill's American patents 91,377 and 91,378 in 1869.

Spill took out another British patent 3102 of 1869, substantially identical with U.S. Patent 97,454 of the same year. This does not differ materially from his prior patents. He mentions a great variety of solvents, many of them mentioned in his previous patents and these he groups under eight numbered paragraphs and gives the following as the only example of his invention :—

Xyloidine..............................	27 parts by weight.
Castor oil	27 parts by weight.
Camphor	6 parts by weight.
Solvents, either of the Nos. 1, 2, 3, 4, 5, 6, 7, 8	40 parts by weight.

The Spill patent 180 of 1870 is for bleaching Xyloidine. His patent 787 of 1870 and his U.S. patent 101,175 of 1870 are for the employment of evaporating and concentrating apparatus, to remove the solvent from the fluid preparations and convert them into masses of a greater degree of consistence, at the same time recovering the volatile solvents evaporated.

These inventions give a fair picture of the condition of the efforts to make a useful plastic from pyroxylin prior to the date of Hyatt's invention of celluloid which was patented July 12, 1870, and which in the clearest and most unequivocal language sets forth the nature of his invention. His claims are as follows :—

1. Grinding pyroxyline into a pulp, as and for the purpose described.

2. The use of finely comminuted camphor-gum mixed with pyroxyline pulp, and rendered a solvent thereof by the application of heat, substantially as described.

3. In conjunction with such use of camphor-gum, the employment of pressure, and continuing the same until the mold and contents are cooled, substantially as described.

Considering the claim that Daniel Spill was the inventor of celluloid, it is very significant that as late as the 11th of May, 1875, he took out a British patent 1739 of that year, for producing and applying Xyloidine. In this patent he makes no references to any material that could possibly be called celluloid. On the contrary, he recommends the following mixture as a suitable solvent for soluble guncotton or Xyloidine :—

250 parts by weight of alcohol.
150 parts by weight of ether.
10 parts by weight of nitrobenzole.
33 parts by weight camphor or camphor oil.
250 parts by weight hydrocarbons, from coal, shale or other bituminous substances boiling between 220 and 400° F.

Or he says the following solvent may be employed :—

400 parts alcohol.
200 parts hydrocarbons, before referred to, and
33 parts of camphor or of camphor oil.

Now this patent was taken out nearly five years after Hyatt's celluloid patent, and although Spill in this patent suggests adding a small quantity of camphor to large quantities of other solvents, volatile and non-volatile, he always mentions it as camphor or camphor oil, regarding them as equivalents. They certainly are equivalents for Spill's purposes to produce liquid solutions of pyroxylin, but camphor oil is not equivalent to camphor in Hyatt's process for making celluloid and it would be absolutely impossible to make celluloid by any process suggested in any one of these patents of Spill or Parkes, or any other inventor prior to Hyatt, and this is what the federal judges decided when the matter was tried out in court.

Meeting held at Chemists' Building, on Friday, April 24th, 1914.

MR. G. W. THOMPSON IN THE CHAIR.

WHO INVENTED CELLULOID?

BY ROBERT C. SCHÜPPHAUS, PH.D.

Being the author of the article on celluloid in the new edition of Thorpe's Dictionary of Applied Chemistry, from which Prof. Chandler* submits a mangled quotation with his emphatic disapproval, and looking back on thirty years' experience in the celluloid industry, I feel constrained to reply to the statements of the Professor.

It is necessary first to repeat that part of the history of the nitrocellulose industry which bears on the pyroxylin-camphor compound best known as celluloid. I concede at the outset that the word "celluloid," the registered trade-mark, was coined by one of the Hyatt brothers and that several books on the industry, all of them written by outsiders, ascribe the invention to Hyatt or the Hyatt brothers. Even Beilstein's great handbook falls into this error.

The first mention of camphor in conjunction with pyroxylin is contained in the British patent 1638 of July 26th, 1854, granted to James A. Cutting, of Boston, U.S.A., for photographic pictures. Cutting dissolved 32 grains of camphor in a pint of collodion, already containing 80 grains of potassium iodide, and claims by this addition to increase the vigour and distinctiveness of delineation of the positive picture and particularly the half tints, also the beauty of the picture, by giving a fineness of deposit not heretofore attained by any other means. The very nature of his solvent prevented him from observing any solvent action on the pyroxylin due to the presence of camphor, and nobody will be rash enough to assert that this disclosure of Cutting constitutes the invention of the pyroxylin-camphor compound.

The next mention of camphor is in British patent "Manufacture of Compounds of Pyroxylin" No. 1313, of May 11th, 1865, of Alexander Parkes, Birmingham, the one which is relied on to try to rob Spill of the credit due to him. Parkes mentions in this specification four solvents of low volatility, aniline, nitrobenzol, glacial acetic acid, and camphor, the latter only casually. The three former are specifically enumerated in his claim, but camphor is omitted, a point of significance to any one familiar with patent matters, especially in view of the fact that Parkes and Spill were associates. There is not a word in either this or any other of Parkes' patents that directs the joint use of absolute alcohol and camphor, as has been deduced by some from the famous decision (rendered August 21st, 1884) which held Spill's U.S. patent of November 30th, 1869, invalid. In patent 1313, Parkes recommends, as he does elsewhere, absolute wood alcohol or what he conceived to be such; and in his British patent No. 2675 of October 28th, 1864, "Preparing Compounds of Guncotton and other Substances," he states that alcohol, treated in an analogous manner, may be substituted for wood alcohol. Now both these alcohols gelatinise pyroxylin, so the dissolving power of camphor was not disclosed. Spill, who was a keen observer, noted that it was possible to use moist pyroxylin, as may be gathered from several of his patents, and drew the conclusion that in certain combinations the employment of anhydrous alcohols was not essential. In his British patent 2666 of September 21st, 1867, "Treating Xyloidine," he gives us the important solvent commercial grain alcohol mixed with benzol. Two years later, in British patent 3102 of October 26th, 1869, and U.S. patent 97,454 of November 30th, 1869, he published his famous formula of a solution of camphor in commercial grain alcohol, and this formula and this disclosure are and have been the foundation of the celluloid industry. Spill's process of gelatinising pyroxylins by means of this solvent and masticating the pasty mass between rolls is and has been the process followed by celluloid manufacturers all over the world, Hyatt and his backers included, and not the visionary, inoperative process of U.S. patent 105,338 of July 12th, 1870, granted to John W. Hyatt, jun., and Isaiah S. Hyatt. The patent covering this alleged invention was several times re-issued, exalted to the state of a fetish, and made an instrument of the most oppressive patent litigation. Hyatt disclaims the use of alcohol, but in practice cannot do without it. What his actual knowledge was, is best evidenced by this quotation from the text of U.S. patent 105,338: "The product is a solid about the consistency of sole leather, which subsequently becomes as hard as horn or bone by the evaporation of the camphor. Before the camphor is evaporated the material is easily softened by heat, and may be moulded into any desirable form, which neither changes nor appreciably shrinks in hardening. We are aware that camphor made into a solution with alcohol or other solvents of camphor has been used in a liquid state as a solvent of xyloidine. Such use of camphor as a solvent of pyroxylin we disclaim."

In passing, I may remark that the step of the first claim "Grinding pyroxylin into a pulp" was published in British patent 2249 of September 15th, 1860, granted to Stephen Barnwell and Alexander Rollason.

That Hyatt experienced great difficulty in circumventing Spill's patents and in fact did not succeed, does not constitute him the inventor of the pyroxylin-camphor compound which Spill first made, and which is made to-day by Spill's original method.

The decision that the step taken by Spill was too short to entitle him to a patent may have appeared very obvious in 1884, especially to his rivals, but I am of the opinion that it was a tremendous leap forward in 1869. But whichever way one may view this decision, it does not establish that Hyatt was the inventor of celluloid, the material, not the trade-mark, nor that Hyatt's process is the one used in the industry. Rather the reverse; it says that anybody may use Spill's process, Hyatt's backers, the defendants in this suit, included.

Considering the exceptional opportunities which Prof. Chandler has enjoyed to acquaint himself with the real processes and the history of the cellulose industry, nothing could be less defensible than the use he tries to make of Spill's British patent 1739, of May 11th, 1875. I append an extract from a circular of the Xylonite Company Limited, bearing date of March 31st, 1871, which shows better than anything else what had been accomplished at that early date.

"The Xylonite Company Limited."
"Manufactory: Hackney Wick, London, N.E."
"Mr. D. Spill, Manager."

"Xylonite: a substitute for Ivory, Bone, Horn, Tortoise-shell, Hard Woods, Vulcanite, Papier Maché, Marbles, Brass, and Veneers for Cabinet Work. It is also applied to Waterproofing Fabrics, Leather, Cloth, Book Binders' Cloth, Card Cloth, Writing Tablets, Bagatelle Balls and Pianoforte Keys, Gear and Friction Wheels, and Bearings for Machinery, Spinners' Bosses, Tubing; and as an Insulator and protector of Telegraph Wires.

"It may be embossed, turned, polished, and worked in the same manner as the substances above named; is not affected by chemicals or atmospheric changes, and is, therefore, valuable for shipment to hot climates.

"It is also applicable to Photographic purposes, viz., as windows for the Dark room, for which the material is chemically prepared so as to arrest the actinic rays of light. It can also be spread upon fabrics for the purpose of Field Tents, thus avoiding the use of coloured glass windows; and lastly, differently prepared, is a substitute for glass plates for Negatives, it having the advantages of being light, flexible, and durable, and perfectly structureless."

(Full instructions are given for surfacing and polishing sheet xylonite and for working and fixing handles.)

Tons of Spill's Xylonite were at this time imported into this country. Worden's description (Nitro-cellulose

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* See preceding, page 677.

Industry, pp. 571, 572) of Spill's work is incomplete; his criticism of Parkes' processes (*ibid.*, p. 568, footnote) does not tally with the facts.

In regard to the dehydration of pyroxylin by means of alcohol, Mr. Hyatt labours under a misapprehension. This process is about as old as collodion itself, and was first patented by Cutting in 1854. It was first employed in an industrial way by J. R. France, the late President of the Arlington Company (died in 1895), and when his Company was sued for infringement of the Hyatt alcohol dehydration patent, it took only one hearing to cause a discontinuance of the suit.

The invention of celluloid has been discussed* before. I think I gave Mr. Hyatt due credit in the article which Prof. Chandler takes exception to, as I also did in 1895, when I said: "In the United States, J. A. McClelland and John H. Hyatt were at work to utilise the valuable properties of soluble pyroxylin. But ani nvention overshadowing all the others in importance was made by Daniel Spill in 1869, when he first produced a pyroxylin-camphor composition, plastic at about 75° C., by gelatanizing pyroxylin by means of a solution of camphor in commercial grain alcohol. As far as the chemical side is concerned, Daniel Spill must be hailed as the father of the celluloid industry, while to John W. Hyatt, at that time of Albany, N.Y., the greatest credit is due for devising suitable machinery for the intricate processes involved, for discerning the importance of pure materials, and for the perseverance which he exhibited under most adverse conditions."

It would have been much better to have the presentation of the Perkin medal to Mr Hyatt based on the things which he accomplished, of which there are a good many.

Discussion.

Prof. C. F. **Chandler** said that Dr. Schüpphaus had laid considerable stress on the fact that he had had thirty years' experience in the celluloid industry. His (the speaker's) familiarity with pyroxylin began about 1851, when as a boy fourteen years of age, he had made explosive guncotton, whilst in 1857 he had made his own soluble pyroxylin and collodion for photographic purposes, and, during recent years, had had occasion to look up the history of pyroxylin plastics as expert in the Kodak film case which had been recently decided. Since that time he had acted as expert in several investigations involving pyroxylin, explosives, varnishes, etc., and in June, 1881, had testified in the suit of Daniel Spill against the Celluloid Manufacturing Company. But in forming an opinion on the subject under discussion, he did not rely on his own experience. The issue was a matter which must be settled by facts. His quotation from Thorpe's dictionary was verbatim as follows: "The substance was first produced by Daniel Spill, of Hackney, England, and came into commerce under the name Xylonite." "Spill's method of converting the nitrocellulose has been followed for more than forty years." A verbatim quotation of two entire sentences, can hardly be said to be "mangled." In the first edition of Thorpe's Dictionary, the credit of first making celluloid is given to Hyatt. Further, Dr. Schüpphaus seemed to err in the use of the word celluloid, by making it include plastics containing not only pyroxylin and camphor but a variety of other substances such as animal and vegetable oils, gums, resins, etc., such as were made by Parkes prior to 1855 and later by his pupil, Spill, who became associated with Parkes in 1864 in the Parkesene Co. They did not call their product "Celluoid," and he had seen no evidence that led him to think hat they had ever made celluloid till after Hyatt made t, and a man who learned the process from Hyatt, later ntered the service of Spill.

The American conditions on which patents were granted were quite different from those that prevailed in England. n the United States, a patent could only be issued to the rst and original inventor. If a man who was not the riginal inventor secured a patent, it became null and void when it was shown that he was not the inventor. In England it was quite different. On March 23, 1876, Daniel Spill's Bill of Complaint against the Celluloid Manufacturing Co. was sworn to, and promptly filed in the Circuit Court of the United States. Spill came over himself, employed the best patent lawyers, testified himself, produced many other witnesses, took testimony in London by Commission, and spent eight and a half years in vainly trying to prove that the Celluloid Co. had infringed his patents. The weakness of his case was shown at the outset. With all his patents and those of Parkes, he was only able to charge two infringements: the use of camphor and alcohol solvent under patent 97,454 of 1869, and the bleaching of pyroxylin under patent 101,175 of 1870. The case was argued before Judge Blatchford, one of the most eminent United States judges, especially experienced in patent litigation. In his opinion given May 25, 1880, he decided that the defendant, the Celluloid Co., had failed to prove that Spill was not the first person to use camphor and alcohol to dissolve pyroxylin, or that he was not the first person to bleach pyroxylin. He declared both patents valid, and awarded to Spill recovery of profits and damages, to be ascertained by reference to a master, and a perpetual injunction. The injunction, however, had proved inoperative, for when the Celluloid Co. continued to manufacture and Spill's counsel made a motion to punish the Company for contempt, the Company showed that it had given up bleaching pyroxylin, and had substituted methyl alcohol for ethyl alcohol. The court had ruled that this was a valid defence and that the Company was not in contempt, so they continued to manufacture. In the meantime, the plaintiffs had proceeded to prove damages and profits and the defendant Company put in further evidence in defence. On February 25, 1884, the Master had filed his report, stating that Spill's lawyers had failed to furnish the necessary data to enable him to report any profits, or to fix any damages. Spill's lawyers claimed $276,667.66 on account of the alcohol camphor patent; $504,306.25 on the pyroxylin bleaching patent. The litigation was continued, more testimony was taken by both sides, and on August 21, 1884, Judge Blatchford reversed his original decision against the Celluloid Co. He decided on the testimony and documents presented that Spill's patent 97,454 was invalid as far as it claimed the use of camphor and alcohol as a solvent for pyroxylin, for the reason that this invention was made by Parkes. Further, he decided that Spill's patent 101,175 was invalid as far as it claimed bleaching pyroxylin, as that was not a patentable invention.

He did not think that either Dr. Schüpphaus or himself was competent to reverse the final decision of Hon. Judge Blatchford, reached after many years of litigation in which Spill had every opportunity to prove his case. He had certainly failed to prove that he invented celluloid, or that Hyatt's company had appropriated anything that he had invented.

Dr. R. C. **Schüpphaus** said in reply to Professor Chandler that he had been in six interference suits, and had been a witness and principal in more than a dozen patent suits. Of course, the fact that Spill was the inventor was shown by his United States patent. He naturally could not sue anybody in the United States on a British patent. He had explained somewhat in detail the decision of Judge Blachford in the suit of Spill against the Celluloid Company. It was not true, as he had said before, that in any of Parkes' patents could be read instructions to use absolute alcohol and camphor in conjunction. It could only be read into them. Spill, of course, did not claim the use of absolute alcohol and camphor, but he did claim the use of commercial grain alcohol and camphor, revealing for the first time the solvent properties of camphor, and that was a tremendous advance. It was very easy for a Judge in 1884 to give a decision that the step was too short to entitle Spill to a patent. But in those days it was a tremendous step, and it was an invention, and he thought that it might be upheld. Of course, the fact that Judge Blachford reversed himself was not a fit subject for discussion in a technical society.

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* Schüpphaus, this J., 1895, **14**, 557; 1907, **26**, 383. Joyer, J. ad. Eng. Chem., **3**, 194, 702.

Communication.

AN EFFICIENT STIRRING APPARATUS.

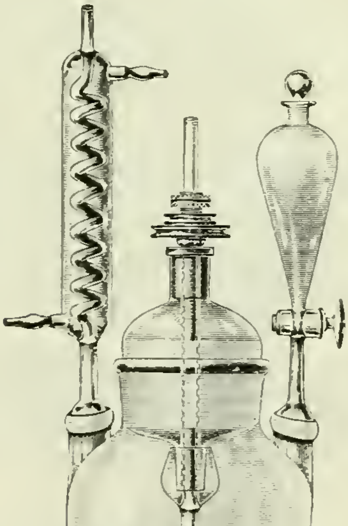
BY WILHELM GLUUD AND RICHARD KEMPF.

(*Contribution from the Davy-Faraday Laboratory, Royal Institution.*)

In chemical literature many suggestions are given for stirring apparatus which can be made by the worker himself from the simplest materials. Modern laboratory work, however, does not afford time for making apparatus: everything must be ready to hand and certain to work. Moreover, no ready-made apparatus would stir under varying conditions, such as under reflux, with exclusion of air, at high temperatures, etc. We had thus to make such an apparatus for ourselves.

The main idea of the construction is to meet as many needs as possible with *one* apparatus. We therefore made a constriction in the vessel, so that the part below the constriction held 500 c.c., in order to secure effective stirring of small quantities of liquid down to 150 c.c. The total capacity of the flask is about 1500 c.c., and this volume of liquid can be easily worked.

We had to avoid all rubber and cork stoppers, so as to be able to use the apparatus for nitration and similar processes, a thing which, so far as we know, is not done by any previous contrivance.* It was also necessary to make it possible to heat the whole arrangement in an oil- or water-bath, which, in spite of the strong glass used in its construction, can be done without any risk, owing to the high efficiency of present-day glass manufacture.



The apparatus also must easily be taken to pieces. This is done by loosening the screw above the driving-wheel. The inside screw is split, and, on screwing down the nut on to it, contact is made between the metal and the stirring-rod. The pear-shaped vessel fused to the shaft of the stirring rod serves the purpose—by trapping the lower end of the ground stopper in a fluid seal—of effectively preventing contact between the vapours in the main flask and the metal parts of the apparatus. In order to make all parts of the apparatus detachable, we had to arrange this pear-shaped vessel inside the main flask in which the reaction takes place.

The shape of the stirrer (which reaches nearer to the bottom than is shown in the diagram) adapts it for stirring up precipitates and making oils into emulsions.

The size of the hollow ground-stopper, which was necessitated by that of the stirrer, at first seemed somewhat dangerous, but nevertheless proved quite satisfactory. We chose this form of stirrer (which corresponds to the form used by Pieraerts (Chem. Zeit. 29, 671 (1905)), and which is like that used in the mash-tubs of breweries) because those with movable arms,* used, for instance, by E. Fischer (*loc. cit.*), often give trouble, especially when dealing with heavy liquids or thick precipitates.

Working at ordinary temperatures, it is sufficient to fill the pear-shaped vessel round the stirrer with water, paraffin oil, or mercury (in the latter case only half full). There is no danger of these liquids coming over the edge. At higher temperatures, some of the reaction mixture will distil over into the pear-shaped jacket. If interaction with the mercury should take place, as, for instance, in nitration, it is better to use instead a liquid heavier than water or dilute nitric acid, such as nitrobenzene or bromnaphthalene, etc., or, better still, to fill the jacket nearly full of water, then set up the whole apparatus, raise the stirrer a little, and, with a pipette, introduce a little paraffin oil into the space thus left between the metallic connection attached to the stirrer and the connection in the neck of the hollow stopper. The oil collects in the elongated joint of the ground-stopper, above the water, which may be contaminated with acid constituents, and prevents these from coming into contact with the metal. Our experience shows that even in rapid rotation the oil always stays in its place inside the elongated part of the stopper, but it is necessary to find out what quantity of paraffin is needed, as the different forces produce a stretching of the oil-layer, which may cause oil to enter the jacket itself.

In cases where contamination by acid vapours may be expected, the apparatus is very useful. When working in an atmosphere other than air, *e.g.* hydrogen, the dropping funnel can be replaced by a stopper fitted with inlet- an outlet-tubes, and liquids can be introduced through th condenser. For purposes of temperature measurement the apparatus is also fitted with an upright condenser int which a thermometer can be inserted.

The apparatus stands firm by reason of its own weight *one* clamp being sufficient, and even in rapid rotation th vibration is very slight. Steady rotation is best maintained by means of a small electro-motor, and the spee is regulated by tightening or loosening the belt connectin the motor to the stirrer.

Care should be taken to oil the joint of the stirrer an to grease the ground-stopper well. If grease must b avoided, graphite can be used instead. (R. Kemp J. Pr. Chem. (2), **78**, 207 (1908).)

After continued working at high temperature, it advisable to loosen the stopper while the apparatus is sti warm. We never experienced any difficulty in doing thi as the grinding is very carefully carried out. We ke the apparatus working for days at 100°, being placed a small porcelain support covered with sacking in a vess of boiling water.

Among the numerous experiments for which th apparatus was successfully used, only the almost qua titative oxidation of *o*-nitrotoluene to *o*-nitrobenzoic ac may be cited, which Ullmann (Ber. 36, 1797 (190 carried out in a specially constructed copper kettle.

The apparatus may be obtained from Gebr. Muenck Schumannstr. 2, Berlin, N.W.

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* E. Fischer. Anl. zur Darstellung organ. Präparate, 7 Aufl, 1905, 23, Ber., **41**, 2882 (1908); Brühl. Ber., **37**, 923 (1904). Hesse. Ber., **39**, 1149 (1906), etc.

* Schulze, Ber., **29**, 2883 (1896); Mittelbach, Chem. Zeit., **31**, 1907). Plaueln, Chem. Zeit., **37**, 691 (1913).

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Paraffin motor; The ——. Times Eng. Suppl., June 26, 1914, **10**, 48.

Paraffin motors are suitable for powers of from 20 to 100 h.p. and have been constructed up to 180 h.p. The power obtained is about 10% less than with petrol, and the consumption is 0·7 to 0·8 pint of paraffin (sp. gr. 0·82) per b.h.p.-hour. The normal speed varies from 500 to 800 r.p.m. with the size of the motor, and the motor can be run down to one-fourth the normal speed. Paraffin carburettors, for running a petrol engine with paraffin, are not entirely satisfactory. In the paraffin motor, the vaporiser is usually heated by the exhaust gases, and the engine is started on petrol or the vaporiser is heated up by a blast lamp. A lower compression is used than in petrol motors.—A. T. L.

Mixing-machine; A new ——. L. Wickop. Z. angew. Chem., 1914, **27**, 318—320.

The stirring gear, working in a cylindrical vessel with a conical bottom, consists of a single paddle driven by a central vertical shaft. The paddle is shaped to act with centrifugal force in producing a funnel-like depression in the contents of the vessel. Adjustable "wave-breakers" are fixed at such a height that the outer and upper parts of the revolving liquid are dashed towards the centre of the funnel. Thorough mixing of the contents of the vessel is thus brought about very rapidly with low power consumption.—T. St.

Patents.

Mixing, washing, and screening materials; Apparatus for ——. F. G. S. Price, Glasgow. Eng. Pat. 12,191, May 26, 1913.

Two drums, mounted end to end, on the same horizontal axis, and containing respectively a right-hand and a left-hand approximately spiral passage, one of which is fitted with blades, communicate by a central opening containing a jet and a screw device for conveying material from one drum to the other. Peripheral ports receive and eject the material when the drums are rotated. The apparatus may be made wholly or partly of perforated material.
—O. E. M.

Boilers or evaporators. C. B. Catt, Harrogate, Yorks. Eng. Pats. 13,188 and 18,597, June 6 and Aug. 15, 1913.

The boiler is provided with vertical heating tubes into which gaseous or liquid fuel and air are passed; the fuel is burnt after impinging on fire-resisting granular material. The tubes are arranged in a circle around the axis of the boiler where the liquid to be heated is admitted. The air and fuel pipes leading to the tubes are similarly arranged in concentric circles and are connected with superposed air and fuel supply chambers. The supply pipes to these chambers are steam-jacketed.—A. T. L.

Evaporation and cooling of solutions or emulsions; Apparatus for the ——. W. G. Schröder. Ger. Pat. 273,547, Dec. 5, 1912.

The inner surface of a rotating jacketed drum serves as the heating or cooling surface. The drum is open at one end, but has a flange projecting inwards to retain the material. The solids which separate are removed from the surface of the drum by an adjustable scraper and fall into a trough whence they are removed by a screw conveyor driven by gearing from a spindle fixed to the closed end of the drum.—A. S.

Separators for treating inflammable or explosive materials; Electrostatic ——. J. Kraus, Braunschweig, Germany. Eng. Pat. 26,802, Nov. 21, 1913. Under Int. Conv., Oct. 27, 1913.

The electrically attracted particles are carried away by a movable dielectric arranged between the material to be treated and the attracting surfaces, the latter being formed of a substance which is a partial conductor, such as wood, marble, or the like, or of a non-conductor, such as glass, parchment, or the like.—B. N.

Centrifugal process of separation. J. Resines, Madrid. U.S. Pat. 1,097,561, May 19, 1914; date of appl., May 10, 1911.

A centrifugal separator comprises a cylindrical vessel rotating upon a vertical axis and having a number of horizontal ring-shaped baffles arranged in proximity to the cylindrical surface, so that the liquid passing through the separator is caused to flow alternately with and against the direction of the centrifugal force. The inner surface of the liquid in the separator is in contact with the atmosphere.—H. H.

Distillation apparatus. E. Hart, Easton, Pa., Assignor to General Chemical Co., New York. U.S. Pat. 1,096,838, May 19, 1914; date of appl., March 27, 1911.

At the top of the still is a horizontal tube from which a number of vertical tubes, closed at the lower end, project downwards into the still. The liquid (acid) to be distilled is run into the lower ends of the vertical tubes through thistle funnels, the heads of which are contained within a supply trough arranged above the apparatus.—H. H.

Crystallisation of salts and the like from solutions by cooling; Process for the ——. E. Fromme. Ger. Pat. 272,983, July 13, 1912.

The solution is forced through a cooling apparatus, under pressure, and with considerable velocity, whereby the crystals are prevented from adhering to the walls.—A. S.

Filtering apparatus. A. Hölken. Ger. Pat. 273,072, April 9, 1913.

The apparatus consists of two drums rotating in opposite directions, each composed of compartments, filled with sand and covered with filtering material. The material to be filtered is fed into the space between the drums and is carried forward and compressed between them. Means are provided whereby the compartments of the drum, as they become covered on their outer surface with the material, are put into communication with a suction device, in order to augment the capillary action of the sand and rapidly remove the liquid from the interstices thereof.—A. S.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Resins in Paleozoic plants and in coals of high rank. D. White. U.S. Geol. Survey, Professional Paper 85 E. pp. 65—83, plates ix—xiv.

The supposed absence of resins from the coals of higher rank has led to the view that the coal-forming floras of the Carboniferous period, to which most bituminous and higher-rank coals belong, were destitute of resin-bearing plants, and that these coals have not at any time existed as peats. From a study of petrified fragments of Carboniferous plants, and from observations of Paleozoic coals ("stone-coals"), the author concludes that some of the Carboniferous coal-forming vegetation contained secretions of a resinous nature which became concentrated in the coals owing to dehydration and the more rapid decay of the other plant tissues. Lump or exudate resins as well as canal secretions were found in Paleozoic coals of low bituminous rank. The failure to detect their presence in coals of higher rank is considered to be due to the changes which the resins undergo during the transformation of the coal. These changes, as shown in coals of the Cretaceous and Tertiary periods (usually lignites or brown coals), are a darkening of the colour to a smoky brown, followed by blackening, cracking and shrinking of the lumps, which are later reduced to dark brownish-black spongy or granular residues and finally to a thin, fine, powdery black scale. The reduction of the resins coincides with rapid de-oxygenation of the coal, and occurs when the proportion of fixed carbon in the coal substance is 60—65%. The qualities essential to the production of high-grade coke are developed at the same time.—A. T. L.

Refractory materials [for gas retorts]. Report of Refractory Materials Committee of the Institution of Gas Engineers. F. J. Bywater. J. Gas Lighting, 1914, **126**, 899—901.

Silica retorts.—These have recently been used in America with satisfactory results. The retorts were made from crushed ganister quartz (95% SiO_2), with 2% milk of lime as binding medium. They were of D-section, and were built up from bricks and tiles. The expansion on heating was 1/8 to 3/16 in. per foot, and was allowed for by making the joints either with thick paper or straw-board, which burned away leaving a thin carbon joint, or with cement consisting of mild aluminous clay, which shrank when heated. The mouthpiece ends of the retorts were made of solid moulded fireclay so as not to crack when cooled by the opening of the lid. The retorts were used with various types of hydraulic discharging machines. In some cases less carbon was formed on the inside of the silica retorts and the surface became glazed, facilitating discharge by pushers. The life of the retorts was 3½ to 4 years. The thermal conductivity was greater than with clay retorts, the fuel consumption was less, and the output greater owing to the shorter period required for burning off the charge.

Testing refractory materials under load.—The melting point of various clays used in the manufacture of firebrick and retort material was found to be 200°—320° C. lower when the clay was under pressures of 54 to 112 lb. per sq. in.—A. T. L.

Coke-ovens; Temperature distribution in ——. O. Simmersbach. Stahl u. Eisen, 1914, **34**, 954—958.

The temperatures in a Koppers oven were recorded every 12 minutes by pyrometers placed at three points along the axis of the oven, 1 metre above the sole, and also at three corresponding points in the free space above the coal. The period of coking was 29 hours. The temperature increased most rapidly, and was finally highest at the narrower charging end. The temperatures in the gas space above the coke did not change in the same way as the temperatures within the mass of coke at the corresponding points, but depended on the position of the gas-outlet. Samples of gas were taken every two hours. The proportion of carbon dioxide decreased from 3·3 to 1% in 19 hours and then became nearly constant; benzene decreased from 1·8% to zero in 17 hours; ethylene fell from 4 to 0·3 and methane from 36·65 to 4·7% during the whole period, whilst carbon monoxide increased from 0·9 to 5·8 and hydrogen from 42·5 to 70%. The heating value decreased from 5402 to 2419 cals. per cb. m.—A. T. L.

Surface combustion; Flameless incandescent ——. H. H. Gray. J. Gas Lighting, 1914, **126**, 786—789.

The author criticises the view that surface combustion consists in a catalytic action of the incandescent surface and that the combustion takes place in molecular layers in contact with the surface. The size of a gas flame is reduced by increased aeration, and depends upon the time required for the gas and the oxygen to mix and burn. The absence of flame when a mixture of gas and air is brought into contact with an incandescent surface is therefore to be expected. The process occurring in the tube of a Bonecourt boiler is considered to be a modified detonation in which the propagation of the combustion through the gaseous mixture is effected by the incandescent solid instead of by the adiabatic compression of a detonation wave. The setting up of a detonation wave is prevented by the rapid flow of gases in the opposite direction and by the baffling effect of the solid material.—A. T. L.

Carburetting water-gas; Thermal reactions in ——. M. C. Whitaker and W. F. Rittman. J. Ind. Eng. Chem., 1914, **6**, 383—392, 472—479.

The first portion of the paper comprises a comprehensive theoretical study of the manufacture of carburetted water-gas from the standpoint of mass action and thermodynamics, the effects of temperature, pressure and concentration on the equilibria being considered. (See also Rittman, this J., 1914, 626.) It is deduced from the theoretical considerations that to obtain a maximum yield of gaseous illuminants by "cracking" petroleum, the process should be carried out at low pressure (to increase the yield of gaseous products) and in an atmosphere of end products, such as hydrogen and methane (to prevent the decomposition of hydrocarbons otherwise necessary to furnish the proportions of such end products required to maintain equilibrium). The equilibrium conditions in the manufacture of "blue" water-gas have already been thoroughly investigated (Hahn, this J., 1903, 1038; Jüptner, 1904, 977; Allcut, 1911, 606; Neumann, 1913, 352), and in the present investigation only the "cracking" of the oil was studied experimentally. The oil used (400 c.c. in each experiment) was "150° (F.) water white oil" of sp. gr. 0·7984 at 15° C., b.pt. 150°—290° C. The results of some of the tests approaching most nearly the desired object, *i.e.*, to increase the yield of illuminants by obtaining the largest yield of hydrocarbons and eliminating, as far as possible, carbon dioxide, water vapour, deposited carbon, and tar vapours, are given in the following table:—

Temp.	Pressure.	Gas.	Carbon.	"Tar."	Illuminants in gas.
C.	atmos.	litres.	grms.	c.c.	%
750	$\frac{1}{20}$ to $\frac{1}{30}$	146	1	153	56·1
850	do.	211	3	100	52·9
900	do.	234	3	60	52·1
950	do.	235	12	58	46·9

In further experiments in which the oil was cracked in an atmosphere of hydrogen, a considerable proportion of the added hydrogen was converted into hydrocarbons, the quantity and quality of the gas increased, and the quantities of tar and deposited carbon decreased. (See also Hempel, this J., 1910, 261.)—A. S.

[Coal-gas;] Purification of —— by heat. C. C. Carpenter. J. Gas Lighting, 1914, **126**, 928—938. (See also this J. 1913, 742.)

Plant for passing purified coal-gas over finely divided nickel at 430° C. so as to convert carbon bisulphide into hydrogen sulphide, which is then removed, has been installed capable of treating 15 million cb. ft. of gas per day. The plant consists of 5 units, each comprising a gas-producer and combustion chamber, two heating chambers containing vertical reaction tubes packed with the catalytic material, and two heat-interchangers for preheating the gas to 400° C. The weight of nickel used is 1321 lb., and the plant consumes 5½ tons of coke per day. The average quantity of sulphur in the gas was reduced from 35·07 to 7·82 grains per 100 cb. ft. or by 77·7%. The greatest reduction was from 63·78 to 10·34 (83·8%), and the least, from 19·21 to 5·34 (72·2%). The quality of the gas was as follows :—

	Before treatment.	After treatment.
Illuminating power (candles)	14·7	14·7
Calorific power (gross B.Th.U.)	590	594·4
Naphthalene (grains per 100 cb. ft.)	5·54	4·71
Hydrocyanic acid („ „)	22·19	18·75
Analysis (% by vol.) :—		
Carbon dioxide	1·44	1·45
Hydrocarbons	3·55	3·63
Oxygen	0·33	0·06
Carbon monoxide	8·16	8·03
Methane	26·85	27·26
Hydrogen	54·19	54·25
Nitrogen	5·48	5·32

One of the retort houses was worked at low temperature so as to produce gas of average candle-power 20·54 ; after treatment the candle-power of this gas was 20·46. The capital cost of the plant was about £1500 per million cb. ft. per day and the working costs were 0·299d. per 1000 cb. ft., including repairs, maintenance, interest, and depreciation. Plant for treating 1½ million cb. ft. of gas per day has been worked for 2 years. The wasting of the reaction tubes is very slight and the efficiency of the catalyser is unimpaired.—A. T. L.

Lighting gas ; Removal of sulphur from ——. G. Anderson. J. Gasbeleucht., 1914, **57**, 547—552, 569—575.

Pure dry hydrogen sulphide was passed through a tube containing either (A) ferric oxide (96·4% Fe_2O_3), (B) ferric hydroxide (Fe_2O_3 66·5, H_2O 17·4, impurities 16·1%), or (C) precipitated ferric hydroxide. The atomic proportion of sulphur absorbed when the material was saturated, as shown by the presence of hydrogen sulphide in the issuing gas, was : (A) 0·48 and 1·06, (B) 0·85 and 0·97, and (C) 0·67 S for each atom of Fe. Further experiments showed an increased absorption of sulphur with increased subdivision of the oxide, and with decreased velocity of the current of gas. Dry ferric oxide was as active as the hydroxide, but the activity could be destroyed by heating. With moist hydrogen sulphide the atomic proportion of S to Fe in the saturated material was less than with the dry gas :—(A) dry gas 0·83, moist gas, 0·76 ; (B) dry gas, 0·97, moist gas, 0·75 ; and (C), dry gas, 0·67, moist gas, 0·63. With precipitated ferric hydroxide, the proportions were 0·55 with moist hydrogen sulphide containing ammonia, 0·59 with moist hydrogen sulphide free from ammonia, and 0·67 with dry hydrogen sulphide, and with more finely divided material, 1·29 with moist hydrogen sulphide containing ammonia, and 1·11 and 1·47 with dry hydrogen sulphide. With a dry mixture of hydrogen sulphide and ammonia, the proportions were 0·996 and 1·073, compared with 1·472 and 1·456 in similar experiments with pure dry hydrogen sulphide. The composition of the spent oxide was the same with pure and with ammoniacal hydrogen sulphide. From 15 to 38% of the sulphur could be extracted with carbon bisulphide and about 4% was present as iron disulphide. The atmospheric oxidation of the spent oxide at the ordinary temperature gave free sulphur, and only traces of ferrous sulphate. The iron disulphide was not oxidised. In experiments with precipitated ferric hydroxide and a purified lighting gas to which 0·3 to 1·85% by volume of hydrogen sulphide was added, the spent material contained a much lower atomic proportion of sulphur (0·56—0·19 S for each atom of Fe), the proportion being higher with moist than with dry gas. In gas works, the author has used oxides obtained as by-products in working up copper ores, and in making alum from bauxite. These materials when finely divided and used without sawdust will absorb 68—69% S. The oxide should contain not more than 25% of moisture. The volume of gas purified per metric ton of the fresh material varied from 188,900—141,730 cb. m., with velocities of the gas-current varying from 8 to 10 mm. per sec., and with a revivified material the volume varied from 163,000—93,270 cb. m. with velocities from 6·0—7·7 mm. per sec. The crude gas contained 0·7% (by vol.) H_2S. Tar, cyanogen and ammonia were first removed from the gas, and 2 to 4% of air added at the inlet to the oxide-purifiers. The proportions of free oxygen in the gas entering the first, second and third purifiers and in the gas leaving the third purifier were 0·7—0·5, 0·5—0·4, 0·35—0·25, and 0·3—0·2% respectively.

For the determination of sulphur in gas the author uses the Drehschmidt apparatus ; the rate of burning the gas should not exceed 15 litres per hour. Oxidation of the combustion products to sulphate is effected with hydrogen peroxide instead of bromine, and the sulphur is determined by titrating the free acid. A determination can be made with half the quantity of gas required when the sulphur is weighed as barium sulphate. Comparative results were :—by titration, (A) 41·22, (B) 53·89, (C) 49·01, (D) 48·24, and by gravimetric analysis (A) 41·69, (B) 53·38, (C) 50·8, (D) 47·87 grms. S per 100 cb. m. of gas.

In laboratory experiments, air containing carbon bisulphide was passed over hydrated iron oxide at various temperatures. The sulphur was partially removed, with formation of iron sulphide and carbon dioxide. At 90° C., the heat of the reaction caused ignition of the gas. Purified lighting gas containing 49—57 grms. S per 100 cb. m. was passed over hydrated iron oxide at temperatures from 32°—87° C. ; the proportion of sulphur removed varied from 7·6—46·0%, being greatest at 80° C. The proportion of sulphur removed was still greater at temperatures up to 250° C.—A. T. L.

Gasoline ; Suitability of natural gas for making ——. G. A. Burrell. Techn. Paper 17. Dept. of the Interior, Bureau of Mines, U.S.A. Sept., 1913, 17—23.

In the state of Oklahoma alone the recoverable gasoline escaping as gas is estimated at 10% of the crude oil obtained. In many of the plants the natural gas is drawn from 50 or more wells 4 miles away under a reduced pressure of 25 in. The gas is first compressed at 25 to 50 lb. per sq. in. and passed through cooling coils sprayed with water. A small amount of liquid is thus obtained, and the residual gas is compressed at 350 lb. per sq. in. and cooled as before. The yield is about 1½ to 4 galls. of liquid per 1000 cb. ft. of gas, and the products range from 0·676 to 0·582 sp. gr. The latter constitute the "wild" products and lose from 10 to 50% on exposure. The methods of testing the natural gas include determinations of the sp. gr. and solubility in "claroline" oil, kerosene, alcohol or olive oil, combustion analysis, and practical trials at the well-head with gasometer and compressor. Gases with density as low as 0·81 (air = 1) and as high as 1·64 have been used, while natural gas with an absorption coefficient of only 30 (in "claroline" oil) is being compressed. The absorption test is made by shaking 100 c.c. of the gas with "claroline" oil or with 50 c.c. of alcohol. Few plants deal with as little as 40,000 cb. ft. of gas daily, and the most successful use at least 125,000 cb. ft. Great variations in quantity and composition of the gas may be shown by adjoining wells. A plant costing $9000 to $10,000 (£1850 to £2055) will deal with 500,000 cb. ft. of gas per day, and can be worked by two men. (See also this J., 1912, 630 ; 1913, 999, 1096.)—C. A. M.

Petroleum from Bioritsu, Formosa ; A study of the crude ——. T. Katayama. J. Ind. Eng. Chem., 1914, **6**, 469—471.

The most important oil deposit in Formosa is at Shukkokosio, 7 miles south of Bioritsu. The crude oil is a clear, mobile, brownish liquid, which solidifies at 0° C. It has the sp. gr. 0·831 at 15° C. and yields the following fractions on distillation : below 100° C., 1·5% by vol. ; 100°—125°, 15·8 (sp. gr. 0·7770) ; 125°—150°, 21·8 (0·7980) ; 150°—

175°, 12·2 (0·8155); 175°—200°, 8·8 (0·8205); 200°—225°, 7·8 (0·8360); 225°—250°, 7·6 (0·8585); 250°—275°, 7·5 (0·8790); 275°—300° C., 4·3; residue, 13·2% by vol. (solid at ordinary temperature). The kerosene fraction (150°—275° C.) after being refined by the usual method could not be used as a lamp oil owing to its very smoky flame. The smoky constituents appear to be aromatic hydrocarbons; they are soluble in acetic anhydride, are readily nitrated, and have a higher sp. gr. than the non-smoky constituents. They can be removed by treating the oil with a sufficient quantity of concentrated sulphuric acid, especially on heating to 100° C. By treating the kerosene with 5% of sulphuric acid for 5 hours at 100° C. an oil giving a non-smoky flame was obtained, and the quality improved as the proportion of acid was increased.—A. S.

Paraffin wax; Separation of —— from petroleum oils by cold methods. M. A. Rakusin. Petroleum, 1914, **9**, 1374—1375.

By centrifuging petroleum oils at the ordinary temperature the proportion of paraffin wax, asphaltic substances, etc., is reduced, as is indicated by the lowering of the solidification pt. (*e.g.*, from 9° C. to 6° C.). This effect increases with the decrease in the temperature of centrifuging. Thus at 5° C. the solid. pt. of the oil was reduced from 9° C. to 1° C. Carbonaceous substances ("*kohligen Substanzen*") are also partially eliminated, as is shown by the increase (about 30%) in the "carbonisation constant" of the oil (see this J., 1909, 514). The sp. gr. of the oil is reduced (*e.g.*, from 0·8619 to 0·8549).—C. A. M.

Naphthenic acids; Experiments upon the deodorisation of ——. E. Schmitz. Les Matières Grasses, 1914, **7**, 4115—4117.

Hexa- and hepta-naphthenic acids, prepared synthetically, had an odour similar to that of the technical products, but by distillation at 250° C. (90 mm. pressure), the odour was considerably diminished though not eliminated. By treating the "petroleum acids" of the alkaline lyes from the refining of lamp oils with dilute sodium carbonate solution, "salting out" the naphthenic soaps, liberating the naphthenic acids, and repeating the process several times, the final product had only a very faint odour. The oxygenated compounds insoluble in sodium carbonate solution but soluble in potassium hydroxide solution were of a phenolic character, and had a dark colour, and an intense penetrating odour. They could be brought into solution in the naphthenic soap by adding a very small amount of sulphuric or hydrochloric acid. They gave an intense bluish-green coloration with copper salts, and to their presence is attributed the well-known reaction of naphthenic acid with copper salts. This reaction, however, is by no means characteristic, since copper oleate is also soluble in petroleum spirit. It is suggested that the "oil," which forms a layer beneath naphthenic soaps when "salted out," should be used as a basis of green lacquers, for wood, etc. It forms about 1% of the crude "petroleum acids." Hydrogenation in presence of a catalytic agent did not affect the odour or properties of crude naphthenic acids. Treatment with ozonised air for 1½ to 2 hours at 14·3° to 16·5° C. caused slight reduction in the odour and colour, and increased the sp. gr. (*e.g.*, from 0·9622 to 0·9665). At 50° C. ozone caused slight bleaching, followed by the formation of a yellow precipitate, whilst at 100° C. it produced polymerisation changing the colour of the acids to wine red, but not improving the odour. Treatment with ozone for a short time at a low temperature would be useful, provided that the naphthenic acids had first been freed from the malodorous phenolic substances by treatment with sodium carbonate or preliminary "salting out" as described.—C. A. M.

Thermal phenomena in carbonisation. Hollings and Cobb. *See* IIB.

Iodine value of linseed and petroleum oils. Smith and Tuttle. *See* XII.

Talc as a lubricant. Thalberg. *See* XII.

Power [gas] from spent tan. Parker. *See* XV.

PATENTS.

[Peat] Fuel; Production of ——. T. O. Franke, London. Eng. Pat. 12,233, May 26, 1913. Under Int. Conv., Nov. 9, 1912.

Combustible substances, such as coke dust, which are mixed with peat to facilitate the escape of water under the press, are rendered impervious by impregnating them with solid or liquid organic substances.—O. E. M.

Coke-ovens. N. Schuster, London. Eng. Pat. 29,494, Dec. 22, 1913.

To avoid overheating the gas with which regenerative coke-ovens are fired, cold air is drawn through channels, parallel and adjacent to the gas passages, by connecting the channels with the uptake. The gas nozzles deliver into a chamber, with inclined walls, below the heating flues, and are thus protected from falling débris. The gas pressure is maintained at the inner ends of the gas passages by gradually diminishing their cross-sectional area and providing an intermediate auxiliary gas passage. —O. E. M.

Coke-oven. F. W. Sperr, jun., Chicago, Ill. U.S. Pat. 1,097,196, May 19, 1914; date of Appl., Jan. 31, 1914.

In a regenerative coke-oven, the fuel passages underneath the heating flues are provided with valves to admit air for consuming carbon deposits therein, the arrangement being such that half the passages can be so treated while the other half are in use for heating the oven. —H. H.

Gas; Charging or discharging retorts used in the manufacture of ——. Drakes Ltd. and A. Dobson, Halifax. Eng. Pat. 4105, Feb. 18, 1913.

The vertical or inclined retort is closed below by two concentric semi-cylindrical drums, one fitting just inside the other, and both having toothed cutting edges. The drums are rotated in opposite directions. When the drums are in one position the coke in the lower portion of the retort descends into the open side of the inner drum; the cutting edges of the drums then approach each other and detach the coke in the drum from that in the retort. —J. L. F.

Gas retorts; Drawing and charging ——. H. Bird and G. Hayter, Hayes. Eng. Pat. 12,976, June 4, 1913.

The coal is held in position in the retort by means of a suitable frame, carrying hinged plates, during the withdrawal of the scoop, the frame being subsequently withdrawn by independent mechanism. The coke is removed by telescopic channel irons severally fitted with rake and plate, which ride up on their hinges upon insertion into the retort, but engage with the coke upon withdrawal. The plate travels twice as fast as the rake, both being arranged to complete their working-stroke simultaneously. —J. L. F.

Vertical retorts for carbonising coal; Heating of ——. A. M. Duckham, Ashtead. Eng. Pat. 12,338, May 27, 1913.

The air or air and gas are preheated by means of the heat of the coke, by passing them through flues disposed around the lower part of the retort. In contact with these flues is a second set of flues through which the waste gases from the heating flues are passed in order further to augment the temperature of the air or gas.—J. L. F.

Gas and coke; Process for the immediate fractional recovery of the bye-products obtained in the production of illuminating town ——. J. Fischer, Vienna. Eng. Pat. 21,290, Sept. 20, 1913.

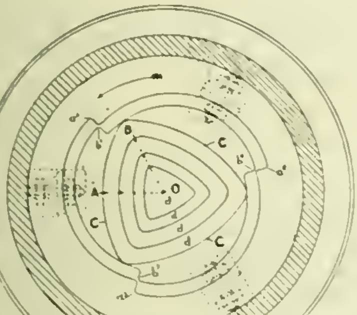
The gases issuing from the retorts are passed in a thin stream through a series of vertical hollow plate condenser maintained at various temperatures by the circulation of air and water respectively. The air-cooled condensers are cooled by a single current of the cooling medium, which is reduced in temperature where necessary in passing from one condenser to another by circulation through long pipes exposed to the air.—H. H.

Water-gas ; Apparatus for producing ——. A. Choury, Nanterre, France. Eng. Pat. 19,363, Aug. 27, 1913.

In a generator in which the air-blast passes upwards and the steam-blast downwards through the fuel, the air and steam are preheated by passing through coiled pipes arranged in an annular chamber between the generator walls and an outer casing.—A. T. L.

Gas producers. A. Sahlin, Brussels. Eng. Pat. 27,888, Dec. 4, 1913.

The blast is distributed by a central stepped conical grate (shown in plan in the figure) carried by a revolving water-sealed ash-pan and having annular orifices between the successive steps, *d*. The several steps, *d*, of the grate are triangular pyramidal frustums with convex sides, so proportioned that the smallest radius, OA, of the base of each frustum is equal to the extreme radius, OB, of the base of the next frustum above it, whereby the blast is distributed as an even sheet and the fuel receives a gentle undulatory and gyratory motion. The ash-pan also carries a cam-shaped scraper formed in two vertical steps, a^1, a^2, a^3, and b^1, b^2, b^3, above which is a vertical wall, C, of the same shape as the lowest section of the conical grate, which ensures the passage of the ashes into the pockets formed by the cam-shaped scrapers.—A. T. L.



Gas producer. H. Poetter, Dusseldorf, Germany. U.S. Pat. 1,097,141, May 19, 1914 ; date of Appl., Nov. 28, 1913.

A portion of the cylindrical wall of a gas producer is rotatable and carries a hollow stirrer which projects laterally into the distillation zone of the producer. As the stirrer rotates, it is simultaneously oscillated in an upward and downward direction by an eccentric. The stirrer is cooled by circulation of air therein.—H. H.

Gas ; Manufacture of ——. H. W. Benner, Bethlehem, Pa., Assignor to International Gas Development Co., New York. U.S. Pat. 1,097,513, May 19, 1914 ; date of Appl., Feb. 25, 1914.

The coal is charged into vertical retorts which have previously been heated to a temperature sufficiently high to initiate the distillation, and water-gas is then passed through the charge from below in sufficient quantity to prevent the deposition of carbon from the distilling gases upon the walls of the retort. The water-gas is preferably produced by forcing steam through a layer of incandescent coke introduced at the bottom of the retorts before they are charged with coal.—H. H.

Gas liquor ; Process for the treatment of ——. Berlin-Anhaltische Maschinenbau-A.-G. Ger. Pats. 269,658, May 10, 1913, and 272,985, Oct. 22, 1913.

(1). The gas liquor is first introduced into a vessel heated by the waste heat of the retort-furnace, whereby a portion of the volatile ammonia is expelled, and the remainder is then driven off by heating the liquor more strongly in a second vessel. The hot liquor from this second vessel serves to heat the acid bath in which the volatile ammonia is absorbed and then passes to the water-seal of the retort-furnace to be evaporated beneath the grate. (2) The evaporating vessels in which the liquor is heated strongly to drive off the last portions of the volatile ammonia are disposed in the masonry at the top of the retort-furnace. —A. S.

Ignition of gases ; Apparatus for determining the speed of —— by measuring the inner cone of the flame. M. Hofsäss. Ger. Pat. 272,705, Aug. 28, 1913.

The gas is burnt in a Bunsen burner connected at its lower end with a pressure-gauge and a regulator for ensuring a constant pressure and at its upper end with a device whereby the height of the inner cone of the flame can be measured or recorded photographically. The supplies of gas and of air are so regulated that the inner flame has approximately the shape of a right cone, the surface of which is directly proportional to its height. The speed of ignition of the gas is equal to the quotient of the velocity at which the mixture of gas and primary air is supplied to the burner and the surface of the inner cone of the flame. For example, under similar conditions the surface of the inner cone of a carbon monoxide flame is about six times that of the inner cone of a hydrogen flame, the speed of ignition of hydrogen being six times greater than that of carbon monoxide.—A. S.

Oils ; Treatment of —— for cracking, particularly for the manufacture of liquid combustibles. C. E. C. Luck, Dartford, Kent. Eng. Pat. 12,059, May 23, 1913.

Liquid fuel for internal-combustion engines is made by fractionally distilling a mixture of petroleum (sp. gr. not exceeding 0·805), benzene, a gum resin or a resin and picric acid. For example, 12 galls. of 90% benzene are mixed with 84 galls. of petroleum and a solution of 5 lb. of rosin in 1½ galls. of 90% benzene. A solution of 5 lb. of picric acid in 2½ galls. of 90% benzene is stirred in and the mixture distilled. The distillate passing over between 125° and 205° C., forming about 75—80% of the original volume, is collected, and any further distillate is added to the original mixture.—A. T. L.

Combustible mixtures for internal-combustion engines. G. E. Heyl, London. Eng. Pat. 18,417, Aug. 13, 1913.

Rich gases such as acetylene, coal gas, etc., are diluted with air sufficiently to preclude ignition, and free hydrogen is added in sufficient quantity to propagate ignition through the mixture in the manner described in Eng. Pat. 4570 of 1913 (this J., 1913, 903).—A. T. L.

Process for obtaining sulphur by the interaction of sulphur dioxide and hydrogen sulphide. Ger. Pat. 272,474. *See* VII.

Gas analysis apparatus. Eng. Pat. 17,676. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Carbonisation ; Thermal phenomena in ——. H. Hollings and J. W. Cobb. J. Gas Lighting, 1914, **126**, 917—924.

Bituminous coals, anthracites, cannel coal, cellulose and dehydrated cellulose were heated under the same conditions as a sample of coke, and the temperature compared with that of the coke in order to determine when heat was being absorbed or evolved by the decomposition of the coal or cellulose. In all cases, distillation commenced at 250° C., and up to 1100° C. various exothermic and endothermic stages of the distillation were observed. The total quantity of heat evolved or absorbed on balance was very small. With coal there was no sudden decomposition at a definite temperature such as occurs with cellulose. In a typical experiment with bituminous coal containing 40·2% of volatile matter, endothermic reactions predominated up to 410° C., exothermic from 410° to 470° C., and endothermic from 470° to 610° C. The exothermic stage above 610° C. was always very marked, and was interrupted between 750° and 800° C. Exothermic reactions probably continue to a higher temperature. The evolution of heat above 610° C. was probably due to reactions in which methane was produced, these reactions being succeeded at 750° C. by others in which large quantities of hydrogen were formed.—A. T. L.

Coal-gas and petrol [air-] gas [for lighting] : a comparison. E. Scott-Snell. J. Gas Lighting, 1914, **126**, 708—710. (See also this J., 1913, 128.)

For equal amounts of heat of combustion, petrol air-gas with petrol at 1s. 10d. per gall. costs four times as much as coal-gas at 2s. 2d. per 1000 cb. ft. When used in incandescence burners for lighting, taking into account the lower density and the smaller proportion of added air in the case of petrol air-gas the author calculates that coal gas must be supplied to the burner-nozzle at a pressure 10·3 times as great as for petrol air-gas in order to form a completely combustible mixture moving with the same velocity. Hence low-pressure petrol air-gas, at say 2 ins. water column, produces a lighting effect similar to that of high-pressure coal-gas at about 20 ins. water column. Light petrol has been found to give 9350 candle-power-hours per gall., and assuming a lower efficiency than this, the cost is calculated at 2·5d. per 1000 candle-power-hours, with petrol at 1s. 10d. per gall. On this basis, petrol-air gas cannot compete with coal-gas in towns ; it is, however, much cheaper than acetylene lighting, estimated to cost 6·7d. for 1000 candle-power-hours.—A. T. L.

Electrodes; Light from unconsumed ——. A. Vosmaer. Met. and Chem. Eng., 1914, **12**, 377—379.

If the discharge from a Ruhmkorff induction coil equipped with a modern Wagner hammer be made to pass between 2 nickel wires about 2 mm. apart, the ends will burn and form globules. If now the distance is increased to 3—4 mm., the wires will go on glowing without further adjustment. No oxidation or vaporisation takes place, as the distance between the wires remains the same, and spectroscopic examination shows a continuous spectrum without lines. Platinum wires melt rapidly under the same conditions. If a copper wire is substituted for one of the nickel wires, the nickel electrode glows while the copper electrode remains dark.—W. R. S.

Patents.

Distillation of wood, soft coal, lignite, peat and shale, and utilisation of the products of the distillation for creosoting timber and for other purposes. D. de Nagy, London. Eng. Pat. 12,427, May 28, 1913.

The wood or other material is stacked upon a circular platform beneath which are a number of chambers, separated by radial walls, communicating with a central chimney. The wood, etc., is covered in with cardboard saturated with soluble glass, and with an outer layer of earth, in which suitable holes are made to maintain combustion. The mass is ignited in the interior, and the distillation products pass downwards through gratings into the chambers beneath the platform, and thence to the chimney, the draught being regulated by a damper. The condensed portions of the distillate are run off from the chambers. Two or four of the chambers are fitted with air-tight iron linings and connected with compressors so that wood can be creosoted in them with the fresh products of distillation.—A. T. L.

Combustion of combustible mixtures. Furnaces or other heating apparatus. C. D. McCourt and Bonecourt Surface Combustion Limited, London. Eng. Pats. 11,956 and 11,957, May 22, 1913.

The apparatus described in Eng. Pats. 25,808 and 29,430 of 1909 (this J., 1910, 1448) is provided with a chamber in which the sprayed liquid fuel, or gas, is mixed with air and partially burnt, before reaching the region of surface combustion.—O. E. M.

Heating or cooling fluids ; Apparatus for ——. H. B. Watson and T. C. Billetop, Newcastle-on-Tyne. Eng. Pat. 19,970, Sept. 4, 1913.

The apparatus of surface-condenser type described in Eng. Pat. 7023 of 1911 is made more efficient by providing diaphragms to promote the circulation of the cooling water round the tubes and of the liquid to be cooled within them, by making the ends of the tubes bell-mouthed, and by leading the hot liquid in at the top and the cooled liquid out at the bottom, to assist in maintaining its flow. —O. E. M.

Incandescent body for electric glow lamps, and process for the manufacture of such bodies. A. Just, Budapest, Hungary. Eng. Pat. 8956, April 16, 1913. Under Int. Conv., April 18, 1912.

Filaments are made from a micro-crystalline solid solution in tungsten of 0·1 to 3·0% Cr, V, Mo, Th, Ti, Mn, Bi, U or Zr. Such solutions are made by melting the metals together *in vacuo* in an electric furnace with tungsten electrodes, or by compressing the powdered metals into the form of a rod and passing an electric current through the rod. The hot metal is chilled by immersion in oil or water, and finally tempered by heating to 1200° C. and allowing to cool slowly, rolled or hammered, and drawn into the required form.—A. T. L.

Arc-light carbons. H. Ayrton, London. Eng. Pats 22,319, Oct. 3, 1913, and 7792, March 27, 1914.

The negative carbon is coated with a thin film of coppe or other material less combustible than carbon. Th copper is volatilised to a distance from the arc dependin on the thickness of the coating, and the thickness i therefore determined so as to give a carbon tip tapere to such a length as ensures a steady arc, and a rate o burning equal to that of the positive carbon. The negativ carbon is made hollow but closed at the outer end, th hole being of such size that the arc completely surround it. There may be a central pencil of carbon within th hole. For an open direct-current arc using a current o 85 amperes with a cored positive carbon, the negativ carbon is made 12 mm. diam. with a hole 2 mm. diam and a coating 0·04 mm. in thickness. The cross-sectio of the negative carbon is less than half that of the ordinar carbon, and the arc throws less shadow.—A. T. L.

White light resembling normal daylight ; Production of —— P. Grosheintz, Basel, Switzerland. Eng. Pat. 26,11 Nov. 14, 1913. Under Int. Conv., Nov. 16, 1912.

The light is produced by surrounding an incandescen electric lamp or other source of light radiating an exce of reddish-yellow rays with an envelope consisting sole of cobalt blue glass of the requisite tint and intensity. —H. H.

III.—TAR AND TAR PRODUCTS.

Trinitrotoluene ; Waste product from the manufacture ——. E. Molinari and M. Giua. Z. ges. Schiess- u Sprengstoffw., 1914, **9**, 239.

The heavy duty on spirit in Italy renders it impossil to make trinitrotoluene from the residues obtained in t manufacture of dinitrotoluene for dyes, as is done Germany. A dinitrotoluene must be prepared of sufficie purity to yield on nitration a trinitrotoluene melting at 80° C. without purification. The orange-red oily liquid removed by the centrifugal from crude dinitrotoluene intended for further nitration was investigated. A series of fractional distillations and crystallisations showed it to contain *m*- and *p*-nitrotoluene, 1.2.4-dinitrotoluene, constituting 20% of the oil, 1.2.5-, 1.2.6-, and 1.3.4-dinitrotoluene, 1.2.3.5- or 1.2.3.6-trinitrotoluene (a new isomeride), 1.2.4.6-trinitrotoluene and a crystalline substance probably consisting of nitroxylenes.—O. E. M.

Nitro-compounds; Investigations on ——. I. Mutual solubility of some nitrotoluenes in the solid state. M. Giua. Ber., 1914, **47**, 1718—1723.

THE fluidity of the oil obtained as a by-product in the preparation of 1.2.4-dinitrotoluene is evidently due to the mutual solubilities of the isomerides present. Four systems were studied: *p*-nitrotoluene and 1.2.4-dinitrotoluene, 1.2.6- and 1.2.4-dinitrotoluene, 1.2.4-dinitrotoluene and 1.2.4.6-trinitrotoluene. In all cases the melting-point curves had a horizontal portion indicating the formation of a compound, which contained in general 3 mols. of the lower to 2 of the higher nitro-compound, and was completely dissociated in the liquid state. These compounds form so slowly that the metastable region could be investigated, so that in all cases but the last the existence of a metastable eutectic point could be demonstrated.—O. E. M.

PATENT.

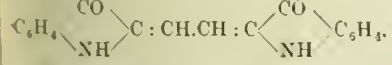
Pitch filter. A. Michel, jun. Ger. Pat. 273,664, Sept. 25, 1913.

THE apparatus comprises a steam-jacketed vessel divided into three superposed compartments. The crude pitch is melted in the top compartment, and flows through a sieve into the middle compartment, in which is the filter proper, consisting of three vertical concentric gauze cylinders, the innermost one having the finest mesh. From the interior of the filter, the pitch passes through a valve, operated from outside, into the bottom compartment, from which it is drawn off.—A. S.

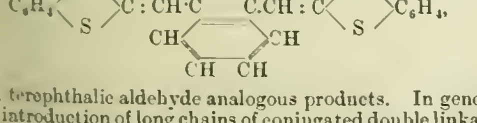
IV.—COLOURING MATTERS AND DYES.

Indigoid dyestuffs. P. Friedländer and F. Risse. Ber., 1914, **47**, 1919—1929.

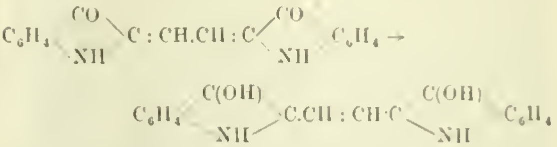
DYESTUFFS of the indigo type but with the group : CH.CH : introduced between the two symmetrical halves of the molecule show only insignificant differences in shade from the parent substances. Thus the dyestuff,


$$C_6H_4\left\langle\begin{matrix}CO\\NH\end{matrix}\right\rangle C : CH.CH : C\left\langle\begin{matrix}CO\\NH\end{matrix}\right\rangle C_6H_4,$$

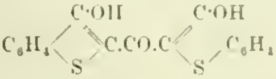
which is obtained from indoxyl and glyoxal, hardly differs from indigo. Analogous products have been prepared from hydroxythionaphthene and glyoxal and from cumaranone and glyoxal. Just as an extra C_2H_2 residue is introduced above, so by the use of maleic aldehyde the residue : CH.CH : CH.CH : can be introduced into known types of dyestuffs. In a similar manner phthalic aldehyde gives dyestuffs of the type


$$C_6H_4\left\langle\begin{matrix}CO\\S\end{matrix}\right\rangle C : CH{\cdot}C\underset{CH\quad CH}{\overset{}{\begin{matrix}\diagup\;\;\diagdown\\ CH\qquad CH\end{matrix}}}C.CH : C\left\langle\begin{matrix}CO\\S\end{matrix}\right\rangle C_6H_4,$$

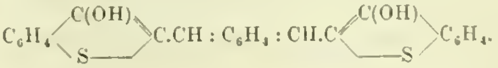
and terephthalic aldehyde analogous products. In general the introduction of long chains of conjugated double linkages in this manner in the indigo series has the effect of displacing the shade of the dyestuff towards the violet end of the spectrum, instead of the expected deepening of the shade. With the exception of the cumaranone derivatives the new dyestuffs give vats with hydrosulphite and dye in the usual way. A displacement of the conjugated double linkages is probable, *e.g.*,


$$C_6H_4\left\langle\begin{matrix}CO\\NH\end{matrix}\right\rangle C : CH.CH : C\left\langle\begin{matrix}CO\\NH\end{matrix}\right\rangle C_6H_4 \rightarrow C_6H_4\left\langle\begin{matrix}C(OH)\\NH\end{matrix}\right\rangle C.CH : CH{\cdot}C\left\langle\begin{matrix}C(OH)\\NH\end{matrix}\right\rangle C_6H_4$$

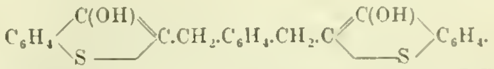
The new leuco compounds are coloured intensely orange-yellow to orange-red like the analogous dihydroxydithionaphthene-ketone


$$C_6H_4\left\langle\begin{matrix}C{\cdot}OH\\S\end{matrix}\right\rangle C.CO.C\left\langle\begin{matrix}C{\cdot}OH\\S\end{matrix}\right\rangle C_6H_4$$

whence it would appear that the .CH : CH. and the .CO. group have the same tinctorial effect. The new dyestuffs from phthalic and terephthalic aldehydes give colourless vats which oxidise first to a blue and then to the original orange-red. This suggests an intermediate quinonoid reduction phase,


$$C_6H_4\left\langle\begin{matrix}C(OH)\\S\end{matrix}\right\rangle C.CH : C_6H_4 : CH.C\left\langle\begin{matrix}C(OH)\\S\end{matrix}\right\rangle C_6H_4.$$

giving finally,


$$C_6H_4\left\langle\begin{matrix}C(OH)\\S\end{matrix}\right\rangle C.CH_2.C_6H_4.CH_2.C\left\langle\begin{matrix}C(OH)\\S\end{matrix}\right\rangle C_6H_4.$$

—J. B.

Anthanthrone. I. L. Kalb. Ber., 1914, **47**, 1724—1730.

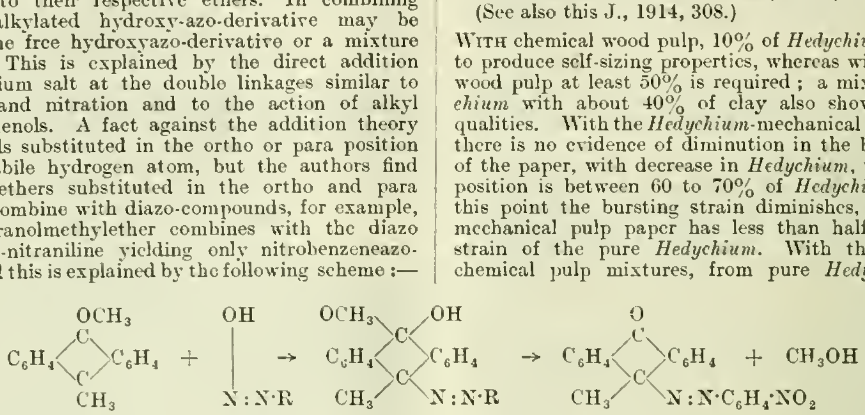
1-1′-DINAPHTHYL-8-8′- and 2-2′-dicarboxylic acids, on treatment with acid condensing agents such as sulphuric acid, chlorosulphonic acid, or aluminium chloride, both yield the same new quinone called "anthanthrone." Fusion of the carboxylic acids with alkali yields the quinone together with a hydroxy-derivative. Anthanthrone is a characteristic, orange coloured, vat dyestuff, soluble in aniline, very slightly soluble in ether, acetic acid, alcohol and benzene, giving pure yellow coloured solutions, and crystallises from nitrobenzene in orange coloured flat spears melting above 300° C. It dyes cotton orange yellow shades of excellent fastness to alkalis and oxidising agents.—G. H. F.

Azine, azoxine and thiazine dyestuffs; The constitution and colour of ——. Quinone-imide dyestuffs. III. F. Kehrmann, E. Havas and E. Grandmougin. Ber., 1914, **47**, 1881—1903.

THE absorption in the visible and invisible portions of the spectrum of a large number of dyestuffs of the above groups has been determined. The tinctorial effects observed with a series of salts of the dyestuffs, with increasing concentration of acid in the solution, agree with the theories as to the constitution of such salts previously advanced by the authors. (See this J., 1913, 783, 973, 1061.)—J. B.

Phenols and phenol ethers; Combination of —— with diazo-compounds. K. H. Meyer, A. Irschick and H. Schlösser. Ber., 1914, **47**, 1741—1755.

FROM a study of the ease with which various diazo-compounds combine with phenols and their ethers, it is shown that combination takes place most readily the more "negative" are the substituted groups in the diazo-compound. Thus the diazo-salt of *op*-dinitroaniline combines instantaneously in acetic acid solution with resorcinol and naphthol ethers, while diazo-benzene does not combine therewith. If the negative group is in the phenol ether, as in *p*-nitroanisol, naphthol-ethersulphonic acid or carboxylic acid, or *p*-nitronaphthol-ethylether, combination is hindered, taking place only very slowly or not at all. The following compounds are arranged in the order of the facility with which they combine: phloroglucinol, α-naphthol, resorcinol, β-naphthol, pyrocatechol, phenol, quinol, *o*-nitrophenol. This order applies also to their respective ethers. In combining ethers the alkylated hydroxy-azo-derivative may be formed, or the free hydroxyazo-derivative or a mixture of the two. This is explained by the direct addition of the diazonium salt at the double linkages similar to bromination and nitration and to the action of alkyl iodides on phenols. A fact against the addition theory is that phenols substituted in the ortho or para position contain no labile hydrogen atom, but the authors find that phenol ethers substituted in the ortho and para positions do combine with diazo-compounds, for example, *p*-methylanthranolmethylether combines with the diazo hydrate of *p*-nitraniline yielding only nitrobenzeneazo-anthranol, and this is explained by the following scheme :—



In support of the addition theory the authors find that unsaturated hydrocarbons give compounds with diazonium salts.—G. H. F.

Selenazine dyestuffs. H. Bauer. Ber., 1914, **47**, 1873—1881.

1.3-Dinitroselenazine is obtained by condensing picryl chloride with *o*-aminoselenophenol and closing the ring with loss of a mol. of nitrous acid by boiling in alcoholic alkaline solution. Further nitration of this substance gives 1.3.6-trinitro-selenazine. Reduction of the nitro-compounds and oxidation with ferric chloride gives 1.3-diamino- and 1.3.6-triamino-phenazselenonium chlorides. The former gives a brown-green, the latter a violet solution in water. On tannin-mordanted cotton the triamino dyestuff gives a bluer shade than the corresponding thiazine. The selenazines show the same behaviour towards trypanosomes as the oxazines and thiazines.—J. B.

Tri-indylmethane dyestuffs. IV. A. Ellinger and C. Flamand. Z. physiol. Chem., 1914, **91**, 15—20.

The dyestuff obtained by the authors by boiling β-indole-aldehyde with acid (this J., 1909, 1120) and described as a tri-indylmethane derivative has been subsequently stated to be a methylindylmethylindolidenmethane derivative by König (Z. angew. Chem., **22**, 1967; J. prakt. Chem., [2], **84**, 194), who obtained it by acting on methyl-indole-aldehyde with acid and also by acting on 2 mols. of methylindole with one mol. of orthoformic ester and the calculated quantity of concentrated acid. Scholtz (Ber., 1913, **46**, 2138, 2539) has come to the same conclusion as König, preparing the dyestuff from methylindole and formic acid. By heating the aldehyde with dilute acid or by a modification of Scholtz's method the authors have obtained a dyestuff (dimethylindylmethylindolidenmethane) which is closely related to the leuco compound of trimethylindylmethane. Further a tri-indylmethane derivative has now been prepared from indole-aldehyde and B_3-chloro-Pr_2-methylindole, which gives yellowish red salts and a yellow colour-base. There is a possibility here of the splitting-off of a mol. of chloromethylindole with the formation of a dyestuff of the indylindolidenmethane group, but the analysis agrees closely with the figures for a tri-indylmethane. It is not unlikely that the constitution of the product is largely influenced by the conditions of reaction, *e.g.* concentration of acid, so that the different investigators have been dealing with mixtures of dyestuffs of varying composition.—J. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Hedychium pulp ; Influence of the addition of —— to chemical and mechanical wood pulps upon the physical qualities of paper produced therefrom. C. Beadle and H. P. Stevens. Chem. News, 1914, **109**, 280—281. (See also this J., 1914, 308.)

With chemical wood pulp, 10% of *Hedychium* is sufficient to produce self-sizing properties, whereas with mechanical wood pulp at least 50% is required ; a mixture of *Hedychium* with about 40% of clay also showed self-sizing qualities. With the *Hedychium*-mechanical pulp mixtures, there is no evidence of diminution in the bursting strain of the paper, with decrease in *Hedychium*, until the composition is between 60 to 70% of *Hedychium*, but from this point the bursting strain diminishes, and the pure mechanical pulp paper has less than half the bursting strain of the pure *Hedychium*. With the *Hedychium*-chemical pulp mixtures, from pure *Hedychium* up to mixtures containing 50% of chemical pulp there is a gradual increase in the bursting strain, and from this point to the pure chemical wood pulp paper there is a corresponding gradual decrease.—B. N.

Uses of collodion in leather finishing. Higgins. *See* XV.

Patents.

Cellulose esters of organic acids ; Manufacture of ——. Act.-Ges. für Anilinfabrik., Treptow, Germany. Eng. Pat. 1156, Jan. 15, 1914. Under Int. Conv., Jan. 14, 1913. Addition to Eng. Pat. 10,706, May 6, 1912 (this J., 1913, 482).

Cellulose derivatives, made by the action of more or less concentrated nitric acid on cellulose, are treated by the usual methods of esterification for producing cellulose esters.—B. N.

[*Viscose*] *Threads, films and the like ; Manufacture of ——.* F. Steimmig, Hanover, Germany. Eng. Pat. 5238, Feb. 28, 1914.

The viscose is squirted into a warm highly-concentrated solution of a neutral salt containing a small percentage of a soluble ammonium salt, and the thread is then exposed to the air for some time (see also Eng. Pat. 11,104 of 1913 ; this J., 1913, 1153).—B. N.

Paper-pulp ; Production of ——. The Watford Engineering Works, Ltd., and J. Paramor, Watford. Eng. Pats. 19,427 and 24,930, Aug. 27, and Nov. 1, 1913.

The machine comprises a steeping chamber and a cylindrical pulping-barrel, traversed by a rotating shaft carrying beating arms. The latter, within the steeping chamber, are carried upon a hollow shaft mounted upon the rotating shaft, with means whereby the relative speeds of the two may be varied to suit particular conditions of working. A stirrer shaft, provided with arms or projections, is also arranged in the lower part of the steeping chamber, and the portion of the pulping-barrel adjacent to the steeping chamber is of a diameter greater than the remainder. —B. N.

Paper ; Drying and surface finishing of ——. C. E. Pope, Holyoke, Mass., U.S.A. Eng. Pat. 2847, Feb. 3, 1914.

Hollow rotating drying drums are arranged in two tiers each provided with an endless apron to guide the web of paper round the drums, and with pressure rolls which bear directly upon the aprons and press the web of paper against the drums. The pressure may be varied by rotatable adjustable cams, which press against the bars carrying the pressure rolls. The guide rolls, for the looped portions of the aprons, are so set with respect to the two tiers of rolls, as to shorten the gaps which the end of the paper must traverse in passing from a lower to an advanced upper drum in starting after a break. The paper is thus gradually dried and finished, which gives it a suitable printing surface without subsequent calendering. —B. N.

Manufacture of products [alginates] from seaweed, and treatment of paper, textiles, etc., with such products. Eng. Pat. 13,777. *See* VI.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Wool; The action of solutions of Glauber's salt on——. M. Fort. J. Soc. Dyers and Col., 1914, **30**, 228—231.

A reply to Herz and Barraclough (this J., 1914, 479). It is shown that exact tintometric determination of the strength of the dyeings obtained by Herz and Barraclough confirm the author's conclusions that the effect of sodium sulphate in dyeing acid dyestuffs from a neutral bath is to increase the amount of dyestuff taken up. The author adheres to his opinion that the injury to the lustre of wool in dyeing in the Glauber's salt bath is caused by loss of wool substance from the fibre due to a reaction between the salt and the wool.—J. B.

Wool; Sorption [absorption and adsorption] of some acids and non-electrolytes by——. A. Dietl. Kolloid-Zeits., 1914, **14**, 319—321.

Von Georgievics (this J., 1914, 251) has shown that in the sorption of acids by wool, the value of the exponent x in Boedecker's distribution formula, which may be taken as a measure of the amount of adsorption, varies in the same way as the strength of the acids. Walker and Appleyard (this J., 1896, 650) found that aromatic acids were more strongly absorbed than other acids, and the author therefore made experiments with salicylic and benzoic acids and also with phosphoric acid. The results show that though these acids are strongly absorbed by wool, the values of x are smaller than in the case of stronger mineral acids, and are in agreement with von Georgievics' rule. Moreover, acetone and sucrose, which, as non-electrolytes should be only slightly adsorbed, gave abnormally low values for x, viz., about 1·47 and 1·1 respectively, indicating that in these cases the absorption is due mainly to the formation of solid solutions; the total sorption is low in the case of acetone and sucrose.—A. S.

Silk-weighting with stannic chloride; The theory of——. F. Fichter and E. Müller. Chem.-Zeit., 1914, **38**, 693—694.

Silk was found to take up stannic chloride in a fixed proportion from a solution of the salt in benzene whatever the concentration of the latter. Adsorption is unlikely here on account of the low surface tension of the benzene and the experiment is considered a confirmation of the theory of chemical combination, in opposition to the views of Sisley and Ley (Chem.-Zeit., 1911, 621; 1912, 1405 and 1466; this J., 1913, 81). The authors' theory is that an addition product is formed between the amino-acid —fibroin—of the silk and the tin salt. They have isolated such addition products in the case of the analogous substances alanin and glycocoll. They have the constitution $Sn(amino\ acid)_4Cl_4$. They are very soluble in water and undergo progressive hydrolysis, the amino-acid and chlorine being gradually replaced by hydroxyl until finally stannic hydroxide is left. Analogous addition products are probably formed in silk-weighting, hydrolysis taking place in the washing, at the end of which process the fibroin is restored to its original condition and is ready to take up a fresh charge.—J. B.

Grey; Fast steam——. E. Justin-Mueller. Sealed Note, No. 2047, dated Oct. 22, 1910. Report thereon by C. Favre. Bull. Soc. Ind.-Mulhouse, 1914, **84**, 217—220.

Hydron Blue G and R is transformed by treatment with bisulphite into a grey which when printed with chromium acetate gives shades perfectly fast to soap and chlorine. Other reducing agents acting on Hydron Blue in slightly acid mediums also give greys (for instance, stannous chloride, glucose and sugar), but differing somewhat in properties from the bisulphite grey. The report states that these dyestuffs also give greys when printed simply with chromium acetate by Bayer und Co.'s process, though the shade is not so good.—J. B.

[Printing.] Fixing dyestuffs on cotton; New process for——. P. Doane. Sealed Note, No. 1305, dated Dec. 4, 1901. Report thereon by H. Schmid. Bull. Soc. Ind. Mulhouse, 1914, **84**, 215—217.

A basic dyestuff (*e.g.*, Thionine Blue, Thioflavin) is printed together with a caustic soda solution of zinc ferrocyanide and, after drying, the cloth is passed into acid, whereby a fast lake is formed without steaming. The process is a modification of the old method of forming lakes on a zinc ferrocyanide mordant first described by C. Reben and afterwards applied for illuminating Aniline Blacks and azo colours by W. E. Key and The Thornliebank Co., Glasgow (Eng. Pat. 713 of 1893; this J., 1893, 1027), and for illuminating Naphthylamine Bordeaux by F. Oswald in 1893 (this J., 1894, 1193).—J. B.

Light on dyed fabrics; The action of——. W. Harrison. J. Soc. Dyers and Col., 1914, **30**, 206—211.

A reply to criticism by Gebhard (Chem.-Zeit., 1913, 601, 622, 638, 662, 679, 717, 765) of the author's theory (see this J., 1912, 681) that the fading of dyed cotton is due to the reducing action of the products of decomposition of cellulose. These decomposition products appear to be of an acid character and are possibly hydroxy-acids like tartaric acid. Dyed cotton faded more quickly if treated with tartaric acid before exposure; also cotton which had been exposed to light from a mercury vapour lamp until slightly tendered was found after dyeing with a benzene solution of picric acid to fade much more rapidly when exposed to sunlight *in vacuo* than did an untreated pattern. Gebhard's theory of auto-oxidation (this J., 1910, 691) is also discussed.—J. B.

Patents.

Mercerisation; Process for cleansing the lye used in—— from size and other organic substances. J. Matter, Laacken, Germany. Eng. Pat. 28,250, Dec. 8, 1913.

Organic impurities are precipitated by treating the mercerising liquor with a finely divided silicate (*e.g.*, kaolin, china-clay, pumice, talc, white bole, etc.) and allowing to settle without heating. The process may be advantageously worked in conjunction with the gypsum-lime process.—J. B.

Cheeses, cops and similarly wound forms of woollen and worsted yarn; Treating—— preparatory to dyeing or bleaching. H. Heymann, Bradford. Eng. Pat. 19,522, Aug. 28, 1913.

The yarn is first degreased by passing a volatile solvent through the cheese, cop or similarly wound form, and the pure solvent remaining is removed by a vacuum pump and condensed.—B. N.

Products [alginates] from seaweed; Manufacture of—— and the treatment of paper, textiles, leather, or the like, with such products. T. Ingham, Liverpool. Eng. Pat. 13,777, June 14, 1913.

Soluble double metallic alginates, such as those of aluminium, zinc, iron, cadmium, copper, or the like, with ammonium, sodium, or potassium, are prepared by treating an alginate solution with an excess of an alkali hydroxide, or carbonate, and then adding a soluble metallic salt, sufficient to normally precipitate the whole of the alginic acid in the mixture. The product is employed for treating or finishing paper, textile fabrics, etc., and a water-repelling substance, such as wax, tallow or linseed oil, is added to render the material waterproof. —B. N.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Platinum vessels: Resistance of —— to hot nitric acid. G. P. Baxter and F. L. Grover. J. Amer. Chem. Soc., 1914, **36**, 1089—1091.

Experiments are described which show, in contradiction to the evidence of Jannek and Meyer (Z. anorg. Chem., 1913. **83**, 51), that hot concentrated nitric acid extracts practically nothing from pure, well-cleaned platinum. Residues obtained after the evaporation of nitric acid which had been distilled through platinum condensers are probably due either to traces of hydrochloric acid in the acid or to the inefficient cleansing of the condenser or of the platinum vessels used for the evaporation.—G. F. M.

Sulphates; Volumetric determination of ——. H. North. Amer. J. Pharm., 1914, **86**, 249—256.

A modification of the chromate method (compare this J., 1910. 455, 902), designed to avoid the carrying down of soluble chromate with the barium chromate precipitate. The solution containing about 0·16 grm. SO_4, is diluted to 30 c.c., treated with sufficient hydrochloric acid (sp. gr. 1·12) to bring the total amount present to 4 c.c., and heated to boiling; 20 c.c. of $N/3$ barium chloride and, after again boiling, 10 c.c. of $N/1$ potassium bichromate are added, then 10 c.c. of rinsing water and a mixture of 15 c.c. of ammonia (sp. gr. 0·98) and 2 c.c. of 36% acetic acid, drop by drop, with constant shaking. The mixture is cooled, diluted to 100 c.c., filtered through asbestos (dried at 110° C.), and 40 c.c. of the filtrate treated with 1 grm. of potassium iodide dissolved in 20 c.c. of dilute sulphuric acid (1 : 9, by volume); 40 c.c. of rinsing water are added, the covered flask allowed to stand for 6 minutes, 150 c.c. of water introduced, and the liberated iodine titrated with $N/10$ thiosulphate. The number of c.c. of thiosulphate, multiplied by the factor 0·008, gives the weight (grms.) of SO_4 originally taken. The barium chloride solution (10 c.c., with 4 c.c. of hydrochloric acid and 40 c.c. of water) is standardised as above, and the thiosulphate likewise checked by adding 20 c.c. of $N/10$ bichromate to potassium iodide (1 grm. in 20 c.c. of dilute sulphuric acid) and titrating as described, 60 c.c. of rinsing water being used in place of 40 c.c. With less than 0·16 grm. SO_4, 0·3 c.c. of $N/10$ thiosulphate should be deducted for every 40 c.c. of filtrate, owing to the slight solubility of barium chromate. The solution may contain the ions $Li^{\cdot}$, $Na^{\cdot}$, $K^{\cdot}$, $NH_4^{\cdot}$, $Cu^{\cdot\cdot}$, $Mg^{\cdot\cdot}$, $Ca^{\cdot\cdot}$, $Zn^{\cdot\cdot}$, $Cd^{\cdot\cdot}$, $Hg^{\cdot\cdot}$, $Al^{\cdot\cdot\cdot}$, $Ni^{\cdot\cdot}$, $Co^{\cdot\cdot}$, Cl', PO_4''' (in limited amount), and B_4O_7'', but not iron. A determination may be made in 50 minutes. —F. Sodn.

Disodium phosphate; Reduction of —— by alternating electric currents. P. Wenger and L. Heinen. Ann. Chim. Analyt., 1914, **19**, 209—211.

The effects of time, temperature, and concentration on the reduction of disodium phosphate by the action of an alternating current are recorded. With a 1% solution of the salt at 18° C., the amount reduced increases from 1·05% in 1 hour to 8·34% in 5 hours; the reduction also increases with rise of temperature, 2·59% being reduced in 1 hour at 80° C. When the concentration of the phosphate solution is increased, the amount reduced diminishes considerably; for instance, with a 10% solution, only 0·1% is reduced in 1 hour at 18° C. Copper electrodes were used, and practically the same results were obtained with stationary as with rotating electrodes. The phosphite produced by the reduction was estimated by titration with iodine in the presence of sodium bicarbonate.—W. P. S.

Fluorides; Action of weak acids on soluble ——. P. A. E. Richards. Analyst, 1914. **39**, 248—250.

Lactic, butyric, tartaric, malic, citric, formic, salicylic, and benzoic acids all liberate hydrofluoric acid from potassium and sodium fluorides, the reaction taking place even with 1% solutions of the acids. Carbon dioxide also liberates hydrofluoric acid from these fluorides, but none of the acids mentioned attacked calcium fluoride. —W. P. S.

Cyanides; Detection of —— in presence of ferro- and ferricyanides and thiocyanates. O. L. Barnebey. J. Amer. Chem. Soc., 1914, **36**, 1092—1093.

The test is based upon the solubility of copper sulphide in alkali cyanides. A suspension of copper sulphide is made by passing a few bubbles of hydrogen sulphide into a weak ammoniacal solution of copper sulphate, and if the colour is discharged on the addition of an ammoniacal solution of the substance, the presence of a cyanide is indicated. By using a sufficiently dilute copper solution, the test has a delicacy of 1 part of hydrocyanic acid in 10,000, and it is not seriously interfered with by the presence of ferro- or ferricyanides or thiocyanates. In presence of 2 grms. of these substances, 0·5, 1, and 0·5 mgrm. respectively of hydrocyanic acid can be detected. By using a standard copper solution the test can be utilised for a rough quantitative determination if only cyanides are present.—G. F. M.

Ferricyanides in presence of ferric iron and cyanides; Volumetric determination of ——. E. Müller and F. Seidel. Z. anal. Chem., 1914, **53**, 416—420.

To suppress the liberation of iodine by ferric iron, potassium fluoride is added to the feebly acid solution of the ferricyanide in the proportion of 6 grm.-atoms of fluorine to 1 of iron. Potassium iodide and zinc sulphate are then added, and the liberated iodine titrated with thiosulphate. Any hydrocyanic acid present is first removed by passing a current of carbon dioxide free from reducing substances through the liquid warmed to 50° C. and made acid with sulphuric acid.—O. E. M.

Cyanamide; Volumetric determination of ——. G. Grube and J. Krüger. Z. angew. Chem., 1914, **27**, 326—327.

The cyanamide solution is diluted to 300 c.c., acidified with 1 c.c. of $2N$ nitric acid, 50 c.c. of $N/10$ silver nitrate added, and the solution made just alkaline to litmus by adding 2% ammonia. Yellow silver cyanamide, $CNNAg_2$, is precipitated. The mixture is made up to 500 c.c., and the excess of silver determined in 250 c.c. of the filtrate by titration with thiocyanate. The results agree with those obtained by Caro's method of determination of nitrogen in the silver cyanamide by Kjeldahl's process (this J., 1911, 23).—W. R. S.

Nitrogen compounds of nitrolim (crude calcium cyanamide); Solubility of the —— in water. C. Manuelli. Annali Chim. Appl., 1914, **1**, 412—413.

Four grms. of nitrolim (N 20·25%) were mixed with 100 c.c. of water and kept at a constant temperature of 13·2°—13·4° C. After one hour about 80% and after 6 hours 88% of the total nitrogen had passed into solution; after this the amount of dissolved nitrogen began t diminish, evidently owing to the transformation o cyanamide into the sparingly soluble dicyanodiamide A sample of granulated nitrolim (N 12·88%) gave simila results, 79% of the total nitrogen being dissolved in 1 hou and 90% in 8 hours.—A. S.

Calcium cyanamide into ammonia; Transformation of —— C. Manuelli. Annali Chim. Appl., 1914, **1**, 388—396.

Although the conversion of the nitrogen of calciun cyanamide into ammonia by the action of steam unde pressure at 170° C. is the basis of a commercial proces carried out on the large scale in Italy, Belgium, German France and Japan, no published data as to the yield ammonia are available. In the author's experiments weighed quantities (usually 100 grms.) of nitrolim (crude calcium cyanamide) were intimately mixed with water and then heated with excess of water under pressure in an autoclave for 6—8 hours at 170°—180° C. Yields of about 90% of the theoretical quantity of ammonia were obtained and these could be increased to 97—99% by using only 10 grms. of nitrolim or by repeating the treatment. In practice, using an autoclave provided with an agitator to prevent formation of hard lumps, nearly theoretical yields of ammonia could be obtained. The cost of fuel, sulphuric acid, and labour for converting the nitrogen of nitrolim into ammonium sulphate by this process would be about 20 centimes per kilo. of nitrogen (0·86d. per lb.).—A. S.

Ammonia ; Anodic oxidation of —— in alkaline solution in presence of silver salts. G. Scagliarini. Gaz. chim. ital., 1914, **44**, I., 543—547. (See also this J., 1913, 138.)

Experiments on the electrolytic oxidation of ammonia, in presence of silver sulphate, in a solution to which potassium hydroxide was added, showed that, as in the experiments of Müller and Spitzer (this J., 1905, 279, 550) in presence of copper salts, with high concentrations of free alkali the oxidation was almost exclusively to nitrous acid. The yield of nitrous acid increased considerably as the concentration of the ammonia solution was diminished and that of potassium hydroxide increased ; it also increased somewhat with rise of temperature up to 52° C. and with increase in the concentration of silver sulphate. The highest yield of nitrous acid recorded (11·92 grms. per 100 grms. NH_3) was obtained in 4 hours at 30° C., using a current density of 2·5 ampères at 20 volts, the cathode liquid being a 3% solution of ammonia and the anode liquid 200 c.c. of a 3% solution of ammonia, 30 c.c. of a 25% solution of potassium hydroxide and 2 grms. of silver sulphate.—A. S.

[*Silicates, borates, etc.*] *Spontaneous crystallisation ; A method of inducing ——.* G. Tammann. Z. anorg. Chem., 1914, **87**, 248—252.

The method consists in heating one end of a column of the material to a temperature above the melting point, the other end being unheated. The material is contained in a receptacle of high heat conductivity to diminish as far as possible the steepness of the temperature gradient. Under these conditions, after some time, a turbidity due to incipient crystallisation will be observed in that part of the column between the temperature of maximum crystallisation velocity and that of maximum power of spontaneous crystallisation (see Z. physik. Chem., 1898, **25**, 441). The zone of turbidity gradually becomes larger and crystals (usually spherolites) visible to the naked eye separate. If the material is contained in a glass tube this may be cut at the zone of turbidity, and the crystals added to a mass of the material heated to a temperature somewhat above that at which the crystals formed, whereupon by vigorous stirring, the whole mass can be made to crystallise. By this method of heating a column of the material at one end only, fine needles containing 10·89% Na were obtained from a fused mixture of B_2O_3.66 and $Na_2B_4O_7$ 34%, and large transparent crystals of K_2SiO_3 from a mixture of equivalent proportions of potassium carbonate and silica.—A. S.

Thorium : New method for the determination of —— in monazite sand. R. J. Carney and E. D. Campbell. J. Amer. Chem. Soc., 1914, **36**, 1134—1143.

The method depends upon the complete precipitation of thorium pyrophosphate by means of sodium pyrophosphate in acid solution. The pyrophosphates of cerous cerium and of the other rare earth metals with the exception of zirconium are soluble in acid and remain in solution. The sand is first decomposed with concentrated sulphuric acid (Meyer and Speter, this J., 1910, 486), and an aliquot portion of the diluted and filtered solution, representing about 2·5 grms. of the mineral, is diluted to 450 c.c., acidified with 5 c.c. of hydrochloric acid and 15 c.c. of 5% solution of sodium pyrophosphate added. After boiling, the precipitate of thorium and zirconium pyrophosphates (containing also traces of ceric and other pyrophosphates mechanically brought down) is filtered off and converted into sulphate by digestion on the filter paper in a Kjeldahl flask with 15 c.c. of concentrated sulphuric acid and a few crystals of ammonium perchlorate. After cooling the clear solution is diluted and the hydroxides are precipitated with sodium hydroxide. These are then after filtration dissolved in hydrochloric acid, a few c.c. of concentrated sulphur dioxide solution added to reduce any ceric cerium, and the phosphate precipitation and subsequent conversion into sulphate and hydroxide repeated. The hydroxides of thorium and zirconium are dissolved in hydrochloric acid and the thorium precipitated from this solution as oxalate by the addition of 2 grms. of oxalic acid. The solution is diluted to 450 c.c. and allowed to stand over night. The pure thorium oxalate is then filtered off, and ignited and weighed as oxide. The oxide obtained was always quite white, and free from phosphate and from cerium. The results of analyses both of mixtures of thoria with pure rare earth salts, and of various samples of monazite demonstrated the reliability of the method, and they were in close agreement with those obtained by the iodate method of Meyer and Speter.
—G. F. M.

Lanthanum and the didymiums ; Action of bromine on ——. P. E. Browning. Comptes rend., 1914, **158**, 1679—1680.

Of the hydroxides of the cerium group of metals remaining after removal of the ceria by the method previously described (this J., 1910, 210), that of lanthanum dissolves most readily in bromine water. This property can be utilised for the separation of lanthanum from neodymium and praseodymium, three treatments sufficing for an almost complete separation. The method is more rapid than that of fractional crystallisation of the double nitrates of the metals and ammonium, though the latter gives better results in the final stages of purification.
—L. E.

Tungstic acid by means of "nitron" ; Separation and determination of ——. A. Gutbier and G. L. Weise. Z. anal. Chem., 1914, **53**, 426—430. (See also this J., 1905, 289, 291, 638.)

The weighed tungstic acid is moistened with water and dissolved with the aid of heat in the smallest possible quantity of concentrated sodium hydroxide solution. The clear liquid is diluted to about 150 c.c. with boiling water, rendered acid with acetic acid, precipitated, while being vigorously stirred, with a small excess of "nitron" (diphenyl-*endo*-anilinodihydrotriazole) acetate solution, and at once allowed to cool. The precipitate is washed with a 0·4% solution of "nitron" acetate, ignited at 890° C. and weighed as tungsten trioxide.—O. E. M.

Uranyl thiocyanate. P. Pascal. Comptes rend., 1914, **158**, 1672—1674.

Uranyl thiocyanate is obtained by mixing cold solutions of equimolecular quantities of uranyl sulphate and barium thiocyanate, filtering, and evaporating the filtrate *in vacuo* over sulphuric acid. The pasty mass thus obtained yields, in the course of some days, orange yellow needles of the compound, $UO_2(CNS)_2+8H_2O$. This salt, which is extremely deliquescent, is very soluble in water, ethyl and amyl alcohols, acetone, and ether. It is strongly ionised in aqueous solution, and is hydrolysed on heating the solution to 100° C. Uranyl thiocyanate forms double salts with alkali and alkaline-earth thiocyanates, *e.g.* :— $UO_2(CNS)_2,3NH_4CNS,6H_2O$; $UO_2(CNS)_2,5NH_4CNS,2H_2O$; and $UO_2(CNS)_2,Ba(CNS)_2,6H_2O$, which are very unstable, none of them, in aqueous solution, presenting the character of a complex salt.—L. E.

Hydrogen peroxide ; The photochemical decomposition of ——. J. H. Mathews and H. A. Curtis. J. Phys. Chem. 1914, **18**, 521—537. (See this J., 1914, 352.)

Acetamide, urea, boric acid and barium chloride had practically no effect on the photolysis of hydrogen peroxide ;

acetic, tartaric and phosphoric acids, sodium chloride, potassium chloride and potassium nitrate were slightly or mildly inhibitive, as also was sulphuric acid of concentrations varying from 0·00176*N* to 0·0349 *N*; barium nitrate acted as a positive, and benzoic acid as a strongly negative, catalyst. The thermal and photochemical decompositions were not similarly affected by the same catalyst. —W. E. F. P.

Metallic oxides and hydroxides; Behaviour of some —— with solutions of ethylene-diamine; W. Traube and B. Loewe. Ber., 1914, **47**, 1908—1919.

Ethylenediamine is known to dissolve certain metallic hydroxides in definite molecular proportions, but the products have not previously been isolated in the solid form. The authors have obtained the compound triethylenediamine nickel hydroxide, $[Ni(C_2H_8N_2)_3](OH)_2+8H_2O$, in the pure state by evaporating the solution obtained either by shaking powdered nickel with ethylenediamine and oxygen or by the addition of barium hydroxide to triethylenediamine nickel sulphate. The corresponding bases derived from other metals decomposed on evaporation, but evidence was obtained that the hydrogen of the amino groups can be completely replaced by copper, and that two of the four hydrogen atoms can be replaced by silver. Mercuric iodide and cadmium hydroxide dissolve in ethylenediamine in indefinite proportions; in presence of oxygen cobalt yields a solution containing one atom of trivalent metal to two mols. of the amine. A divalent cobalt derivative was obtained in solution by the action of cobalt on the copper compound in absence of oxygen. On admission of oxygen the cobalt passed quantitatively to the trivalent condition.—O. E. M.

Colloidal carbon obtained by a chemical method. L. Sabbatani. Kolloid-Zeits., 1914, **14**, 29—31.

Two grms. of finely powdered sugar are added, gradually, during 2 hours, to 20 c.c. of concentrated sulphuric acid, with constant agitation, and the mixture allowed to stand at the ordinary temperature. After 24 hours the viscous, deep black liquid is poured gradually, with agitation, into 80 c.c. of water, the solution filtered, and dialysed until free from sulphuric acid. The clear, black solution of colloidal carbon thus obtained is very stable; the colloidal particles have an electro-negative charge. Gelatinous carbon is obtained by mixing the sugar and acid as described above, shaking for 2 hours, allowing to stand for 3—4 days at the ordinary temperature, then pouring into a shallow vessel and leaving it together with a vessel of water under a bell. After 7—9 days the viscous solution is converted into a gelatinous mass, which is freed from acid by immersion in water, the latter being frequently changed. When withdrawn from the water and exposed to air, the jelly gradually shrinks and loses weight. After drying it forms a very hard, shiny mass, difficult to pulverise, and showing a conchoidal fracture. It swells slightly in water, and dissolves sparingly in alkalis, yielding a colloidal solution.—A. S.

Patents.

Sulphuric acid; Chambers used in the manufacture of ——. W. G. Mills, C. T. Packard, and E. Packard and Co., Ltd., Ipswich. Eng. Pat. 12,067, May 23, 1913.

The chamber is of the shape of a frustum of a cone or pyramid and is cooled by water flowing over the exterior, preferably from a series of perforated pipes surrounding the chamber at different heights to form a number of cooling zones. The water from each zone flows into a corresponding gutter which also surrounds the chamber and, being attached to the main framework as well as to the chamber itself, helps to support the walls.—F. Sodn.

Caustic alkalis from alkali carbonates; Manufacture of ——. E. Schütz. Ger. Pat. 272,790, April 19, 1913.

Alkali carbonate and quicklime are intimately mixed in the dry state, and the mixture treated with sufficient water to slake the lime. The heat developed is sufficient to ensure the conversion of half of the alkali carbonate into hydroxide, and the remainder is then causticised in the usual manner.—A. S.

[Zinc] Sulphate liquors; Process for the electrolysis and treatment of ——. E. J. Hunt, Oldbury, and W. T. Gidden, Warley. Eng. Pat. 11,634, May 19, 1913.

In the electrolysis of zinc sulphate solution containing free acid, with lead anodes, particles of undissolved lead compounds (peroxide and sulphate) are prevented from reaching the cathode by interposing a porous diaphragm (*e.g.*, of asbestos cloth) which allows sufficient circulation to ensure substantially the same electrolyte at the anode and cathode. Fresh supplies of electrolyte are prepared, preferably, by treating crude zinc oxide or carbonate with acid liquor free from suspended lead compounds and then agitating the solution with the separated peroxide, in order to remove iron and manganese.—F. Sodn.

Zinc sulphate liquors; Process for treating ——. E. J. Hunt, Oldbury, and W. T. Gidden, Warley. Eng. Pat. 2952 of 1914, date of Appl., May 19, 1913.

Crude zinc sulphate liquors intended for electrolysis are purified from ferrous iron and manganese by treating (preferably hot) with lead peroxide, obtained, for example, as described in Eng. Pat. 11,634 of 1913 (see preceding abstract). An alkali or metallic oxide or carbonate may be added to complete the separation.—F. Sodn.

Boron suboxide; Processes of producing ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 15,757, July 8, 1913.

An intimate mixture of a boron compound and oxidisable silicon material (*e.g.*, borax, 7—8 parts, and silicon, 1 part) is heated electrically to the boiling point of the charge in a refractory container, which is lined, preferably, with paper. The crushed product may be purified by boiling with sodium hydroxide solution (to remove uncombined silicon and by-products).—F. Sodn.

Cyanogen compounds; Process of preparing ——. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co. U.S. Pat. 1,094,976, April 28, 1914; date of Appl., Dec. 18, 1912.

In the process of producing alkali cyanides by the interaction of alkali carbonate, carbon dissolved in iron, and atmospheric nitrogen, the iron acting as a catalytic agent (see Fr. Pat. 455,799 of 1912; this J., 1913, 943), the alkali cyanide when formed is removed from the reaction zone by distillation under diminished pressure.—A. S.

Sulphur; Process for obtaining —— by the interaction of sulphur dioxide and hydrogen sulphide. W. Feld. Ger. Pat. 272,474, Dec. 31, 1911.

The two gases, alone or mixed with other gases or vapours, or dissolved in liquids, are allowed to act simultaneously or successively on a solution of one or several thiosulphates of metals, the sulphides of which are soluble in water. For each part by weight of hydrogen sulphide one part or more of sulphur dioxide must be present, and if the gases contain also ammonia, an additional two parts of sulphu dioxide for each part of ammonia must be added. The polythionate produced by the excess of sulphur dioxide is reduced to thiosulphate by treating the solution with basic or reducing substances, *e.g.*, with gases or vapour containing hydrogen sulphide or ammonia or both. Thi may be effected by using the solution for removin ammonia or ammonia and hydrogen sulphide from gase by the process described in Fr. Pat. 431,241 (this J., 1911 1381). Any hydrogen sulphide remaining in gases which have been treated as described in Fr. Pat. 431,241 (*loc cit.*) may be removed as described above. The thiosulphat solution is diluted from time to time to maintain it activity.—A. S.

Hydrogen peroxide; Process for the cathodic production of —— in electrolytes containing oxygen or an oxygen-containing gas. Henkel und Co. Ger. Pat. 273,269, Aug. 5, 1913. Addition to Ger. Pat. 266,516.

In carrying out the process described in the chief patent (see Eng. Pat. 8582 and Fr. Pat. 457,696 of 1913; this J., 1913, 791, 1010), tantalum, tungsten, niobium, molybdenum, or a metal of the platinum group is used as cathode. Cathodes of these metals do not deteriorate in use as do the amalgamated gold cathodes described previously.
—A. S.

Hydrazoic acid or azides; Manufacture of ——. H. Standinger. Ger. Pat. 273,667, May 27, 1913.

Hydrazine hydrate or a hydrazine salt is treated with the nitrosamine of a secondary amine, such as diphenylamine, in alcoholic solution, in presence of caustic alkali or alkali carbonate. The reaction proceeds slowly in the cold, more rapidly on heating:—

$$(C_6H_5)_2N.NO+NH_2.NH_2+NaOH=(C_6H_5)_2NH+N_3Na+2H_2O.$$

—A. S.

VIII.—GLASS; CERAMICS.

Nitrates; Use of —— in the glass industry. L. Springer. Sprechsaal, 1914, **47**, 361—363.

The value of nitrates in glass-making depends on their oxidising, purifying and decolorising effects. They counteract the reducing action of the fire-gases and of sulphur dioxide in lead glazes and in colours dependent on chromates or manganates. On the other hand, nitrates are costly and strongly attack the hearth and walls of the furnace, with consequent solution of alumina in the glass. For this reason it is recommended that not more than 5 parts of saltpetre should be used with 100 of sand, and that not more than 15% of the total alkali content should be introduced as saltpetre, this proportion being reduced to 10% in the case of crystal glass.—H. H. S.

Gold; Use of —— in ceramics. A. Granger. La Céramique, 1912, 262 and 1913, 3; Sprechsaal, 1914, **47**, 359—360, 373—375.

Gold is used on pottery either for gilding or as a colouring agent in glazes. Its value for gilding lies in its resistance to oxidation and the fineness of layer which can be produced, for which reason it is not an expensive stain. The aid of a flux is employed in application, and mercurous oxide is found to reduce the amount of gold required. A mixing of the composition: 30 parts by weight of precipitated gold, 15 of black mercurous oxide, 2·5 of basic bismuth nitrate, and 0·3 of melted borax, is recommended; the addition of 3 parts of silver carbonate to this produces a greenish tint. After firing in the muffle the gold has a matt surface, and must be polished with bloodstone or agate. A cheaper process, which does not require polishing after the burn, is the use of "Glanzgold" or "Meissen gold," a preparation of gold solution with an organic medium such as turpentine, lavender oil and a balsam or resin. As a colouring agent in glazes, gold produces shades from violet to purple and red, of which the best known is purple of Cassius, a lake of precipitated gold with a metallic hydroxide, preferably that of tin, which was formerly regarded as a definite compound. The presence of ammonia or alum in the stannous chloride solution produces shades from dark to rose purple, and the tint may be further modified by the substitution of antimony or magnesia for tin. Choice of flux materially influences the colour; various recipes are given containing lead oxide, borax or felspar; and kaolin may be used as a base for the lake. In lead glazes 1 part of gold in 1000 parts of glaze powder will produce a deep red glaze; and in leadless glazes, 1 in 10,000. An underglaze stain can be produced from 50 parts of pegmatite, 50 of alumina and 1 of gold chloride. Gold may be applied under a glaze on places previously moistened with gum tragacanth solution.—H. H. S.

Lead problem; The ——. J. Dorfner. Sprechsaal, 1914, **47**, 390—391.

Leadless glazes are much more sensitive to firing conditions than those containing lead, and proper management of the burn is more important than molecular composition. The author recommends the following formulæ for a stoneware glaze fired at cones 010—07, the composition of the basic side being the most difficult of adjustment:—

	1	2	3	4	5	6
SiO_2 ..	2·5	2·2	2·02	2·52	2·447	2·245
Al_2O_3 .	0·255	0·23	0·21	0·393	0·105	0·292
B_2O_3 .	0·5	0·4	0·4	0.482	0·438	0·439
CaO ..	0·375	0·4	0·4	0·339	0·4	0·372
MgO .	0·175	0·1	0·2	—	0·055	0·112
Na_2O .	0·25	0·4	0·3	0·468	0.4	0·375
K_2O ..	0·125	0·1	0·1	0·193	0·145	0·141
ZnO ..	0·075	—	—	—	—	—

All these glazes fall within the limits prescribed by Pukall, who gives the general formula: R_2O, 0·1—0·4 R_2O_3, 0—0·5 B_2O_3, 2—4 SiO_2.—H. H. S.

Refractory materials [for gas retorts]. Bywater. *See* IIa.

Patents.

Glass; Ovens for the manufacture of sheet ——. Montan- und Industrialwerke vorm. J. D. Starck. Eng. Pat. 6357, March 12, 1914. Under Int. Conv., April 15, 1913.

In a spreading oven for the manufacture of sheet glass, the movements of the spreading trucks and of the traverser, or the movements of their driving parts, are transmitted to a switch gear controlling the driving motor and the change-over devices in the power transmission or driving gear, so as to ensure the automatic stopping of the motor as well as the automatic operation of the change-over devices of the driving gear. Electric clutches are thrown out of gear by means of a switch gear provided with a number of contacts corresponding to the four movements of the trucks and of the traverser, and comprising two contact rings mounted on a hollow spindle, one ring carrying the contacts used for reversing the driving motor, the other the contacts intended for throwing out of gear the clutches. Other claims refer to the driving of the trucks and to a grid conveyor.—H. H. S.

Silvering of mirrors and the like; Protecting ——. Marly Frères, Bordeaux, France. Eng. Pat. 10,006, April 22, 1914. Under Int. Conv., April 30, 1913.

To prevent deterioration of the foil of mirrors by friction during transport and manipulation, and adherence of silvered sheets of glass by contact, two distinct coatings are applied to the silver or to a suitable varnish previously spread over the silver. The first is an adhesive, resistant to chemicals, *e.g.*, guttapercha, certain tars, bitumens, or resins, gums or waxes, used at a temperature above the normal. The second consists of thin supple sheets, of paper for example, resistant to mechanical change, applied at a temperature sufficient to render the first coating pasty.—H. H. S.

Illuminating-glass; Method and batch or mixture for making ——. G. A. Macbeth, Assignor to Macbeth-Evans Glass Co., Pittsburgh, Pa. U.S. Pat. 1,097,600, May 19, 1914; date of Appl., May 9, 1913.

A foundation mixture capable of making substantially colourless clear glass (and preferably including a chloride) is fused with an aluminium compound and a fluoride, the weight of aluminium compound being greater than that of the fluorine, *e.g.*, 150 parts of foundation mixture, 9—15 of alumina, and 3—8 of the fluoride; the heating operation is stopped before the melt returns to a clear glass stage and before the specks are eliminated.—F. Sodn.

Glaze, slip, and the like; Apparatus for sifting and separating potter's ——. F. Beardmore, T. H. Gaskell and W. Boulton Ltd., Burslem, Staffs. Eng. Pat. 12,284, May 27, 1913.

A COMPACT apparatus contained in one frame comprises a sifting device, a pump for circulating the slip, and one or more dipping tubs, together with valved pipe connections so that the slip can be pumped to the sifter and from the dipping tubs back to the sifter. A magnetic separator may be provided for removing metallic particles from the slip during circulation.—H. H. S.

IX.—BUILDING MATERIALS.

Cement plants; Determination of the dust fall in the neighbourhood of ——. J. P. Mitchell. J. Ind. Eng. Chem., 1914, **6**, 454—459.

METHODS in which the air is passed through box-like chambers or through filters give the quantity of dust present but not the amount which would be deposited under normal conditions. The author uses glass plates coated with vaseline which are exposed on horizontal platforms mounted at the top of poles at a height of 25—30 ft. After exposure the plates are cleaned with gasoline, the dust recovered by filtration, and incinerated. From analyses of the dust thus obtained, of field dust obtained in a similar manner at a place outside the possible path of the cement-dust, and of dust issuing from the stack of the cement plant, the approximate relative proportions of "field dust" and "cement dust" in the collected samples are calculated. In some determinations made by this method the fall of cement dust calculated to lb. per acre per day varied from 0·4 to 10·4 at different stations according to the direction of the wind and other conditions.—A. S.

Magnesia and dolomitc Portland cements and their properties. M. v. Glasenapp. Chem.-Zeit., 1914, **38**, 589.

THE calcium oxide in Portland cement was replaced by an equivalent quantity of magnesia, the clinker then containing 59% MgO and 41% silicate. To effect solution of the magnesia in the silicate a much higher temperature (1700°—1800° C.) was required than in the case of ordinary Portland cement. This magnesia cement only reacted with water after 6 to 8 months, crystals, apparently of magnesium hydroxide, then being discernible. No gel formation could be detected in this period. The dolomite cement prepared from normal dolomite required a temperature of 1600° C. It was but little affected by water, and the magnesia prevented the separation of calcium hydrosilicate crystals. The use of magnesia as a substitute for calcium oxide is thus impracticable, although there is a possibility that ignited magnesite might be added to Portland cement without injurious effect; since although the magnesia combined with silica is hydraulically inactive, caustic magnesia in the form of a very fine powder slowly hardens into monoliths of great stability. The higher the temperature of burning the more slowly does the magnesia harden.—C. A. M.

Mortars; Formation of crystalloids and colloids in the hardening of ——. M. von Glasenapp. Chem.-Zeit., 1914, **38**, 588—589.

IN all cases of the hardening of mortars there is a new formation of crystalloid or colloid monolith elements through the action of water or salt solutions. The hardening of all mortars, with the exception of Portland, Roman and slag cements, depends exclusively upon the formation of crystalloids, whilst in the case of silicate cements (Portland cement, etc.) formation of both crystalloids and colloids occurs. Crystallisation processes alone will produce monoliths equal in hardness and durability to those of Portland cement and even superior (*e.g.* in the case of Sorel's cement) in regard to the proportion of filling materials which can be incorporated. This is opposed to the commonly accepted view that crystallisation tends to disintegration of the mortar. The separation of large crystals of calcium hydroxide in thin sections of Portland cement clinker is cited in support of this view, but such formation of large crystals is not to be observed in the hardening of cement mortars in practice. In addition to calcium hydroxide, hydrosilicates and aluminates also crystallise in the hardening of cement mortars, and even gel-like substances show a similar tendency. The alterations in Portland cement after 3 years are attributed, not to chemical action, but to structural changes, through the slow conversion of colloids into crystalloids. This is supported by the fact that thin sections of old cement mortars (up to 30 years) showed increased transparency to polarised light with their age, and minute crystals could be found. The colloidal substances appear to act, in part, less through their action as a "mineral glue" than through conversion into crystalloids during the hardening process.—C. A. M.

Plaster of Paris; Contribution to the knowledge of —— *from the technical point of view.* G. Gallo. Gaz. chim. ital., 1914, **44**, I., 497—537.

EXPERIMENTS on the conversion of gypsum into plaster and the setting of plaster are described. Ordinary plaster of Paris when freshly prepared consists mainly of soluble anhydrite, but rapidly absorbs moisture and in a few hours is converted into the half-hydrate, $CaSO_4,\frac{1}{2}H_2O$. In calorimetric tests the heat liberated during the setting of plaster corresponded very closely with the heat of formation of the dihydrate, $CaSO_4,2H_2O$, from the half-hydrate. The following scheme for the analysis of plaster of Paris is submitted:—*Hygroscopic moisture* is first determined by drying for 2 hours at 50°—60° C. and then to constant weight over sulphuric acid of sp. gr. 1·4; and the dried material is used in the following tests:—*Soluble anhydrite.* The sample is exposed together with a vessel of water for 12 hours under a bell, then dried over sulphuric acid of sp. gr. 1·4 till of constant weight. The quantity of water absorbed multiplied by 15·11 represents the soluble anhydrite. *Half-hydrate.* The sample is treated with excess of water, dried first at 60°—65° C., then for 24 hours over sulphuric acid of sp. gr. 1·4. The quantity of water absorbed, less that required for converting the soluble anhydrite (previously determined) into the dihydrate, is multiplied by 5·3707 to obtain the quantity of half-hydrate. *Total water* is determined by heating to incipient redness for 10 mins. The difference between the total water and that from the *half-hydrate* represents that from the *dihydrate* (*unburnt gypsum*). The difference between 100 and the sum of the percentages of solubl anhydrite, half-hydrate, and dihydrate, represents th percentage of *natural anhydrite* (or *overburnt plaster*) o foreign impurities. If overburnt plaster be present, th total SO_3 will not correspond with that present as solubl anhydrite, half-hydrate, and dihydrate. A commercia sample of plaster contained: soluble anhydrite, 0; half hydrate, 94·05; dihydrate, 2·21; and overburnt plaster 0·36%. (See also Davis, this J., 1907, 727.)—A. S.

PATENTS.

Stone work and plaster; Method and means for treatin damp porous bodies, especially ——. A. Finkle Moscow. Eng. Pat. 26,079, Nov. 13, 1913.

THE surface is treated with a solution of celluloid i acetone or strong wood spirit, mixed with a solution vegetable tar (*resini pini*) and rosin in ether, to which added white manganese (manganese borate); *e.g.*, aceto 22 kilos., ether 22, celluloid 8, manganese borate 1 *resini pini* 16, and colophony 16. The mixture counte acts the influence of hygroscopic salts, causes moisture evaporate (with the ether and acetone) from the poro body, and forms a waterproof layer on exposure to t air.—F. SODN.

Concrete and the like; Method of mixing ——. L. H. Eichelberger, Baltimore, Md. U.S. Pat. 1,097,084, May 19, 1914; date of Appl., May 21, 1913.

The constituents are fed into a container into which multiple jets of water-laden compressed air are so directed as to maintain a vertical whirling movement of the mass. —F. Sodn.

Distillation of wood, soft coal, lignite, peat and shale, and utilisation of products of distillation for creosoting timber. Eng. Pat. 12,427. *See* IIb.

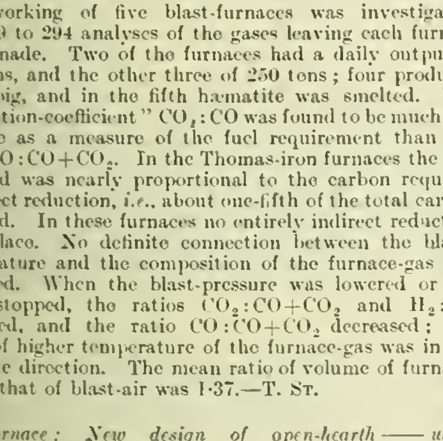
X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast-furnaces; The relations between the composition of the throat-gas and the working conditions of ——. M. Levin and J. Wesselmann. Ferrum, 1914, **11**, 261—271.

The working of five blast-furnaces was investigated, from 59 to 294 analyses of the gases leaving each furnace being made. Two of the furnaces had a daily output of 400 tons, and the other three of 250 tons; four produced basic pig, and in the fifth hæmatite was smelted. The "reduction-coefficient" $CO_2:CO$ was found to be much less suitable as a measure of the fuel requirement than the ratio $CO:CO+CO_2$. In the Thomas-iron furnaces the fuel required was nearly proportional to the carbon required for direct reduction, *i.e.*, about one-fifth of the total carbon required. In these furnaces no entirely indirect reduction took place. No definite connection between the blast-temperature and the composition of the furnace-gas was observed. When the blast-pressure was lowered or the blast stopped, the ratios $CO_2:CO+CO_2$ and $H_2:CO$ increased, and the ratio $CO:CO+CO_2$ decreased; the effect of higher temperature of the furnace-gas was in the opposite direction. The mean ratio of volume of furnace-gas to that of blast-air was 1·37.—T. St.

Steel-furnace: New design of open-hearth —— *using producer-gas.* H. F. Miller, jun. Trans. Amer. Inst. Min. Eng., 1914, **45**, 346—354.

The furnace (fig.) has a single air-uptake, A, at the back of the gas-uptake, B, the latter being 6—10 ft. from the bath and of the same width as the port which is made



ow and of small cross-section to promote rapid union of he pre-heated air and gas and produce a short but very t flame well under control throughout the run. A urnace in Sweden similar in principle to the design lescribed was operated for 58 weeks without repairs. —W. E. F. P.

Iron; The γ-transformation of pure —— *and the influence of carbon, silicon, cobalt and copper thereon.* R. Ruer and R. Klesper. Ferrum, 1914, **11**, 257—261.

Pure electrolytic iron containing C 0·009, Cu 0·03 and S 0·001 to 0·002% gave a distinct γ-transformation point at 1401° C. on cooling, and 2 to 3 C. higher on heating. The temperature of the transformation rose with increasing carbon to 1487° C. with C about 0·1%; it then remained constant up to C about 0·4%, above which concentration γ-solid solution crystallised at once. Silicon up to 1·2% lowered the melting point of pure iron very little, and up to 0·2% had no effect on the γ-transformation temperature. Higher proportions up to 1·2%, when the indications had become very indistinct, caused increasingly greater falls in the transformation temperature which had dropped to 1335° C. with Si 1·2%. The γ-transformation curve for alloys of cobalt and carbonless-iron rises in a straight line to 1492° C. at Co 16·5%, and the horizontal of complete equilibrium running from this point meets the melting point curve at Co 25%. With copper-iron alloys the γ-transformation curve rises to 1477° C. at Cu 6·5%, the horizontal from this point meeting the melting point curve at Cu 13%. The results with the cobalt- and copper-alloys are little different from those previously obtained using iron containing C 0·08% (this J., 1913, 1111).—T. St.

Iron-carbon alloys: Observations on the hardness and the electrical resistance of ——. R. Vondráček. Int. Zeits. Metallog., 1914, **6**, 172—182.

Andrew's theory that the hardness of quenched steels is due to the presence of finely divided cementite embedded in a groundmass of austenite and α-iron (this J., 1914, 359) is not in accord with the law that the hardness of such alloys is the mean of the corresponding hardness values of the components, nor with the results of the author's experiments on the electrical conductivity of hardened steels. The total carbon in quenched steels is practically all in solution, and the theory is advanced that the hardness is a particular function of the transformation, and is due to the breaking up of the metal, as it were, during recrystallisation. In this respect there is no essential difference between iron alloys and bronzes. It is deduced from the resistance of hypoeutectoid steels that the ferrite which they contain has an appreciable carbon content, which increases as the total carbon increases. Eutectoid ferrite probably contains from 0·05 to 0·07% C, and with falling temperature the carbon content rises to a maximum of 0·14%.—T. St.

[*Iron.*] *Castings; A study of the annealing process for malleable* ——. O. W. Storey and E. L. Leasman Met. and Chem. Eng., 1914, **12**, 383—389.

Bars of white iron containing C 2·60—2·70, Si 0·65—0·70, S 0·06, P 0·14, and Mn 0·27% were converted into malleable iron under varied conditions. The influence of the several variable factors on the structure of the casting was as follows: *Packing materials.* The ordinary packing materials did not directly affect the structure; with a loose packing, allowing a free circulation of oxidising gases, a carbonless rim was produced, but in a neutral atmosphere the structure of the rim was the same as that of the interior. *Temperature and time of annealing.*—The decomposition of the cementite into ferrite and temper carbon, which determines malleability, required more than 70 hours at 740° C.; it was complete after 18 hours at 985°, and 36 hours at 870° C. The *rate of cooling* after annealing is an important factor: a high rate of cooling results in a steely structure. The critical cooling range is between 830° and 740° C., in which all the carbon separates if the rate is sufficiently low; if so, the rate of cooling below 700° C. has little effect upon the iron. —W. R. S.

Mild-steel; The changes produced in —— *by annealing.* A. Stadeler. Ferrum, 1914, **11**, 271—276.

Sheets of basic Siemens-Martin steel containing C 0·1% were rolled to a thickness of 15·5 mm. and annealed in a tin-plate annealing furnace at the usual temperature for from 1½ hours to 25 days. A slight excess of carbon monoxide was maintained in the furnace and the sheets were protected from the direct action of the flames. After 25 days the thickness of the samples had become reduced to 13·6 mm. Decarburisation was observable at the edges after 3 hours, and was complete in 15 days. Manganese and phosphorus remained constant throughout, and sulphur for eight days, after which it rose slightly. Mechanical tests showed that the strains produced by rolling were removed by annealing at about 860° ± 10° C. for 1½ hours. This produced also maximum strength under impact test. Grain-development began after 3 hours, and was found to be a function of the time of annealing. So long as decarburisation was insignificant the strength under impact test diminished with increasing size of grain.—T. St.

Cementation; Prevention of —— by metallic deposits; diffusion of solid metals. L. Guillet and V. Bernard. Bull. Soc. d'Encour., 1914, **121**, 588—618.

A layer of electrolytically deposited copper, 0·02—0·04 mm. thick, is stated to be the most advantageous coating agent for protecting portions of an article from cementation. Nickel cannot be used instead of copper as it is permeable to carbon monoxide.

Diffusion of solid metals. When the following pairs of metals were heated together, with their surfaces in intimate contact to a temperature below the fusion-point of the lowest-melting metal, diffusion of one metal into another was observed: Fe-Al; Fe-Cu; Cu-Ni; Cu-bronze; Cu-Sn; Cu-brass; Cu-Zn.—W. R. S.

Tool steels; General properties of ——. M. Denis. Rev. Mét., 1914, **11**, 569—669.

The effect of chilling and annealing at various temperatures on the hardness, resiliency, and tenacity, both in the cold and hot state, of a number of tool steels was determined, and also the temperature at which the edge attained its maximum cutting power. Seven carbon steels, three chrome-, two tungsten-, and two nickel-chrome special steels, and six chrome-tungsten and four chrome-tungsten-vanadium high speed steels were used in the tests. Two pages of curves and tables are given for each sample. The resiliency of the carbon steels increased after repeated chilling followed by annealing, being double the original in some cases after 5 successive treatments. After 10 successive treatments, the hardness of carbon steels with more than 0·7% C. ceased to be uniform, whereas the special steels showed uniform, though slightly decreased, hardness. Following, the steels are arranged in order of efficiency, as measured by output (quantity of articles finished, and quantity of turnings removed, before the edge of the tool was blunted:—Cold tests: (1) chrome steels (Cr 2·2—3·4%); (2) hypereutectoid carbon steels (C 0·91—1·26%). Hot tests: (1) special steels; (2) hypereutectoid carbon steels; (3) hypoeutectoid carbon steels. The samples showing the highest cutting efficiency at higher temperatures were: (1) tungsten steel (W 3·53%); (2) hypereutectoid carbon steels (C 0·95—1·26%); (3) chrome steel (Cr 3·40%).—W. R. S.

Iron and steel; Direct determination of carbon in ——. W. D. Brown. Met. and Chem. Eng., 1914, **12**, 390.

In the process described the boat containing the metal is placed in the cold part of a silica tube, which is then closed with a two-hole stopper fitted with a nichrome plunger rod. After the air has been displaced by oxygen the boat is pushed into the hottest part of the tube by the plunger; oxygen is passed at the rate of 400 c.c. per minute. The tube contains a layer of loosely packed ignited asbestos which acts as a catalyser. Under these conditions, with an initial temperature of about 980° C., a temperature of about 1650° C. is obtained momentarily and complete combustion takes place as fast as the oxygen is supplied. The determination may be completed in 10 minutes.—W. R. S.

Carbon in steel and iron by the barium carbonate titration method; Determination of ——. J. R. Cain. J. Ind. Eng. Chem., 1914, **6**, 465—468.

Carbon in iron and steel may be rapidly determined by burning it to carbon dioxide, absorbing the latter in barium hydroxide solution, filtering off the barium carbonate, with exclusion of air, on a filter composed of a mat of asbestos and a layer of quartz grains of different sizes (50% passing a 20-mesh, and the remainder passing a 10-mesh and retained by a 20-mesh sieve), washing with water free from carbon dioxide (150 c.c. are usually sufficient), dissolving in excess of $N/10$ hydrochloric acid, and titrating the excess of acid with $N/10$ sodium hydroxide, using methyl orange as indicator. The usual purifying train connected with the combustion tube may be dispensed with, an 8-bulb Meyer tube containing the barium hydroxide solution being directly attached. The oxygen should not be passed too rapidly. In tests with U.S. Bureau of Standards analysed irons and steels, the mean error in eight determinations was —0·000056 grm. —A. S.

[Silver ores.] Desulphurising process at the Nipissing mill, Ontario. Min. and Eng. World, June 6, 1914, 1070.

A wet desulphurising process in which the slime pulp is mixed with caustic soda solution and passed through a revolving tube mill in which there are a number of aluminium ingots. A further treatment is given in a tank lined with aluminium plates, in which the pulp is slowly agitated for 24—36 hours. The slime is then dewatered in a Butters filter plant, and cyanided for 48 hours. The silver is obtained in a spongy metallic state, readily amenable to the cyanide treatment, resulting in improved extraction after shorter contact with the cyanide liquor. (See also Eng. Pat. 18,660 of 1912; this J., 1913, 915.) —W. R. S.

Silver bar; Fineness of the 800 standard ——. O. Yamagata. J. Coll. Eng. Imp. Univ., Tokio, 1914, **5**, 191—212.

The silver bars used for 50-sen coinage at the Imperial Mint, Osaka, are 584 mm. long, 49·2 wide and 11·88 thick; they are cast "on end," and, after removal of the top portion (2—3 cm.), rolled down to "fillets," 56·6 mm. wide and 1·73 thick, from which the "blanks" are cut. A number of fillets (some from whole bars, *i.e.*, as cast) were cut lengthwise into equal strips and then transversely at equidistant points, each portion being assayed separately. It was found that throughout the length of the fillet the fineness was highest along the middle and gradually decreased towards both sides. The portion
representing the top and bottom ends of the bar wer
respectively richer and poorer in silver than the bulk. th
composition being irregular at the former, but unifor
at the latter, part; for this reason, at least 2 cm. shoul
be cut off the top of the bar before rolling, and it woul
also be advisable to reject a small portion of the botto
of the finished fillet. At all other parts of the fillet th
average fineness was practically uniform and in agreemen
with the pot assay. The fineness of a bar cast from th
very bottom of a pot (*i.e.* the residue of a melting) wa
irregular and considerably higher than the correspondin
pot assay. Accurate sampling of the normal bar by th
method of cutting assay-pieces is regarded as practicall
impossible. A 50-sen coin was sampled by taking thr
equal, circular punchings, one from each angle of a
equilateral triangle described in a concentric circle havi
five-sevenths of the coin's diameter; this method ga
better results than that involving a central punching
the coin. The average fineness of the alloy at each sta
of minting was as follows:—pot assay 798·9, fillet 799·
"scissel" (the portion of the fillet remaining after t
"blanks" have been cut out) 798·5, blank 799·2, co
799·6.—W. E. F. P.

Copper-nickel ores; Chloridising the Sudbury ——. A.
Carpenter. Eng. and Min. J., 1914, **97**, 1085—1089.

In tests made on the applicability of the Longma
Henderson process to the treatment of cinders fr

Sudbury copper-nickel ores, in order to leach out the copper and obtain a residue suitable for direct smelting to ferro-nickel pig or steel, the most favourable conditions were found to be as follows: the final temperature in roasting must be high enough to decompose the nickel sulphate; the chloridising roast must be conducted at 370°—425° C. to prevent the formation of nickel chloride and its volatilisation. The sulphur content should be reduced to 1½ times the copper content, and if more is removed by roasting, a suitable amount of pyrites is added previous to chloridising. Low-grade copper-nickel matte was also treated successfully by this method. —W. R. S.

Spelter; Production of —— in Upper Silesia. A. Rzehulka. Z. angew. Chem., 1914, **27**, 327—328.

The production of spelter in Silesia dates back to 1809, the total production up to 1913 inclusive being 5,047,421 tons. Oxidised ores were treated exclusively until about 1860; since then blende also has been worked, and is now by far the most important ore. Belgian retorts have lately displaced the large Silesian muffles, although the latter were more advantageous in the treatment of low-grade ores.—W. R. S.

Zinc blendes; Treatment of roasted —— for the decomposition of zinc ferrites previous to distillation. V. Lindt. Metall u. Erz, 1914, **11**, 405—408.

Zinc ferrites formed in the roasting of blende may be decomposed by reduction with producer gas. In a laboratory experiment in which a sample of roasted blende was treated with coal gas, the content of zinc present in the form of combined ZnO fell from 6·4 to 2·5% after 40 minutes' heating.—W. R. S.

Aluminium; Nickel-plated ——. E. Tassilly. Rev. Mét., 1914, **11**, 670—673.

An adherent nickel deposit on aluminium is easily obtained by Canac's process (Eng. Pat. 24,019 of 1911; this J., 1912, 394). The aluminium is treated with boiling potassium carbonate solution, then brushed with milk of lime, and immersed for a few minutes in a 0·2% solution of potassium cyanide, and in a solution of 1 grm. of iron in 1 litre of hydrochloric acid (1 : 1) until it acquires a moiré appearance. The nickel is deposited as usual, *e.g.*, from a bath containing 50 grms. of nickel chloride and 20 grms. of boric acid per litre. The addition of iron to the last preparing solution is essential: a minute deposit of iron (0·25—0·5 grm. per sq. metre) was found on the aluminium, and microscopical examination of the surface showed a cellular structure. The iron appears to form a network of microscopic galvanic couples, which produces a rough surface. This accounts for the strong adhesion of the deposit, which cannot be detached without also tearing off aluminium particles.—W. R. S.

Arsenic; The melting point of ——. W. Heike. Int. Zeits. Metallog., 1914, **6**, 168—171.

Heating and cooling curves of arsenic contained in an exhausted porcelain vessel packed in sand in an iron bomb, gave a melting point of 830° C. No other thermal effects were observed between this temperature and 50° C. The arsenic after having been melted was steel-ray to lead-gray in colour; it was very brittle and broke asily with a brilliant fracture; the hardness on Mohs' cale was 3½—4.—T. St.

Resistance of platinum vessels to hot nitric acid. Baxter and Grover. *See* VII.

Determination of nickel by dimethylglyoxime. O. Brunck. *See* XXIII.

Patents.

on; Treatment of ——. A. V. Dismore, Slough, Bucks. Eng. Pat. 4292, Feb. 19, 1913.

E iron is made the cathode in an electrolyte composed "nickel salts" 1 lb., common salt 1¼ lb., platinum bichloride 3·75 grains, and water 1 gallon, the anode consisting of nickel and carbon placed respectively on opposite sides of the iron. A low-tension current is first passed through the bath, and then a high-tension current (up to 1000 volts), which automatically cuts out the first current, is suddenly switched in. After a suitable time the iron is cleaned by immersion in boiling water. The treatment is stated to produce enhanced malleability, ductility, and tensile strength.—T. St.

Cast-iron; Production of ——. A. W. Gregory, London. Eng. Pat. 6530, March 17, 1913.

Cast iron suitable for conversion into malleable castings is made by melting steel or wrought iron scrap with carbonaceous and silicon-bearing materials. Manganese is removed by the addition of a sulphur-bearing material, preferably an inferior coke, high in sulphur, whereby manganese sulphide is formed and passes into the slag. —T. St.

Steel manufacture. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 11,370, May 15, 1913.

The hysteresis action of silicon steel is reduced by 10—30% by heating it for 2—5 hours at 1100°—1325° C. in a reducing atmosphere (hydrogen) or in a vacuum (2—2·5 mm. of mercury).—W. E. F. P.

[*Steel*]. *Metallic articles such as gun-barrels, and turbine blades, which require great power of resistance to corrosion, that is against the influences of moist air, water, sea-water, and the like (not acids).* C. Pasel, Essen (Ruhr), Germany. Eng. Pat. 13,414, June 10, 1913. Under Int. Conv., Oct. 17, 1912.

The steel alloys used contain Cr 7 to 25, Ni 20 to 0·5, and C up to 1%, and when the articles are required to be non-magnetic, the chromium should be not less than 8%. Those of the alloys with a Brinell hardness above 380 are made soft and workable by heating to between 500° C. and the critical point (720°—780° C.) and cooling. Preliminary heating to 800°—1000° C. imparts great strength and toughness, and subsequent heating to 800°—900° C. rehardens the alloys. Those of the alloys with a Brinell hardness below 350 are made very tough and non-magnetic, by heating to 1100°—1200° C. and cooling rapidly.—T. St.

[*Steel.*] *Metal articles such as vessels, tubes, and parts of machinery, which require great power of resistance to attack by acids and great strength.* C. Pasel, Essen (Ruhr), Germany. Eng. Pat. 13,415, June 10, 1913. Under Int. Conv., Dec. 20, 1912.

A steel alloy containing Cr 15 to 40, Ni 20 to 4, and C up to 1%, is very resistant to the action of acids, especially nitric acid, and possesses great strength. After being heated to 1100°—1200° C., the cooled alloy is very tough and may be worked up into sheets, tubes, etc., without difficulty.—T. St.

[*Iron and copper.*] *Metal and carbon; Manufacturing agglomerates of reduced ——, termed in particular "ferro-carbonite" and "cupro-carbonite."* J. G. Aarts, Dongen, Holland. Eng. Pat. 17,613, July 31, 1913. Under Int. Conv., Aug. 1, 1912.

A mixture of the (iron or copper) ore with powdered coal is "carbonised" in a vertical retort the upper part of which is heated (attaining a temperature of about 1200° C. at the hottest zone) while the lower end is immersed in water. The red-hot agglomerate is continuously discharged into the latter, the steam generated passing upwards through the charge and producing hydrogen and carbon monoxide by which the ore in the upper zones of the retort is reduced. The proportions of ore and coal are adjusted so that the agglomerate contains sufficient fuel for subsequent fusion in the cupola.—W. E. F. P.

[Iron] Ores; Process of reducing ——. H. C. Alford, St. Louis, Mo. U.S. Pat. 1,097,156, May 19, 1914; date of Appl., Sept. 1, 1911.

Powdered iron oxide ore is preheated, then mixed with excess of carbon and heated to about 1000° F. (538° C.) in order to effect reduction without fusion. Two horizontal cylinders, one above the other, and geared to rotate together in opposite directions, are mounted in a heating-chamber. They are connected within the chamber by a vertical end-piece, fitted with an inclined side-pipe through which coal is introduced by means of a screw conveyor. Within each cylinder is a fixed worm or screw so that, on rotation, the charge is propelled through the apparatus continuously. The ore is preheated in the upper and reduced in the lower cylinder.—W. E. F. P.

Armour-plate; Method of treating ——. S. S. Wales, Munhall, Assignor to Carnegie Steel Co., Pittsburgh, Pa. U.S. Pat. 1,097,572, May 19, 1914; date of Appl. Nov. 15, 1906.

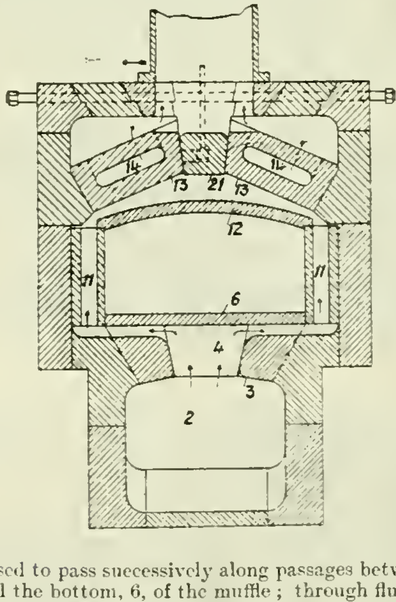
The forged plate is successively heated to 700° C., re-forged, heated to 875° C., quenched, heated to 775° C., air-cooled, machined, re-heated to rather less than 775° C., formed, annealed, machined, and water-hardened. One surface of the hardened plate may be softened by heating and air-cooling, the opposite side being sprayed during the operation to prevent equalisation of the temperature through the material.—W. E. F. P.

Metals; Anti-friction ——. C. Billington, Stoke-on-Trent. Eng. Pat. 11,138, May 13, 1913.

Sn-Sb-Cu-alloys, with or without Pb and containing Ni 0·1—5·0%. The following percentage compositions are given as examples:—(1) Sn 84, Sb 9, Cu 6, Ni 1; (2) Sn 74, Sb 9·75, Pb 10, Cu 5, Ni 1·25.—W. E. F. P.

Furnaces; Muffle and similar ——. August's Muffle Furnaces Ltd. and J. R. C. August, Halifax. Eng. Pat. 11,386, May 15, 1913.

A furnace in which the gases issuing from the fire-box, 2 (see fig.), through a series of slots, 4, arranged along the middle of the slab, 3, forming the roof of the fire-box, are caused to pass successively along passages between this slab and the bottom, 6, of the muffle; through flue bricks, 11, forming the sides; over the top, 12, and towards the front of the muffle, beneath removable, wedge-shaped slabs or blocks, 13, supported along the middle of the structure by a keystone, 21, secured to the upper portion of the apparatus; through internal, horizontal passages, 14, in the slabs, 13, towards the back of the furnace; above the slabs, 13, towards the front, and thence to the chimney.—W. E. F. P.



[Lead and zinc.] Ores; Separation of metallic sulphide ——. F. J. Lyster, Broken Hill, N.S.W. Eng. Pat. 11,939, May 22, 1913.

The ore is treated twice by froth-flotation at atmospheric temperature: first in a neutral or alkaline solution to produce a concentrate relatively rich in galena; and then in water to produce a concentrate relatively rich in blende. The medium in which the first separation is effected may be a natural "mine water" or a prepared solution containing one or more of the following compounds: chloride, hydroxide, nitrate or sulphate of calcium, magnesium, sodium or potassium; chloride of barium, carbonate or bicarbonate of sodium, sulphate of manganese, zinc, iron or aluminium.—W. E. F. P.

Sulphide ores; Flotation process for the concentration of —— by means of oil and nascent gases. Tellus A.-G. für Bergbau und Hüttenindustrie. Ger. Pat. 273,266, March 1, 1913.

The finely ground ore is mixed with water to which sodium sulphide or carbonate is added, and with oil, and the pulp is distributed uniformly over the surface of a body of water to which acid is supplied below the surface. The hydrogen sulphide or carbon dioxide evolved adheres to the oiled sulphide particles and carries them over the edge of the receptacle, whilst the particles of gangue sink to the bottom. The proportions of sodium sulphide or carbonate and of acid may be adjusted so as to give a neutral effluent.—A. S.

Silver-lead-zinc ores; Treatment of —— by smelting with zinc chloride or its double salts. E. Langguth. Ger. Pat. 273,483, April 5, 1913.

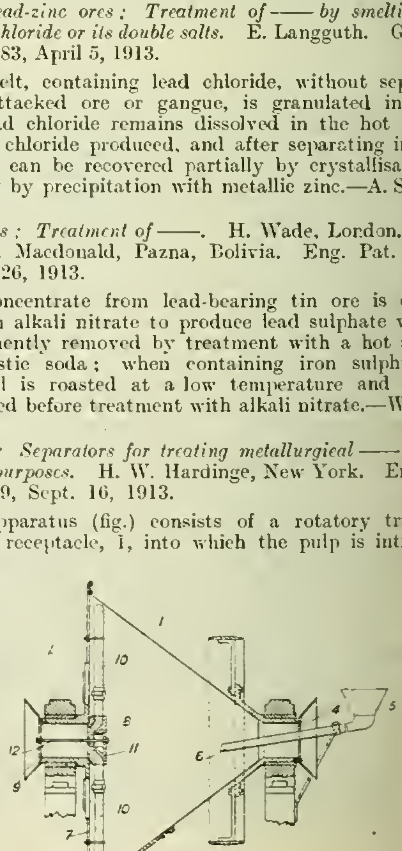
The melt, containing lead chloride, without separation of unattacked ore or gangue, is granulated in water. The lead chloride remains dissolved in the hot solution of zinc chloride produced, and after separating insoluble matter, can be recovered partially by crystallisation, or entirely by precipitation with metallic zinc.—A. S.

Tin ores; Treatment of ——. H. Wade, London. From J. B. Macdonald, Pazna, Bolivia. Eng. Pat. 12,267, May 26, 1913.

The concentrate from lead-bearing tin ore is calcine with an alkali nitrate to produce lead sulphate which i subsequently removed by treatment with a hot solutio of caustic soda; when containing iron sulphide th material is roasted at a low temperature and re-concentrated before treatment with alkali nitrate.—W.E.F.P

Slimes; Separators for treating metallurgical —— and fo like purposes. H. W. Hardinge, New York. Eng. Pat 20,919, Sept. 16, 1913.

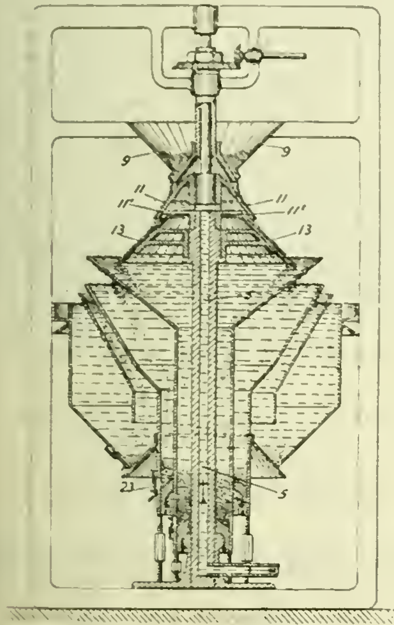
The apparatus (fig.) consists of a rotatory truncate conical receptacle, 1, into which the pulp is introduce through the smaller end, 4, from a hopper, 5, by a pipe, and discharged in part from a central opening 8, in t



larger end, 7. The opening, 8, is provided externally with a funnel, 9, and internally with a series of open, radial pipes, 10, which rotate with the receptacle and are carried at their converging ends in a block, 11, clamped against the side of the vessel by means of a rod, 12. During rotation the heavier particles of the material gravitate to the larger end of the receptacle, are taken up by the pipes, 10, and discharged through the funnel, 9; while the lighter particles are discharged through the opening, 4, the level for discharge being preferably such that the receptacle will never be quite half full.—W. E. F. P.

Ore: Apparatus for washing ——. H. A. Brackelsberg, Hagen, Germany. Eng. Pat. 13,987, June 17, 1913.

The finely powdered, dry ore is allowed to fall freely from a hopper, 9 (fig.), on to a distributing cone, 11, and thence to a spreader cone, 13, upon the surface of hich is maintained a continuous stream of water, supplied through a pipe, 5, to the interior of the cone, 11, rom which it is delivered, through openings, 11′, under steady pressure by reason of the air cushion in the pper part of the cone. Beneath the spreader cone, a eries of funnel-shaped vessels, filled with water and velled by means of screws and ball-headed bearings t the base of the apparatus, are disposed concentrically, shown, classification of the ore pulp being effected means of the successive overflows, and clear water ischarged peripherally from the outermost vessel. —W. E. F. P.



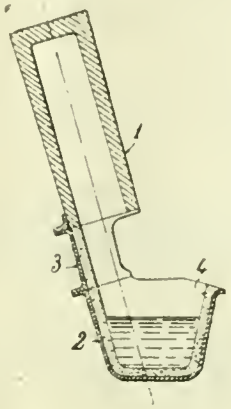
ungsten.] *Wire; Process of drawing* ——, *and apparatus r same.* H. Schinnerling, Reinickendorf-Ost, Germany, Assignor to General Electric Co. U.S. Pat. 1,096,866, May 19, 1914; date of Appl., April 16, 1913.

HE (tungsten) wire is drawn through a die immersed in bath of lubricant (oil) at 300°—400° C.—W. E. F. P.

ires; Method of pointing —— *for wire-drawing.* Wolframlampen-A.-G. Ger. Pat. 272,731, May 7, 1912.

HE end of the wire is treated with a fused chlorinating sulphurising bath of inorganic chlorine or sulphur mpounds. For example the wire may be dipped into fused timony pentachloride or used as anode in the electrosis of fused calcium chloride.—A. S.

Metals and alloys; Process of casting ingots of ——, *and apparatus therefor.* P. H. G. Durville, Paris. Eng. Pat. 23,719, Oct. 20, 1913. Under Int. Conv., Nov. 21, 1912.



The apparatus (fig.) consists of a mould, 1, having an extension, 3, to which a reservoir, 2, is attached, the latter and extension being lined with refractory material, 4. The reservoir is charged and the apparatus slowly inverted so as to fill the mould without agitating the molten metal.—W. E. F. P.

[*Zinc from brass.*] *Volatilised matter; Process of separating and recovering* ——. G. Mellen, East Orange, N.J. U.S. Pat. 1,097,135, May 19, 1914; date of Appl., Dec. 19, 1912.

Molten brass is caused to flow down a series of steps within a vertical furnace and exposed to the action of a gaseous stream traversing the furnace in the opposite direction. Volatilised zinc oxide is collected at the top, and the molten residue at the bottom, of the apparatus. —W. E. F. P.

Metals and oxides; Process for separating and recovering —— *from molten slags and other products.* A. Desgraz. Ger. Pat. 273,047, June 13, 1913.

The metals or oxides are separated from the slag or the like by treatment with reducing agents, with or without other additions, in a reverberatory furnace so arranged that the charge moves with decreasing velocity towards the hottest part of the furnace, whilst simultaneously its surface increases. The furnace is divided into several compartments arranged in steps, so that as the surface of the charge becomes larger its depth becomes less. As the charge moves towards the hottest part of the furnace, and the desired metals are separated from the slag, the latter becomes lighter and, separating from the heavier portion, becomes exposed in increasing degree to the flame.—A. S.

Platinum; Process for separating —— *from iridium and other metals.* Verein Chemischer Fabriken in Mannheim. Ger. Pat. 273,178, March 28, 1913.

The mixture of metals is treated with chlorine above 585° C. until the iridium is completely converted into chloride. A portion of the platinum is converted into chloride and volatilised, but most of it is unattacked and is separated from the non-volatile iridium trichloride by elutriation or by dissolving in *aqua regia*.—A. S.

Chemical reactions sensitive to air or oxygen [e.g., reduction of easily oxidisable metals]; Process for carrying out —— *in an inert atmosphere.* O. Knöfler und Co. Ger. Pat. 273,218, Oct. 18, 1912.

A solid or liquid substance, which on heating gives off non-oxidising vapours, is added to the reaction mixture. Formaldehyde, for example, is decomposed into carbon monoxide and hydrogen at 500° C., and easily oxidisable metals such as thorium, zirconium, cerium, titanium, and vanadium may be obtained from their compounds by heating with metallic calcium in presence of 5—10% of trioxymethylene. Ammonium compounds and hydrocarbons may be used in a similar manner to produce a non-oxidising atmosphere.—A. S.

Metals; Furnace for obtaining easily oxidisable ——. A. Zavelberg. Ger. Pat. 273,308, Aug. 7, 1913. Addition to Ger. Pat. 226,257.

In carrying out the process described in the chief patent (this J., 1910, 1460), in order to maintain the inner portions of the walls of the reaction chamber at a uniform temperature and restrict the cooling to the outer surface, heating flues are constructed in the walls.—A. S.

Iron and manganese ores, pyrites cinder, blende, etc.; Process for roasting and sintering ores and metallurgical products, e.g. ——. W. Buddeus. Ger. Pat. 273,277, Jan. 16, 1913.

Thin metal tubes, spaced apart, are placed in the sintering chamber and the ore is fed in around the tubes. The fuel is then introduced into the spaces enclosed by the tubes and the latter are withdrawn. Sintering is effected by a blast of air forced through the charge in a direction parallel to the columns of fuel.—A. S.

Aluminium; Production of a coating on —— *resisting the action of sea-water and concentrated acids or alkalis.* Z. D'Amico. Ger. Pat. 273,292, Dec. 10, 1912. Addition to Ger. Pat. 248,857 (this J., 1912, 824).

The aluminium is treated first with a solution of caustic alkali and then, without removing the aluminate formed and the excess of alkali, with a solution containing potassium-iron tartrate and cupric, ammonium, ferric, zinc and stannic chlorides. The coated metal is washed with lime water and warm water, heated, and treated with a mixture of oils and balsams as described previously (*loc. cit.*). The cupric chloride may be replaced by copper sulphate, and finely powdered calcium carbonate or a caustic alkali may be added to the solution of metallic salts. —A. S.

Aluminium; Process for protecting and decorating ——. J. Tronel. Ger. Pat. 273,498, May 21, 1912.

The metal is first sprayed with a mixture of an alkaline cleansing agent, ammoniacal nickel sulphate solution, precipitated silica, and small quantities of zinc and tin compounds, then washed with water, dried, treated with a solution of rubber, gutta-percha, and nitrated castor oil or its substitutes, again dried, at a high temperature, and then treated with a solution of nitrocellulose, celluloid (inflammable with difficulty), fatty acids, and gum-like substances produced by the transformation of lactic acid in presence of organic and inorganic salts. An elastic transparent coating is obtained which is not broken even when the metal is worked mechanically.—A. S.

Electrolytic furnaces for the production of light metals. G. B. Ellis, London. From Sodium Process Co., New York. Eng. Pat. 29,418, Dec. 20, 1913.

See U.S. Pat. 1,092,178 of 1914; this J., 1914, 555.—T.F.B.

Treatment of phosphate slag for agricultural purposes. Eng. Pat. 922. *See* XVI.

XI.—ELECTRO-CHEMISTRY.

Mercurous sulphate; Commercial preparation of —— *for normal cells.* E. Warburg. Z. Elektrochem., 1914, 20, 345

Ordinary commercial mercurous sulphate is not suitable for the preparation of Weston normal cells, but there is now on the market material prepared under the advice of, and tested by, the Physikalisch-technische Reichsanstalt specially for this purpose. The salt is contained in sealed and stamped vessels under saturated cadmium sulphate solution. It is prepared by von Steinwehr's precipitation method (Z. Instrumentenkunde, 1905, **25**, 205: to obtain preparations composed of crystals of uniform size, and hence having the same solubility, and giving, in the cell, the same E.M.F., one of the reacting solutions is heated to 80°—100° C., and the other is added, drop by drop, with constant agitation; the very small crystals are removed from the product by elutriation).—W. H. P.

Anodic oxidation of ammonia in alkaline solution in presence of silver salts. Scagliarini. *See* VII.

Reduction of disodium phosphate by alternating electric currents. Wenger and Heinen. *See* VII.

Patents.

Refractory materials fusible only at high temperatures; Fusion of ——. E. Podszus. Fr. Pat. 465,604, Dec. 2, 1913. Under Int. Conv., Dec. 2, 1912.

The process is designed for the fusion of oxides of zirconium thorium, aluminium, etc., which is impossible in an ordinary electric arc on account of their combination of low conductivity and high melting-point. An inner chamber of refractory clay, surrounded by sheet iron, is provided with electrodes of which the upper can be manipulated in order to adjust their distance apart. The current is started with the electrodes close together, and the lower one, packed in the badly conducting material —which is in a granular condition and not powdered lest it should be scattered and thus extinguish the arc— attains a high temperature and melts the surrounding particles which percolate to the bottom and in the melted condition are sufficiently good conductors to take the place of the lower electrode, so that the arc plays on the surface of the melt. Volatilised fumes raise the conductivity of the atmosphere, and by raising the upper electrode, an arc of 20 cm. length is obtained at a tension of 22 volts. Electrodes of composition resembling the materia to be fused may be used.—H. H. S.

Process for treating zinc sulphate liquors. Eng. Pat. 2952 *See* VII.

Electrolysis and treatment of [zinc] sulphate liquors. Eng Pat. 11,634. *See* VII.

Electrostatic separators for treating inflammable or explosi materials. Eng. Pat. 26,802. *See* I.

Cathodic production of hydrogen peroxide in electrolyt containing oxygen or an oxygen-containing gas. Ge Pat. 273,269. *See* VII.

XII.—FATS; OILS; WAXES.

Fats; Preparation of optically active ——. *I. Synthes of optically active halogenhydrins.* E. Abderhald and E. Eichwald. Ber., 1914, **47**, 1856—1866.

Allylamine was neutralised with hydrobromic acid a brominated, and from the resulting dibromopropylami hydrobromide, $CH_2Br.CHBr.CH_2.NH_2.HBr$, the *d*-tartra (m.pt. 131° C.) was obtained by treatment with *d*-silv tartrate. On fractional crystallisation crystals wi $[\alpha]_D = +25{\cdot}59°$ and $+31{\cdot}17°$ were obtained. By treati the *d*-tartrate with sodium nitrite, *d*-dibromhydr ($[\alpha]_D = +6{\cdot}25°$) separated, whilst the *l*-product could separated from the mother liquor. The optically acti dibromhydrin was transformed by alcoholic potassi hydroxide into *d*- and *l*-epibromhydrins, the former havi $[\alpha]_D = +6{\cdot}45°$. Introduction of caproic acid into t hydroxyl group produced a pronounced increase in t optical rotation. Attempts to remove both bromine ato from the dibromhydrin were unsuccessful.—C. A. M.

Linseed and petroleum oils; Iodine value of ——. W Smith and J. B. Tuttle. U.S. Bureau of Standar Technologic paper No. 37. J. Franklin Inst., 19 **177**, 687.

The iodine values of raw linseed oils determined with Han solution, were concordant for amounts up to 0·25 grm., decreased with the increase in weight above that limit. With burnt oils, an increase in the degree of burning reduced the limit of agreement with different weights of oil. With petroleum oils the iodine values were concordant for quantities of 0·6 grm. and upwards, the maximum absorption being obtained in about 10 mins. Oils with the highest iodine values did not require the largest excess of iodine to obtain the maximum absorption. The influence of temperature was greater upon the iodine value of burnt than of raw or boiled linseed oils.—C. A. M.

Acetyl value of oils, fats, etc.; Determination of the ——. E. B. Holland. J. Ind. Eng. Chem., 1914, **6**, 482—486.

The author recommends determination of the saponification value of the fat before and after acetylation, the difference being the acetyl value and representing the number of mgrms. of potassium hydroxide required for the saponification of the acetyl fixed by 1 grm. of oil on acetylation. 5 grms. of fat are heated with 10 c.c. of acetic anhydride for 1—1½ hours under a reflux condenser, and the acetylated fat with addition of sufficient pure ceresin, washed and separated as in the determination of the insoluble acids, and its saponification value determined. If the original fat contains free soluble acids, a correction must be applied.—A. S.

Hardened oils. E. Mellana. Annali Chim. Appl., 1914, **1**, 381—387.

Samples of cottonseed, soya bean, kapok seed, whale and sperm oils were hardened by hydrogenation in presence of reduced nickel, and the characters of the products compared with those of the original oils. Samples of "talgol" (from whale oil), "candelite" (from whale oil) and "coryphol" (from castor oil) were also examined. The results are shown in the following table:—

	M.pt.	M. pt. of fatty acids.	Solidif. pt. of fatty acids.	Saponif. value.	Iodine value.	Acetyl value.	Refractometer reading at 60° C.
	°C.	°C.	°C.				
lardened :							
Cottonseed oil	59	57	50·3	192·3	41	—	—
Soya bean oil	68	66	61·2	190·9	15·2	—	—
Kapok seed oil	55	53	48	191	32	—	42
Whale oil ..	52·5	49	44	169·5	28·8	—	39
Sperm oil ..	50	48	39	131·7	17·3	—	29·5
'algol	43	41	35·7	190·2	61·3	14	—
'andelite ..	55	54	50·4	191	4	—	—
'oryphol	81	75	68	186·5	18·5	125	—

'he oils after hydrogenation responded to the general olour reactions for seed or marine animal oils respectively, ut less distinctly and with more or less modified colour ffects. Halphen's and Milliaus' reactions for cottonseed nd kapok seed oils usually gave negative results with the ardened oils. All of the samples contained traces of ickel. (See also this J., 1912, 996; 1913, 201, 370, 665.) —A. S.

oaps; Contribution to the knowledge of ——. The gelatinisation of solutions of potassium laurate and oleate. and of mixtures of the two. J. Kurzmann. Kolloidchem. Beihefte, 1914, **5**, 427—484.

o obtain information regarding the property of forming jelly which is possessed by solutions of potassium laurate id of mixtures of which it is a large constituent, especially presence of an electrolyte, the author determined the scosity and electrical conductivity of solutions of this lt and of potassium oleate and of mixtures of the two. ıe determinations were made under very varied contions of temperature and concentration and in the esence of different electrolytes, the viscometer used ing specially designed to permit of determinations ing carried out with highly viscous solutions. The scosity of potassium oleate at first increased gradually th increasing concentration, but with solutions of ½ grm.-ol. per litre and upwards the rise was extremely rapid, the viscosity attaining a very high value, even exceeding that recorded for potassium palmitate by Farrow (this J., 1912, 289). Solutions of the oleate of 0·4*N* strength and less exhibited a high temperature coefficient of viscosity. The rise in the viscosity of potassium laurate solutions was very moderate and gradual, and even with the more concentrated solutions the temperature coefficients were of a lower order of magnitude than those of the oleate. The behaviour of potassium myristate gave results intermediate between those obtained with the laurate and oleate though it most resembled the laurate. The behaviour of the potassium soap obtained from palm-kernel oil, the chief constituent of which is potassium laurate, was very similar to that of the pure laurate. The addition of small proportions of potassium laurate to potassium oleate slightly raised the viscosity at 90° C. and considerably reduced it at 20° C., the temperature coefficient of the viscosity of such mixtures being considerably less than that of pure potassium oleate solutions, especially at fairly high concentrations. The addition of potassium hydroxide to a neutral soap solution decreased the viscosity at low concentration but at higher concentration increased it. To obtain the same effects with potassium oleate solutions as with potassium laurate solutions much smaller quantities of the hydroxide were required and the action of the hydroxide was greater the more concentrated the oleate solution. The addition oven of small quantities of potassium laurate to the oleate caused the properties of mixtures to approximate to those of the pure laurate. The action of the hydroxide varied with the temperature in such a way, that concentrations which reduced the viscosity at high temperatures increased it at lower temperatures. The critical concentration of the potassium hydroxide at which the viscosity was increased may be called the "gelatinising" concentration since at this point cooling the solution brought about the formation of a jelly. The temperature coefficient of the viscosity was decreased by the addition of small quantities of potassium hydroxide and increased by the addition of larger quantities before the "critical concentration of gelatinisation" was reached. The temperature coefficient of the oleate was much higher than that of the laurate. The viscosity of the potassium soap obtained from palm-kernel oil was much less affected by potassium carbonate than by potassium hydroxide when the effect of solutions of equivalent concentration was compared, but when equimolecular solutions were compared the effect of potassium carbonate was of the same order as that of potassium hydroxide. This indicates that the effect is due to the anion, the divalent carbonate ion being more active than the monovalent hydroxyl ion. It is not yet possible to explain the peculiar course of the viscosity curves which represent the effect of increased additions of potassium hydroxide. The peculiar minimum on the viscosity curves observed on adding increasing quantities of potassium hydroxide cannot be ascribed to the influence of electrolytic or hydrolytic dissociation of the soap since, on the one hand, similar effects may be observed with potassium hydroxide and potassium chloride (Goldschmidt and Wiessmann, this J., 1912, 593) and on the other hand, colloids which cannot dissociate exhibit similar behaviour on the addition of an electrolyte (Woudstra, Kolloid-Zeitschrift, 8, 80). The properties exhibited by the potash soaps were distinctly different from those of the albumins in which the formation of albumin ions or alkali salt seems to be associated with an alteration in viscosity. This change in the viscosity is an increase and not a decrease and is similar to the behaviour of ammonia soaps on the addition of ammonia (this J., 1913, 201). The curves of the molar conductivities were abnormal for all the soaps examined and were similar to those already determined for the soda soaps. An addition of potassium hydroxide or potassium carbonate lowered the conductivity of all the soaps examined, the conductivity of the mixture tending to become lower than that of the pure electrolyte which had been added. The temperature coefficient of the conductivity of the mixtures fell regularly from the high values characteristic of the neutral soaps to those already known for pure potassium hydroxide solution. The conductivity of a mixture of potassium laurate and potassium oleate was higher than the sum of the conductivities of its components and this increase in the conductivity was more pronounced at low than at higher temperatures. When applied to technical operations the results of this investigation show that a calculation to determine the behaviour of a mixture of fats cannot be made additively from a knowledge of the properties of its constituents and that complicated reciprocal influences operate in mixtures of soaps of different molecular weights.—J. A.

Soap; Determination of the fatty acid content of ——. A. A. Besson. Chem.-Zeit., 1914, **38**, 645—647, 686—687.

The author compared the efficiency of petroleum spirit and ether as solvents for fatty acids. The latter is to be preferred on account of the greater ease with which it can be vaporised without leaving any appreciable residue. The short period of heating required to remove this solvent also reduces the loss of volatile fatty acids to a minimum, this loss always being considerable when even carefully distilled petroleum spirit boiling below 65° C. is employed. Further, ether is a better solvent for lactones and hydroxyfatty acids, which occur in many fats (sulphur olive oil for instance) used extensively for soap making. The solubility of water in ether is not objectionable as this is considerably reduced by the presence in the water solution of the salt formed when the soap is decomposed with an acid.—J. A.

Talc as a lubricant. F. Thalberg. Chem.-Zeit., 1914, **38**, 711—712.

Talc does not behave like graphite on treatment with tannin solutions, but may be brought into a finer molecular state by being heated with ammonium carbonate, or by treatment for several hours with a current of dry ammonia. Afterwards the talc is dried *in vacuo*, since heating causes the particles to agglomerate again. The treated material forms fine suspensions in water which are very difficult to filter, and subsides exceedingly slowly in lubricating oils of medium density. When once suspended in a neutral oil no subsidence of the talc occurs on heating. The change in the character of the talc is attributed to the absorption of a minute quantity of ammonia. From 40 to 60% of ordinary talc may be introduced into heavy mineral oil provided that the oil be added to the talc and not the reverse.—C. A. M.

Deodorisation of naphthenic acids. Schmitz. *See* IIa.

Treatment of grain [in the distillery] for the recovery of oil, utilising enzymes. Vasseux. *See* XVIII.

Patents.

Catalysing agents [for hydrogenation of oils]; Manufacture of ——. W. Fuchs, Vienna. Eng. Pat. 11,542, May 17, 1913. Under Int. Conv., May 18, 1912.

To reduce unsaturated liquid fatty acids and their glycerides, carbonates of base metals easily dissociated, such as nickel carbonate, are heated to 230° C. beneath the surface of the oil, and subjected to the action of hydrogen under pressure. When metallic nickel has been formed, the reduction of the oil is brought about at a lower temperature. (See also Eng. Pats. 29,612 of 1910, 13,519 and 25,326 of 1911, 4702 of 1912, and 4144 of 1913; this J., 1912, 398, 650, 1190; 1913, 705.)—B. N.

Oil; Hydrogenated or hardened —— and process of making same. C. Ellis, Montclair, N.J. U.S. Pat. 1,097,308, May 19, 1914; date of appl., Nov. 22, 1912.

Edible products free from toxic metallic compounds, and of the consistence of butter or lard, are obtained by the catalytic hydrogenation of cottonseed oil or mixtures of edible oils.—C. A. M.

Fatty acids and their esters; Process for reduction [hydrogenation] of unsaturated ——. C. H. Maryott, Dallas, Tex. U.S. Pat. 1,097,456, May 19, 1914; date of appl., Nov. 30, 1912.

A solution of the fatty acid or oil in ether or other suitable solvent is treated with hydrogen in the presence of a catalytic metal of the palladium group, and in the absence of any material quantity of water or other liquid in which fats are insoluble.—C. A. M.

Fish oil; Process for the preparation of clear and odourless oils from ——. F. Bergius, Hanover, Germany. Eng. Pat. 18,925, Aug. 20, 1913. Under Int. Conv., Aug. 20, 1912.

Fish oil is deodorised by a single heating for several hours at a temperature between 250° and 300° C., without preliminary treatment with steam, etc. After deodorisation, purification of the oil may be completed by washing or steaming. (See also Eng. Pats. 15,491 of 1887, 7901 of 1906, and 15,012 of 1912; this J., 1888, 756; 1907, 420; 1913, 34, 436).—C. A. M.

Hydraulic presses for seeds and the like. Harburger Eisen- und Bronzewerke Aktienges., and G. Koeber, Harburg, Germany. Eng. Pat. 28,262, Dec. 8, 1913.

A constant quantity of material is supplied to the press, the piston of which is made to descend automatically in regulated stages by discharging definite amounts of the pressure-medium, *e.g.*, water, through a measuring device, the discharge being controlled by the movements of the hopper into which the material is fed.—C. A. M.

Press-filters for seeds containing oil. Harburger Eisen- und Bronzewerke Aktienges., Harburg, Germany. Eng. Pat. 29,913, Dec. 29, 1913.

The lateral inner walls of the filter-chamber are pierced with numerous small holes which open radially into larger holes at an angle to the axis of the latter, thus increasing the outlets for the oil without notably weakening the walls.—C. A. M.

Process for obtaining a substitute for boiled linseed oil Ger. Pat. 273,347. *See* XIII.

XIII.—PAINTS; PIGMENTS; VARNISHES RESINS.

White lead; Experiments on ——. R. S. Owens. J Phys. Chem., 1914, **18**, 461—473.

By precipitating lead hydroxide and carbonate, separatel or together, from solutions of lead acetate, crystals of th former were obtained varying in size according to th concentration and temperature employed. Lead carbo ate was not obtained in definite crystalline form, bu between narrow limits, the particles varied in size accordi to the conditions of precipitation. By keeping a mixtu of lead carbonate and hydroxide (separately precipitate under a solution of sodium acetate, white lead was obtain in particles of one size irrespective of the dimensions of t reacting particles. White lead obtained by co-precipitati of the carbonate and hydroxide was composed of rounde translucent, non-crystalline particles which were larg or smaller according as the precipitation was slow or rapi The commercial white leads examined, and those produc in the laboratory by the Wolterecl and Luckow electr lytic processes, were found to consist of particles cor sponding in size to those of white lead obtained by sl precipitation. When composed of the smaller partic precipitated white lead absorbed less oil and produc a better paint than when composed of larger partic uniformity in size of particles is, however, not necessar an advantage in a paint.—W. E. F. P.

Red lead ; Physico-chemical and technical studies on ——. Preparation of pure lead orthoplumbate. J. Milbauer. Chem.-Zeit., 1914, **38**, 477—479, 559—560, 566—567, 587—588.

The author critically reviews published methods for the preparation of pure red lead, and gives two new methods. *Dry method.*—Fifty grms. of potassium nitrate are slowly heated to 339° C., and a tube containing recrystallised lead chloride (m.pt. 484° C.) is immersed in the melt. Lead peroxide is gradually added with constant stirring, and the heating continued until oxygen ceases to be evolved, and the lead chloride in the tube has melted. The mass is then extracted with hot water, washed until free from nitrate, and dried at 110° C. Products thus obtained invariably contained 100% Pb_3O_4, were of a bright red colour, and had sp. gr. 8·7 at 17° C. *Wet method.*—A mixture of lead oxide and lead peroxide ($3PbO : 2PbO_2$) is gradually added to a concentrated solution of potassium hydroxide (150 to 200 grms. per 100 c.c.), and the liquid heated for 5 mins. A deposit of red lead is formed, with layers of other oxides above it, and the former, when washed with water, yields 100% Pb_3O_4. With other proportions of the lead oxides preparations ranging from green to brown or purplish-red in colour were obtained.

By extracting commercial red lead (58% Pb_3O_4) with boiling potassium hydroxide solution (100 grms. in 100 c.c.), there was obtained after 25 minutes a residue containing 92 to 96% Pb_3O_4, whilst a second extraction of 5 minutes yielded 99·7% Pb_3O_4. This method is not universally applicable, since it does not remove impurities such as calcium carbonate. (See also this J., 1913, 97, 151.)
—C. A. M.

Thitsi [Burmese lacquer]. L. Rosenthal. Farbenzeit., 1914, **19**, 1573—1574. Chem. Zentr., 1914, **1**, 1979.

"Thitsi" is obtained from the stems of the *Melanorrhoea usitata* as a grey, very viscous liquid of sp. gr. 1·0016 at 20° C., which on exposure to air becomes first brown and then, very rapidly, deep black. The drying of the lacquer is not accelerated by siccatives and is retarded by dry heat, the presence of moisture being essential. The constituent of the lacquer soluble in alcohol is identical with the urushinic acid, $C_{14}H_{18}O_2$, of Japan lac. The ether extract consists of a gummy substance soluble in water and a nitrogenous, coagulable substance, similar to a protein, which is insoluble in water ; this latter substance acts as an oxygen carrier in the drying of the lacquer, but loses its activity when heated above 60° C. The composition of two samples of the lacquer was : urushinic acid, 86·24, 83·24 ; gum, 3·08, 3·52 ; oil, 0, 0·53 ; residue insoluble in ether, 1·71, 2·14 ; moisture and volatile matter, 8·97, 10·57%.—A. S.

Patents.

Linseed oil ; Process for obtaining a substitute for boiled ——. E. F. Waentig. Ger. Pat. 273,347, Feb. 28, 1913. Addition to Ger. Pat. 272,465.

The oils are heated with water under pressure before being treated with superheated steam as described in the chief patent (this J., 1914, 604).—A. S.

Sealing and bottle wax ; Manufacture of a —— insoluble or sparingly soluble in alcohol. J. von Jasinski. Ger. Pat. 273,346, Aug. 17, 1913.

The resins obtained by extracting raw rubber or gutta-percha with solvents in which caoutchouc is insoluble, are used, together with the usual colouring and filling materials, in the preparation of the wax.—A. S.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber ; Combustion method for the direct determination of ——. L. G. Wesson. J. Ind. Eng. Chem., 1914, **6**, 459—462.

A detailed description of the method for the determination of caoutchouc by converting it into the nitrosite and determining the carbon content of the latter by combustion (see this J., 1913, 614). Contrary to the statement of Alexander (see this J., 1907, 422, 538 ; 1911, 560) it was found that no appreciable quantity of carbon dioxide is formed during the conversion of caoutchouc into the nitrosite.—A. S.

Patents.

Rubber ; Method of vulcanising —— and means therefor. F. E. Blaisdell, London. Eng. Pat. 11,257, May 14, 1913.

The vulcaniser consists of a steam-jacketed vessel with means for admitting both steam and compressed air into the inner vessel. The rubber articles are placed in the inner vessel into which steam is then admitted, and in which the pressure is afterwards raised by the admission of compressed air. Steam is at the same time led into the outer jacket in order to raise the temperature to that necessary for vulcanisation. The temperature and pressure at which the goods are vulcanised can thus be regulated independently.—E. W. L.

Rubber, caoutchouc and the like ; Recovery of the solvent from ——. A. Boecler, Hamburg, Germany. Eng. Pat. 22,638, Oct. 7, 1913.

The work tables or rollers over which the materials used in the production of rubber textures, such as rubber-asbestos sheets, are passed while the solvent is evaporating, are completely enclosed in a casing, which is divided by the table or rollers into an upper and a lower compartment. The two compartments are connected by relatively small passage-ways at the sides, the bottom or sides of the lower compartment being inclined, and the walls of this compartment being provided with a cooling device for the purpose of collecting and assisting in the downflow of the condensed solvent, which is run off from an outlet at the bottom.—E. W. L.

Rubber ; Treatment [coagulation] of —— [by means of smoke]. F. Ripeau, Paris. Eng. Pat. 2281, Jan. 28, 1914.

The latex is poured into shallow pans which are then placed on a supporting stand in a smoke chamber. When the latex is coagulated sufficiently to enable the whole of it to be removed as a sheet, it is taken out, and may then be placed flat in a mould of such a size as to prevent lateral extension, and there subjected to gentle pressure in order to remove excess of water. The coagulated sheet may be turned and subjected to further smoking, and a further quantity of latex may then be coagulated upon it. The sheets are finally placed upon drying racks and kept in a drying shed until their surfaces are smooth and silky to the touch without being sticky or tacky.—E. W. L.

Manufacture of a sealing and bottle wax insoluble or sparingly soluble in alcohol. Ger. Pat. 273,346. *See* XIII.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Colloidal tannins. M. C. Lamb. Leather Trades Year Book, 1914, 127—130.

Quebracho, containing 7 parts of tannin to 1 part of non-tannin, penetrates hide much more rapidly, especially in dilute solutions, than oak bark, which contains 7 parts of tannin to 4 parts of non-tannin Diffusion is slower with oak bark on account of its more colloidal character due to the relatively greater amount of non-tannins which it contains. Green pelt is first placed in liquors which have become mellowed by the accumulation of dissolved hide-substance and calcium salts and from which most of the astringent tannins have been removed by earlier packs of goods, or drawn grain and case-hardening is the result. The colloidal character of the tannin matter has an important bearing on the subsequent behaviour of the solution. C. F. Cross has found that the colloidal substance "tragasol" extracted from seeds, when mixed with tannin, produces a curdy precipitate in which the two substances are combined approximately in the ratio of their formula weights. The precipitate is insoluble in water but readily mixes with it; on heating a transparent and continuous solution is formed with a great increase of viscosity. The substance is suitable for tanning as the transition to the insoluble condition by combination with pelt is comparatively slow. Goods may be placed, after deliming, direct into a concentrated solution of the tragasol-tannin precipitate, with no water added except that held by the pelt, and there is no liability of causing drawn or case-hardened grain. Such strengths can be used as to tan sole-butts completely in 30 hours. The mixture is best applied in the drum and the leather produced is water-resistant and of good colour as there is little oxidation and the tragasol-tannin complex parts with water very slowly. Tannage may also be carried out first with the colloidal material followed by the use of liquid extract in undiluted form.—D. J. L.

Tan; Power from spent ——. C. E. Parker. Leather Trades Year Book, 1914, 201—202.

The combustion furnace (producer) for converting tan into power gas is necessarily larger than that for a similar plant using coke or anthracite. Before feeding into the producer, the tan is put through a tan-press to remove excess of moisture. Special features in the scrubbers for cleaning the gas are necessary as trouble may arise from clogging of valves or piston if tar is carried forward with the gas. A very efficient gas is produced from spent tan, some materials being better than others in this respect. Myrobalans, on account of their oily nature, give a good gas of high calorific value. Crude tar is deposited in the washer, but the quantity of saleable by-products (oils) obtainable therefrom has, so far, not been found to render recovery profitable.—D. J. L.

Leather finishing: The uses of collodion in ——. C. A. Higgins. Leather Trades Year Book, 1914, 148—151.

Solutions of collodion cotton or nitrocellulose (celluloid solution, soluble cotton mixture, pyroxylin, nitro-cotton solution and zapon) are finding application as a varnish or a vehicle for the application of pigments and decorative materials on account of the ease of application and the strength and insoluble nature of the film produced. Careful selection of solvents and efficient airing of leather after coating should leave no cause of complaint of residual odour. The advantages of the process over the old method of japanning with linseed oil are that no ovens are required, sunning is unnecessary, and the leather retains its natural grain surface owing to a thinner coating being used in the collodion process. The enamel is stronger and has not the brittleness or liability to crack of oil-enamelled leather. —D. J. L.

XVI.—SOILS; FERTILISERS.

Phosphate rock; Reserve supply of —— in the United States. W. H. Waggaman. J. Ind. Eng. Chem., 1914, **6**, 464—465.

The estimated supplies of rock grading from 58 to 70% "bone phosphate of lime" are as follows. In the case of low-grade phosphate and wash-heaps, the equivalent of high-grade phosphate has been calculated. The estimates for Kentucky and Arkansas, where little development work has been done, are probably not close to the truth, but are regarded as ultra-conservative. High-grade rock: Utah, Idaho, Wyoming, and Montana, 2,500,000,000 tons; high-grade equivalent of all grades: Utah, Idaho, Wyoming and Montana, 7,500,000,000; Florida, 354,300,000; Tennessee, 115,075,000; S. Carolina, 10,000,000; Arkansas, 20,000,000; Kentucky, 500,000; high-grade equivalent of wash-heaps: Florida, 20,000,000; total 10,519,875,000 tons. Taking the average output during the life of the deposits as three times the present output (nearly 3 million tons in 1912), the available supplies will last for over 1100 years provided proper mining methods are employed and means devised for utilising the lower-grade material. Attention is drawn to the increasing use of raw ground phosphate rock as a fertiliser.—A. S.

Basic slag; Sources of error in the analysis of ——. M. Popp. Chem.-Zeit., 1914, **38**, 741—742.

The sample should be well mixed after it has been passed through the usual sieve, since the sifting operation tends to yield layers of material of unequal composition. The time of contact of the sample with 2% citric acid solution should be exactly 30 mins. at 17·5° C., with continual shaking, and the solution should then be poured on a large filter; further quantities of the solution must not be poured on to the filter as the latter empties. Fifty c.c. of the filtrate are treated with 25 c.c. of iron citrate solution (see this J., 1913, 953), 1 c.c. of 3% hydrogen peroxide, and 25 c.c. of magnesia mixture.—W. P. S.

Ammonium citrate; A comparison of neutral —— with sodium citrate and N/10 citric acid. P. Rudnick, W. B. Derby, and W. L. Latshaw. J. Ind. Eng. Chem., 1914, **6**, 486—487.

In the determination of insoluble phosphoric acid in phosphatic fertilisers, sodium citrate solution of sp. gr. from 1·043 to 1·231 gave results considerably higher than those obtained with neutral ammonium citrate solution of sp. gr. 1·09. N/10 citric acid gave results agreeing well with those furnished by ammonium citrate and has the advantages that it is more easily prepared and standardised than the latter, and allows of the extraction and filtration being performed more rapidly.—A. S.

Solubility of the nitrogen compounds of nitrolim (crud calcium cyanamide) in water. Manuelli. *See* VII.

Volumetric determination of cyanamide. Grube an Krüger. *See* VII.

Use of dicalcium phosphate ("phospho-gelose") an kieselguhr for clarifying cane juice in Brazil. Pelle *See* XVII.

Patent.

Phosphate slag for agricultural purposes; Treatment of — H. Küppers and Act.-Ges. Peiner Walzwerk, Peir Germany. Eng. Pat. 922, Jan. 13, 1914.

Silicious material, *e.g.*, sand, is added to the molten sl as it leaves the converter and is intimately incorporat by a rotary stirrer which is plunged beneath the surfa of the mixture after a crust has been allowed to form. T phosphoric acid of the slag may be rendered almost co pletely soluble in citric acid by the process.—F. Sodn.

XVII.—SUGARS; STARCHES; GUMS.

Sugar; Evolution of —— in the beetroot during its sec period of vegetation. M. Levallois. Bull. Assoc. Ch Sucr., 1914, **31**, 903—909.

During the period of flowering of the sugar beet the wei t of the root gradually increases, decreasing again slowly a r the appearance of the seed. On the contrary, the suc e content rapidly falls, the decrease observed in e experiments of the author being from 18—21% in A il to 8% at the moment of flowering in August and to o on the formation of the seed in September and Octo r. —J. P.

Maize; Manufacture of sucrose from ——. J. B e Dent. Zuckerind., 1914, **39**, 538—540.

In a large scale experiment, maize grown in Tucu n, Argentina, was crushed in a double 3-roller mill. n extraction of 55% by weight was obtained and the had the composition: Brix reading, 15·9; sucrose, 8·75; and purity, 55·0%. After clarifying by the addition of lime and soda, allowing to settle, sulphiting to a slightly acid reaction, and boiling, the composition was: Brix reading, 14·7; sucrose, 8·69; and purity, 59·1%. The concentrated syrup did not crystallise readily in the pan, but after breaking the vacuum, and allowing the strike to stand for 10 mins., a fine grain separated, which on subsequently centrifuging and "covering" with steam gave a sugar of the composition: water, 1·15; sucrose, 97·6; ash, 0·34; and reducing sugars, 0·31%. In a laboratory experiment with an extraction of 64·5% by weight, and a sucrose content in the juice of 12·27, the yield of first and second sugars, calculated to 100° polarisation, was 5·35 and 1·25% respectively. It is concluded that the working-up of naize juice in the factory presents no inconvenience; ut that on the agricultural side there are considerable difficulties, namely, the necessity of harvesting within 8—21 days to avoid a great loss of sucrose by inversion; he brief duration of the point at which the maximum of ucrose is reached; and the sensitiveness of the plant to iseases and pests, especially in its early period of growth. —J. P. O.

agasse; Weight of —— in [sugar] factory control. G. L. Spencer. Intern. Sugar J., 1914, **16**, 254.

s the author's method of determining the weight of agasse, the weight of the mixed juice is deducted from at of the cane and saturation water. This procedure is aimed to be much more reliable than that in which the tio of the percentage of fibre in the bagasse and in the ne is determined, though it is subject to certain errors, ., the partial drying of the bagasse in passing through e mills, and the possibility of water entering the juice ns from the mill journals. Error in other directions is minated as far as possible by the use of automatic mpling devices, by taking the actual weights of cane d juice, and by the measurement of the water.—J. P. O.

calcium phosphate ("phospho-gelose") and kieselguhr; Use of —— for clarifying cane juice in Brazil. L. Pellet. Bull. Assoc. Chim. Sucr., 1914, **31**, 849—858.

E raw sulphited juice is treated in mixing tanks with ie and a mixture of dicalcium phosphate and kieselguhr, ssed through heaters, which raise it to 95°—100° C., d sent to the decantation tanks. After settling, clear and brilliant juice is obtained, whilst the ms are filtered, washed, and dried, to be subsequently ployed as a fertiliser, their composition being: organic tter, 64·25; organic nitrogen, 1·47; total phosphoric d, 11·16; total lime, 12·87%. Depending upon the ity of the juice, the amount of the dicalcium phosphate kieselguhr used may vary from 0·8—2·8 kilo. and 0·3— kilo. respectively per ton of cane ground.—J. P. O.

rose; Modification of the double polarisation (Clerget-lerzfeld) method of determining the —— in (beet) molasses. . Stanek. Z. Zuckerind. Böhm., 1914, **38**, 429—440. See also this J., 1914, 96 and 433.)

obviate the influence of salts and optically-active ogenous substances in the double polarisation method n applied to beet molasses, the author proposes to e the direct reading in the presence of exactly the same unt of potassium chloride and citric acid as the inver- reading, clarification being effected with bromine er in place of lead acetate. *Preparation of the citric solution.*—380 grms. of pure potassium hydroxide are ted with about 250 c.c. of water, and when about e-quarters have dissolved, the liquid (solution 1) is red off, the remaining hydroxide being dissolved in t 250 c.c. of water (solution 2). 400 grms. of pure c acid are mixed with 100—200 c.c. of water, and tion 1 gradually added while stirring. After cooling, liquid is diluted to about 750 c.c., neutralised with tion 2, phenolphthalein being used as indicator, and finally after again cooling made up to 1000 c.c. This constitutes the neutral potassium citrate solution, 10 c.c. of which will combine with the 5 c.c. of hydrochloric acid (sp. gr. 1·188) used for inversion, forming potassium chloride and free citric acid. 500 c.c. are treated with 250 c.c. of hydrochloric acid (sp. gr. 1·188), cooled, and made up to 1000 c.c. This is the potassium chloride and citric acid solution, 20 c.c. of which contain the equivalent of 5 c.c. of hydrochloric acid (sp. gr. 1·188) used for inversion, combined as potassium chloride. *Procedure for beet molasses.*—Twice the normal sugar weight of the sample is dissolved in 200 c.c. of water without the addition of any clarifying agent. For the direct reading, 50 c.c. are placed in a 100 c.c. flask with 20 c.c. of the potassium chloride and citric acid solution, and the liquid made up to the mark with saturated bromine water, being polarised in the 200 mm. glass tube. For the inversion reading, 50 c.c. of the normal molasses solution are hydrolysed with 10 c.c. of hydrochloric acid (1 part of acid of sp. gr. 1·188 to 1 of water) in the usual manner, cooled, and 10 c.c. of the neutral potassium citrate solution and sufficient bromine water added to make up the volume to 100 c.c. After 20 minutes, the liquid is polarised in the 200 mm. water-jacketed tube, preferably at 20° C., and the content of sucrose calculated from the formula:

$$\frac{(D-I)\,100}{132 \cdot 6} \text{ for } 20^\circ \text{ C.; or } \frac{(D-I)\,100}{142 \cdot 6 - \frac{t}{2}} \text{ at any other}$$

temperature, t, D and I being the direct and inversion polarisations respectively. Under the conditions of working, bromine has no effect either on the sucrose or on the invert sugar. The coefficient of 132·6 was established with the new procedure in the presence of molasses salts and nitrogenous optically-active bodies for the concentration used. This modification gives results that agree well with the Andrlik-Stanek method (this J., 1911, 62), but are about 1% higher than those obtained by the ordinary procedure, which is known to be incorrect on account of the influence of optically-active amino-acids. —J. P. O.

Adsorption of dextrose. II. P. Rona and K. v. Tóth. Biochem. Zeits., 1914, **64**, 288—295. (See this J., 1909, 535.)

The inhibitive action of acetic acid on the adsorption of dextrose by charcoal (*loc. cit.*) must be due to the undissociated molecules of acid, for it is not affected by addition of sodium acetate or hydrochloric acid. The power of inhibition depends on the extent to which the inhibitive substance is itself adsorbed, and this again depends on the extent to which it lowers the surface tension of water; for example, the inhibitive action of propionic acid is greater than that of acetic acid, but less than that of butyric or isobutyric acid. The strong mineral acids, which are only weakly adsorbed, have very little influence on the adsorption of dextrose, whereas in the case of the urethanes (methyl, ethyl, propyl and butyl) adsorption by charcoal and inhibition of adsorption of dextrose are both strongly pronounced, and both increase with the molecular weight of the urethane. The distinction between "mechanical" adsorption by charcoal and "electrochemical" adsorption by kaolin and ferric hydroxide (*loc. cit.*) is well exhibited by the urethanes, which are strongly adsorbed by charcoal, but not at all by kaolin or ferric hydroxide.—J. H. L.

Laevulose; Action of ultraviolet rays on ——. Formation of formaldehyde and carbon monoxide. A. Ranc. Biochem. Zeits., 1914, **64**, 257—287.

Pure aqueous solutions of lævulose, exposed to the action of ultraviolet rays, undergo decomposition even at 20° C., with production of gas consisting of carbon monoxide together with small quantities of formaldehyde and carbon dioxide. The solutions afterwards contain aldehydic and acid substances. (See also Bierry, Henri and Ranc, this J., 1910, 1029; Berthelot and Gaudechon, this J., 1910, 1081).—J. H. L.

PATENTS.

Megass furnaces. The Stirling Boiler Company, Ltd., London. From E. C. Knight, Tucuman, Argentine. Eng. Pat. 12,141, May 24, 1913.

In furnaces in which the megass is passed through a retort on its way to the fire, a pipe containing a plunger communicates at one end with the retort, and near the other with a regulating shoot above it. The shoot has a flap arranged to open and drop a fresh charge of megass as the plunger is returning.—O. E. M.

Sugar juices; Apparatus for boiling —— by the steam from the juice, without addition of fresh steam. E. Portemont. Fr. Pat. 465,565, Dec. 1, 1913.

The heating apparatus contains two concentric tube systems, A and B. The system, A, which serves to heat the juice initially, is supplied through the pipe, 13, with steam say from the Pauly apparatus, and the system, B, through the pipe, 16, with steam from the juice, the steam in each case being utilised for two or more effects. Condensed water is discharged through the pipes, 14 and 17, and non-condensable gas through the pipes, 15 and 18.—L. E.

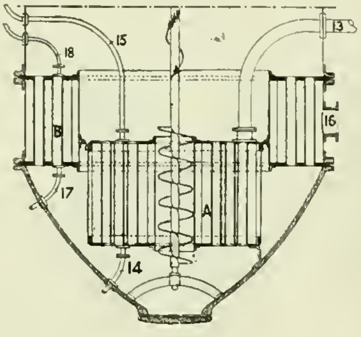


Fig. 1.

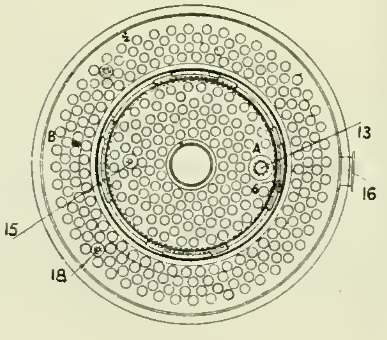


Fig. 2.

XVIII.—FERMENTATION INDUSTRIES.

Enzymes; Specific action of —— with regard to their synthetic properties. E. Bourquelot. J. Pharm. Chim., 1914, 9, 603—606.

When glucosidase-β is allowed to act upon an alcoholic solution of dextrose the β-alcoholglucoside is produced. At the same time the equilibrium between the α- and β-glucoses becomes disturbed, with the result that the whole of the dextrose becomes converted into the β-modification. On the other hand, treatment of a similar alcoholic solution of dextrose with glucosidase-α leads to the production of α-alcoholglucoside. Similar results can be obtained by treating a solution of galactose with galactosidase-α or -β. Methylgalactoside-β has $[\alpha]_D=$ —0·419°.—F. Shdn.

Benzoylcarbinol and other substances; Formation of —— from phenylglyoxal by the action of fermenting yeast. H. D. Dakin. J. Biol. Chem., 1914, 18, 91—93.

When phenylglyoxal is added to an actively fermentin mixture of dextrose solution and yeast, the main product of the action are benzoylcarbinol and *l*-mandelic acid small amounts of benzyl alcohol, benzaldehyde, an phenylpyruvic acid are also formed.—W. P. S.

Nitrogen; Question of the assimilation of elementary —— by yeasts and mould fungi. A. Kossowicz. Biochem Zeits., 1914, 64, 82—85.

No evidence for the assimilation of elementary nitroge was afforded by the author's experiments, in whic various organisms, including *Aspergillus niger, Penicilliu glaucum*, and some yeasts, were cultivated for three week in nitrogen-free nutrient liquids (cp. Lipman, this J., 191 1273).—J. H. L.

Yeast; Asymmetric and symmetric action of —— on racem combinations of naturally occurring amino-acids. Ehrlich. Biochem. Zeits., 1914, 63, 379—401. (S also this J., 1905, 683; 1907, 480; 1909, 848; 1910, 835 1911, 566.)

Fermenting yeast acts selectively on racemic compoun of alanine, valine, leucine, isoleucine, serine, glutam acid, phenylalanine, histidine and the dipeptide alan glycine, so that in some cases after the whole of t naturally occurring isomeride has been decomposed abo 60—70% of the other form can be recovered unchange There is no such selective action with aspartic ac proline and tyrosine, both forms of which are decompos at the same rate. In his experiments the author employ only one yeast, a top-fermentation race.—J. H. L.

Yeast autolysis; Synthetic processes of ——. N. Iwan Biochem. Zeits., 1914, 63, 359—368.

Suspensions of hefanol in water, autolysed until most the protein had been hydrolysed (*e.g.*, for 24 hours 53°—55° C.) and then rendered alkaline with dipotassi phosphate, recovered 4—9% of their original prote content within 24 hours, whilst at the same time content of proteolytic products precipitable by l acetate (peptic products) correspondingly decreased. is concluded that, provided proteolysis has advanced enough in the autolysis of yeast, it is possible to reve to some extent the hydrolytic action of the peptase pres by rendering the liquid alkaline with dipotassium p phate.—J. H. L.

Yeast juice; Synthesis of nitrogenous substances in mac tion ——. S. Kostytschew and W. Brilliant. physiol. Chem., 1914, 91, 372—391.

Lebedeff's maceration yeast juice (this J., 1911, contains endotryptase and a considerable quantity proteins. A large proportion of the proteins is hydrol on keeping the juice, slightly acidified with acetic at 34° C. for 2 days, though the remainder is not atta even in the course of 9 days. This hydrolysis is foll by synthesis on adding a considerable quantity of s to the juice (2—4 grms. of dextrose per 8 c.c.); synthesis only occurs, however, if hydrolysis has fairly considerable, a fact which appears to show the synthesis is aided by the proteolytic enzyme. result of synthesis, the amount of "protein nitro determined by Stutzer's method of precipitation copper hydroxide, may increase by as much as 16 that in the original juice; the increase appears to be less however, if the "protein nitrogen" is detern by precipitation with basic lead acetate, and it is cluded therefore that the synthetic products are identical with the true proteins of yeast juice.—L. E.

Enzymes ; Contribution to the chemistry of proteolytic ——. E. Herzfeld. Biochem. Zeits., 1914, **64**, 103—105.

It is suggested that the active constituents of pepsin and trypsin are respectively peptones and amino-acids, *i.e.*, compounds identical with or similar to the products of their activities. As regards their content of nitrogen, and of dialysable substances capable of reacting with triketohydrindene hydrate, there is a certain resemblance between pepsin and peptones and between trypsin and amino-acids or their derivatives. Moreover, peptones exert a proteolytic action comparable with that of pepsin, but only towards their parent proteins, *e.g.*, albumin is decomposed by peptone from albumin, but not by silk peptone. Similarly, amino-acids exhibit tryptic activity, which, however, does not appear to be specific like the peptic action of peptones.—J. H. L.

Yeast ; Relation of protein substances of —— *to sucrase.* P. Thomas. Comptes rend., 1914, **158**, 1597—1600. (See also this J., 1913, 762 and 803.)

Cerevisin proved capable of hydrolysing sucrose, and the action could be increased by finely powdering, warming to 52° C., or boiling for a short time with a weak solution of urea. The other protein isolated from yeast had no such action. Sucrase is considered to be derived from cerevisin.—F. Shdn.

Yeast ; New observations on the production of pyruvic acid by ——. A. Fernbach and M. Schoen. Comptes rend., 1914, **158**, 1719—1722. (See this J., 1914, 97.)

A solution of 1·8 kilos. of inverted sucrose in 24 litres of water containing mineral salts, was fermented by the myco-yeast of Duclaux in presence of chalk, and 279 grms. of calcium salts were obtained (cp. *loc. cit.*). The latter were acidified and extracted with ether, and the soluble acids distilled *in vacuo*. The quantity of pyruvic acid in the distillate corresponded to only 1·23% of the sugar fermented, but the residue from the distillation contained much larger quantities of a condensation product of pyruvic acid. From the quantity of acetic acid produced by oxidation of the calcium salts (see above) with chromic acid, the authors conclude that the amount of pyruvic acid present was 8% of the sugar originally fermented. Experiments with other yeasts gave similar but not quantitatively identical results. In the course of fermentation the amount of pyruvic acid appears to increase in proportion to the sugar consumed, until fermentation is complete, after which it diminishes.—J. H. L.

Hops ; Aroma of ——. *The volatile oil in relation to the geographical sources of the hops.* F. Rabak. J. Agric. Research. 1914, **2**, 115—157.

The essential oil was extracted from hops grown in various places during several seasons. The physical properties and results of fractional distillation showed strong similarities amongst related oils and dissimilarities amongst unrelated oils. The following figures give the average ester numbers of the respective oils: Bohemia 3·5 ; Washington 52·8 ; New York 50·9 ; Oregon 58·8 ; alifornia (five districts) 41·0—51·0. The ester numbers f the oils from hops of any particular season or locality ere found to be very similar.—F. Shdn.

ines ; Solubility of bitartrate in —— *: an indication of dilution.* L. Tissier and H. François. Ann. Falsif., 1914, **7**, 251—254.

nce wines in their original condition are saturated ith potassium bitartrate, a determination of the amount the salt that can be dissolved by a sample of wine fords an indication as to whether and to what extent the ine has been diluted. Thus, of 14 samples of undiluted d wine, only one dissolved as much as 9 mgrms. of bitarate per 100 c.c. at 25° C., whilst most of the others ssolved none or even lost a few mgrms. (*i.e.*, were ghtly supersaturated). Three of the samples also, ere cooled to 2° C. for 10 days prior to the determination, it only one was affected thereby, the amount of bitartrate ssolved increasing from 9 to 19 mgrms. On diluting the wines to 10%, the amounts of bitartrate dissolved per 100 c.c. at 25° C., ranged from 23 to 63 mgrms. In the case of undiluted white wines, the solubility of bitartrate ranged from 48 to 63 mgrms. per 100 c.c. at 25° C. ; cooling the wine to 2° C. for 10 days prior to the determination, increased this solubility by 8—19 mgrms., whilst dilution of the wine to 10% increased the solubility by 44—51 mgrms.—L. E.

Grain ; Treatment of —— *[in the distillery] for the recovery of oil, by the aid of enzymes.* A. Vasseux. Bull. Assoc. Chim. Sucr., 1914, **31**, 882—886.

The germ of the grain (maize), and amounting to 20%, and which contains almost all the oil, is separated, and saccharified at 72°—75° C. with the addition of 2—3% of malt, the remaining 80% of the grain being treated in the usual manner. It is claimed that in this way the recovery of oil is greater, and the flavour of the finished spirit is better, than by following the usual procedure.—J. P. O.

Cognac ; Maturation of ——. E. P. Häussler. Z. öffentl. Chem., 1914, **20**, 184—197.

Distillates from wine were stored for 9—15 months in contact with oak chips (*e.g.*, 400 grms. in 3600 c.c.) and analysed from time to time. The gravity of the liquids increased slightly and in most cases the alcohol-content decreased by 1—2 %, but fluctuated considerably ; alcohol was probably absorbed by the wood in amounts depending on the temperature. The content of extract increased, *e.g.*, from 0·1 to 2·9 grm. per litre in 2 months and to 7·3 grms. in 15 months. The reducing substances, calculated as dextrose, constituted 4—8% of the total extract before and 8—14% after hydrolysis with acid. The volatile and total acidities increased uniformly with the time, and the ash increased slightly. The content of higher alcohols fluctuated without any general rise or fall, and the content of esters (determined in the steam distillate) showed no considerable change. A pure aqueous solution of alcohol, treated similarly to the wine-distillates, underwent similar changes of composition, and afterwards responded positively to some of the usual reagents for vanillin. Wine distillates stored for 12 months in glass vessels underwent no considerable change in composition. The author considers that evidence as to sophistication of brandy may be obtained from the ash-content which should not greatly exceed 0·3 grm. per litre, and from the contents of extract and reducing substances (see above).—J. H. L.

Alcohols ; Action of formaldehyde on —— *in presence of sulphuric acid.* J. Buraczewski and W. Matejko. Oesterr. Chem.-Zeit., 1914, **17**, 130—131.

A reddish-brown coloration was produced when alcohol was mixed with an equal volume of concentrated sulphuric acid in presence of a small quantity of formaldehyde. By boiling the mixture and then diluting with water, a solid product of indeterminate composition was obtained. Since the higher alcohols, fusel oil, etc., gave the coloration more readily, and with diluted acid, the reaction was made the basis of a colorimetric determination of fusel oil in raw spirit. Sulphuric acid diluted with half its volume of water, and an equal volume of 40% formaldehyde solution were the reagents employed.—G. F. M.

Patents.

Beer or other liquids ; Method of clearing ——, *and apparatus therefor.* E. R. Curtis, Brighton, and J. W. Huxley, Guildford. Eng. Pat. 13,619, June 12, 1913.

The beer is passed, under high pressure, through a vessel mounted axially on a revolving shaft, the inlet and outlet for the beer being situated at or near the axis. The revolving vessel, which may be contained in an outer, stationary one, is fitted with vanes so that the liquid is caused to rotate with the vessel ; the solid particles thus move towards the periphery and clarified liquid is discharged through the outlet. The revolving vessel may be fitted with a disc so placed that the beer circulates round it in passing through the vessel. In another form of apparatus, the beer is introduced through tubular arms mounted radially on the revolving shaft.—L. E.

Wort ; Apparatus for extracting ——. W. T. Ramsden. London. Eng. Pat. 19,745, Sept. 1, 1913.

A cylindrical basket, mounted horizontally on a rotatable shaft and closed at one end, is fitted at the other, open end with an inturned flange. The mash is fed into the basket at the closed end, and the wort passes by centrifugal action through the wall of the basket to an outer casing fitted with an outlet. A screw conveyor, mounted on a shaft passing axially through the shaft which carries the basket, causes the mash from which the wort has been extracted to flow over the inturned flange. Sparging water is introduced through a perforated pipe extending within the basket.—L. E.

XIXa.—FOODS.

Bacteria in milk ; A comparison of the microscopical method and the plate method of counting ——. J. D. Brew. New York Exper. Stat., Bull. No. 373, Feb., 1914, pp. 1—38.

Although there is little relationship between the results obtained by the plate method and the direct microscopic method when used for counting the number of bacteria in single samples of fresh milk, there is a certain relationship when a series of samples is examined ; the microscopic method yields higher and probably more accurate figures. In the case of milk showing plate counts of less than 10,000 bacteria per c.c., the count by the microscope shows about 44 times as many individual bacteria, or 17 times as many when the clumps and isolated bacteria are counted as units. With more than one million bacteria per c.c., the microscope count shows about 5 times as many as the plate count, or even less than the latter count when the clumps are taken as units. The difference is due to the fact that a colony on an agar plate develops either from a clump of bacteria or from a single individual. Since the two counts are practically the same when the plate count is approximately one million per c.c., it appears that nearly all the bacteria in market milk grow on nutrient agar media when incubated at ordinary temperatures. The microscope count, in spite of its limitations, possesses the advantage that in some cases it shows the presence of bacteria not adapted to grow on gelatin or agar ; further, the results may be obtained within a few minutes of taking the sample. At the same time, the adoption of the microscopical method of counting bacteria in milk would involve a complete readjustment of bacteriological standards, and more data should be obtained before any such change is made.

The microscopical method employed by the author consisted in placing 0·01 c.c. of the milk (by means of a capillary pipette) on a glass slide and spreading the drop over a surface of 1 sq. cm. ; the milk was then dried, treated with xylene to remove fat, fixed with 95% alcohol, and stained with methylene blue. The counting was done under an oil-immersion lens of 1·9 mm. focus. The medium employed in the plate method consisted of Liebig's meat extract, 5, Witte's peptone, 10, agar, 15, lactose, 10 grms., and water, 1 litre ; the plates were incubated for 5 days at 21° C.—W. P. S.

Milk ; Composition of ——. H. D. Richmond. Analyst, 1914, **39**, 243—248.

The average composition of 19,807 samples of milk received from the farms during 1913, was as follows :—

	Morning's milk.	Evening's milk.	Average.
Specific gravity	1·0319	1·0315	1·0317
Fat, %	3·52	3·83	3·67
Solids not fat, %	8·82	8·79	8·81

During the months of May, June and July, a small percentage of the morning milks yielded less than 3% of fat. The percentages of fat and the aldehyde figure (see this J., 1911, 148) were determined in a number of samples of cream ; the average aldehyde figure, calculated on the cream devoid of fat, was 20·8, practically the same figure as is found in the case of milk devoid of fat. The aldehyde figure is of use for detecting whether a cream has been watered or not, for should a cream be low in fat due to the addition of milk, no alteration of the figure would take place, whilst added water would lower it.—W. P. S.

Milk ; Determination of the viscosity of —— *as a means of detecting addition of water.* W. D. Kooper. Milchwirtsch. Zentr., 1914, **43**, 169—179, 201—208. Chem. Zentr., 1914, **1**, 1975—1976.

No definite relation was observed between the viscosity of milk and its fat content or specific gravity, although in general a high fat content corresponded with high viscosity. In 50 samples of mixed milk the relation between the total solids, T, and the viscosity constant, V (ratio of the times of efflux of the same volume of milk and of water from the viscosimeter at 15° C.) was, on the average, $T=\frac{V}{0{\cdot}1384}$. In the case of milk from which a portion of the fat has been removed, or to which water or skimmed mil has been added, the ratio $\frac{V}{0{\cdot}1384}$ gives a higher value tha corresponds with actual percentage of total solids.—A. S

Proteins of the maize kernel ; Nutritive properties of the —— T. B. Osborne and L. B. Mendel. J. Biol. Chem., 1914 **18**, 1—16.

Experience in the use of maize as a food has led to th belief that, compared with other foodstuffs, it is in som respects inadequate. This deficiency appears to be du to the fact that zein, the chief protein of maize, does n yield amino-acids which are necessary for nutritio For instance, glycocoll, lysine, and tryptophane a entirely absent from the products of hydrolysis of zei whilst arginine and histidine are present in only sma amounts. The addition of amino-acids considerab increases the food value of zein, and, although this brought about to some extent by the other proteins maize when the latter is used as a whole, a very sma addition of a substance such as lactalbumin to maize foo would probably be of great advantage.—W. P. S.

Crude fibre [in grain, bran, etc.] ; New method for t determination of ——. H. Stiegler. J. f. Landw., 191 **61**, 399—426. Chem. Zentr., 1914, **1**, 2016—2017.

Three grms. of the sample (less if it contain a hi proportion of crude fibre), in the form of an impalpa powder, are mixed with 20 c.c. of water in a 300 c Soxhlet flask such as is used for sterilising milk, 60 c of hydrochloric acid of sp. gr. 1·19 are added and w mixed, and after 10 mins. the mixture is diluted to 200 c with boiling water and heated for 1 hour on the wat bath whilst a slow current of air is drawn through. Af allowing to settle, the clear liquid is drawn off throug tube of 7 mm. diam., with a contracted portion ab 2 cm. from one end and having therein a roll of gl wool which projects about 1 cm. from the end of the tu whilst drawing off the liquid the end of the roll of gl wool is kept quite close to the residue at the bottom of flask ; the glass wool is subsequently knocked out of tube into the flask and the tube rinsed. The conte of the flask are neutralised and an excess of 50 c.c. of potassium hydroxide solution added, the mixture diluted 200 c.c. with boiling water, and heated for ½ hour on water-bath whilst a current of air is drawn throu The insoluble residue is collected on asbestos in a Go crucible, washed with 500 c.c. of hot water, and w alcohol, left in contact with ether for ½ hour, then dried 2 hours at 100°—105° C., weighed, the residue incinerat and again weighed. The results agree well with corrected values for crude fibre obtained by Weene method and with the cellulose values obtained by Toll method.—A. S.

Sugars in gingerbread and similar products; Separation and determination of ——. J. König and W. Burberg. Z. Unters. Nahr. Genussm., 1914, 27, 761—774.

A quantity of 6·25 grms. of the powdered sample is mixed in a 250 c.c. flask with 25 c.c. of water, and, during a period of 2 hours, quantities of 50 c.c. of 96% alcohol are added until the flask is filled to the mark. The alcoholic solution is then filtered, evaporated to small volume, and diluted to 250 c.c. with water. Portions of this solution are used for the determination of the polarisation before and after inversion, total sugars (total solids by evaporation), dextrose and invert sugar (by Soxhlet's method), and sucrose. Starch and dextrins are determined in the portion insoluble in alcohol.—W. P. S.

Patents.

Flour or like material; Treatment of —— [*with liquids*]. E. Samuelson, Banbury, Oxon., and J. Backhouse, Bootle, Lancs. Eng. Pat. 12,299, May 27, 1913.

Flour is introduced into the bottom of a chamber, preferably wider at the top than at the bottom, by means of a screw conveyor, or through a hollow vertical shaft, leading to a spreader, and is carried upwards by means of revolving lifters, beaters or brushes and fan blades arranged on the vertical shaft. Liquid is atomised in a separate chamber below the flour chamber, and passes upward into the latter, where it comes into intimate contact with the flour. The atomisers are arranged tangentially and the supply of atomised liquid may be regulated automatically by means of a valve actuated from the flour-supply valve.—E. W. L.

Grain cleaning appliances; Treatment of residue from ——. T. Robinson & Son, Ltd., C. J. Robinson, and T. J. Stevenson, Rochdale, Lancs. Eng. Pat. 13,037, June 5, 1913.

Residues from grain cleaning appliances are freed from dust and then passed through closed, air-circuit aspirators, whereby the small seeds and impurities are separated and collected in different compartments.—W. P. S.

Cream, milk, and the like: Apparatus for use in pasteurising ——. H. Tödt, Lensahn, Germany. Eng. Pat. 27,208, Nov. 26, 1913.

A vertical rotating drum is mounted in a vessel contained in a casing. The liquid to be pasteurised is passed upwards through the space between the drum and the vessel, and the inner wall of the drum and the outside of the vessel are heated by jets of steam. The heated liquid leaving the top of the apparatus is conducted to a spraying chamber and thence to a cooling apparatus. The drum and the vessel may be slightly conical so that the width of the space between them can be adjusted by raising or lowering the drum. Means are provided for removing condensed water from the apparatus.—W. P. S.

XIXb.—WATER PURIFICATION; SANITATION.

Hardness of water; Determination of ——. L. W. Winkler. Z. anal. Chem., 1914, 53, 409—415.

The total alkalinity is found by Lunge's method; carbon dioxide is then reduced to about 1 c.c. per 100 c.c. of the water by means of a current of air, and the total permanent hardness found by Blacher's method (this J., 1913, 158). The hardness due to lime is found by running a standard solution of pure sodium oleate into a measured quantity of the water containing alkaline Rochelle salt solution, until a permanent lather is produced. The magnesia, which is not precipitated, is found by difference.—O. E. M.

Manganese in water, its detection and determination. J. Tillmans and H. Mildner. J. Gasbeleucht., 1914, 57, 496—501, 523—526, 544—547.

Manganese in water, in the absence of iron salts and other oxidising compounds, may be detected by rendering the water alkaline, shaking it in a vessel containing air, acidifying with sulphuric acid and adding potassium iodide and starch, when a blue coloration develops. Iron salts may be removed previously by means of zinc oxide, or sodium phosphate may be added to prevent their action on the potassium iodide. Very small quantities of manganese (down to 0·05 mgrm. per litre) may be detected by shaking the water with potassium periodate, acidifying with glacial acetic acid and adding a solution of tetramethyldiaminodiphenylmethane; a blue coloration is obtained when manganese is present. Excess of periodate does not interfere with the reaction, but iron salts, when present in large quantity, should be removed. To determine manganese the authors recommend a modification of Marshall's process. Ten c.c. of the water are treated with 0·5 c.c. of dilute sulphuric acid (1 : 3), from 3 to 10 drops of 5% silver nitrate solution and 0·5 grm. of potassium persulphate, and heated for 20 mins. in a boiling water-bath. After cooling, the permanganate coloration obtained is compared with that exhibited by an alkaline standard phenolphthalein solution, prepared by dissolving 50 mgrms. of pure phenolphthalein in 100 c.c. of absolute alcohol and diluting to 100 times its volume with 50% alcohol; 1 c.c. of this solution, when diluted with 10 c.c. of water and treated with 4 drops of $N/1$ sodium hydroxide solution, gives a coloration equivalent to the permanganate coloration shown by 1 mgrm. of manganese per litre of water. With less than 0·5 mgrm. of manganese per litre, it may be determined by means of the tetramethyldiaminophenylmethane colour reaction, whilst quantities above 5 mgrms. per litre may be determined by treating the permanganate formed with potassium iodide and titrating the liberated iodine with thiosulphate solution, or the permanganate may be converted into manganese dioxide and the latter determined iodometrically after the addition of sodium phosphate to prevent the interference of ferric salts.—W. P. S.

Manganese in water; Colorimetric determination of small quantities of ——. H. Lührig. Chem.-Zeit., 1914, 38, 781—783.

100 c.c. of water are mixed with 3 c.c. of concentrated nitric acid and sufficient silver nitrate to precipitate the chlorides, then 3 grms. of ammonium persulphate in strong solution are added, and the liquid heated to boiling for five minutes. If manganese compounds are present the colour of permanganate is produced, and as little as 0·005 mgrm. can be detected. By comparing the colour with that given by a standard solution, the method can be made quantitative. The distilled water used must be purified by oxidation and redistillation. As a standard, permanganate solution, freshly prepared with the special distilled water and containing about 0·05 to 0·10 mgrm. per c.c., was used. The addition of too little silver nitrate hinders the formation of the colour, and the addition of too much, or too long standing, renders the liquid dark. A water containing much chlorine causes the colour to be bluer than the true violet shade; this difference can be eliminated by adding about the same quantity of common salt and a known amount of the standard manganese solution to distilled water, and using this to obtain the comparison colours. The varying depths of colour are most sharply distinguished when 100 c.c. of a water is taken containing between 0·3 and 0·6 mgrm. Mn per litre. In two series of experiments under different conditions on 50 c.c. of water containing 0·044 mgrm. Mn, the means of the amounts found were 0·0498 and 0·0483. Increasing quantities of common salt and ferrous sulphate added to the water tended to make the results too high. In tests with tap-water to which from 1—10 mgrms. Mn was added per litre, satisfactory results were obtained provided the water was not allowed to stand too long before titration.—J. H. J.

Lead-poisoning; Value and importance for the German lead industry of blood examination in ——. J. Schoenfeld. Z. angew. Chem., 1914, 27, 313—315.

"Colour" signs and hæmatoporphyrinuria are not by themselves reliable indications of lead poisoning. Examination of the blood, stained either with weak borax-methylene-blue solution, or "azure II-giemsa" solution, is the only reliable test. An alteration of the colour of the red corpuscles is to be seen before true basophilic granulation sets in. The author gives the results of his investigations among lead workers, and suggests regulations for the control of lead-working industries. The best remedy for lead poisoning is occupation in fresh dust-free air.—T. St.

Mercuric iodide; Bactericidal power of ——. H. Stassano and M. Gompel. Comptes rend., 1914, **158**, 1716—1719.

Comparative experiments with mercuric chloride, iodide, cyanide and benzoate, carried out with very dilute solutions (*N*/1000—*N*/500,000) in order to avoid the use of double salts, indicate that mercuric iodide is a much more powerful bactericide than the other salts and is about ten times as active as the chloride.—J. H. L.

Patents.

Liquids; Method of and apparatus for pasteurising ——. C. Krug, Frankfurt-on-Maine, Germany. Eng. Pat. 27,904, Dec. 4, 1913. Under Int. Conv., April 26, 1913.

In steam chambers for pasteurising liquids in bottles, compressed air is admitted through pipes so arranged that the air is heated by the steam. When the steam supply is cut off, the current of compressed air is continued in order to expel the hot air and steam from the chamber and gradually cool the bottles.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Morphine; The non-interference of ptomaines with certain tests for ——. J. Rosenbloom. J. Biol. Chem., 1914, **18**, 131—132.

The products formed during the aerobic and anaerobic putrefaction of human organs do not give a reaction with ferric chloride, nitric acid, and iodic acid, or with Fröhde's, Pellagri's, and Husemann's tests for morphine, and there was no difficulty in detecting the presence of morphine in putrefied organs removed from a body 13 months after burial. Further, the bacterial products did not give any reactions similar to those yielded by coniine, nicotine, atropine, strychnine, digitaline, veratrine, colchicine, and delphinine.—W. P. S.

Strychnine; Use of manganese carbonate for detecting traces of ——. G. Guérin. J. Pharm. Chim., 1914, **9**, 595—597.

The alkaloidal residue is dissolved in two or three drops of sulphuric acid and a few mgrms. of manganese carbonate are stirred in with a glass rod. With strychnine a blue coloration appears which slowly changes first to violet and finally to rose: 0·01 mgrm. of the alkaloid can be detected in this way.—F. Shdn.

Euquinine and aristoquinine. P. Biginelli. Annali Chim. Appl., 1914, **1**, 397—400.

Euquinine and aristoquinine are usually described respectively as the ethylcarbonate and carbonate of quinine. They are, however, not true salts of quinine, for they are unaffected even by hot caustic alkali solutions. Quinine can be recovered from them quantitatively in the form of bisulphate by boiling with dilute sulphuric acid. The compounds must be regarded as derivatives of a quinine-carbonic acid, euquinine being $C_2H_5O.CO.C_{20}H_{23}N_2O_2$, or quininecarbonic acid ethyl ester, and aristoquinine, $(C_{20}H_{23}N_2O_2)_2CO$ or carbonylquinine. True quinine carbonate $(C_{20}H_{24}N_2O_2)_2,H_2CO_3$, m. pt. 168°—169° C., was prepared by passing carbon dioxide into a solution of quinine in aqueous ether.—A. S.

Santonin [in wormseed] determination; Fromme's method of ——. C. E. Caspari. J. Amer. Pharm. Assoc., 1914, 634. Pharm. J., 1914, **38**, 819.

The finely powdered wormseed (13·0 grms.) is allowed to macerate with occasional shaking with 130 grms. of chloroform. 102·5 grms. of the liquid (=10 grms. of the drug) are drawn off and evaporated till the residue weighs 7 to 8 grms., which is then mixed with 100 grms. of 5% barium hydroxide solution and heated on the water bath till the odour of the chloroform has disappeared. The liquid is filtered through a wet filter and the insoluble matter washed twice with 10 c.c. of hot water. The filtrate and washings are acidified with 5 grms. of 25% hydrochloric acid, heated on the water bath for a few minutes, cooled, and shaken out with 20, 15, and 15 c.c. of chloroform. The extracts are filtered and evaporated to dryness. The residue is dissolved in 7·5 grms. of absolute alcohol and 42·5 grms. of hot distilled water added. The milky liquid is filtered immediately into a tared flask and the filter is washed twice with 10 grms. of 15% alcohol. After 24 hours the liquid is filtered through a tared filter, and the flask and filter washed twice with 10 grms. of the dilute alcohol. The flask and filter are then dried at 100° C. to constant weight, 0·04 grm. being added to the weight of santonin found.—F. Shdn.

Phytin; Observations concerning ——. W. Heubner. Biochem. Zeits., 1914, **64**, 409—421.

Commercial barium and sodium salts of phytic acid were found to contain 4 atoms Ba or 8 atoms Na for every 6 atoms P, and it is suggested that the sodium salt, for example, may be a di-substitution product of inositol, $(Na_2O_4P)_2PO·C_6H_{10}O_{12}·PO(PO_4Na_2)_2$. The rate of hydrolysis of phytic acid in presence of 1·5 *N* mineral acid at 37° C., is less than 1% per day, and appears to be somewhat accelerated by light. (See Plimmer and Page, this J., 1914, 660.)—J. H. L.

Sandalwood oil; Determination of santalol in ——. E. Wende. Apoth.-Zeit., 1914, **29**, 541—542.

A stoppered bottle of 100 c.c. capacity containing 5 grms. of sandalwood oil, 5 grms. of acetic anhydride and 1 grm. of finely powdered anhydrous sodium acetate is well shaken and heated in a water-oven for an hour with occasional shaking. The acetylated oil is then separated in the usual way, and 1·5—2·0 grms. are dissolved in 3 c.c. of alcohol in a 100 c.c. stoppered bottle, neutralised, and 25 c.c. of *N*/2 alcoholic potassium hydroxide solution added. The bottle is securely fastened, placed in a water oven, heated for 30 mins. after the water has begun to boil, and the excess of free alkali titrated. If *a* grms. be the weight of acetylated oil taken and *n* the number of c.c. of *N*/2 potassium hydroxide solution consumed, the percentage of santalol, S, is given by the formula: $S = \frac{11n}{a - 0·021n}$.—F. Shdn.

Oil of Chinese bitter orange [Citrus sinensis, Person]; Characters of ——. P. Fenaroli. Annali Chim. Appl., 1914, **1**, 408—412.

The Chinese bitter orange is used largely in the manufacture of preserves, and recently extraction of the oil from the outer skins has been undertaken on a commercial scale in Italy. The cultivation of this fruit is extending in Italy and the oil is likely to acquire some importance as a commercial product. The oil has the sp. gr. 0·847—0·848 at 15° C., $\alpha_D^{20} = +94·10°$ to $+95·40°$, $n_D^{17} = 1·17388$—1·47408. It dissolves in 4—4½ vols. of 90% alcohol, but is only partially soluble in 80% alcohol. When distilled at 80 mm. pressure it yielded the following fractions: 102°—104° C., 62·5% ($\alpha_D^{14} = 96·76°$); 104°—105°, 27·5% ($\alpha_D^{14} = +98·80°$); 105°—110°, 5·2% ($\alpha_D^{14} = +96·28°$); 110°—120° C., 2% ($\alpha_D^{14} = +80·64°$); residue, 2·8% ($\alpha_D^{14} = +23·40°$). Examination of the various fractions showed that the oil contains 97—98% of *d*-limonene, and small quantities of a substance of lower boiling point, probably *d*-pinene, and of ethers and aldehydes boiling much above 176° C. Citral could not be detected in the higher-boiling fractions.—A. S.

Cineol; Iodo-derivatives of ——. [*Determination of cineol.*] E. Fromm and H. Fluck. Annalen, 1914, **405**, 175—180.

On shaking cineol with a crude concentrated aqueous solution of hydriodic acid, fine dark-green crystals of a fairly stable iodine compound are obtained. Hydriodic acid containing no free iodine does not give these crystals but yields dipentene di-iodide. The crystals were found to be identical with a substance obtained by Wallach and Brass (Annalen, 1884, **225**, 300) by the action of iodine in petroleum ether on cineol and by Kraut and Wahlfors (Annalen, 1863, **129**, 295) by the action of iodine in potassium iodide on wormseed oil, and described as cineol di-iodide $(C_{10}H_{18}O_2)_2I_2$. From the elementary analyses and iodometric determinations the crystals are considered to be a double compound of cineol di-iodide and cineol hydriodide. Cineol can be determined quantitatively by adding a known excess of acidified $N/10$ iodine solution, filtering off the iodo-compound and titrating the excess of iodine with standard thiosulphate solution.—T. C.

Galangal oil; Constituents of ——. E. Fromm and H. Fluck. Annalen, 1914, **405**, 181—187.

About 1 kilo. of galangal oil was fractionally distilled. All fractions yielded only traces of substances soluble in alkalis, and the presence of eugenol, previously recorded, is doubtful. The first runnings, distilling at 157°—159° C., formed the smallest fraction and were not examined. The chief fraction distilled at 171°—173° C. and consisted largely of cineol, which was determined by means of the hydriodide of the iodo-compound and obtained pure by decomposing this compound with cold aqueous caustic soda solution (see preceding abstract). The fraction boiling at 208°—210° C. formed only 1 to 2% of the oil and its constituents could not be ascertained. Repeated fractionation gave a fraction boiling at 260°—263° C. containing two new sesquiterpenes, one boiling at 150°—155° C. at 18 mm. and giving no hydrochloride, and the second giving a hydrochloride crystallising in needles from alcohol, m. pt. 118° C. The sesquiterpene previously lescribed by Schindelmeiser (Chem.-Zeit., 1905, **29**, 308) ould not be detected. On standing, the highest boiling ractions yielded a small amount of a substance crystallising from diluto alcohol in needles, m. pt. 167° C., having he formula, $C_{15}H_{26}O$.—T. C.

inalool: Constitution of ——. P. Barbier and R. Locquin. Comptes rend., 1914, **158**, 1554—1558.

Vhen reduced by means of platinum and hydrogen at he ordinary temperature, linalool yielded a saturated terary alcohol, $(CH_3)_2 : CH{\cdot}CH_2{\cdot}CH_2{\cdot}C(OH)(CH_3){\cdot}CH_2{\cdot}CH_3$, oiling at 86°—88° C. at 10 mm., sp. gr. 0·851 at 4° C., nd $a_D = -24'$. This was readily converted by heating ith anhydrous formic acid into an unsaturated hydroarbon, b. pt. 162° C. The latter yielded methylisohexyletone when oxidised with chromic acid. Isoamylacetyl etate was hydrolysed and the ketone converted into trahydrolinalool which had the same physical characters the above tertiary alcohol but was optically inactive. he allophanate from the inactive tertiary alcohol melted 110°—111° C., whilst that from the active modiation melted at 88° C. The formula for linalool, $H_4)_2 : CH{\cdot}CH_2{\cdot}CH_2{\cdot}C(OH)(CH_3){\cdot}CH : CH_2$, proposed by mmler and Tiemann was thus confirmed.—F. Shdn.

ytosterols. Hydro-carotin. E. Beschke Ber., 1914, **47**, 1853—1856.

rrot roots (*Daucus carota*) were extracted with water, ied, and extracted with light petroleum. The residue m the latter consisting of hydro-carotin was crystallised m alcohol and melted at 135°—136° C., the yield being 1%. By treatment of the bromine addition products the acetyl compound, it was found that hydro-carotin isisted of 90% of sitosterol, m. pt. 136°—137° C., and % of stigmasterol, m. pt. 170° C.—F. Shdn.

nethylglyoxime: The preparation of —— *without the se of hydroxylamine.* J. M. Johlin, jun. J. Amer. hem. Soc., 1914, **36**, 1218—1221.

Nitrosomethylethyl ketone (diacetyl monoxime) ociates, under the influence of strong acids, in part east, into diacetyl and hydroxylamine, which recom under suitable conditions to give the less soluble ime. 850 c.c. of methylethyl ketone were treated, rding to the method of Diels and Stephan (Ber., 1907, **40** 4337) for the preparation of diacetyl, with 30 c.c. of hydrochloric acid and 1000 c.c. of amyl nitrite. The resulting mixture was shaken with sodium hydroxide, and the alkaline layer acidified with 25% sulphuric acid. After standing 24—36 hours 50—60 grms. of dimethylglyoxime had crystallised out and the oily layer had almost disappeared. The mother liquors were further treated for the recovery of diacetyl according to the prescribed method.—G. F. M.

1.5-*Diketones; Action of sodamide on* ——. E. Bauer. Comptes rend., 1914, **158**, 1680—1683.

The author has already shown (Comptes rend., 1913, **156**, 1470, 1684) that sodamide converts 1.6- and 1.7-diketones into cyclopentane and cyclohexane derivatives. With 1.5-diketones it forms disodium compounds which interact with methyl iodide and yield dimethyl derivatives of the original diketones. Dibenzoylpropane, for example, yields amongst other products dimethyldibenzoylpropane, whereas benzaldiacetophenone yields 83% of a mixture of ethylphenylketone and benzalpropiophenone, both of which are doubtless produced by fission of the dimethylbenzaldiacetophenone first formed.—J. H. L.

Acetone; Equilibria in the systems, water, ——, *and inorganic salts.* G. B. Frankforter and L. Cohen. J. Amer. Chem. Soc., 1914, **36**, 1103—1134.

An investigation of the equilibria in the four systems: water, acetone, and potassium fluoride; water, acetone, and potassium carbonate; water, acetone, and calcium chloride; water, acetone, and sodium chloride, has led to the following conclusions. Potassium fluoride is as efficient as potassium carbonate for salting out acetone, and acts more rapidly, giving cleaner cut separations. The saturated solution of potassium fluoride dehydrates to 98% of acetone, that of potassium carbonate to 96·5%, and of calcium chloride to 98·4%. The use of calcium chloride entails loss of acetone since the aqueous solution retains 23%, whilst in the saturated solutions of the other substances acetone is practically insoluble. Sodium chloride is the least satisfactory substance for salting out acetone as it retains 21% and dehydrates only to 85·8%. The lower critical solution temperatures for a series of solutions are given: no upper critical solution temperatures could be observed. A method for the quantitative determination of acetone in aqueous solution, provided no other substance is present, depends on the fact that for every mixture of acetone and water there is a corresponding amount of potassium fluoride required to produce the just homogeneous mixture. This amount is determined experimentally, and from the table for the binodal curve of the system water, acetone, potassium fluoride, the corresponding amount of acetone is obtained. —G. F. M.

Acetaldehyde from acetone; Quantitative separation of ——, E. Hägglund. Z. anal. Chem., 1914, **53**, 433—439.

On heating in the water-bath a mixture of 15 c.c. of water, 50 c.c. of $N/2$ silver nitrate, 9 c.c. of $N/1$ sodium hydroxide, 25 c.c. of ammonia of sp. gr. 0·92, and 10 c.c. of a solution containing not more than 2% of acetaldehyde, the whole contained in a closely stoppered bottle, the aldehyde is oxidised and may be estimated by titrating the unreduced silver in an aliquot portion of the clear liquid. Acetone and acetaldehyde may be determined together by adding excess of bisulphite and titrating the excess in alkaline solution with $N/10$ iodine. The acetaldehyde having previously been determined as described above, the acetone is obtained by difference.—O. E. M.

Carbon dioxide snow; Substitute for —— [*Trichloroacetic acid*]. E. Sommer. Schweiz. Rundsch. Med., Jan. 10, 1914. Pharm. J., 1914, **38**, 786.

The use of trichloroacetic acid in the solid form or in aqueous solution is recommended in place of carbon dioxide snow in dermatology.—F. Shdn.

Selenazine dyestuffs. Bauer. *See* IV.

Aroma of hops. The volatile oil in relation to the geographical sources of the hops. Rabak. *See* XVIII.

Determination of inorganic phosphoric acid in presence of phosphoric acid esters. Heubner. *See* XXIII.

Determination of phytin by titration. Heubner and Stadler. *See* XXIII.

PATENT.

Orthovanadic esters and their solutions ; Preparation of ——. L. Hess. Ger. Pat. 273,220. March 28, 1913.

VANADIUM pentoxide dissolves in primary, secondary, tertiary mono- or polyhydric alcohols with formation of esters of the type, R_3VO_4. Vanadic acid ethyl ester, $(C_2H_5)_3VO_4$, is a liquid of faint yellow colour, sp. gr. 1·167 at 15° C., b. pt. 108° C. at 26 mm. The isopropyl ester is a yellowish liquid boiling at 124° C. at 21 mm. The amyl ester boils at 161° C. at 19 mm. and has the sp. gr. 0·993 at 15° C.—A. S.

XXII.—EXPLOSIVES; MATCHES.

Explosion at the works of the Aktien-Gesellschaft für Anilinfabrikation, Rummelsberg, Germany. Chem. Ind., 1914, **37**, 337—342. (See also this J., 1914, 376.)

THE Commission appointed to enquire into this accident considered the following suggestions among others: That it was due to the admission of large quantities of acid, cooled below the reaction-temperature, to the nitrating vessel, followed by an uncontrollable reaction on a rise of temperature; and that ignition of the mixture of benzene vapour and air was due to direct action between benzene and nitric acid at 100°—170° C. An apparatus was described by Neumann in which the quantities reacting are small and are rapidly removed: the liquids flow through the annulus between an inner rotating and an outer fixed cylinder, both carrying blades and cooled or heated, locally or throughout, as required. Ter Meer's apparatus (Ger. Pat. 228,544; this J., 1911, 373) was also described. Further suggestions were: the interlocking of cocks and striking gear, the provision of a pendulum in the liquid, with an exterior indicator to show that the liquid is in motion, the use of a cast iron fume pipe leading to a separate tower, and of a stronger cover.—O. E. M.

Perchlorates of aromatic amines. R. Spallino. Annali Chim. Appl., 1914, **1**, 435—440.

THE perchlorates of aniline, *p*-nitroaniline, *p*- and *m*-phenylenediamine were prepared by double decomposition of barium perchlorate and the sulphate of the amino-compound, the solution, after filtering off the barium sulphate, being evaporated over a direct flame to incipient crystallisation. They were stable on exposure to air and light, and began to decompose, without exploding, only at 200°—220° C. when heated. When wrapped in tinfoil and submitted to the falling weight test, using 0·1 grm. of substance and a weight of 2 kilos., the fall required to produce an explosion was 70—75 cm. for the perchlorate of aniline, 80 cm. for that of *p*-nitroaniline, 55 cm. for that of *p*-phenylenediamine, and 50 cm. for that of *m*-phenylenediamine, as compared with 73—75 cm. for picric acid.—A. S.

Waste product from the manufacture of trinitrotoluene. Molinari and Giua. *See* III.

PATENT.

Explosives. F. L. Nathan, W. Rintoul, and F. Baker, Ardeer, Scotland. Eng. Pats. 4940 and 4941, Feb. 26, 1913. (See also Eng. Pats. 12,743 to 12,746 of 1912; this J., 1913, 991.)

A PROPELLANT is obtained by incorporating a gelatinising agent, which remains in the powder, and a stabiliser, both freely soluble in nitroglycerin, with nitroglycerin and nitrocellulose, without the use of a volatile solvent. The stabiliser may have little or no gelatinising effect, and is used with a substance of relatively high gelatinising action. Amyl or ethyl phthalate, mono-, di-, or triacetin, or a nitro-derivative of an aromatic hydrocarbon, such as di- or trinitrotoluene, is used as a gelatinising agent, with or without methyl- or ethyl-β-naphthyl ether, phenylbenzyl ether or phenanthrene, as stabiliser. Such a propellant contains about 40% of nitroglycerin, 50 of soluble nitrocellulose, and 10 of gelatiniser and stabiliser together, and may be made by bringing the ingredients together suspended in water, removing the excess of water, and gelatinising at 50°—70° C.—O. E. M.

XXIII.—ANALYTICAL PROCESSES.

Mercury resistance thermometer as a reproducible empirical temperature scale. W. Jaeger and H. von Steinwehr. Ann. der Physik, 1914, [4], **43**, 1165—1185. Chem. Zentr., 1914, **1**, 1985.

THE thermometer used by the authors consists of a quartz capillary about 1 m. long and 0·9 sq. mm. cross-section, bent into W-form and connected at the ends with somewhat wider quartz tubes to receive the platinum electrodes. Accurate measurements showed that when pure mercury was used, the calculated and observed resistances at different temperatures were identical within the limits of accuracy of the measurements, so that only one fixed point (*e.g.*, 0° C.) is necessary for calibrating the instrument throughout the whole range—30° to + 300° C.—A. S.

Copper and tin groups ; New procedure for the separation of the ——. L. J. Curtman and J. K. Marcus. J. Amer. Chem. Soc., 1914, **33**, 1093—1103.

THE objectionable features of the ammonium polysulphid and sodium hydroxide methods for the separation of th copper and tin groups may be avoided by a scheme o analysis of which the following are the principal points Preliminary precipitation of the alkaline-earth metal and some of the lead from the filtrate of group I. b sulphuric acid and analysis for these metals by the metho of Curtman and Frankel (this J., 1912, 1203). Treatmen of the filtrate from the precipitation of the alkaline earth metals with sulphur dioxide, before passing i hydrogen sulphide, to oxidise stannous tin and reduc quinquevalent arsenic. The complete separation of th sulphides of the divisions of group II. by means of 25° potassium hydroxide solution.—G. F. M.

Potassium ; New method of determining ——. F. Marshal Chem.-Zeit., 1914, **38**, 585—587, 615—616.

THE solution containing only the alkalis as chlorid (about 0·05 grm. of K_2O) is evaporated on the water-bat the residue dissolved in the smallest possible quant of water, and the solution treated in the cold with excess (20 c.c.) of a 2% alcoholic solution of tartaric ac which has been stirred at intervals for several days wi solid potassium bitartrate and then filtered. After t precipitation from 10 to 20 c.c. of 96% alcohol saturat with potassium bitartrate are added, and the liquid boil for about 10 mins. on the water-bath. It is then l (with frequent stirring) for 24 hours, after which t precipitate is collected in a weighed Gooch crucib washed first with the saturated alcohol and then w pure 96% alcohol, dried at 80° C. and weighed potassium bitartrate. The results are in close agreem with those given by the platinum chloride method. —C. A. M

Nickel ; Determination of —— by dimethylglyoxime. Brunck. Z. angew. Chem., 1914, **27**, 315—318. (this J., 1907, 643.)

To ensure the complete precipitation of the nickel af adding the dimethylglyoxime, the solution should allowed to stand for one hour before filtering. Ignition of the precipitate to oxide gives accurate results if proper precautions are taken (this J., 1908, 812). When a solution of ferric and cobalt salts containing tartaric acid and dimethylglyoxime is made ammoniacal, an insoluble iron-cobalt compound of dimethylglyoxime is precipitated, but if the iron is present in the ferrous condition only, no precipitate is formed. Hence to determine nickel in a steel containing cobalt it is necessary first to bring and keep all the iron in the ferrous condition. This is conveniently accomplished with an excess of sulphurous acid. Dimethylglyoxime then gives a quantitative precipitation of the nickel, the iron and cobalt being left wholly in solution.—T. St.

Tellurium; Gravimetric determination of ——. A. Gutbier and S. Huber. Z. anal. Chem., 1914, **53**, 430—433.

THE method of Lenher and Homberger (J. Amer. Chem. Soc., 1908, **30**, 387) is convenient and accurate. To the boiling solution of the sample in 10% hydrochloric acid are added 15 c.c. of saturated sulphur dioxide solution, 10 c.c. of 15% hydrazine hydrochloride solution, and a further 25 c.c. of the sulphur dioxide solution. The precipitated elementary tellurium settles in the boiling liquid. and is washed, dried at 100°—105° C., and weighed. The use of 35—40 c.c. of sulphur dioxide solution instead of 25 c.c. is suggested.—O. E. M.

Iodine; Determination of —— especially in organic substances. R. Grützner. Chem.-Zeit., 1914, **38**, 769—770.

ORGANIC matter is destroyed by fusing with pure sodium hydroxide, adding sodium peroxide, barium peroxide, or a readily fusible mixture of alkali and nitre, and heating to dull redness (excess of the oxidiser may be removed by adding charcoal after cooling and again heating); the melt is either dissolved in water, and the solution diluted, and filtered, or (with barium peroxide) it is treated with boiling water, then with carbon dioxide and sodium sulphate, and the precipitate well washed with water containing sodium sulphate. The solution is treated by a modification of the method of Bernier and Péron (this J., 1911, 359), iodide being oxidised to iodate by boiling with permanganate, the mixture carefully acidified with sulphuric acid, again boiled, cooled, made alkaline with solid sodium carbonate, boiled with alcohol, filtered, and the residue washed, whilst hot, with water containing alcohol. Excess of alcohol is boiled off, the solution made acid to litmus with a mixture of phosphoric and sulphuric acids (prepared by treating a hot mixture of 3 vols. of phosphoric acid, 1 : 4, and 2 vols. of sulphuric acid, 1 : 4, with $N/10$ permanganate in slight excess, and decolorising with $N/10$ oxalic acid), and, after adding solid ammonium sulphate, again boiled. The cooled solution is made acid to Congo red, treated with potassium iodide, and the liberated iodine titrated with thiosulphate. One-sixth of the iodine found represents that originally present. The method is accurate in presence of other halogens and cyanides.
—F. SODN.

Fluorine; Greef's method for the volumetric determination of ——. I. Bellucci. Annali Chim. Appl., 1914, **1**, 441—446.

THE author has found that the method recommended by Greef (this J., 1913, 992), namely titration with ferric chloride solution of a neutral solution of alkali fluoride to which sodium chloride and potassium thiocyanate have been added, gives satisfactory results when the quantity of fluoride is about 0·2 grm.; the results are much too low, however, when the quantity of fluoride is less than 0·1 grm. The variable results appear to be due to the influence of the sodium chloride. Using 25 c.c. of solution, the most satisfactory results were obtained with 10—20 grms. of sodium chloride for 0·2 grm. of sodium fluoride, with 2 grms. for 0·04 grm., and with 1 grm. for 0·02 grm. of fluoride.—A. S.

Phosphoric acid; Determination of inorganic —— in presence of phosphoric acid esters. W. Heubner. Biochem. Zeits., 1914, **64**, 401—408.

FROM solutions containing 4% of concentrated sulphuric acid by volume, and 15% of ammonium nitrate, inorganic phosphoric acid can be quantitatively precipitated as ammonium phosphomolybdate of normal composition within 6 hours at 37° C. The precipitation is not affected by small quantities of phytin; and provided the phytin-phosphorus does not exceed in amount six times the inorganic phosphorus, and the concentration of the former does not exceed 0·05%, at least ¾ of the inorganic phosphorus present can be found by one precipitation as phosphomolybdate, followed by titration by Neumann's method (cp. Plimmer and Page, this J., 1914, 660). The disturbing influence of glycerophosphoric acid is less than that of phytin.—J. H. L.

Phytin; Determination of —— by titration. W. Heubner and H. Stadler. Biochem. Zeits., 1914, **64**, 422—437.

IN solutions containing 0·6% of free hydrochloric acid and 0·03% of ammonium thiocyanate, phytin may be determined by titration with ferric chloride solutions containing 0·05—0·2% of iron and 0·6% of free hydrochloric acid. Under these conditions ferric phosphate is not precipitated, but phytic acid is converted into an insoluble salt. The titration is complete when the liquid assumes a faint red colour which does not fade within 5 mins. One mgrm. of iron corresponds to 1·19 mgrm. of phosphorus present as phytin. The titration is not affected by the presence of a moderate excess of inorganic phosphates or glycerophosphate.—J. H. L.

Volumetric determination of sulphates. North. *See* VII.

Volumetric determination of ferricyanides in presence of ferric iron and cyanides. Seidel. *See* VII.

Detection of cyanides in presence of ferro- and ferri-cyanides and thiocyanates. Barnebey. *See* VII.

Volumetric determination of cyanamide. Grube and Krüger. *See* VII.

Determination of thorium in monazite sand. Carney and Campbell. *See* VII.

Separation and determination of tungstic acid by means of "nitron." Gutbier and Weise. *See* VII.

Direct determination of carbon in iron and steel. Brown. *See* X.

Determination of carbon in iron and steel by the barium carbonate titration method. Cain. *See* X.

Determination of the acetyl value of oils, fats, etc. Holland. *See* XII.

Determination of the fatty acid content of soap. Besson. *See* XII.

Combustion method for the direct determination of rubber. Wesson. *See* XIV.

Sources of error in the analysis of basic slag. Popp. *See* XVI.

A comparison of neutral ammonium citrate with sodium citrate and $N/10$ citric acid. Rudnick and others. *See* XVI.

Modification of the double polarisation (Clerget-Herzfeld) method of determining sucrose in (beet) molasses. Stanek. *See* XVII.

Action of formaldehyde in presence of sulphuric acid. Buraczewski and Matejko. *See* XVIII.

A comparison of the microscopical method and the plate method of counting bacteria in milk. Brew. *See* XIXa.

Determination of the viscosity of milk as a means of detecting addition of water. Kooper. *See* XIXa.

Determination of crude fibre [*in grain, bran, etc.*]. Stiegler. *See* XIXa.

Separation and determination of sugars in gingerbread and similar products. König and Burberg. *See* XIXa.

Determination of hardness of water. Winkler. *See* XIXb.

Manganese in water, its detection and determination. Tillmans and Mildner. *See* XIXb.

Colorimetric determination of small quantities of manganese in water. Lührig. *See* XIXb.

Non-interference of ptomaines with certain tests for morphine. Rosenbloom. *See* XX.

Use of manganese carbonate for detecting traces of strychnine. Guérin. *See* XX.

Fromme's method of santonin determination [*in wormseed*]. Caspari. *See* XX.

Determination of santalol in sandalwood oil. Wende. *See* XX.

Iodo-derivatives of cineol. [*Determination of cineol*]. Fromm and Fluck. *See* XX.

Equilibria in the systems, water, acetone and inorganic salts. Frankforter and Cohen. *See* XX.

Quantitative separation of acetaldehyde from acetone. Hägglund. *See* XX.

Patents.

Gas analysis apparatus. J. G. Taplay and J. Abady, London. Eng. Pat. 17,676, Aug. 1, 1913.

Combustion of the non-absorbable constituents (hydrogen and methane) of a gas mixture such as coal gas or producer gas, is effected in a vessel containing a tube or rod made from copper oxide and a suitable matrix such as china clay. The combustion products are displaced by mercury instead of by nitrogen or carbon dioxide as is done when the copper oxide is used in granular form. The oxide is reduced to cuprous oxide and no metallic copper is formed, so that no amalgamation can occur.—A. T. L.

Sampling liquids ; Apparatus for ——. R. L. Chambers, Broxburn, Scotland. Eng. Pat. 17,828, Aug. 5, 1913.

The liquid flows from a constant-level tank into an adjustable tilting trough which, when full, delivers partly to waste and partly into one of a circle of bottles moved round by a step-by-step device actuated by the trough. —O. E. M.

XXIV.—MISCELLANEOUS ABSTRACTS.

Fluorine in mineral waters. A. Gautier and P. Clausmann. Comptes rend., 1914, **158**, 1631—1640.

All mineral waters contain fluorine, the amount found in a number of waters from different sources ranging from 0·15 to 6·32 mgrms. per litre. The fluorine-content appears to bear no relation to the temperature of the water. The ratio, fluorine : saline residue, is highest in sulphurous waters. Sea water contains about 0·3 mgrms. of fluorine per litre.—L. E.

Light; Chemical action of ——. (*XXX.*) G. Ciamician and P. Silber. Ber., 1914, **47**, 1806—1814.

The production of an addition-compound of two mols. of benzaldehyde and one of benzophenone, by the action of light on a mixture of these compounds, is confirmed. A polymeride of benzaldehyde (Paternò, Gaz. chim. ital., 1914, **44**, I, 153) is not formed. Acetophenone and ethyl alcohol yield, in addition to ordinary acetophenonepinacone (this J., 1901, 844), its optical isomeride of m. p. 86°—87° C. Benzophenone and acetophenone, with isopropyl alcohol, give respectively benzopinacone and the two acetophenones together with acetone. With ethyl alcohol ethylphenylketone behaves similarly to acetophenone, giving ethylphenylpinacone and its optical isomeride. Acetophenone and benzyl alcohol yield acetophenonepinacone ; from the residue, on benzoylation, dibenzoylhydrobenzoïn and the monobenzoyl derivative of diphenylmethylethyleneglycol are obtained.—O. E. M.

Books Received.

Electric Furnaces for Making Iron and Steel. By D. A. Lyon and R. M. Keeney. Department of the Interior. Bureau of Mines. Bull. 67. Govt. Printing Office, Washington. 1914. Price 20c.

Volume ($9\frac{1}{8}$ by $5\frac{7}{8}$ in.), containing 133 pages of subject matter with 36 illustrations, a selected bibliography, a list of publications on Mining and Mineral technology, and an alphabetical index.

The text is classified as follows :—I. The electric furnace in pig-iron manufacture. II. The electric furnace in steel manufacture.

Geschichte des Elektroeisens, mit besonderer Berücksichtigung der zu seiner Erzeugung bestimmten elektrischen Oefen. Von Dr. techn. Oswald Meyer. Julius Springer's Verlag. Berlin. 1914. Price M. 7 ; bound M. 8.

Volume ($9\frac{1}{2}$ by $6\frac{1}{2}$ ins.), containing 182 pages of subject matter, with 206 illustrations, a bibliography, and alphabetical index of names. The text is classified under the heads : I. History of the electrical preparation of iron and of the furnaces designed for the purpose. II. The present forms of furnaces and of those in course of construction, for the preparation of iron and steel. III. Classification and general review of the known systems of electric furnaces for iron and steel. IV. The revolving electro-furnace of Schatzl-Krieger.

Enzyklopädie der technischen Chemie. Unter Mitwirkung von Fachgenossen. Herausgegeben von Professor Dr. Fritz Ullmann. Erster Band. Urban and Schwarzenberg. Berlin N. Friedrichstrasse, 105b, and Vienna, 1, Maximilianstrasse 4. 1914. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C. Price £1 12s. net.

Volume ($10\frac{5}{8}$ by $7\frac{5}{8}$ ins.), containing 795 pages of subject matter with 295 illustrations, and an alphabetical index of subjects. There is a preface, list of co-workers with the editor, Dr. Ullmann, and a table of abbreviations and their meaning.

The subjects begin in Vol. I. with "Abanon" and end with "Äthylalkohol" (p. 636—795). At the close of each subject under the title "Literatur," is given a list with references, of all the works, etc., the contents o which are utilised.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Bale*, M. P.: Gas and Oil Engine Management. 4th ed., enlarged. Cr. 8vo, pp. 176. C. Lockwood, London. 1914. Net 2s. 6d.

Davey, N.: The Gas Turbine. 8vo, pp. 262. Constable, London. 1914. Net 15s.

Moyer, J. A. Steam Turbines. 2nd ed., revised and enlarged. 8vo. Chapman & Hall, London. 1914. Net 15s.

Riedler, A.: Dieselmotoren. Beiträge zur Kenntnis der Hochdruckmotoren. (V, 274 S.) 8°. Berlin, Verlag f. Fachliteratur. 1914. M. 5.

Stromeyer, C. E.: Marine boiler management and construction; being a treatise on boiler troubles and repairs, corrosion, flues and heat, on the properties of iron and steel, on boiler mechanics, workshop practices and boiler designs. 4th ed. N.Y., Longmans. 20+410 p. il. diagrs. tabs. O. 1914. $4.

IIA. *Biège*, H.: L'industrie du gaz d'éclairage, 100 fig., in-18. Baillière et fils. Paris. 1914. 5 fr.

Gobiet, A.: Die Fabrikation des Benzols aus Koksofengasen. (20 S. m. 19 Fig.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1914. M. 1.

Donath, Prof. E., u. A. *Lang*. Ueber "Oberflächenverbrennung" u. "flammenlose" Feuerungen. (12 S. m. 16 Fig.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1914. M. 1.

Forster, G.: Safety Lamps and the Detection of Fire-Damp in Mines. 8vo, pp. 92. Routledge, London. 1914. Net 1s. 6d.

Kohlen-Untersuchungen 1913. Im Auftrag des Vereins f. Feuerungsbetrieb u. Rauchbekämpfg. in Hamburg ausgeführt durch die thermochem. Prüfungs- u. Versuchs-Anstalt Dr. Aufhäuser, Hamburg. (23 S.) Lex 8°. Hamburg, Boysen & Maasch. 1914. M. 2.

IIB. *Planck*, M.: The theory of heat radiation; auth. tr. by Morton Masius. Phil., Blakiston. 15+225 p. il. 8°. 1914 $2.

V. *Barker*, A. F., and E. *Midgley*: Analysis of Woven Fabrics. 8vo, pp. 320. Scott, Greenwood, London. 1914. Net 7s. 6d.

Directory of Paper Makers, 1914. Pocket ed. 12mo. pp. 127. Marchant Singer, London. 1914. Net 2s. 6d.

Herzberg, Prof. W.: Die aus dem Materialprüfungsamt in den J. 1885—1913 herausgegangenen Arbeiten üb. Papierprüfung. (22 S.) Lex 8°. Berlin, J. Springer. 1914. 40 Pf.

VI. *Hurst*, G. H.: Textile Soap and Oils. 2nd ed., revised and partly rewritten. 8vo, pp. 202. Scott, Greenwood, London. 1914. Net 7s. 6d.

Keghel, M. de: Le blanchissage rationnel et automatique du linge. in-8°. H. Nolo, Paris. 1914. 1 fr. 50.

VII. *Trautz*, M., u A. *Helmer*. Die langsame Verbrennung des Iodwasserstoffgases. I. (36 S. m. 5 Fig) gr. 8° Heidelberg. C. Winter. 1914. M. 1.25.

Trautz, M.: Die langsame Verbrennung des Iodwasserstoffgases. II., u. die Reaktionsgeschwindigkeit unvollkommener Gase. (28 S.) gr. 8°. Heidelberg. C. Winter. 1914. M. 1.

IX. *Laborbe*, H.: L'industrie de la chaux hydraulique et du ciment portland de Grappiers dans la région de Beffes, 51 fig., in-4°. Dunod et Pinat. Paris. 1914. 4 fr.

Magny, A. V.: La construction en béton armé, théorie et pratique, préf. de P. Piketty, 428 fig., 9 pl., in-8°. Ch. Béranger. Paris. 1914. Cloth 20 fr.

Wiley, C. C.: The Mortar-making Qualities of Illinois Sands. 8vo, swd. Chapman & Hall. London. 1914. Net 1s.

X. *Giolitti*, F.: La cémentation de l'acier, trad. par A. Portevin. 155 fig., in-8°, cart. Hermann et fils. Paris. 1914. 16 fr.

Horner, J. G.: Practical Iron-Founding. 4th ed., thoroughly revised and enlarged. Cr. 8vo., pp. 418. Whittaker, London. 1914. Net 5s.

Pfann, Dr. E.: Die Unterscheidung v. galvanisch- u. feuerverzinktem Eisen. (40 S. m. 6 Taf.) gr. 8°. Wien, C. Fromme. 1914. M. 1.70

Köbrich, C.: Der Bergbau des Grossherzogt. Hessen. Kurze Uebersicht üb. geschichtl. Entwicklg. u. gegenwärt. Stand des Berg-, Hütten- u. Salinenwesens, vornehmlich in der Prov. Oberhessen. Unter Benutzg. amtl. Materials zusammengestellt. (101 S. m. 29 Abbildgn. u. 2 [1 farb., 1 eingedr.] Karten.) kl. 8°. Darmstadt, Buchh. grossh. hess. Staatsverlags. 1914. M. 1.

Tammann, G.: Lehrbuch der Metallographie. Chemie u. Physik der Metalle u. ihrer Legiergn. (XVIII. 390 S. m. 205 Fig.) Lex 8°. Leipzig, L. Voss. 1914. Cloth M. 20.

XI. *Danneel*, Dr. H.: Elektrochemie. II. Experimentelle Elektrochemie, Messmethoden, Leitfähigkeit. Lösgn. Mit 26 Fig. u. mehreren Tabellen. 2. Aufl. (159 S.) Berlin. G. J. Goschen. 1914. 90 Pf.

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XIV. *Fresenius*, Dr. R.: Natürlicher u. künstlicher Kautschuk. Vortrag. (S. 53—66.) gr 8°. Wiesbaden, J. F. Bergmann. 1913. 50 Pf.

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XX. *Berall*, Dr. W.: Chemisches Praktikum f. Mediziner u. Pharmazeuten sowie zum Privatstudium. (Enth. anorgan. u. organ., Mass- u. Gewichtsanalyse, Harnanalysen, physiologischchem. Untersuchgn., Alkaloïde etc.) Gründliche Anleitg. bei den prakt. Uebgn. im chem. Labaratorium. (Unter Mitwirkg. von E. Firster.) (62 S.) gr. 8°. Wien, A. Schönfeld. 1914. M. 2.50.

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XXIV. *Artini*, E.: I minerali. Milano, 16° Fig., p. xvi, 422, con 40 tav. M. Hoepli. 1914. Lire 9.50.

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Swarts, F.: Cours de chimie inorganique, 2e édit. rev., fig., in-8°. Paris, Hermann et fils. 1914. 15 fr.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Henry E. Roscoe 1914.

Journal of the Society of Chemical Industry.

No. 14, Vol. XXXIII. JULY 31, 1914. No. 14, Vol. XXXIII.

The Society of Chemical Industry.

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PROCEEDINGS

OF THE

THIRTY-THIRD ANNUAL MEETING.

NOTTINGHAM.

WEDNESDAY, JULY 15TH, 1914.

The Thirty-Third Annual General Meeting of the ty was held in the large lecture theatre of University llege, Nottingham, on Wednesday, July 15th, 1914, the resident, Dr. Rudolph Messel, F.R.S., in the chair.

The Mayor of Nottingham, Mr. FREDERICK BALL, ttended to offer a welcome to the members on behalf of he City. He said that as the representative of a city hose past was crowded with historic events of national nportance, and whose Castle had been the home of Kings nd Parliaments; as the representative of a city, the terest of which was bound up with the industrial and mmercial development of our country, he had the ivilege and honour to give them a cordial welcome, and hope that their deliberations might be profitable to dustry and manufactures. Many people had formed an inion that this country had not made the advance in emical science and manufacture attained by others. If ere were any truth in such an opinion he trusted that s Society would see to it that this stigma was removed, d that British manufacturers would have as much aid m chemical science as their competitors abroad. King rge, when Prince of Wales, on his return from his npire tour, and speaking at the Guildhall on December , 1901, had said "Wake up, England!" He was sure Society was alive to the important part it could play giving effect to that injunction. The aid chemical ence could render to the local trades of bleaching, eing and dressing of lace and hosiery fabric, was beyond ception. The municipality of Notttingham was alive the importance of imparting knowledge of chemical nce as applied to industry and had, through the Uni- ity College, given every facility for its study, especially onnection with the staple trades.

The PRESIDENT, in acknowledging the welcome, desired behalf of the Society of Chemical Industry to offer their dial thanks for the hearty reception which the Mayor l given to them. The Mayor was perfectly right to ind them of the words of the present King, when, as nce of Wales in 1901, he said "Wake up, England!"; was also right to expect that the Society should do great ngs for chemistry and industry. As far as chemical ustry was concerned, His Majesty's words held as good lay as they did in 1901. It was true that they had de considerable strides in many directions, especially his district; still they had a great deal of leeway to ke up. It was curious that many inventions which had origin here in England seemed, after all, not to have n worked in this country as they ought to have been. tish manufacturers ought to take up new industries. a case in point, he referred to the synthetic production mmonia, the invention of Prof. Haber; he did not see this could not be made one of the great industries of country, where the facilities for carrying it on were al to those in Germany. He regretted, however, to that there was no indication of any intention to take p in this country. It was not only a case of "Wake England," but of "Wake up, masters," to whom he ld say: "Be less conservative, and see that you take intage of everything that science offers and that energy ccomplish."

APPOINTMENT OF SCRUTATORS.

n the motion of Mr. J. T. Wood, seconded by Prof. . Messrs. T. D. Morson and J. P. Bowley were inted scrutators.

RESIGNATION OF THE EDITOR.

e PRESIDENT said that since the Report of Council drafted by the Council he had received a letter from Editor of the Journal, who stated that, being now in his 70th year, he desired, owing to failing health and strength, to be relieved from his duties. The Council could do no other than accept the resignation with great regret and appreciation of over 33 years' faithful service. The Council desired to bring this before the Annual Meeting so that they might show their concurrence in its statement of regret and appreciation of the services of the Editor.

The meeting unanimously agreed.

REPORT OF COUNCIL.

The Secretary read the annual report, which was adopted on the motion of Professor A. G. Green, seconded by Mr. R. B. Batty, as follows:—

The number of members now on the register is 4142.

The losses by death amount to 35, viz.:—Frank Baker, W. P. Bloxam, Dr. E. A. Byrnes, M. Bythway, C. C. Connor, L. M. Denne, Daniel Drew, Prof. R. Kennedy Duncan, W. J. Evans, Walther Feld, Herman Frasch, E. R. Gabbett, Dr. John Gibson, Wm. Hammersley, R. C. Heath, W. D. Howard, H. Howell, C. C. Hutchinson, Dr. J. Lewkowitsch, John Macallan, D. McKechnie, Dr. Hugh Marshall, R. C. Menzies, Jas. Pass, H. T. Penterman, W. Pethybridge, H. Pocklington, F. L. Senior, W. T. Skaife, E. S. Sperry, Jos. Stirk, Sir Joseph Swan, F.R.S., Dr. W. E. Tetlow, Jos. W. Thomas, and G. C. Vogel.

Four Ordinary Members retire from the Council, and to fill the vacancies thus created, seven nominations have been received, one of which was invalid. A ballot will therefore be taken.

The following Chairmen of Local Sections retire, viz.:—Prof. R. F. Ruttan (Canada), Mr. T. W. Lovibond (Newcastle), Sir John Turney (Nottingham), Dr. Thomas Ewan (Scotland), Mr. Loxley Meggitt (Sydney), and Mr. George Ward (Yorkshire). The following have been elected to succeed them:—Prof. J. W. Bain, Dr. F. C. Garrett, Mr. John White, Mr. Robt. Hamilton, Prof. C. E. Fawsitt, and Mr. F. W. Richardson. The following Hon. Local Secretaries retire, viz.:—Mr. J. R. Coste (London), Dr. F. C. Garrett (Newcastle), and Dr. H. Sand (Nottingham), and are succeeded by Mr. T. D. Morson, Mr. E. F. Hooper, and Mr. J. M. Wilkie. Mr. W. H. Coleman (Manchester) was succeeded by Mr. L. E. Vlies soon after the last annual meeting. The Council desires to express its thanks to the retiring Chairman and Secretaries for their services to the Society.

The Balance Sheet and Annual Statement of Account, which has already appeared in the June 30th number of the Journal, will be laid before the meeting.

The Society's Medal has been awarded to the Rt. Hon. Sir Henry Roscoe, LL.D., F.R.S., for his services to science, education, and to the Society.

At the close of last year, our President, Sir William Crookes, was elected President of the Royal Society, and consequently relinquished his office in this Society. Dr. Rudolph Messel, who had but recently resumed his former post of Hon. Foreign Secretary on the death of Dr. Lewkowitsch, consented to be nominated President for the remainder of the term, and the Society is deeply indebted to him for his aid in this emergency. Sir William Crookes continues to take the closest interest in the Society's affairs, and now becomes a Vice-President.

The Journal in 1913 contained 1172 pages of text as compared with 1204 pages in 1912. Books received for notice or review will in future become the property of the Society, and add to the usefulness of the Library.

Dr. Messel, who represents the Society on the governing body of the Imperial College of Science and Technology, has been instrumental in securing the establishment of full Professorships both for Organic and for Physical Chemistry. He also strongly supports the movement in favour of the complete independence of the College.

The Council has accepted an invitation to hold the next Annual General Meeting of the Society in Manchester in September, 1915. The British Association meets there about the same time, and special arrangements are being made for giving facilities to members of this Society who attend the meeting. The Council is giving serious consideration to proposals for adding to the scientific value and interest of Annual Meetings by the addition of conferences on matters closely allied to the interests of Chemical Industry.

The Council nominated delegates to take part in a deputation to the President of the Board of Trade with regard to amendment of the Patent Act.

A Committee has been appointed to report to the Council on means for increasing the membership and usefulness of the Society, and several valuable suggestions have been received which are still under consideration.

A letter has been received from Mr. Watson Smith, stating that, being now in his 70th year, he desires to be relieved of his duties, owing to failing health and strength. The Council can only accept the resignation with great regret and with appreciation of over 33 years' faithful service.

TREASURER'S REPORT.

Mr. TYRER said that it had been an uneventful year so far as finance was concerned. The only item to which attention should be drawn was that, in common with commercial and financial affairs generally, there had been a depreciation in gilt-edged investments. Of investments amounting to the very respectable sum of £19,648 17s. 1d., the market value on December 31st was £17,349 18s. 5d. But one thing had to be remembered, namely, that the dividends were the same. The Stock Exchange latest records showed them to be better off on this statement by some £300 or £400 than they were in other years. Investments had appreciated rather than depreciated, even to that small extent. General expenses were much the same as in 1912 and 1911. Subscriptions were less by £102 11s. and advertisements less by £32 19s. 6d. That was not very serious, but from a business point of view the result ought to be better having regard to the character and large circulation of the Journal. On the other hand, sales of Journals had increased £88 14s. 2d., making a total of £867 6s. 6d.—a very respectable sum. There was a large stock of collective and decennial indexes which were very valuable and which they would be pleasde to see sold. Expenditure was less in some directions. They must not be misled by the £1285 3s. 11d. stated as excess of income over expenditure. That included interest on their savings and certain items which had to go to capital account. The accounts had been carefully kept, and the auditors had been particularly inquisitive before they had attached the usual professional certificate.

Mr. WALTER F. REID moved a hearty vote of thanks to the treasurer. The work that Mr. Tyrer placed before them in such detail and order took much valuable time. The Society knew no better friend than Mr. Tyrer had been from the commencement.

Mr. N. H. MARTIN seconded the resolution, remarking that Mr. Tyrer had brought to bear on his office the same conspicuous ability which had marked the other departments of his work.

The resolution was carried, and Mr. Tyrer, in acknowledging it, said that so long as he had health and strength and the Council would submit his name for their approval as treasurer, so long would he be pleased to hold the office.

The PRESIDENT said the meeting in Nottingham had promised to be one of the most illustrious ever held by the Society. They had expected Sir William Crookes and Sir Henry Roscoe to be present. Both were octogenarians, Sir William Crookes being 82, and Sir Henry Roscoe in his 82nd year. At the last moment neither of those gentlemen was able to come on account of ill health. All knew, of course, that Sir William Crookes was his predecessor in office, being elected last autumn, but he had very soon to retire because a great honour was done to him and through him to their Society, by his being elected President of the Royal Society—the greatest scientific honour in this country, and it was an unwritten law of the Royal Society that its President should hold no similar office simultaneously. The Royal Society had only had two chemical Presidents in a century, the first one being Sir Humphry Davy and the second their worthy President, Sir William Crookes.

PRESIDENTIAL ADDRESS.

BY SIR WILLIAM CROOKES, O.M., PRES. R.S.

In the absence of Sir William Crookes his address was read by the President, as follows (omitting the references to himself) :—

I fear that you may feel a little ennuied at being calle upon to listen to a Presidential Address delivered by on who no longer has the honour of being your Presiden But I cannot forego the opportunity of expressing m regret at being compelled to resign my position. M election to the Presidency of the Royal Society mak it impossible for me to continue to hold the office, but m interest in the Society of Chemical Industry, of which th Nottingham section is so vigorous and flourishing a branc can suffer no diminution. My regret at parting is great tempered by the reflection that in Dr. Messel, who h consented to step into the gap, the Society will have President of pre-eminent suitability and unrivalled quali cations. There is little need for me to remind you th Dr. Messel's knowledge of Industrial Chemistry and h close connection and acquaintance with foreign manufa turing practice will be of great value to English Chemist His work on the industrial applications of Catalytic pr cesses has brought him world-wide fame, and our Socie is fortunate in having a man of such eminence at the he of its affairs. I must congratulate you heartily upon t energy and enterprise displayed by your Members, a upon the success of the work accomplished. Techni chemistry makes great strides. The past year has se the publication of results which, although perhaps r sensational enough to stir public imagination, nor intrin cally important enough to be described as epoch-maki are a sufficient tribute to the steady industry of inves gators, to their resource in overcoming difficulties, a their acumen in elucidating the causal relations of so particularly interesting phenomena.

Foremost I must mention Haber's process for t production of ammonia. Ammonium sulphate is n synthesised by the Badische Company, which is about enlarge their plant by the end of 1915 to a capacity 130,000 tons per annum. The catalyst osmium has b replaced, first by uranium, later on by Fe_2O_3. T investigation of the process has shown that the lat catalyst is made more active by the addition of cert substances, *e.g.*, oxides, hydroxides, and salts of all metals, while other substances, such as arsenic, act specific poisons towards ammonia catalysts.

The demand for nitrogenous fertilisers steadily advan There is also an increasing demand for nitrogenous prod for industrial purposes, concentrated nitric acid being of the most important of these products. The N wegian Hydroelectric Nitrogen Company, Limited, am others, have worked out a simple method of obtai dilute nitric acid by the oxidation of atmospheric nitro and then concentrating the dilute acid by making of the hot gases of the furnaces. The concentrated can thus be very cheaply obtained. The Norwe Company find that the pure acid can be transporte aluminium tanks. A steamer equipped with alumin tanks for 40 tons is already in regular service betw Notodden and Eugene on the Christianiafiord, and de are in progress for 600 to 700 tons tank steamers for reg service to England and the Continent. The ou of the Company's work at Rjukau and Notodden now reached—

80,000 to 90,000 tons of nitrate of lime,
10,000 tons of nitrite of soda,
5,000 to 6,000 tons of refined nitrate of soda,
15,000 tons of nitrate of ammonia.

The work of Dr. E. J. Russell and others on the a of antiseptics on soil in increasing the growth of has led to deeply important results. The anom effects of the partial sterilisation of the soil in ca first a fall and then a rapid rise in the number of bac were first observed. Further study showed that increased productiveness of partially sterilised soil i to the increased production of ammonia, and tha increase in bacteria is the result of an improve of the soil as a medium for bacterial growth. the experiments Dr. Russell concludes that ord soil contains a factor which limits the bacterial popul and prevents its reaching its maximum. The searc this soil organism revealed the presence of many prot now being examined from a zoological point of The fact that the detrimental organisms are more killed than the useful organisms explains many parad esults—such as the ultimately beneficial influence on roductiveness of long-continued frosts and droughts, hich are harmful to organisms. The "sickness" of eenhouse soil has been investigated; it is found that it ay be ascribed to two causes—an accumulation of pests ad an abnormal development of factors detrimental bacteria. Methods are now in progress for the partial erilisation of the soil on a large scale. The action of fferent antiseptics has been studied and interesting nclusions drawn from the work. It is found that there a decided difference in the action of different antiseptics; ly actual trial will decide which may be best in special ses. Generally speaking formaldehyde and pyridine e the most useful for sick soils; cresol, phenol, etc., ming next, while the higher homologues of benzene e the least effective. None of these, however, answers as ll as steam—the most efficient of all sterilisers.

A remarkable achievement in technology is due to a mber of our Society who recently died. I refer to Frasch—to whom the Society's Perkin Medal was arded in 1912. Frasch successfully solved the blem of the extraction of sulphur from the deeply ried deposits of Louisiana. He conceived the idea melting the deposit *in situ* by means of superheated am, and forcing the molten sulphur to the earth's face through an inner tube. The process has worked isfactorily and large quantities of sulphur are thus racted.

An interesting modern process is that of Dr. Walther d, whose death in his prime is a severe blow to science. strenuous worker of great orginality, Feld has iched technology with many discoveries; the most ortant relates to the preparation of ammonium hate direct from crude coal-gas. The problem of the isation of the sulphur of the crude gas has thus been pletely solved by a particularly neat and ingenious hod. Using ammonium polythionate, ultimately aining ammonium sulphate, sulphur, and sulphurous , the two latter are again utilised in the process, le the ammonium sulphate is obtained by evaporating solution. The practical value of a process in which moaium sulphate is obtained without the use of sulric acid is obvious. The researches of Feld in working the details of this method also throw light upon y interesting scientific questions.

nother method of fixing nitrogen by utilising the har of coal is that of K. Burkheiser. In this process iron ore is used to absorb the sulphuretted hydrogen, the sulphurous acid produced from it is used for formation of a mixture of ammonium sulphate and hite. The process is working at Flemalle Grande, Liège, in Belgium, and is giving satisfactory results.

cent work on the synthesis of Rubber has attracted h attention, and notable advances have been made. ong ago as 1882 Tilden noticed that isoprene is cond into rubber by certain chemical reagents; ten s later he showed that the synthetic product obtained isoprene is capable of vulcanisation. Subsequent led to the recognition of the fact that most subes containing a conjugated double linking tend to nerise, the polymers ranging from sticky substances igh well-defined rubbers to hard resins. Polymerisamay be spontaneous, or it may be brought about by ical reagents—acids or alkalis—by heat, or sunlight. 0S it was simultaneously discovered by C. Harries and Matthews that sodium is an excellent agent for the nerisation of isoprene. The action is practically titative, and is not affected by the presence of imies. Moreover, it takes place in the cold, or on ng very moderately. Harries showed that a superior y rubber could be obtained by the polymerisation of iene. Research showed that the isoamyl alcohol ned from commercial fusel oil was the most suitable ial to work upon. By means of dry hydrochloric was converted into the chloride, and then chlorinated e the dichloride, from which the hydrochloric acid eliminated by passing over hot soda-lime. The ne was then sealed up with 3 per cent. thin sodium and heated for several days to 60°. The dark product thus obtained was treated with acetone cipitate the rubber.

To obtain fusel oil, Fernbach has worked out a new process of fermentation, starting with starch. Holt has recently made some valuable discoveries relating to the manufacture of isoprene from the fraction of petroleum of lowest boiling-point, and the preparation of butadiene from benzene or phenol, tetrahydrobenzene being formed as intermediate product. He has also observed that isoprene when treated with sodium in an atmosphere of carbon dioxide gives quite different products from those obtained by the same action in air. No perceptible change occurs at first, but finally a black voluminous mass is obtained, which gives pure white caoutchouc with water or alcohol. Recent work shows that all synthetic caoutchoucs differ chemically from natural caoutchouc. Physically the vulcanised products from synthetic (isoprene) caoutchouc are equal in quality only to products from medium grade natural rubbers.

Another series of remarkable syntheses is due to Fischer and Freudenberg, who, starting from gallic acid, have succeeded in obtaining lichen constituents and tannins, for which the general name "depside" has been suggested.

The process recently patented by Dr. F. Bergius for the preparation of hydrogen, and his investigations of the preparation of coal from cellulose at high temperatures and pressures, are of deep interest. At high temperatures water acts as a fairly strong acid or base, provided it is kept liquid. In presence of a metal such as iron hydrogen is evolved. The gas is obtained in a pure state and the speed of the reaction is very high. The cost of production is about ½d. per cubic metre at atmospheric pressure, and this would be reduced in large plants; it is considerably less than that of the cheapest method now known.

Water kept liquid by high pressures acts as an excellent thermostat in consequence of its high specific heat; this fact can be applied in the preparation of coal by the decomposition of cellulose. The product has all the chemical properties of natural coal, though physically it differs from it. If, however, the temperature and pressure during formation is greatly increased a substance is obtained which closely resembles anthracite. The specific gravity increases with the duration of compression and the temperature employed.

The use of hydrogen in the hardening of fats has recently found favour. The natural supply of hard fats is absorbed in the manufacture of margarine and other foodstuffs—hence for soap-making and other similar purposes artificially hardened fats are employed. Whale oil gives a good fat for soap-making when hardened in presence of reduced nickel; the product seems likely to be useful for lubricating and other purposes.

I may perhaps be allowed to allude to such parts of my own work as may be of interest to Industrial Chemists. Such are the investigation of the spectrum of silicon in a very pure state, and also the preparation of eye-preserving glass for spectacles. The main object of this last research is to prepare a glass which would cut off those heat rays from molten glass which are injurious to the eyes of workmen, without obscuring too much light, or materially affecting the colours of objects seen through the glasses. The research was afterwards extended to the examination of the screening properties of different glasses for ultra-violet and luminous rays, and many specimens of glasses containing known quantities of pure metallic oxides and earths were prepared in my own laboratory. I succeeded in obtaining a glass which cut off 98% of the heat rays, while others, which I have called "Anti-glare Glasses," cut off practically all the ultra-violet and a considerable proportion of the heat rays. I am now investigating the question of the choice of a glass which will reduce to a minimum the fading and alteration of the colours in water-colour paintings on exposure to sunlight and diffused daylight. This series of experiments is not yet concluded.

In spite of the advances which I have just briefly brought to your notice, and notwithstanding the fact that the active investigation of scientific and industrial problems is going on at a rapid rate, the World is greatly in need of able Researchers, perhaps more so now than at any previous time in its history. We may be certain that discoveries of vast importance are waiting their Newtons. Secrets of nature are lying hidden ready to disclose themselves to the "immortal mind." But is not the attitude of the public towards investigators lacking in understanding and imagination, and do not the authorities treat Scientific exploration in a niggardly spirit ? Scientific men have to deplore the fact that there appears to be a lack of men gifted with the genius for Research and for grappling with the Riddles of the Earth. Scientific research has been and is being starved. It is high time measures should be taken to remedy this state of affairs, which otherwise can only end disastrously for the nation. I do not wish to come before you as an alarmist, but rather as one who can diagnose the disease and suggest the remedy. I know you will be in hearty and enthusiastic agreement with me when I say that the allotment of public monies to the furtherance of scientific work, the tangible recognition of the services of scientific men, the provision of opportunities for all kinds of investigations of scientific problems without reference to their immediate commercial value—these are the benefits we look for at the hands of Government and of the Nation. And what are our responsibilities and duties in regard to research ? I think our chief care should be to see that we encourage and cultivate the right type of man for research work. We should make more definite efforts to select suitable men from among our students and to train them to the highest point of efficiency, after having made up our minds what are the special qualities we need. I think we can learn a great deal from the training of our Army Scouts. Our researchers are actually Scouts, penetrating strange and unknown countries, and the keys to success are the same as for all scouts. The principal qualifications are confidence, keenness, intrepidity, inspiration. The knowledge that you are well equipped for your work, the belief that your training has been thorough, and that you have made the best possible use of it, should develop in you the self-reliance and boldness indispensable in a scientific scout ; other valuable qualities, quickness of eye and mind, and the power of reasoning and expression, can undoubtedly be developed and perfected. And what can be promised as the reward of scientific work ?—" Not the reward, the work makes man sublime." Perhaps after all only the Fight, the Struggle, the Search—but Research, like Virtue—

> " Desires no isles of the blest, no quiet seats of the just,
> To rest in a golden grove, or to bask in a summer sky :
> Give her the wages of going on, and not to die."

Dr. MESSEL, having read the address said : You will agree that it is very remarkable that a man, the greater part of whose life work has been devoted to scientific research, should take an interest in technology such as is shown in his address, which I have just had the pleasure of reading to you. He does not, however, do himself justice. He refers here to the famous Haber process for the synthetic production of ammonia, and to the Norwegian process for the production of nitric acid and nitrates in various forms, but not a word does he say as to whom all this work is in the first instance due. It is, I contend, due to no one else than our Past-President, now the President of the Royal Society, Sir William Crookes. He says at the end of his address here : " I do not wish to be an alarmist." In his address on the great food problem before the British Association in 1898 he undoubtedly seemed to be an alarmist lest our food supply could not keep pace with our requirements. He pointed out that ever larger quantities of manurial material would be required if food supplies for future generations were to be sufficient to meet the enormous increase of population and its requirements. But though it may be right that he was an alarmist, yet he has rendered a great service by calling attention to the facts. Not sufficient stress, however, is laid on the fact that, as a true physician, he likewise prescribed the remedy. In his address of 1898 he asked if it was not possible to solve this momentous problem, and he proceeded to describe the fixation of nitrogen as vital to the progress of civilised humanity. Not only in general terms did he refer to it, but he pointed out that as far back as 1892 he had exhibited before the Royal Society an experiment on " The Flame of Burning Nitrogen." This method has since been made use of by Lord Rayleigh for the purpose of eliminating nitrogen from the air, with the object of producing argon. The data thus obtained Crookes made use of in calculating the cost of nitrate soda, and he proceeded to show that electricity produce by means of coal and steam engines would be too costl for industrial purposes, but that at Niagara, where wate power was utilised, electricity was sold at one-seventeent of a penny per Board of Trade unit, and at this rate nitrat of soda would not cost more than £5 per ton ; the lim of cost, however, had not yet been reached. He al pointed out that Niagara alone was capable of producin all the energy required to supply the world with nitr genous fertilisers, without materially reducing its might flow. The address in question has thus called attentic to the necessity of producing and fixing nitrogen in son way or another for the purpose of increasing crops. S William likewise shows how absolutely practicable would be to combine atmospheric nitrogen, whi costs nothing and which is at our hands in su quantities that it can never be a question of our having starve, if only we make use of it. True there have co after him other inventors, one greater perhaps than t other, devoting themselves to nitric acid and ammo problems, and I do not for one moment wish to ta away the credit from these great men who have bu up these important new industries. On the contra But if, at an earlier stage of this meeting, in answer some remarks of the Mayor, I endorsed the words of t King, " Wake up, England," I am equally anxi to give credit where credit is due, and to point that these vast problems were really first of suggested here in our country, and that the impu to achieve these great results was primarily to the foresight of an Englishman, Sir William Crook Then again, his reference to the work he has done w regard to the discovery of a glass that enables peo to work at furnaces without suffering injury to eyesig is of the greatest importance. He also refers here t paper on the production of hydrogen for use in connect with the hardening of fats and the production of ammo But one of Crookes' very early investigations and coveries was that of thallium in 1862, and it is notewor that now, after more than 50 years, this work has fo practical application in a recently patented pro involving the use of thallium chloride in produ hydrogen. I could not refrain from making s comments on the work and address of Sir William Croo and I ask you now to accord a hearty vote of thank him.

Prof. G. G. HENDERSON, seconding, referred to the that Dr. Messel had omitted to read Sir William Croo reference to himself in the early part of his address. Ha read the passage in question, Prof. Henderson remin them that three years ago, in recognition of his scien achievement and of his services to the Society, Dr. M was elected to the Presidential chair, that he had charged the duties of his office for the normal period the greatest advantage to the Society, and that also du the following year, when the chair was occupied by Bogert, Dr. Messel was acting as president during Bogert's absence from this country ; and finally, the Royal Society had risen up in its might and taken a from them their President, the Council had unanim agreed to ask Dr. Messel to fill the gap thus cre believing that in the interests of the Society would consent so to act. This was a unique re The Society was under a debt to Dr. Messel, w it would be very difficult to pay, but at least recognised their indebtedness by offering him their cordial thanks. That he would ask them to do.

The resolution having been supported by Mr. Eu CAREY, was carried unanimously.

The PRESIDENT, in acknowledging the vote, said the members having again shown their confidence in and having received him with such heartiness, he only say how very greatly he appreciated their kin towards him. The fact that he had had the hea support of everybody had made it possible for him to h successful year of office once more. If he had anything for the Society in the past he was only delighted to have done it, and he was equally rea assist the Society in the future.

PRESENTATION OF THE SOCIETY'S MEDAL.

The PRESIDENT then proceeded to make the presentation of the Society's medal, the recipient being the Right Hon. Sir Henry E. Roscoe, LL.D., F.R.S., who was unable through indisposition to be present. Dr. Messel first read a telegram from Sir Henry, sending affectionate greeting and wishing success to the meeting, and also a letter expressing his sincere regret that he found it impossible to attend to receive at the President's hands the medal with which the Society had honoured him. He felt confident that his enforced absence would not be taken by the members as indicating either want of interest on his part in the proceedings of the Society or of gratitude to them for the award of the medal. With regard to the first point, that was impossible for a man who was present at the birth of the Society, acted as its first President 33 years ago, and since then had watched its progress from year to year and rejoiced in its increasing usefulness. As regarded the second point, all he could say was that the honour was a great one, and for any service he had rendered to the Society in the past he had been more than amply repaid. Sir Henry then referred to the origin of the Society and mentioned that one of its objects was to promote a good understanding and friendly intercourse between professional and industrial chemists.

The PRESIDENT then proceeded as follows :—

"The recipients of the Society's medal form a record of eminence in pure and applied chemistry and in the furtherance of the objects of the Society, of which any association may feel justly proud. The addition of the name of the Right Hon. Sir Henry Roscoe, which has already been announced by the Council of the Society, will add further lustre to our roll of medallists, and will, I feel sure, be welcomed most heartily by every member of the Society.

"According to our Charter the recipient of the medal shall be a person who, in the opinion of the Council, has rendered conspicuous service to applied chemistry, or to the Society in furtherance of its objects.

"Sir Henry Roscoe's long record of eminent service both to chemistry and to the Society needs no words of mine to justify our selection, but I may be permitted to recall something of the work of his distinguished career, especially at a time when modern advances in science are apt to make us unduly forgetful of the past.

"Roscoe's earliest researches, which were conducted in conjunction with Bunsen nearly 60 years ago, were on the measurement of the chemical action of light, a series of investigations which laid the basis of quantitative photo-chemistry and which have played a large part in modern developments of the photographic industry. Some few years later, during the early days of his tenure of the Chair of Chemistry at Owens College, Manchester, he carried out his well-known work on the composition of he halogen acids of constant boiling point and on perchloric acid. Then followed in 1868 his classical research on vanadium. Roscoe proved that the substance previously described as vanadium by Berzelius was, according o the method adopted in its preparation, either an oxide r nitride. He was the first to isolate the element and to ssign to it its right place in the periodic classification ; in ddition he determined its atomic weight and prepared a arge number of new vanadium compounds.

"It is worthy to note that with all the improvements uggested by the vast amount of research work on atomic eights, both in America and in this country, practically o difference is found in the latest determinations of the tomic weight of vanadium. Many valuable technical ses of vanadium have followed in the wake of Roscoe's scoveries. Vanadic acid has been employed as an idising agent in the aniline colour industry, whilst the etal has received many important applications in tallurgy.

"Apart from these direct services of Roscoe's own work applied chemistry, he has contributed a large indirect are to the advance of chemical technology through the nspicuous success of the School of Chemistry he estabhed at the Owens College (now the University), Manester. During the 30 years of his professorship—from 57 to 1887—close on 2,000 students passed through the rriculum of his laboratories. Of these many occupy sitions of trust and responsibility in chemical industry and have contributed much to the advancement of applied chemistry.

"Roscoe's association with this Society commenced with its inception and his selection as its first President was an augury of its future success which has been so amply realised. He gave his active support to making the Society a national institution and secured the interest of many notable chemists in its work. Throughout the life of the Society Sir Henry's interest in its welfare has never waned and we owe much of its progress to his stimulating activity.

"I must not omit one other feature of Roscoe's many-sided labours which has reflected on our welfare, his work in technical education. With a firm belief in the efficacy of scientific training, he taught his students and his fellow citizens in Manchester to realise the value of the application of science to industry. He was a member of the first Royal Commission on Technical Education and during his subsequent Parliamentary career took every opportunity to forward the means for the technical training of chemists and to bring the best methods for the education of future captains of industry before the authorities concerned.

"The success that has marked all Roscoe's work in its exceptional breadth and thoroughness is the most lasting memento of its merit. Its recognition by the members of this Society is but one further record of appreciation to the many that have been accorded to him. It is the highest honour we can confer on one who has done much for the advancement of chemical industry and who by his wonderful personality and high character has endeared himself to us all.

"May he long be spared to us !"

Dr. MESSEL intimated that Sir Henry had asked him to receive the medal on his behalf, and he would hand it to him in due course in the name of the Society.

ELECTION OF AUDITORS.

On the motion of Mr. W. T. GENT, seconded by Mr. S. H. DAVIES, Messrs. Feasey and Co. were re-elected auditors at a fee of 20 guineas. Mr. Davies said he hoped that the suggestion of seeing whether some papers of scientific interest could not be arranged for at the annual meetings would be considered. They did not want to belittle the social side, but as they generally met sectionally all the year through it was desirable that something more should be added to the Annual Meeting.

The PRESIDENT intimated that the matter had been favourably discussed by the Council, and the resolution was carried unanimously.

ELECTION OF COUNCIL AND OFFICERS.

The PRESIDENT announced that 128 ballot papers had been examined of which 4 were spoilt. The nominations for President, Vice-Presidents, and officers were confirmed, and the following had been elected ordinary members of the council : Mr. J. H. Coste, Professor F. R. Ruttan, Mr. A. Gordon Salamon, and Mr. J. T. Wood. A list of the new Council will be found on page 717.

NEXT YEAR'S MEETING.

Mr. J. HÜBNER said the Council had kindly accepted an invitation to hold the next annual meeting of the Society in Manchester, and it was his pleasant duty to extend to the Society a most hearty welcome. In 1915 they would be in an exceptionally fortunate position as the British Association were to meet in Manchester and extensive preparations for it would be made. Many of these he had no doubt their Society would also be able to enjoy.

Mr. HOSEASON supported the invitation, which was unanimously approved, and the PRESIDENT, on behalf of the Society, tendered to Manchester a hearty vote of thanks.

THANKS TO UNIVERSITY COLLEGE.

The PRESIDENT said that they were grateful to the authorities of University College for lending them that splendid room. The interests of the Society were identical with those of Colleges like the one in which they met. It was very important that colleges should keep in touch with applied science, and that the Society should keep in touch with the colleges.

Sir JOHN TURNEY said he had been asked to second the vote, but it seemed rather strange that he should be doing so, because indirectly he was associated with University College as a member of the City Council, which he had been for a few years. However, he would like to say on behalf of the people who controlled the work in this College that they were always willing to do all they possibly could to forward that which was for the benefit of the people in regard to things scientific or practical.

The meeting then closed.

VISIT TO SOUTHWELL CATHEDRAL.

After luncheon at the Victoria Station Hotel, by invitation of the Nottingham Section, members and ladies proceeded by motor to Southwell where they visited the Cathedral, Chapter House, and ruins of the Palace of the Archbishops of York.

GARDEN PARTY AT BRACKENHURST HALL.

On leaving Southwell, the party drove back a short distance to Brackenhurst Hall where they were entertained at a garden party by Mr. and Mrs. W. N. Hicking. Tea was served in the park, and was followed by a pastoral play entitled the "Spirit of the Future," rendered by Miss M. Pratt and Messrs. Carey and Creighton. In the intervals, music was rendered by an excellent band. Mrs. Hicking escorted parties round her fine rose gardens, and identified many rare trees and shrubs.

RECEPTION AT THE CASTLE.

The Mayor and Mayoress of Nottingham received the guests in the Art Gallery, Mr. Charles Foulds' orchestral band played in the Long Gallery, and refreshments were served in the Textile Gallery.

SECOND DAY.

VISITS TO WORKS.

THE CORPORATION GAS WORKS.

The Nottingham Gas Works were founded in 1818. and have been gradually extended to their present productive capacity of 10½ million cubic feet of gas per day (including 1½ million cubic feet of carburetted water gas).

The gas is produced at three different works:—

Basford.—Horizontal retorts fitted with West's compressed air charging and discharging machinery.

Eastcroft.—Horizontal retorts fitted with De Brouwer electrical stoking machinery; also inclined retorts.

Radford, where an installation of vertical retorts (continuous carbonization) has recently been put into operation. There is also one bench of hand-worked retorts still standing at Radford.

The district served by the Nottingham Gas Department covers an area of 130 square miles, the total length of mains being upwards of 400 miles.

The tar produced is distilled at the Giltbrook Chemical Works, where also the manufacture of sulphuric acid and artificial oxide of iron is carried on. The sulphuric acid is made principally for use in the sulphate of ammonia plant at the Basford Works, where about 2,300 tons of sulphate are manufactured annually. The oxide is used at the different gas works in the process of purification.

The following figures relate to the year ended March 31st, 1914:—

Coal carbonized	190,025 tons.
Gas oil used	131,911 gallons.
Gas made	2,332,876,000 c. ft.
Gas sold	2,251,303,000 c. ft.

NOTTINGHAM CORPORATION ELECTRICITY WORKS.

The Nottingham Corporation own two electricity works, the one in Talbot Street, the other in St. Ann's Well Road. The output of these Works last year was approximately 13½ million units. The St. Ann's Well Road Works contains 16 Lancashire boilers, 30 ft. by 8 ft., eight of which are fitted with Vicars' mechanical stokers and coal conveying plant. There are 2 Green's fuel economisers and 2 Berryman feed water heaters. This generating plant consists of eleven Willans-Siemens sets of 440 kilowatts each, and a 1200 kilowatt Willans exhaust steam turbine coupled to two Siemens continuous current generators arranged in tandem. The condensing water is artificially cooled by means of a Balcke cooling tower.

TURNEY BROTHERS, LTD., TRENT BRIDGE LEATHER WORKS.

These works were established in 1862 by the brothers Edward and John Turney, and stood originally on an island surrounded by canals and the River Trent. A considerable part of the canal has been filled in since 1898, and buildings have been erected upon the site. The area at present is 2½ acres, and the number of workpeople employed is from five to six hundred.

Near the entrance to the central yard are the main boilers, Lancashire type, 3 in number, 28 ft. by 8 ft. supplying steam to 15 engines, and also very largely for boiling and heating purposes. Two smaller boilers in other parts of the works supply steam to special departments. There is a large number of electric motors, many of which are attached to separate machines.

The bulk of the skins worked are sheep, but goat and calf are also used. The sheep skins are received from the fellmonger after the latter has removed the wool. The skins are first inspected and classed in the central yard, and then pass to the liming process. As this occupies from 2—3 weeks, a capacity of over 100,000 skins is necessary in the "pit sheds." After liming the skins are taken by the "cobbers," who remove any wool or hair still adhering, and also cut off the heads. The pelts are then handed over to the "fleshers" who remove the flesh by means of knives over wooden beams. The flesh is afterwards pressed in a hydraulic press to recover the grease contained in it. The "pieces" are sent to the glue works for making into glue and gelatin. After fleshing, the skins pass on to the "splitting" shop, where they are carefully sorted into various substances and qualities, and then split by machine. The wool side is then known as a "grain," the flesh side as a "lining." From the splitting shop the two sides of the skin take different channels. The grains are washed to remove the lime, bated or pierced, scudded in special machines invented by Sir John Turney, then "drenched," and are ready for the tanning process proper. For this, ground sumac leaves imported from Sicily are used, and the tanning conducted in paddles, the time taken being about 24 hours The tanned skins are dried in the weather, and are then known as "skivers." The drying rooms are very extensive and capable of holding over 50,000 skins. They have been recently enlarged. Large quantities of skins are tanned without splitting, and are known as "basils," part being tanned with larch bark and part with extracts.

Another tannery is devoted to chrome tanning of sheep and lamb skins for motor clothing and for shoe linings and other purposes. Calf skins are also tanned for hat leathers and for shoe work, bookbinding, etc. A special department is devoted to the manufacture of hat leathers. Sheep skins contain much grease, and one of the features of the works is the plant for extracting this by volatile solvents and afterwards recovering both the grease and the solvent. Grease is also removed from some skins by hydraulic pressure. The flesh side of the skin is made into chamois leather, and goes through the following processes: (1) Frizing; by which the skin is cut dow or shaved by skilled workmen to the proper thickness (2) liming, (3) washing, (4) pressing in hydraulic presse to remove water, (5) milling with fish oil, (6) stoving (7) heating off, (8) pressing to remove the oil, which i completed by (9) scouring. The oil pressed from th leather is known as sod oil, and is used for currying heav leather. The finer sorts of chamois go for gloves, th poorer quality for wash leathers.

THE LACE WORKS OF MESSRS. THOMAS BIRKIN & CO.

The oldest part of this factory dates back about 8 years, and contains a machine built by Mr. R. Birkin f the 1851 Exhibition. About eight hundred people a employed in the factory, and the work comprises all t different processes for the production of lace, from ya in the hank to the finished product ready for use. The operations carried out include designing, drafting, slip winding, brass bobbin winding, warping, threading, actual lace making and also all the finishing processes such as mending, dyeing, dressing, drawing, clipping and scolloping.

Various processes in connection with the Lace Curtain branch of the firm's business are also carried out in the Nottingham Works. Among these are the production of the designs and their preparation for the jacquard process, and the mending, finishing, and packing of the goods.

The consumption of cotton yarn involved, both American and Egyptian, amounts to from 7 to 10 tons a week.

The Works of the Raleigh Cycle Co.

The Raleigh Cycle Company was founded twenty-five years ago, and in 1896 the present works in Faraday Road, Lenton, were opened. The frontage is 400 ft., the depth 552 ft., and the building covers an area of over 6 acres. Over 1,600 workpeople are employed and the annual output amounts to 60,000 bicycles, in addition to 150,000 Sturmey-Archer gears, and a large number of motor cycle gears, coaster hubs, etc.

Among the chief characteristics of the Works is the ery complete equipment of power processes. Excellent esults are achieved in the shaping of handle bars, crank rackets, frame loops and other portions of the bicycle rom sheets of high-grade cold-rolled steel.

In the liquid brazing plant a much more certain junction s effected by dipping the frames into molten brass in rucibles, than by the ordinary method of hand brazing t an open hearth with fire and blow pipe.

"Coslettising," a process for forming a rust-resisting eposit upon tubing and other parts before enamelling, as seen in operation; and in the wheel building departnents some clever devices for spoke making, cutting, eading, bending and threading were shown.

The Company makes its own gas for driving, heating nd manufacturing purposes, and the power required for riving the machinery is obtained from eighteen gas ngines, with an aggregate brake horse power of 972.

The most recent addition is a tube making and welding lant. Long strips of sheet steel are drawn through dies nto tubular form, their edges welded by the oxygencetylene process, and the tubes passed through finishing ies, the result showing an improvement upon ordinary ubing both in strength and appearance.

Boots Cash Chemists.

This business consists of five companies, all of which raw their supplies from Boots Pure Drug Co., Ltd., of ottingham. Their combined capital is approximately 2,500,000. The companies employ over 9000 people and ay over £10,000 per week in wages. They control 560 ops and employ about 800 qualified chemists.

The premises in Nottingham occupied by the companies mprise extensive offices and at least ten factories. The fices of all the companies, with a floor space of 81,583 uare feet and a staff of 560 persons, are collected under e roof at Station Street, Nottingham.

After inspecting the various office departments, the sitors were shown the girls' gymnasium, the patent edicine stock room, the printing works, and finally the w pharmaceutical laboratory.

E Locomotive Works of the Midland Railway at Derby.

On these works devolves the duty of building the comotives of the Midland Railway, and maintaining in nning condition the 3000 locomotives owned by the mpany. The works date back to the days before 1844, en the North Midland, the Midland Counties and the rmingham and Derby railways were separate organisaons. The area covered by buildings alone is about acres, with ground amounting to about 80 acres, and devoted solely to the locomotive department, the rriage and wagon works having been moved to a new e in 1873. The number of workmen employed in the omotive works amounts to 4264, that of foremen, rks, draughtsmen, etc. to 383. Some of the more portant departments visited were the boiler shop, the eel and tyre shop, the press shop, the foundry with a weekly capacity of about 420 tons, the machine shops containing about 570 machines, the erecting shop which will hold 72 engines, and the paint shop.

Most of the machines are electrically driven, the power being generated in the company's own station by means of two 1250 K.W. Parsons' turbogenerators producing three-phase alternating current of 50 cycles and 440 volts. This station also supplies the Carriage and Wagon Works.

The new chemical laboratory has been built on the site of the old electric light station, and is fitted with the most recent appliances for chemical, physico-chemical, metallurgical and metallographic analysis.

The Works of the Royal Crown Derby Porcelain Co.

The following is an account of the history of Derby China, abstracted by kind permission from the Porcelain Company's book: "The Story of Derby China."

Porcelain was first produced in Derby very soon after its introduction into Europe. Although it was not until the early part of the 18th century that John Böttger, the pioneer of the ceramic art, made his important discovery, a China Factory was established at Derby, on the Nottingham Road, by William Duesbury in 1750 and the Derby ware soon attained national fame. It furnished the tables of the King, and was sought after by the nobles. Duesbury acquired the right to use the Royal Crown to distinguish his wares, and his factory became the most celebrated of its kind in the United Kingdom. In 1769, Duesbury acquired the famous factory at Chelsea, and it and the Bow Works which were shortly afterwards established were in 1776 amalgamated with the Derby factory.

On the death of Duesbury in 1786 he was succeeded by his son William, and from him the works passed, at short intervals, into the hands of Messrs. Kean, Bloor, and Clark, until, in 1848, they were closed down. The production of china in Derby was, however, not allowed to die out. Mr. Sampson Hancock, assisted by other hands from the Bloor factory, carried on a small works, which produced articles of the old type and character. In 1877 a Company, styled the Derby Crown Porcelain Co., Ltd., was formed to revive the industry, and works were established on the Osmaston Road. Considerable success attended the venture, and in the year 1890, on the representation of the 7th Duke of Devonshire, Her Majesty, Queen Victoria was graciously pleased to command that the Company should in future be styled The Royal Crown Derby Porcelain Company, Limited.

The Company's craftsmen have been and are, in the very front rank of their profession. Among them may be named Desiré Leroy, who made a speciality of old-time Sèvres flower, bird, and trophy painting, and was also strikingly successful with white enamels. Another artist whose work is well known is A. Gregory, who has made a special study of flowers.

The Works of Bemrose and Sons, Limited.

Fine Art, General, Railway, Calendar and Collotype Printers, Lithographers, Manufacturing Stationers, Bookbinders, etc.

The firm was established in 1825, by the late Mr. William Bemrose, and converted into a Limited Company on December 21st, 1891. It has branches in London and Leeds. Messrs. Bemrose and Sons, Limited, are the Printers to the Midland Railway, and their works are situated close to the Company's Offices. The premises cover an area of 78,768 square feet, excluding outbuildings and open yards. The number of employees is 1100.

The chief speciality of the firm is fine art and colour printing, and they possess for the production of this class of work facilities which embody the latest types of modern machinery.

Some of the departments shown to visitors were the Composing Rooms (including the Linotype Gallery and the Monotype installation) the Bindery, the Folding Department, the Rotary Printing Machine, the Engine Room, the Machine Ruling Department, and the Envelope and Die Stamping Room.

The Motor-Car Works of Messrs. Rolls-Royce, Ltd.

The first car of the Rolls-Royce make, a two-cylinder vehicle of 10 h.p., was produced in 1904, and was in the same year, awarded a Special Medal and Diploma by the Commissioners of the Paris Salon. At the present day the only type of chassis manufactured is a 40-50 h.p. six-cylinder model.

The various operations are carried out in more than a dozen buildings. Of the more important departments, mention may be made of the shop containing the automatic and semi-automatic machines, the grinding shop, the coppersmiths' shop, the smiths' and hardening shop, the pattern shop and foundry, the axle-testing and gear-box testing shops, the large main shop in which beside a number of machine and fitting bays is housed the erecting bay, and lastly the testing department for the finished car.

The automatic machines produce parts to gauges having predetermined limits of error; most of these parts are handed to other departments for finishing.

Wherever extreme accuracy is required on diameters or bores the parts are handed over to the grinding department, where there are machines by means of which crank shafts are ground on the pins and journals, to produce a perfectly round and accurate diameter, also cylinder-grinding machines, piston ring grinders, ball race grinders, and various surface grinders.

In the smiths' and hardening shop were seen the hardening and carburising furnaces, in which practically all the steel parts used in the car are heat-treated at some point in the course of their manufacture.

In the foundry are two oil fired tilting furnaces, one of them of the latest pattern.

The completed cars are first subjected to a preliminary examination, and are then passed over to the testing department, in which after various other tests they are placed on one of the dynamometers. They may thus be submitted to a far more rigorous test than is possible on the road, *e.g.*, they may be run for long periods at full load or they may be run under full load at various speeds. Before despatch the chassis undergoes several road tests during which the various adjustments are completed.

A special testing track is owned by the works and an experimental shop is also provided in which any new designs are developed and thoroughly tested preparatory to their adoption as standard

Garden Party at Gedling House.

In the afternoon, members and ladies went by special train to Gedling, near Carlton, and walked to Gedling House where they were received by Sir John Turney, Chairman of the Section, and Miss Turney. Gedling Park differs from Brackenhurst in that it depends for its beauty on its fine timber, in which Sir John Turney takes the greatest interest. The trees were of great service to the garden party as the afternoon turned out wet, and refreshments were thus served under natural shelter. A photograph of the President, the President Elect, the Mayor, Sir John Turney, and other Members of Council was secured by Mr. J. W. Russell, of Hounds Gate, Nottingham.

THE ANNUAL DINNER.

The Annual Dinner took place on Thursday evening, July 16th, in the Council Chamber of the Exchange Hall. The President (Dr. Messel) presided, and was supported by the Mayor and Mayoress, Professor G. G. Henderson, Sir John Turney, and many others.

The toasts of "The King," "The Queen, Queen Alexandra, the Prince of Wales and other Members of the Royal Family," and "The President of the United States of America," were submitted by the President and fittingly honoured.

Professor G. G. Henderson proposed "The Society of Chemical Industry." He said that before he addressed himself very briefly to the toast he wished to thank the President and the members of the Society for the very great honour they had conferred upon him by electing him as their President. He knew only too well that it was no easy task to endeavour to tread worthily in the footsteps of the great men who had occupied the chair of that Society, but he could at least promise them that he would do his best, and no man could do more. He thought every member of the Society ought to consider it a privilege to propose this toast, because every member must feel, as he did, a very great pride in the past history of the Society and very great confidence in its future. Since it was born, now more than 30 years ago, the Society had never looked back: it had gone on from strength to strength until, numerically at least, it could claim a place amongst the greatest technical Societies. And if they tried to find a reason for this great, this amazing development, one, of course, was that there was need for the Society; but another, he thought possibly of equal importance, was that the foundations of the Society were laid with wisdom and remarkable foresight by those who presided at its inauguration. This Society was a composite organism. It was built up, as they knew, of a number of different Sections in this country, and also in Canada, Australia, and the United States of America. Each of these Sections was practically a society within a society, but all were linked together directly by means of the upper house—if he might call it so, the Council; and the strength of the Society arose not so much from the fact that they had a number of independent, active Sections, but that these Sections were united together. In that respect, as was true of all other societies, it was union that was strength. At the same time, a Society such as ours, however strong it might be, could not stand still: it must advance, or it must of necessity fall behind; and, as the report had informed them, methods of promoting further development and strengthening it still more were engaging the serious attention of the Council under the fostering care of Dr. Messel. But let them remember that however good a Council the Society might have, however much it might record, and however hard it might work, it could not advance unless members also fell into line with the Council, and thus he appealed to every individual member, and more particularly to the younger members, to take an active part in the work of the Society as a whole and of the Sections to which they belonged, and especially to contribute to the proceedings of the Section. Even the sun had its spots, and this Society was not quite perfect, and one of the imperfections—a marked imperfection—to his mind was to be found in this fact, that they had a huge membership, a membership of very high qualit indeed, and yet the number of original contribution received from that huge membership was most distinctl not what they were entitled to expect. There were, o course, obvious difficulties in the way, but he though that if the members acquired the habit—if he might cal it so—of publication to a larger extent, the Journa would be very much stronger than it was and thes comparative difficulties would disappear. He desire to remind them that the Society's year which they ha just brought to a conclusion had been a notable one i various ways. They had only just heard of the resignatio of the first and only Editor the Society had ever had It was not necessary for him to say anything, he thought beyond reminding them that there was a stately ro of witnesses to the capacity, faithfulness, and loyalty t their Editor in the great series of volumes of the Society' Journal which had been issued under his direction. H would say one word only—that no Society had ever a mor loyal officer than they had had in their Editor. In anoth way this had also been a very notable year: they had ha two Presidents. They all knew the circumstances unde which Sir William Crookes was torn from them, and the also knew how the Council felt that one man—and o man only—could fill the breach created in their rank and how that man—of course, as they expected—ro to the occasion. Dr. Messel was almost a unique Presiden He did not know of any other man who had acted President for three years, and he should feel it a impertinence to endeavour to say more than a single word i commendation of his services to the Society. He woul however, say one word. That was that he had made very difficult for any man to succeed him. But he wou like to remind them that it was no recent development Dr. Messel's part to be an active worker in th Society. Since its foundation he had been intimate associated with it. If they would turn to the fir volume of the Journal they would find that the fir paper in that volume was contributed by Dr. Messel, a ever since that date he had taken an active, strenuo and invaluable part in promoting the development a the great prosperity of the Society, and they rejoiced that they could still depend upon the benefit of his wisdom and experience upon the Council. He asked them to drink with all heartiness to the general prosperity of the Society and especially to drink to the health of Dr. Messel.

The **President**, in responding, referred to the election of Sir William Crookes as President of the Royal Society which prevented his continuing to hold the Presidency of the Society of Chemical Industry. The Royal Society knew a good thing when they saw it, and they had come to the Society of Chemical Industry to find it. The Council had come to the decision, with reference to their annual meeting, that some time should be devoted to the consideration of special subjects, but as that would not come into operation until next year they could enjoy themselves this year. He had become so accustomed to the chair that he should be quite sorry when his year of office expired. But to be quite serious, he wished to return them his very sincere and grateful thanks for the support he had received during the years he had had the honour to fill the chair.

Mr. W. F. **Reid**, past President, submitted the toast of "The City and Institutions of Nottingham." He said he felt that he ought to say "My Lord Mayor," because a city of 270,000 inhabitants and which had had a Mayor for 600 years certainly deserved one. At any rate no worthier holder of the position of Mayor was needed than the present occupant of the office. He had been present on the historic occasion when the King had advised England to "wake up," but he felt sure that Nottingham was one of the last places in the world where that admonition was required. They could not fail to be impressed not only by the importance of the industries of this neighbourhood themselves, but by the finished way in which the work was conducted—the organisation of the business, the machinery used, etc. In every way Nottingham was absolutely up to date in manufacturing processes. Nottingham lace was worthy of being used and treasured not because of the way it was made, but because it was beautiful. The lace industry was a very important one, but there might be dangers ahead from lace made without the intervention of spinning or weaving at all—by a simple chemical process. A thick solution made by dissolving old linen was passed over an ingrained, rotating cylinder and the product was peeled off. It had, however, one defect: it was not quite so durable when moist. At the same time, as artificial silk had not diminished the consumption of natural silk, but rather increased it, so an article of this kind might also increase the sale of the genuine article. This artificial lace was used a good deal in Paris, he believed in millinery. There was also an intimate connection between the hosiery trade and chemical industry. Again, some of the leather made in Nottingham was the best that was made in this country: what he had seen in the factories of Nottingham convinced him that the care devoted to the production of leather and in the selection of the material used was a guarantee that leather made in Nottingham was beautiful as well as lasting. Having mentioned also the tobacco industry, Mr. Reid proceeded to say that he did not think there was any city outside Nottingham where there were so many small industries, which meant, moreover, that there was an endeavour on the part of individuals. All these industries employed a large number of people. The preponderance of women, he understood, was a feature of Nottingham: it showed that there was a suitable class of labour for them, and that they felt that they were earning their living in a congenial way.

The **Mayor** acknowledged the toast, remarking that the position of the leather industry was largely due to Sir John Turney, of whose works they were very proud. They were also proud of his connection with the public life of the city, no man having filled public offices with greater ability and distinction than he. The business of Boots was established by Sir Jesse Boot not more than 25 or 30 years ago, and it was now a vast concern. The city highly appreciated the work that both Sir Jesse and Lady Boot had done, the benefit of which was felt all over the country.

Professor **Kipping** also acknowledged the toast, referring to the connection of University College with the local Section of the Society of Chemical Industry. The College welcomed the Section and provided it with what accommodation it had at its disposal. A great effort was being made to obtain a full charter for the College and transform it into a University for the City of Nottingham and the East Midlands, and he hoped that when the Society of Chemical Industry met in Nottingham again the University would have some years of successful progress behind it. He would like to mention the name of Dr. Sand, their honorary local secretary, in connection with University College and the local Section, to whose efforts so much of the success of the present meeting was due.

Mr. **Thomas Tyrer** proposed the toast of "The Sections of the Society." He was convinced that the Sections had a unique opportunity of justifying their existence. There was no reason why the Sections should not become greater centres of activity than they had ever been. Excellent work had been done, and members could show their greater appreciation of the Journal by contributing papers. There was no Section which contributed more useful technological papers, crisp and to the point, than Nottingham. Mr. Tyrer referred to the services of Mr. Archbutt, Mr. Trotman, Mr. Pentecost, Mr. White, and Dr. Sand.

Sir **John Turney** responded to the toast.

Dr. **Russell W. Moore** proposed the toast of "Our Guests," which was suitably acknowledged by Mr. G. Thornton-Simpson.

Some of the members availed themselves of the privilege of honorary membership conferred on them by the Notts Golf Club at Hollinwell. The Constitutional and Reform Clubs also opened their houses to members.

THIRD DAY.

Excursion to the Dukeries.

Members and ladies left early by motor. The route was past Rufford Park, through Edwinstowe to Welbeck Abbey, where, by kind permission of the Duke of Portland, the stables, gardens, underground rooms, chapel and library were visited. Luncheon was taken in the riding school, at which the President acknowledged the obligations of the Society to the Duke for his courtesy, extended to the Society not for the first time. The President also took the opportunity to offer a special welcome to Mr. John Hargreaves, one of the founders of the Society, who was present.

In the afternoon Clumber Church was visited by permission of the Duke of Newcastle, and the homeward way was through the Lime Tree Avenue and Normanton, past Thoresby House to Ollerton, where tea was taken.

Reception at "Plaisaunce."

Sir Jesse and Lady Boot received the members and ladies at "Plaisaunce," their summer house at West Bridgford, and offered them a charming entertainment.

London Section.

Meeting held at Burlington House, on Monday, June 8th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

BLEACHING EFFICIENCY CONSIDERED IN CONNECTION WITH SUGGESTED STANDARD FOR TESTING BLEACHING QUALITIES OF CHEMICAL WOOD PULP.

BY CLAYTON BEADLE AND HENRY P. STEVENS, M.A., PH.D.

We regret very much that we were not able to be present at the reading of Messrs. Baker and Jennison's paper, but our experience so far as it goes appears to fall in with several of the observations and conclusions arrived at by these authors.

We have had a good deal of experience in bleaching at different temperatures in paper mills, and one of us devised a circulating bleaching system for rags which was in use for many years, whereby the liquor in course of circulation was continuously drawn from the bottom and sprinkled upon the top of the material. The liquor was maintained at a constant temperature by means of live steam. By studying the temperature and observing the conditions of the bleached material, we came to the conclusion that the result was as good in point of strength of fibre, yield, etc., at 100° F. as at any lower temperature, but that immediately we raised it to say 110° F. or over, we noticed weakening and deterioration of the material as well as increased consumption of chlorine. We therefore maintained the circulating liquor at 100° F. and the bleaching was done in about one-eighth the time of that required at an ordinary atmospheric temperature. This seems to confirm Messrs. Baker and Jennison's statements for wood pulp.

Then, as regards the use of spent liquors, if liquor is drawn from a material which is in course of bleaching and periodically titrated for chlorine strength, it will be found that the chlorine strength diminishes after the liquor is out of contact with the material to be bleached, and diminishes fairly rapidly.

Another factor in bleaching is the question of agitation, which is a very important one. It is a common practice in some mills to add bleach during the process of beating, especially in rag mills. One of us has made determinations of the rate of exhaustion of bleach during the process of beating and compared the chlorine consumption with that of material bleached, say in the form of half stuff, but without undergoing the beating operation, and discovered that for the same amount of bleaching effect, the material which is undergoing beating consumes only about 40% of the amount of chlorine as compared with that in the form of half stuff which is not being circulated or beaten.* With electrolytic bleaching for linen half stuff a saving of 30% was effected, and for cotton half stuff, 47%, by circulating in comparison with non-circulating of liquor. No doubt the circulation and the rapid agitation in contact with air, and possibly with the assistance of carbonic acid of the air, enormously accelerates the action, as well as making it more economical. Although concentration is a very important factor in the economy of bleaching, agitation is also important, particularly if the beating operation is proceeding at the same time. We have found that, when comparing bleaching efficiencies of different hypochlorites solutions such as by making a comparison between (a) bleaching powder solution in its normal condition, (b) the same on the addition of sufficient acid to combine with the base, (c) sodium hypochlorite, and (d) calcium hypochlorite produced by bubbling chlorine into milk of lime, as well as (e) hypochlorites in the presence of salt, a certain relationship of efficiencies is obtained with any one particular material at a given concentration, temperature, etc., but if several materials are compared with one another, these various solutions behave relatively differently both in regard to efficiencies, *i.e.*, chlorine consumption and rapidity of action, so that it cannot be said that one particular form of hypochlorite is more efficient than another except in relationship to one given material to be bleached, and under given conditions. For instance, we have compared chemical wood pulps with different forms of cotton half stuff and we have found these different hypochlorite solutions to behave relatively very differently.

Quite a number of papers have recently been published on the subject of relative bleaching efficiencies of the hypochlorites. The conclusions arrived at in most cases are in our opinion most erroneous. First of all there has only been one kind of raw material experimented upon, such as boiled linen, and another material might have led to quite a different order of so-called efficiencies. We have an instance in the above-cited comparison of cotton and linen half stuff and wood pulp compared with cotton half stuff. Secondly, the relative efficiencies have been expressed as chlorine consumption per unit weight of raw material on the assumption that the same bleaching effect is always accompanied by the same chlorine consumption, the higher the figure in unit time, the greater the so-called efficiency. As a fact, the reverse is the case. The relative efficiencies of all hypochlorite solutions should be judged by the amount of chlorine consumed per unit of bleaching effect, and the smaller the chlorine consumption the greater the efficiency. Thus the Hermite solution was found to be much more effective than the ordinary bleaching powder solution because the chlorine consumption per unit of bleaching effect was so much less than with ordinary bleaching powder. This, from the fact that a large amount of unelectrolysed salt is present, may be accounted for by the influence of the undecomposed salt and not by any special qualities of the electrolysed hypochlorite, as it is now found that salt, when added in different quantities to solutions of hypochlorites, has a marked effect upon their efficiency.

In many cases, certainly, the addition of the spent liquor is a doubtful economy, as Messrs. Baker and Jennison clearly show in their paper, but we know cases in practice where the bleaching liquor which would otherwise have to go to waste is usefully expended by using it as a wash water in the breaker, the unbleached material in a very few moments completely exhausting the chlorine, after which, it is slightly further washed and then fresh bleach is added. In this manner the spent liquor is taken out of the sphere of action before the fresh liquor is added.

We have often found that bleaching is much more effective if followed by an acid treatment or by washing and then again bleach added. Many materials seem to come to a full stop unless the bleaching products are removed. Furthermore, the addition of acid after the hypochlorite bleaching very materially improves the colour in many cases. The "more water more bleach" maxim is fully borne out in the results obtained by the Dobson process where the material is bleached with the maximum concentration, the amount of total liquor being only enough to make the material wet, and furthermore, in the old-fashioned method of tumbler bleaching, as was employed in the early days for rags. We have recently drawn attention to the fact that, with some lignified fibres, chlorination is produced in acid solution of hypochlorites (*i.e.*, by hypochlorous acid) but in alkaline solution the ordinary bleaching effect is produced. Either one or the other effect is brought about according to whether the solution is rendered basic or acid, but the behaviour is largely controlled by the amount of boiling to which these lignified fibres have been previously subjected.

The use of carbon dioxide as an accelerator to bleaching powder was patented by Thompson in 1883, B.P. 959. One of us tested this process at the time that it was under investigation by Cross and Bevan, and subsequently suggested in a publication the use of carbonic acid gas by discharging same under the roll of a potcher or hollander in which the bleaching operation was going on. On visiting a German mill many years afterwards we saw this very operation. It is quite evident that a relatively small amount of carbon dioxide is sufficient to produce a marked acceleration which rather suggests that carbon dioxide acts catalytically. Very good commercial results are got and it is well worth while following up, but so far no relative figures are available for comparing the bleaching efficiency of such a solution with that of ordinary bleaching powder without carbon dioxide as an accelerator.

We have tested a process which involves the use of liquefied chlorine in steel cylinders. This has been in use for some years on the Continent. This bleaching process in some mills shows a considerable economy, in point of bleaching value and also in actual cost, over ordinary bleaching powder. For this purpose the chlorine is supplied in cylinders under a pressure of 5 atmospheres at 15° C. The process is conducted in the following manner :—

The half stuff is run off on an ordinary wet end machine and delivered in rolls containing from 40—50% moisture. These rolls are packed through a manhole door into a large rectangular cement-lined chamber. The chamber is then hermetically sealed. The cylinder containing chlorine is placed on a weighing machine and connected up with the chamber, and chlorine gas passed in equal in weight to 2% of the dry weight of the material under treatment. At the beginning there is considerable pressure in the chamber. After a few hours the whole of the chlorine is absorbed, there being no trace of chlorine when the workman enters for the removal of the rolls. The rolls are penetrated to the interior and uniformly bleached. There are no lime salts but of course a slight hydrochloric acidity, which is sufficient to dissolve any basic salts already present in the half stuff. The bleached stuff, which is now place in the beater, generally receives a slight further treatment with bleaching powder solution. In a case of cotton rag half stuff, which under normal circumstances requires 12% of bleaching powder, the consumption by the above treatment was 2% of chlorine + 2% bleaching powder, and with a better colour produced than can be obtained by bleaching powder alone. The point here is that, apart from a better colour, 2% of chlorine as gas replaces 10% of bleaching powder and therefore 2% of chlorine as gas is equal to 3·5% chlorine as bleaching powder; that is, the bleaching efficiency of chlorine as gas in this case is nearly double that of bleaching powder. In fact, for equal colours it is probably more than double but in point of fact it shows quite as great an increase in bleaching efficiency as an electrolysed solution of magnesium chloride + sodium chloride does over that of ordinary bleaching powder. Besides seeing it operated as a regular process in Germany we have tried it in this country. The only difficulty here is the question of transport of the compressed chlorine in cylinders, which is not an easy matter to arrange with the railways.

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* Beadle, Chapters on Papermaking, Vol., 1 p. 57.

With iron mordanted rags, bleaching powder sets the iron in a more insoluble condition. In such cases, when bleaching powder is used, it is preferable to acidify for the removal of the iron before adding the bleaching powder solution. Otherwise the iron salts frequently refuse to dissolve by subsequent acid treatment, but in the case of chlorine, the iron is chlorinated and consequently easily removed by subsequent washing. In Germany the Badische Co. are able to supply to some mills chlorine in this form at a rate that renders the process cheaper than using bleaching powder. They generally supply the gas in cylinders for use by bubbling into caustic soda, 12·87 kilos. of chlorine being required to transfer 100 kilos. of lye of 14·5% NaOH into bleaching liquid (sodium hypochlorite).

Some years ago one of us made trials in a paper mill on a commercial scale with potassium permanganate in comparison with bleaching powder, and found that 1 lb. of bleaching oxygen as contained in permanganate did just as much bleaching as 5½ lbs. of bleaching powder oxygen when reckoned from the available chlorine equivalent of ordinary bleaching powder. The rapidity of attack in the case of permanganate is infinitely greater. Generally speaking, the rapidity of attack and bleaching efficiency seem to go together.

The foregoing examples, which might be multiplied, merely serve to show that there is a range of bleaching efficiency varying with the bleaching agents and the materials operated upon, as well as with the conditions employed.

In spite of all the work that has been done upon the subject, the economic problems involved in such operations offer one of the most promising fields for industrial research. To arrive at practical conclusions it is most important that the work should be done under mill conditions, or at least having due regard to mill conditions.

It is perfectly clear, therefore, that in the case of disputes as to the bleaching qualities of pulps, etc., a great difference of opinion might exist between the two parties, and it is a most desirable thing that a uniform and standard method should be agreed upon not only in case of dispute, but also on the question of making contracts. Messrs. Baker and Jennison have made out a very excellent case for their own standard which could easily be worked out in an ordinary laboratory, and the proposal to use standard colours in the form of porcelain is far more workable than recording the colours by means of the Lovibond Tintometer, and would appeal to the practical man. We would suggest, however, that instead of specifying that a pulp should exactly correspond with any particular one standard, it should be specified that it should fall between two of the standard colours, on account of the fact that there might sometimes be a dispute as to which of the particular standards it most closely corresponded with, but, if it falls between two, then there can be no question, and it gives a slight latitude to the manufacturer.

Discussion.

Mr. A. **Baker** thought that the treatment of rags for the production of high priced rag papers could almost be regarded as a specialised branch of paper manufacture, because in rags the fibres were spun, whereas in chemical wood pulp they were dealing with ultimate fibres. In the former case, no doubt, it was more economical from a chlorine point of view, certainly from a power point of view, to do a portion of the bleaching during the breaking and possibly during the actual beating operation. He thought, however, that it was far better to make the bleaching of chemical wood pulp a separate process.

They were inclined to think that the effect of agitation was somewhat over-estimated, and were firmly of the opinion that concentration was even more important than agitation. In actual manufacturing practice when bleaching large quantities of pulp, complete chlorine exhaustion on a large scale could be obtained with about 8—10% concentration in reasonable time, whereas if the concentration was neglected it was very difficult to get complete exhaustion by a considerable amount of agitation in 6 or 8 hours, and certainly not within two hours.

They agreed that the only legitimate use of bleach residual liquors when containing available chlorine was to wash material which had been boiled previously by alkaline treatment, and which received a thorough washing before the actual bleaching was carried out.

The Dobson process was really the revival of an old process. Whilst the concentration was brought to the extreme limit there were grave objections to be urged against that process, one of the chief being that all the residual chemicals had been left in the bleached pulp and all the chlorinated organic compounds, resinous matter, etc., removed from the pulp, which really demanded another process in order to wash them completely out. In the making of high class papers there would be danger of sizing troubles, and generally speaking he thought it was enough to condemn the process in many cases. The use of potassium permanganate presented other difficulties, because the brown oxide of manganese formed required removal by sulphurous acid or some other treatment.

The use of oxygen, in addition to the ordinary hypochlorites, was out of the question on account of cost. He did not see how, at any rate in the paper industry, the erection of electrolytic bleach liquor plant in a paper mill could compete with the ordinary bleaching powder at the price the latter could be bought, because in England they had a highly organised and successful alkali industry and obtained their bleaching powder very cheaply.

R. L. Taylor (this J., 1914, 308) had found that linen did not bleach very well with chlorine water, and that there must be present hypochlorites, and also that there was difficulty with ordinary bleach powder solution, principally due to the presence of free lime; by neutralising the free lime completely or almost completely a very much better result was obtained. In the paper industry where large quantities of linen, cotton, as well as wood pulp were bleached, the matter might be worth further investigation, and at the present time Mr. Jennison and himself were engaged in carrying out some investigations on a manufacturing scale which might possibly be of interest.

He thought Mr. Beadle's suggestion about colour standards was useful. Possibly if the number of standards were increased say from 4 to 6, one could, in specifying a contract, say the pulp should fall within two colours.

Dr. L. T. **Thorne** said that the exact reproduction of conditions in the experiments was of great importance, especially in beating and circulating, because there was present in all these tests an additional influence that was generally neglected, namely, that of atmospheric oxygen. He had carried out extensive experiments on a large manufacturing scale both in cotton and wood pulps of all sorts, by introducing oxygen into the potcher at the same time that the action of the bleaching powder was going on. In some cases 50 tons of paper pulp were experimented on at the time. By introducing oxygen in a fine state of division in the same potcher one could reduce the amount of bleach required by 30% and in some cases nearly 50%, by the use of the oxygen in conjunction with the bleaching powder. Whether it was that nascent chlorine, being liberated from the bleaching powder, rendered the oxygen active, or whether the oxygen was able to oxidise intermediate unstable compounds produced by the bleach from the colouring matters present, it was difficult to say; but there was undoubtedly the fact that if the oxygen were passed into the pulp in the potcher without bleaching powder, there was practically no effect, but if it was passed in whilst the bleaching solution was there and the action was going on, the amount of chlorine or bleaching powder could be enormously reduced. To his mind that was a reason that caused a great deal of difference of opinion where experiments were made on the efficiency of the different bleaches. If experiments were carried out in different potchers the results might be affected owing to the different amount of aeration due to difference in the speeds and the character of the beaters, and so on. The possible action of oxygen should certainly be taken into account in all tests, where comparisons of efficiency of different bleaching materials were being made.

Dr. ERIC RIDEAL asked whether atmospheric oxygen had any effect. They had found that the carbon dioxide had a marked action, but it had been suggested that the oxygen also had an influence. He thought that the question of bleaching fibre had, to a certain extent, been looked at from the wrong point of view. It was not the fibre they wanted to bleach, but the colour of the fibre. These colours were acidic or basic, and in the case of basic colours, one would at least expect the bleach to be slightly acid, while for acid colouring one might reasonably suppose that the bleach should be a little more basic or less acid. He thought it would be rather interesting if, in the case of the coloured fibres used in commerce, the addition of small quantities of alkali or acid would be shown to have any dependence on that fact.

When using liquid chlorine, he had noticed that the corrosion of the reducing valve was a very serious problem, and he did not know of any valve for chlorine which would stand continuous work without giving trouble.

Mr. CLAYTON BEADLE, in reply, said he thought that the beating effect which Dr. Thorne had mentioned must be distinguished from the effect of agitation, because the process of disintegration, which went on all the time during the process of beating, had a very marked effect in accelerating the action of the bleach. Quite apart from the question of more agitation, *i.e.*, the churning effect, the fibre was being reduced and bruised, and that no doubt very much accelerated the process of bleaching. There was a tremendous amount of agitation in the ordinary beater. The roll revolved at a very rapid rate, it was half immersed in the liquid mass of pulp, and it brought a large quantity of air into close contact with the pulp as it travelled round. He thought himself, the oxygen of the air played a very considerable part in the economy as well as the rapidity of the bleach when it was admitted during the process of beating. They had found somewhere between 50 and 60% economy. Inasmuch as every kind of raw material behaved differently, and different kinds of wood pulp also behaved differently, each material might be said to be specialised and required to be studied independently in comparison with other materials. When bleaching, varying bleaching efficiencies had been found for different kinds of chemical pulp, distinguishing sulphides from sulphates and so forth. There was a variation in the rate of bleach and the order in which the various solutions behaved relatively, so it was a very complex problem. He quite agreed with Mr. Baker with regard to the Dobson process. Subsequent treatment was necessary to remove the products. Permanganate bleach had not been mentioned in the paper with the view to suggesting it as a commercial proposition, although it might be on account of the much smaller quantity required in comparison with hypochlorite, but merely as showing that what they called oxygen equivalent varied so enormously in the case of hypochlorites and other oxidising agents which were used for the purpose of bleaching.

Apart from the work Dr. Thorne had done, he did not think any work had been done on the subject of the distinct effect of oxygen as compared with the effect of carbon dioxide. The bleaching process was not entirely a matter of removing the colouring matter; with some materials it was a purification process as well. In most cases when the solution was basic, it was inclined to be sluggish, and when it was acid there was considerable acceleration.

He had visited a mill in Germany where liquid chlorine had altogether taken the place of the hypochlorite bleach: there appeared to be no trouble with regard to the valve, and considerable economy was obtained in point of cost as well as in increased efficiency in comparison with bleaching powder.

APPARATUS FOR THE DRYING OF PAPER FOR TEST PURPOSES.

BY CLAYTON BEADLE AND HENRY P. STEVENS.

As the qualities of paper are largely affected by the method of drying, it is important to imitate in the laboratory as far as possible the methods of drying employed in practice. All papers contract in the course of drying from 5 to 15 per cent., if not kept stretched. If tension is put upon the web, the paper may in some cases actually elongate as in the case of the production of fast running news, where the tension is so great as to render it necessary to run the drying cylinders at a considerably greater speed than the machine wire. If sheets liable to considerable contraction are dried by merely placing in an oven, they become cockled and quite useless.

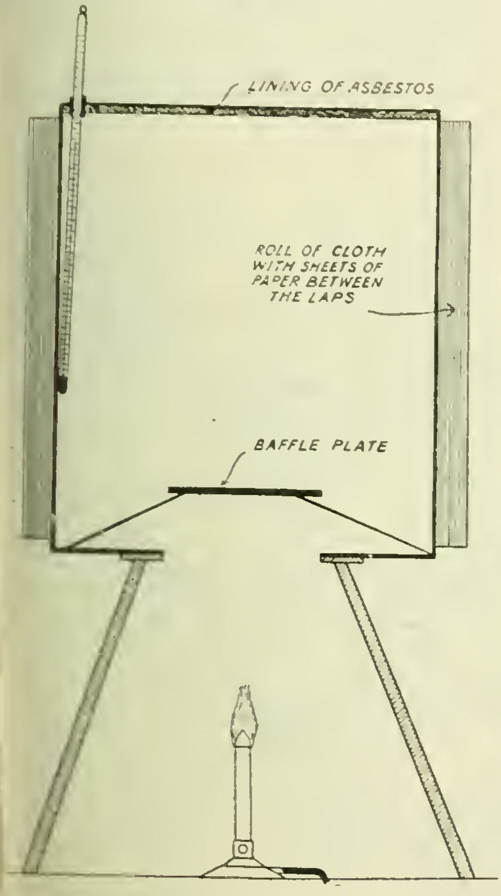
The air drying or loft drying of paper which only slightly contracts is easily imitated on a small scale by hanging the sheets upon a line stretched across the room, but in the majority of tests it is necessary to ascertain what qualities are likely to be obtained by drying under tension in contact with a felt to keep the sheets taut, so as to prevent cockling, this being the method employed in the manufacture of machine-made paper.

To imitate the action of drying cylinders we have employed a hot plate made by fixing a full-sized billiard table-iron in an inverted position over an atmospheric burner consisting of a row of very small gas jets placed at some distance from the plate. With a mercury lute and a thermometer laid down in a convenient position upon the iron, it is possible to record the temperature with a sufficient degree of accuracy to imitate the temperature of the surface of a steam cylinder under any given steam pressure. The sheets of paper are pressed upon the surface of the iron by means of the same kind of felt as is used for the manufacture of the drying felts of the paper machine. By such means the conditions of the machine drying are fairly well imitated but this method entails considerable care and attention to detail, and moreover each sheet has to be dried separately.

We have recently devised a simple apparatus which makes it possible to dry under tension 50 small sheets at a time. When finished they are in much the same condition as they would be if dried over a steam-heated cylinder of a paper machine. This apparatus consists of a cylinder of tin plate, blocked at the top end but with a flange hole at the lower end, and stands upon a tripod. Beneath it is a small Bunsen burner and resting upon the flange is a baffle (see sketch). The heat strikes the baffle and travels upwards to the top and passes downwards along the sides and escapes at the bottom, rising again around the outside. The baffle is so designed as to produce a uniform temperature at top and bottom of the cylinder. Without a baffle the top half is much hotter than the bottom half.

To economise heat, the top of the cylinder can be covered either externally or internally with a sheet of asbestos.

For filling, the cylinder is placed horizontally upon a table and tightly wound with cloth for one and a half revolutions. The sheets of paper are then laid upon the unrolled cloth whilst the cylinder is revolved, keeping the cloth as taut as possible. Finally, the cloth is kept taut by tying tape round near each end of the cylinder. The cylinder is then placed in its position upon the tripod. A hole for the insertion of a thermometer may be placed near the top edge so that the thermometer bulb can be brought in contact with the inner surface of the cylinder and by raising and lowering can be made to indicate the mean temperature. The sheets of paper are dry and ready for removal in about half an hour.



he hot air may be made to escape through holes drilled nd the bottom of the vertical walls but the apparatus wers equally well if no holes are provided, in which case, ourse, the air mostly escapes at the circumference of the b.

convenient sized cylinder is 13 in. long by 10 in. meter, provided with a 6 in. hole. For this sized nder a very small Bunsen with ¼ in. tube without air ulator and flame 2½ in. to 3 in. long is sufficient.

Ve exhibit (*a*) paper made by drying down in oven, (*b*) o air dried on line, (*c*) ditto dried by our apparatus. s from stuff very liable to contraction and cockling. the great difference in the appearance of the sheet is evident.

Sydney Section.

ting held at Sydney on Wednesday, 19th November, 1913.

MR. LOXLEY MEGGITT IN THE CHAIR.

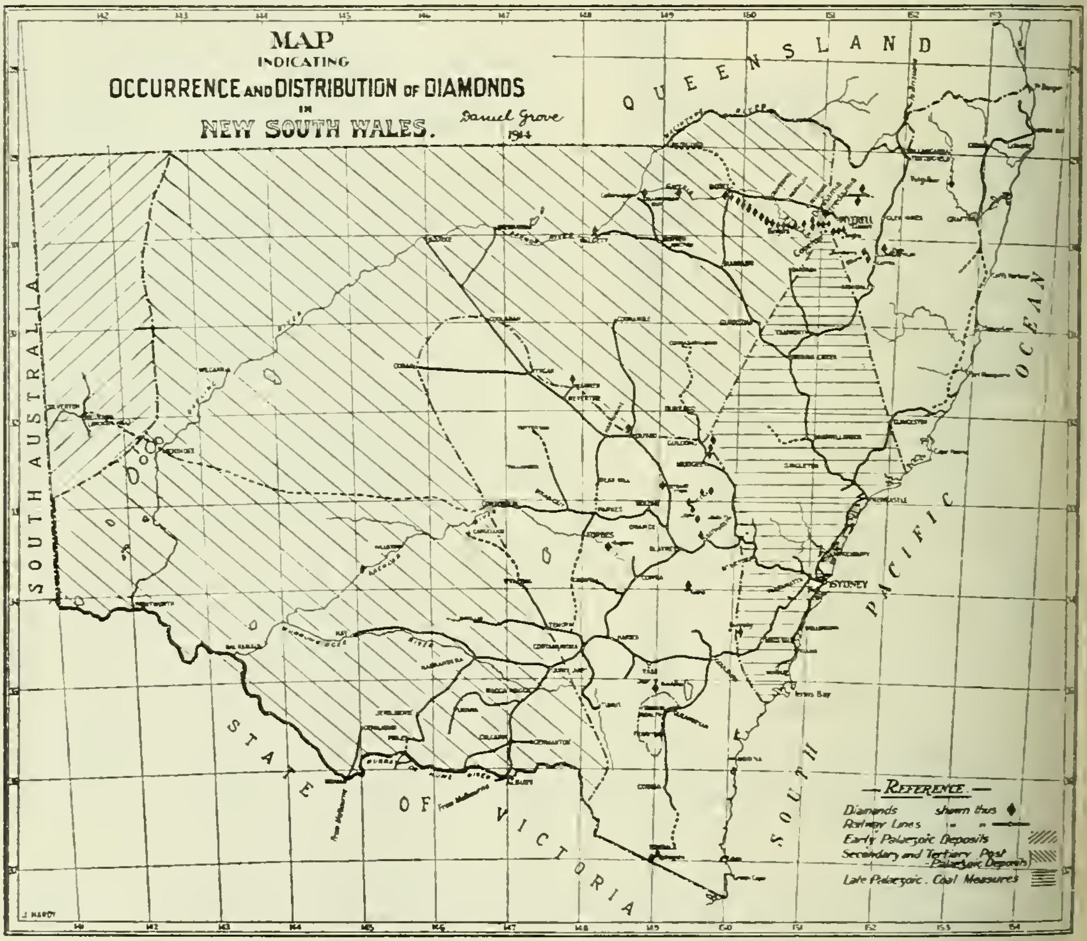
IE OCCURRENCE AND DISTRIBUTION OF DIAMONDS IN NEW SOUTH WALES.

BY DANIEL GROVE.

ie chief Diamond and Gold Fields in South Africa are ed within the 25th and 29th parallels of south latitude. On the East Coast lies the Portuguese Province of Mozambique, containing vast coal measures that extend beyond Middleburg into the Transvaal. The rivers emptying into the Mozambique Channel are (*a*) Post Tertiary and (*b*) Pleistocene, containing gold and tin derived from the Lydenburg and Swaziland Tin Fields, comprising part of the eastern plateau of South Africa. This section embraces pegmatitic granites intersected by diorites and euritic granites veined with quartz and quartzites. Magnetite occurs along the Steelport Valley at Magnet Heights heavily charged with titanium; in that locality no coal occurs, whilst to the South West at the Middleburg Coal Fields chromate of iron occurs in patches as far as the Oliphant River, where tin deposits have been found in a mineralised matrix that belongs to the red granite type of eruptive rocks. Thence to the Premier Diamond Mine near Pretoria, a distance of about 50 miles, are alternate patches of magnetic iron and hæmatite up to within a few miles of Brayton. Twenty miles south is the Witwatersrand gold-bearing conglomerate which extends westward to Potchefstroom and Klerksdorp, which are on the eastern edge of the Upper Karroo Measures. From this western limit to Griqua Town in a westerly line, the whole of the Kimberley diamondiferous pipe and alluvial formation is intersected and embraced. I shall now show the analogy of this to the New England Plateau which forms part of the northern section of the main dividing range of New South Wales. Throughout the length of that section the main divide is dominated by a peneplain structure, namely a plateau of sub-aerial denudation. The drainage of the plateau from Guyra to Maryland and Liston, forming numerous streams that wear away hard and soft rocks, is, in so far as the eastern water shed is concerned, eventually carried out to sea by the Clarence. These waters in their downward career reach the level or inclined surface that slopes gradually from a line somewhat below sea level to a slight altitude inland, forming what is called "base level." A chain of volcanoes extends from Guyra *via* Ben Lomond to a point situated between Tenterfield and Lionsville, the huge flows from which followed the eastern and western water shed, not only filling deep valleys in which were concentrated gold, tin, and other minerals, liberated by erosive agency from their different matrices, but also covering ranges of hills, giving them a "skin" that produces an exceedingly fertile soil. These lava plains are called volcanic plains. I will endeavour to show the importance of the New England Plateau in the whole scheme of diamond and other mineral productions. Our honoured former President, Professor Sir William Crookes, who has made a special study of the diamond, is of opinion that the original matrix was metallic iron in the first place, whilst Professor Bonney states that diamonds have now been traced to two not dissimilar rocks, namely, eclogite in South Africa and dolerite at Oakey Creek in New South Wales. Professor David wrote that "The Oakey Creek Diamond is actually in situ in the hornblende diabase." Mr. Pitman, Government Geologist, New South Wales, wrote that "in view of the authentic occurrence at Oakey Creek, near Inverell, it seems now more logical to search for diamonds in this country in horn-blende diabase rather than in the volcanic breccia containing eclogite boulders."

Following upon the expressed opinions of these scientists, and after numerous conversations with practical diggers on the field, I have made it my duty to ascertain to what extent there exists an analogy between the New South Wales and the South African occurrences and distribution of diamonds. Let us take a section lying between the 29th and 30th parallels of south latitude, and we find in this State that the Clarence River not only contains appreciable quantities of alluvial gold, thereby corresponding with the rivers emptying into the Mozambique Channel, but it has been stated to me by Mr. Alderman that he obtained two beautiful diamonds, small in size, from St. Joseph's Creek, which is a tributary of the Clarence. Again, at Coaldale, about 40 miles from Grafton, I found bituminous coal, corresponding to the coal in the district of Lourenço Marques. At Gordon Brook, along the south bank of the Clarence, rich chromate of iron occurs that corresponds with the Belfast-Middleburg chromates in the

Eastern Transvaal. At Yulgilbar, magnotite, similar to that of Magnet Heights, Transvaal, occurs also containing titanium. At Lionsville, gold is found in rich reefs in diorite and felsite encased in granite somewhat similar to the formation at Moodie's, Transvaal. Near Guyra is situated a crater not inferior in size to any in South Africa, of which the plug or core is undoubtedly dolerite. I have therefore come to the conclusion that the first eruptive rock to intersect that region was the dolerite, and that the general bearing is north and south of all fissures connected with this and other pipes. Recently, upon examining the country between Copmanhurst and Guyra, I found that a very large carboniferous area has been destroyed by these volcanic pipes and fissures, thus corresponding in a remarkable manner with that Eastern portion of South Africa situated between the 26th and 29th par. in south latitude as far as their intersection by the 28th degree of east longitude. In short the 152° of east longitude where it intersects the 29th and 30th parallels of south latitude in this State are as nearly as possible identical in geology and mineralogy with the same latitudinal bearing intersected by the 28° of east longitude in South Africa. In the New South Wales section quoted, only the Ashford Coal Measures to the north of Inverell and the Clarence Coal Measures at and near Coaldale have escaped destruction. Then again, the Cape Free State diamond area quoted is separated from the Great Artesian Water Basin underlying Bechuanaland and Namaqualand by the Upper Karroo beds, just as the Queensland-Northern New South Wales Artesian Wate bearing Basin is separated from the diamond fields b Triassic coal measures called the Western Secondar and Tertiary Beds. There is a noticeable dissimilarit geologically along the respective sections in the matte of erosion. The New England Plateau has yielded t erosive forces at three different periods, the firs synchronising with the doleritic eruptions which penetrate the carboniferous rock; the second dealt with euritic an appelitic granites, quartz, porphyries, felsites, and diorite which pierced the Silurian and Devonian formation bringing with them gold, tin, copper, and other metall ferous minerals; whilst the third era is contemporary wit ourselves in that the basalts and tuffs of the Tert period which cover the two previously mentioned de are now being swept by the board, revealing in many p isolated deposits of diamonds associated with tin other minerals and gem stones. The more notabl these deposits are at present being worked at Sol Hill, the Old Farm, the Mount Ross, the Crown J the Streak of Luck, and the Malacca Tin and Dia Mines situate on the Copeton Diamond Fields. O these mines in particular, called the Round Mount, personally inspected and tested by myself and fou contain excellent white and yellow diamonds of a good I may state that Mr. Cant sold me a parcel of dia taken from this mine which included one weighi carats and one weighing $1\frac{1}{4}$ carats which were of p octahedron shape, spotless and flawless, thus conf



Scale 140 miles to 1 inch.

what has been stated over and over again, that there are diamonds in that region of good commercial size. No similar erosion on anything like the scale exhibited in this State is proceeding between Pretoria and Kimberley in South Africa, for which reason those who are engaged in the local industry must not jump at hasty conclusions. My personal observations are that diamonds have been found not only by Mr. A. R. Pike in the matrix in the Donnamia Mine at Oakey Creek and by myself, but also by my own independent staff of men who were employed to confirm or refute Mr. Pike's remarkable discovery. The specimen of dolerite exhibited this evening is similar to the specimen containing a diamond which Mr. Pike has exhibited to Professors Sir Wm. Crookes and David, among others. The inference, therefore, is that the Inverell Division of New England, where diamonds have been found in the dolerite dyke nentioned, is intersected by a series of dykes running orth and south approximately, and connecting with pipes, t being understood that the subsequent deposition of baalt of the Tertiary period has, in the majority of instances, bscured the pipes, craters, cores and plugs. My men pened the Donnamia Dyke at two levels so as to obtain he exact magnetic bearing, which is 10° west of north by 0° east of south, the thickness of the principal body being 6 ft. 6 in. The matrix, which decomposes on exposure the atmosphere with a facility almost equal to that btaining in connection with the "blue" extracted from outh African pipes, is extremely hard in the lower level. rom nine loads of the decomposed matrix my men btained two beautifully white diamonds which weighed ightly under one carat, unspotted and unfractured.

Mr. Pike and his party indicated to me another matrix rmation at Staggy Creek since called the Alfredamia ine, situated on property owned by Mr. A. F. Kemp Gowrie. The return of 770 diamonds weighing 175 1/32 rats from 200 loads of the overlying alluvial containing uch decomposed dolerite, although satisfactory, does t convey any definite estimate as to the value of the atrix itself. Since that work was carried out, however, have seen several most promising-looking matrix alities in the New England Plateau, and to the south-st of the Donnamia Mine, finding the conditions which I d all along hoped to find, namely, a pipe intact, and a pe that has been deprived of its crater and exterior rock erosion, both containing diamond associates. I have, erefore, been led to believe that a chain of pipes will be nd stretching from the contact of the coal measures at hford with the Secondary Beds along the line of contact, rough Warialda, Bingara, the Copeton Diamond Fields, Narrabri, thence to Boggabri, Gunnedah, Napier, and lgong to Rylstone, as the Western Series, corresponding th the Griqualand West series of pipes in South Africa, ilst an eastern series will most probably be found along New England Plateau between Tenterfield, Deepwater, n Innes, Oban, Guyra, and Walcha, which will respond with the Premier Transvaal Crater and other ters. The Eastern Watershed has undoubtedly iveyed many diamonds and associated minerals to the t into the Clarence Basin, just as the Western Water-d has conveyed diamonds, tin, and other minerals ough Newstead, Elsmore, Gilgai, Toppers Mountain l Stannifer, Tingha, Copeton, into the Gwydir. I her from returns published by the Mines Dept., Sydney, t 178,971⅜ carats of diamonds have been registered the output of this State, valued at £120,407, with an lanatory note that the returns cannot possibly reflect omplete and correct record.

n conclusion I may state that I have not been able to l the matrix of the topaz or wolfram, although I have nd several water-worn pebbles containing half wolfram topaz, thus suggesting that at some spot in the New gland Plateau both occur in situ together.

am referring to the topaz because it is really a most iable associate of the diamond in the alluvial, cutting polishing extremely well, and being saleable in many ntries as a substitute for the diamond itself. The tralian diamonds are hard but extremely fiery when ; in fact, I cannot imagine anything more beautiful rilliant than a cut one-carat stone and upwards from Copeton region set in a lady's pendant or tiara. Carbons or borts are found associated therewith of great hardness and specially adapted as diamond drills. The Government would be exceedingly well advised to equip an expert geological and prospecting expedition to make a systematic investigation throughout the areas referred to in this paper, for certain it is that sooner or later diamonds will be found in the deep alluvial leads of this State and in matrices which will be profitably worked.

From a test working at the Alfredamia mine, Inverell, extending over 230 hours, 200 loads were examined, yielding 770 diamonds which weighed in all 175 carats, and were valued at £150; 80% were white, and 20% yellow; and they were singularly free from carbon spots. Very few were octahedral in shape. The associated minerals were tin (about 1 cwt.), garnet, sapphire, topaz, zircon, and tourmaline.

During my residence on the field a total of 4062 diamonds have passed through my hands, which I have classified as under :—

No.	Colour.	Remarks.	Value per carat.		
			£	s.	d.
2212	Colourless crystals	5% contained black specks	0	16	3
1004	Straw, yellow or bye-waters	20% cleavages or fractured stones	0	10	0
482	Light yellow	2% specks and 3% cleavages	0	13	3
22	Raw siennas		0	10	6
263	Steel grey granulated borts		4	0	0
12	Black borts (Copetonado)		5	0	0
60	Mixed specks and cleavages		0	9	6
3	Blue white		10	0	0
2	Pink		7	0	0
2	Port wine		3	0	0
4062					

The black specks on the colourless crystals were mostly near the surface and could be removed in cutting without much loss. These and the two following lots compared very favourably, weight for weight, with selected Vaal River diamonds. So far there does not appear to be any market in Australia for the borts, for which £4 per carat was paid on the field. These are considered to be equal in value to Brazilian carbonados for use in diamond drills, and should be utilised in Australia, where so much diamond drilling is carried on.

As is well known, Australian diamonds are considerably harder than those from South Africa, hence it would seem that Mohs's scale will require extension to include these stones.

LECTURE ON CATALYSIS.

BY P. SABATIER.

Professor of Chemistry, University of Toulouse.

Abstract of a lecture delivered at King's College, London. Rev. Gén. Chim. Pure et Appl., 1914, 17, 185—193.

Definition.—Catalysis is the name given to certain chemical processes induced by the presence of substances which apparently take no part in the reactions. Thus, hydrogen peroxide in dilute solution decomposes only slowly into water and oxygen; when a little platinum black is dropped in, effervescence takes place, showing the rapidity of the decomposition induced by the platinum black. The latter can be recovered unchanged by filtration and can be used again indefinitely to induce the same decomposition. The platinum black is called the "catalyst."

Commonness of catalytic reactions.—Very many catalytic reactions are known, occurring in all branches of chemistry.

Many reactions resemble catalytic ones in that the presence of substances which are apparently inactive, serves either to accelerate or to retard the change. The reactions include decompositions, as with hydrogen peroxide; combinations, *e.g.*, the union of hydrogen with oxygen, and the direct oxidation of sulphur dioxide induced by spongy platinum, the commercial application of which was suggested half a century ago by the English chemist P. Pelegrin; and double decompositions, such as the formation of esters from alcohols and acids in contact with certain oxides.

Solid catalysts.—Solid, liquid and gaseous substances may act as catalysts. The most numerous catalysts are solids, and include metals, oxides, chlorides and other salts. Since solid catalysts remain unchanged by use, they evidently act only at the surface, and for equal weights, the activity will be in proportion to the area of surface, that is, to the fineness of the particles. Platinum black is more active in proportion to its lightness and porosity. Nickel foil and filings are only slightly active, whilst the activity of finely-divided nickel, prepared by reducing the oxide with hydrogen or carbon monoxide, is very great. Some solid substances, however, only act as catalysts when dissolved, and thus resemble liquid catalysts, the activity being in proportion to the mass present; examples are, iodine in processes of chlorination, and aluminium chloride in the Friedel-Crafts reaction.

Gaseous catalysts.—These are less common than solid or liquid catalysts; their activity is generally in proportion to the mass. Examples are: the action of nitrous vapours in the manufacture of sulphuric acid by the chamber process, and the action of aqueous vapour, the presence of which has been shown by Dixon and Baker to be necessary for the oxidation of hydrogen and of carbon monoxide, and for the combination of gaseous ammonia with hydrochloric acid.

Theories of catalysis.—Berzelius, who first called attention to the phenomenon, offered no real explanation, but suggested that catalysis was due to a change in the polarity of the atoms concerned. The importance of a fine state of division of the catalyst has suggested a physical explanation, long unchallenged. According to this theory, when platinum black is introduced into a mixture of oxygen and a combustible gas (hydrogen, alcohol vapour, etc.), the gases are absorbed rapidly by the porous material which attracts them to its surface, and the gases thus absorbed are subject to increased pressure and a local rise of temperature, both of which conditions assist the chemical interaction of the gases. The products are immediately removed, and replaced by a fresh quantity of the original gases, and so the reaction continues. The heat, set free by compression and by the combination of the gases, accelerates the action, and the platinum may even become incandescent. The function of the catalyst is thus to produce a local increase of pressure and temperature, so as to render possible, apparently at ordinary temperatures, a reaction which normally occurs only at higher temperatures. Ostwald regards the catalyst simply as the accelerator of a possible reaction which would, without the catalyst, take place slowly, and sometimes so slowly as to be incapable of detection. This theory does not offer an explanation as to the attraction of certain gases and not others by the surface of the catalyst; thus, platinum black must be supposed to attract hydrogen and oxygen, but not aqueous vapour. Further, certain catalytic actions are effected by platinum foil or wire, as well as by platinum black. A platinum spiral, heated to expel gases from its surface, and held over methyl alcohol, causes oxidation of the vapour to formaldehyde, the heat generated keeping the metal incandescent. A large sheet of platinum foil, slightly heated and held above an unlighted Bunsen burner causes combination of the gas and air; the foil becomes incandescent and may start a flame. In these cases, the porous solid is not present. Moreover, in the physical conception of catalysis the important differences in the effects of various solid catalysts having the same structure and state of division, are ignored. Zinc oxide and titanic oxide are physically similar but act very differently on formic acid vapour at 300° C. With zinc oxide, equal volumes of carbon dioxide and hydrogen are formed, whilst with titanic oxide, water and carbon monoxide alone are produced. The physical explanation of catalysis is not applicable to liquid and gaseous catalysts which form a homogeneous mixture with the reacting substances. A rational theory of catalysis must be based on the chemical action of the catalyst which can unite with some of the reacting substances to form an unstable intermediate compound.

Reciprocal catalysis.—Two chemical systems, which are themselves stable though capable of undergoing change, such as hydrogen peroxide, and chromic acid solution mixed with sulphuric acid, will, when mixed, act catalytically one on the other, the two changes taking place simultaneously in identical proportions. The hydrogen peroxide and chromic acid are both decomposed, and the same quantity of oxygen is generated from each. This indicates that the cause of the decomposition is the formation of an unstable compound of 3 mols. H_2O_2 and 2 mols. CrO_4H_2. This compound is decomposed as quickly as it is formed, into free oxygen, water and chromium sesquioxide which dissolves in the sulphuric acid. This intermediate compound can be isolated by suitable means. When dilute solutions are used, instead of oxygen being evolved, a blue liquid is produced. The blue substance can be extracted with ether, and isolated by evaporating at —20° C. At the ordinary temperature this substance decomposes into oxygen, water, and chromium sesquioxide. A similar example is the interaction of hydrogen peroxide and potassium permanganate, and the existence of an intermediate unstable compound must be assumed in this case also.

Ordinary catalysis.—By analogy, it may be concluded that the catalyst combines rapidly with one of the substances present, and the compound formed reacts quickly with the other substances, setting free the catalyst which can act again in the same manner indefinitely. The intermediate compounds can sometimes be readil detected, when they are stable at some other temperatur than that of the catalytic reaction. This is the cas in the production of ether or of ethylene from alcoho by means of sulphuric acid. Concentrated sulphuri acid combines with alcohol to form ethyl-sulphuric acid :—

$$C_2H_5.OH+SO_4H_2=SO_4H.C_2H_5+H_2O.$$

If the liquid be kept cold, no further change occur On heating to 60° C. in the presence of an excess o alcohol, the latter reacts on the ethyl-sulphuric acid t give ether, which distils off, and sulphuric acid whic again combines with alcohol :—

$$C_2H_5.OH+SO_4H.C_2H_5=(C_2H_5)_2O+SO_4H_2,$$

the sulphuric acid thus acting as catalyst in the reaction :—

$$2(C_2H_5.OH)=H_2O+(C_2H_5)_2O.$$

A small quantity of acid can in this way transfor a large quantity of alcohol into ether. If the liquid quickly heated to over 150° C., the reaction is differen The ethyl-sulphuric acid is decomposed with formation ethylene and sulphuric acid :—

$$SO_1H.C_2H_5=C_2H_4+SO_4H_2.$$

The acid thus formed acts again in the same way, servi as catalyst in the reaction :—

$$C_2H_5.OH=C_2H_4+H_2O.$$

The intermediate compound in both of these reactio is easily detected, since it is stable at a lower temperatu Another example is furnished by Squibb's method the production of acetone. The vapours of acetic acid a passed over calcium carbonate at 500° C. The init reaction is evidently the formation of acetate :—

$$CaCO_3+2(CH_3CO_2H)=CO_2+H_2O+(CH_3CO_2)_2Ca.$$

Below 400° C., the reaction produces calcium acetate whi is stable at that temperature, but at 500° C. the acet is decomposed into acetone and calcium carbonate :—

$$(CH_3.CO_2)_2Ca=CaCO_3+CH_3CO.CH_3,$$

and a small quantity of calcium carbonate can thus cha any quantity of acetic acid into acetone. In both th examples, it is impossible to overlook the intermedi compound which serves as a step in the reaction. J usually the intermediate compound cannot be detected with certainty because it is not sufficiently stable at any temperature to be isolated. This is the case in most of the catalytic reactions induced by platinum or finely divided metals. But some idea of what occurs can be formed by analogy. Platinum black, when introduced into a mixture of alcohol vapour and air, fixes oxygen on its surface in the form of a true chemical compound, such at PtO, and the oxide reacts immediately with the alcohol vapour to form aldehyde, the platinum being set free and acting again in the same way indefinitely. Similarly, reduced nickel placed in a mixture of hydrogen and benzene vapour, fixes hydrogen on its surface in the form of a thin layer of an unstable hydride, such as NiH_2. At a suitable temperature, about 180° C., this hydride reacts immediately with the benzene vapour, forming cyclohexane, and the nickel is regenerated and acts again in the same way.

Reversible catalysis.—It frequently happens that the unstable intermediate compounds formed by the catalysts can determine the reaction in either direction. Thus, platinum black absorbs free oxygen and yields it again immediately to oxidisable substances, but it can also, by virtue of the same affinity, take oxygen from substances capable of readily losing it. When platinum black is dropped into hydrogen peroxide, the platinum immediately takes up oxygen, forming the unstable oxide, which decomposes at once. Platinum black thus acts as catalyst in processes involving the addition or the removal of oxygen, according to circumstances. Finely divided copper or nickel placed in an atmosphere of hydrogen, fix the gas temporarily and pass it on to other substances. Conversely, in the presence of substances capable of giving up hydrogen, these metals take up hydrogen, which is immediately set free Thus aldehydes passed with excess of hydrogen over nickel below 200° C. form the corresponding primary alcohols. Conversely, the vapours of the primary alcohols, passed over nickel at 250° C. are decomposed into aldehydes and hydrogen. Cases of this kind are very numerous. In conjunction with Mailhe the author has shown that the vapour of phenol when passed over thoria at 450° C. loses water and is converted into phenyl ether Later, the author and Espil showed that a mixture of phenyl ether and water vapour, passed over thoria at 450° C. readily forms phenol. The two reactions occurring at the same temperature necessarily do not proceed to completion. A similar inversion of the effect of the catalyst is often met with. The recent researches of Bourquelot have shown that emulsin, a soluble organic catalyst, not only effects hydrolysis of glucosides, but can very often lead to the formation of the same glucosides by dehydration.

Influence of the mass of the catalyst.—The catalyst thus appears to play an active part in the reactions which it determines. The temporary combination of the catalyst with one of the reacting substances makes the reaction possible, and a small amount of the catalyst can change a arge quantity of the reacting substances, because the catalyst is regenerated by the rapid decomposition of the ntermediate compound. There is thus no definite relation between the mass or the active surface area of the catalyst and the weight of the substances which it can produce. The reactions will, however, be more rapid as the quantity of catalyst is greater. Their velocity will be, in some degree at least, proportional to the mass of the catalyst n a homogeneous system, or to the surface in the case of olid catalysts which act only at their surface.

This chemical conception of catalysis has led the author ith his pupils to the discovery of new facts, which may e grouped under two headings, catalysis (1) by metals nd (2) by oxides.

CATALYSIS BY METALS.

In a series of researches extending over nearly years, in collaboration with Senderens, Mailhe, urat, and Espil, it has been shown that the common etals iron, copper, cobalt, and especially nickel, a fine state of division such as is produced in the duction of the oxides by hydrogen, carbon monoxide, alcohol vapour, form very active catalysts in processes of adding or withdrawing hydrogen, and in molecular decompositions.

Addition of hydrogen by means of nickel.—The catalytic action of finely divided platinum had been used chiefly for effecting oxidation. Only in few cases had its power of effecting the addition of hydrogen been recognised. These were the conversion of nitric oxide into ammonia (Kuhlmann, 1838), the rapid combination of iodine with hydrogen (Corenwinder, 1852), the conversion of hydrocyanic acid into methylamine (Debus, 1862), and the production of ethane from acetylene (de Wilde, 1874). In 1897, the author discovered with Senderens, that in the presence of reduced nickel, free hydrogen at a very low temperature can rapidly change ethylene into ethane, and it has since been shown that this catalytic action of nickel is quite general and is capable of effecting the addition of hydrogen not only in known reactions usually carried out by means of ordinary reducing agents (zinc and hydrochloric acid, sodium amalgam and water, concentrated hydriodic acid, etc.), but also in other reactions which could not be effected by the old methods. The method employed for volatile substances is very simple; it is only necessary to pass them together with hydrogen in excess through a column of reduced nickel kept at a suitable temperature. In this way, nitro-compounds can be converted into amines, *e.g.*, nitrobenzene into aniline. Ethylenic and acetylenic compounds are readily converted into saturated compounds. Aliphatic aldehydes and ketones yield the corresponding alcohols, and amines are readily obtained from nitriles, oximes and amides. Carbon monoxide and dioxide are converted into methane, and this may possibly be the basis of an important commercial process for manufacturing from water-gas or coal-gas a lighting gas rich in methane and having a high calorific power. The most valuable application of the new method is the formation of cyclohexane derivatives by the addition of 6 atoms of hydrogen to the benzene nucleus. By simply passing benzene vapour with hydrogen over reduced nickel at 180° C., the benzene is completely converted into cyclohexane. In the same way, phenol is converted into cyclohexanol, and aniline into cyclohexylamine. In conjunction with his pupils, the author has shown the addition of hydrogen to aromatic compounds by means of nickel to be almost general, and this should form the starting point for important synthetic manufacturing processes. Thus, the *p*-cyclohexanol formed from *p*-cresol may serve as the raw material for the manufacture of caoutchouc. Hydrocarbons with multiple or complex nuclei, naphthalene, anthracene, phenanthrene, terpenes, etc., can also be caused to combine with hydrogen by means of reduced nickel.

Conditions necessary for the addition of hydrogen.—Certain conditions are essential for the success of the process. The temperature must be kept within certain limits, which are wide in some cases, as with nitro- and ethylenic compounds, but narrow in others. The reduction of benzene cannot be effected above 250° C.; at higher temperatures cyclohexane loses hydrogen. The best temperature is usually about 180° C. The catalyst should be prepared in the reaction tube itself, by reducing with hydrogen an oxide as free as possible from chloride and sulphate. The oxide obtained by calcining at dark red heat nickel nitrate prepared from commercial nickel and nitric acid is generally used. The nickel is more active the lower the temperature at which it is prepared, and the lighter the oxide from which it is formed. The metal obtained by reducing the green hydroxide below 300° C. is exceedingly active and often causes molecular changes in compounds subjected to catalysis. Nickel reduced above 750° C. will not convert benzene into cyclohexane, but will change nitrobenzene into aniline. An essential condition is the conservation of the catalyst, the activity of which may be spoiled by impurities in the hydrogen or in the reacting substances. Chlorine, bromine, iodine and sulphur are specially harmful in the case of nickel. In conjunction with Espil, the author has recently shown that the humidity of the hydrogen has no unfavourable effect, and is favourable in certain cases. But while it is useless to dry the gas, it is necessary to purify it thoroughly. This may be done by passing it over copper turnings heated to dull redness and then over moist potash. It has been supposed that traces of chlorine, bromine, iodine or sulphur would immediately render the nickel inactive, but this is not the case. Benzene containing 0·5% of iodine can be converted into cyclohexane, and during an experiment lasting several hours, 150 c.c. of the solution was treated. On breaking the tube, the first half of the column of nickel was found to have taken up iodine and was inactive, and the second half was unaltered and was capable of continuing the reaction. Thus the destruction of the catalyser by iodine took place slowly through successive layers, and in the actual experiment 250 c.c. of cyclohexane could have been obtained before the tube became inactive. A similar result was obtained with benzene containing 10% of carbon bisulphide.

Addition of hydrogen in a liquid medium.—Reduced nickel effects the combination of hydrogen with numerous substances, which need not necessarily be in the gaseous state. When a current of hydrogen is passed through a fatty oil, such as earthnut (arachis) oil at 180° C., in which reduced nickel is suspended, the oleic esters are converted into stearic esters and the reaction is completed in a few minutes. The oil changes to a fat, which solidifies on cooling. This conversion of oils into fats is usually accompanied by deodorisation. It is now the object of important industrial applications.—A. T. L.

Journal and Patent Literature.

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I.—GENERAL PLANT ; MACHINERY.

Patents.

Steam ; Generation of ——. C. D. McCourt, Streatham Common, and Bonecourt Surface Combustion, Ltd., London. Eng. Pats. 11,958 and 11,959, May 22, and 26,255, Nov. 15, 1913.

Liquid or semi-fluid fuel is fed into a heated chamber, with a regulated supply of air. The liquid is volatilised and partially burned in this chamber and the mixture of air and gas or vapour passes into a chamber fitted for surface combustion, or into tubes filled with lumps of porous refractory material.—W. H. C.

Steam ; Generation of ——, *feed water heating, and the heating of liquids.* P. St.-G. Kirke and Bonecourt Surface Combustion, Ltd., both of London. Eng. Pat. 26,769, Nov. 21, 1913.

Heating tubes are provided with refractory material for promoting surface combustion, and with a further quantity of refractory material, through or over which the combustion products pass so that their heat is transmitted rapidly to the liquid. The first part of the tube forms a mixing chamber for the air and gas, in which combustion begins, so that the gases need not be forced through the refractory material at a speed greater than that of propagation of the flame, and a lower pressure can be used. The front end of the mixing chamber is open to the air and one or more gas-supply nozzles are arranged to deliver into the open end. A refractory sleeve in the mixing chamber forms a restricted outlet for the partly burnt gases. (See also Eng. Pats. 29,430 of 1909, 4362 of 1910, and 11,958 of 1913 (this J., 1910, 1448; 1911, 406 and *supra*).—A. T. L.

Evaporating frothing liquids ; Apparatus for ——. F. Seeger, Magdeburg, Germany. Eng. Pat. 12,265, May 26, 1913.

The vapour and froth pass from a tubular evaporator first into a froth chamber situated above and thence through a turbine separator into the first separating chamber where the froth bubbles are broken up owing to the lower pressure which exists in this chamber. The vapour then passes through an impact separator into a second separating chamber and thence to a third from which it passes to the condenser.—W. H. C.

Evaporators ; Process for supplying liquid to —— *in which the liquid is circulated.* A.-G. für Vakuumverdampfanlagen. Ger. Pat. 274,153, July 23, 1911.

The liquid is injected directly into the lower ends of the heating tubes from nozzles fitted in a system of concentric or parallel supply tubes. Or, the liquid-supply pipe, mounted so that it can be rotated, may be provided at its upper end with branch tubes fitted with nozzles, which come in turn below the heating tubes as the liquid-supply pipe is rotated.—A. S.

Fractionising and cooling the constituents of products of distillation, boiling at higher temperatures ; Process for —— *and condensing apparatus for carrying the process into effect.* J. Fischer, Vienna. Eng. Pat. 21,928, Sept. 29, 1913.

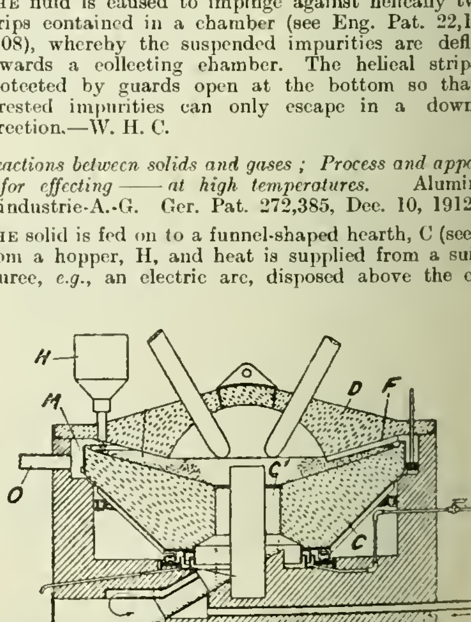
The vapours are cooled by the condensed liquid which is caused to flow back for this purpose through alternate cells of suitable plate condensers.—W. H. C.

Separators for removing impurities from fluids. W. H. Yardley, Sheffield. Eng. Pat. 22,120, Oct. 1, 1913.

The fluid is caused to impinge against helically twisted strips contained in a chamber (see Eng. Pat. 22,184 of 1908), whereby the suspended impurities are deflected towards a collecting chamber. The helical strips are protected by guards open at the bottom so that the arrested impurities can only escape in a downward direction.—W. H. C.

Reactions between solids and gases ; Process and apparatus for effecting —— *at high temperatures.* Aluminium-industrie-A.-G. Ger. Pat. 272,385, Dec. 10, 1912.

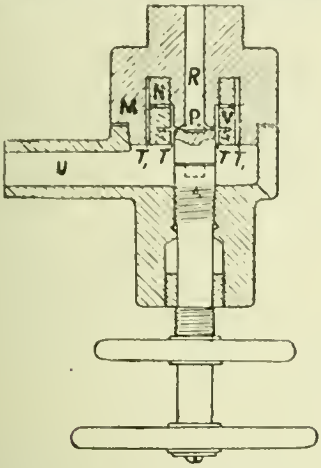
The solid is fed on to a funnel-shaped hearth, C (see fig.), from a hopper, H, and heat is supplied from a suitable source, *e.g.*, an electric arc, disposed above the centre of the hearth. The hearth rotates about its vertical axi and the charge gradually moves in a spiral path fro



the outer edge to the centre, being spread out as a thin layer by ribs, F, projecting from the roof, D. The gases are supplied to the central opening, C^1, flow outwards, over the charge on the hearth, to the annular channel, M, and are discharged through O.—A. S.

Liquids ; Process for rendering —— homogeneous. F. M. Berberich. Ger. Pat. 273,917, Dec. 1, 1912. Addition to Ger. Pat. 269,540.

A modified form of the apparatus described in the principal patent (this J., 1914, 302). The liquids are supplied under pressure through the channel, R, and pass, on the one hand through the annular passages, P_1, and T, and, on the other hand, through M and T_1, into the outlet pipe, U. Part of the liquid is forced into the *culs-de-sac*, V and N, and in returning therefrom is intimately mixed with liquid flowing in the opposite direction.—A. S.



Purifying and cooling hot gases ; Process and apparatus for —— and the condensation of vapours. G. F. Jaubert, Paris. Eng. Pat. 14,420, June 21, 1913. Under Int. Conv., June 22, 1912.

See Fr. Pat. 456,580 of 1912 ; this J., 1913, 1095.—T. F. B.

Gases or vapours ; Apparatus for treating —— with liquids. I. Moscicki, Freiburg, Switzerland. U.S. Pat. 1,097,870, May 26, 1914. Date of appl., April 27, 1909.

See Fr. Pat. 403,401 of 1909 ; this J., 1910, 76.—T. F. B.

Gases ; Apparatus for the chemical transformation of —— by multiple-contact action at regulatable temperatures. T. Wolff, Leverkusen, Germany, Assignor to General Chemical Co., New York. U.S. Pat. 1,099,530, June 9, 1914. Date of appl., Jan. 16, 1913.

See Fr. Pat. 453,470 of 1913 ; this J., 1913, 741.—T. F. B.

Extraction apparatus. H. A. Gill, London. From Harburger Eisen- und Bronzewerke A.-G., Harburg, Germany. Eng. Pat. 27,014, Nov. 24, 1913.

See Fr. Pat. 465,640 of 1913 ; this J., 1914, 633.—T. F. B

Separating fine-grained admixtures from slimes ; Apparatus for ——. A. Freygang, Hamburg, Germany. U.S. Pat. 1,097,855, May 26, 1914. Date of appl., Nov. 6, 1912.

See Eng. Pat. 25,548 of 1912 ; this J., 1913, 221.—T. F. B

Furnace with regenerative firing. K. Wendt, Assignor to Georgs-Marien-Bergwerks- und Hütten-Verein, Georgsmarienhütte, Germany. U.S. Pat. 1,097,900, May 26, 1914. Date of appl., Dec. 14, 1911.

See Ger. Pat. 258,147 of 1910 ; this J., 1913, 540.—T. F. B.

Furnaces ; Refractory lining for ——. O. Serpek, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pat. 1,099,131, June 2, 1914. Date of appl., Jan. 26, 1912.

See Fr. Pat. 436,596 of 1911 ; this J., 1912, 499.—T. F. B.

Furnace provided with regenerative chambers. H. Poetter, Düsseldorf, Germany. U.S. Pat. 1,100,985, June 23, 1914. Date of appl., Dec. 22, 1913.

See Eng. Pat. 26,411 of 1913 ; this J., 1914, 408. -T. F. B.

Mixing powdered substances or highly concentrated solutions with a liquid or dissolving them in the latter ; Process of and apparatus for ——. W. Loebel, Leipzig, and K. Franz, Frankfort, Germany. U.S. Pat. 1,098,811, June 2, 1914. Date of appl., Dec. 11, 1911.

See Eng. Pat. 20,585 of 1912 ; this J., 1913, 740.—T. F. B

Drying apparatus ; Vacuum ——. A. Ravautte, Assignor to A. Ravautte, Marseilles, E. C. A. Fleurent, and Soc. Anon. des Etabl. Egrot, Paris. U.S. Pat. 1,100,028, June 16, 1914. Date of appl., Feb. 24, 1912.

See Fr. Pat. 428,374 of 1911 ; this J., 1911, 1147.—T. F. B.

Grading finely-divided materials ; Method of and apparatus for ——. H. K. Hitchcock, Tarentum, Pa. U.S. Pat. 1,100,302, June 16, 1914. Date of appl., June 7, 1912.

See Eng. Pat. 1212 of 1913 ; this J., 1913, 587.—T. F. B.

Smoke ; Apparatus for cleaning ——. J D. Jackson, Kensington, Victoria. U.S. Pat. 1,100,307, June 16, 1914. Date of appl., Aug. 26, 1913.

See Eng. Pat. 4636 of 1913 ; this J., 1914, 341.—T. F. B.

Melting and projecting fusible substances ; Apparatus for ——. E. Morf, Zürich, Switzerland. U.S. Pat. 1,100,602, June 16, 1914. Date of appl., Sept. 20, 1913.

See Eng. Pat. 28,001 of 1912 ; this J., 1913, 792.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Methane ; Limits of inflammability of ——. F. Leprince-Ringuet. Comptes rend., 1914, **158**, 1793—1796.

An empirical expression is deduced showing the effects of water content and temperature on the limit of inflammability of methane and air. It is also shown that ordinary atmospheric fluctuations of pressure have little effect. The diameter of the explosion tube has a distinct effect (*e.g.* in a 5·15 mm. tube the limit was 6·95% while in an 8·15 mm. tube it was 6·17%). The direction of the explosion (from above or below) may also cause the results to vary considerably (*e.g.* from above 5·76% to below 5·20%).—W. H. P.

Coal gas ; Synthetic preparation of ——. L. Vignon. Comptes rend., 1914, **158**, 1809—1811.

The author has attempted to devise a scheme for the gasification of the whole of the carbon of coal to produce a combustible gas with a low percentage of carbon monoxide and possessing the calorific power of ordinary coal gas. Making use of reactions previously studied (this J., 1911, 121 and 488 ; 1913, 76, 742 and 817) he suggests various technical processes starting from water-gas, coke, or coal. Lime is added to the coal, and the whole distilled at 900°—950° C., 100 kilos. of coal giving about 25 cb. m. of rich gas. Then water vapour is passed over the coke and lime at 900°—1000° C., which brings up the yield to about 200 cb. m. of a gas containing: H_2 70—78, CH_4 15—20, CO 5—10%. The amount of carbon monoxide may be reduced even further if necessary. The calorific value of such a gas is only slightly inferior to that of coal gas. The volume obtained is 8—10 times greater than that obtained by simple distillation and practically all the nitrogen is converted into ammonia.—W. H. P.

[Gas] Purification by heat. C. C. Carpenter. J. Gas Lighting, 1914, **126**, 928—938.

The presence of carbon bisulphide in coal gas was first demonstrated by Lewis Thompson, and the proposals for the removal of sulphur compounds other than hydrogen sulphide by the aid of heat are based on the reaction: $CS_2+2H_2=2H_2S+C$. With pure materials the amount of carbon deposited is exactly proportional to the carbon bisulphide decomposed, and the reaction has been used for determining the content of carbon bisulphide in coal gas. In the original test of Vernon Harcourt the gas was passed through an inverted Florence oil flask filled with pebbles and heated by a gas burner. Later, an active contact substance—platinised pumice—was substituted for the pebbles, whereby it became possible to use a small bulb in place of the large Florence flask.

Efficiency of certain catalytic and contact substances with increasing temperatures.

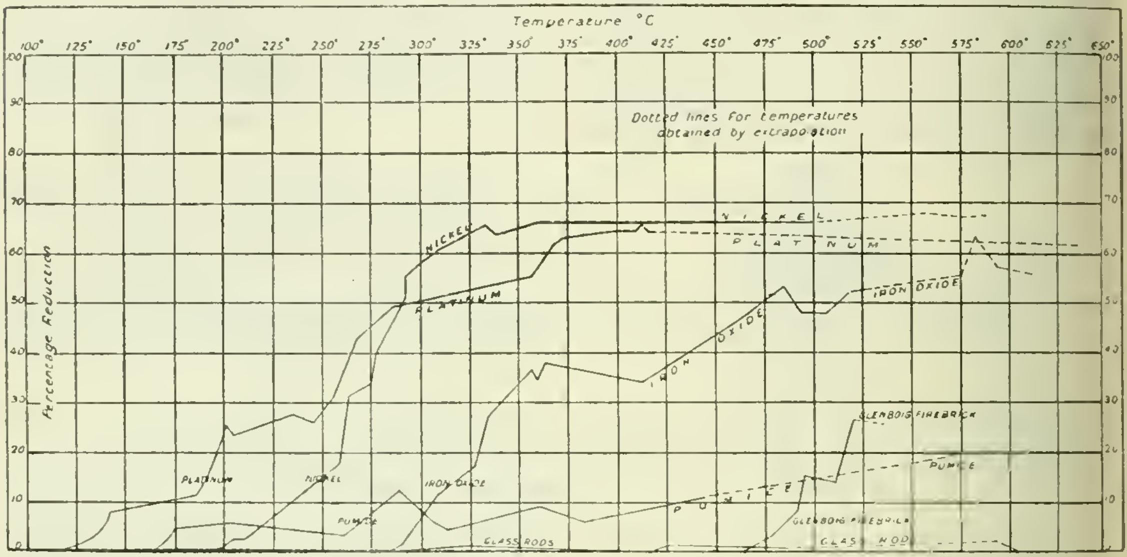
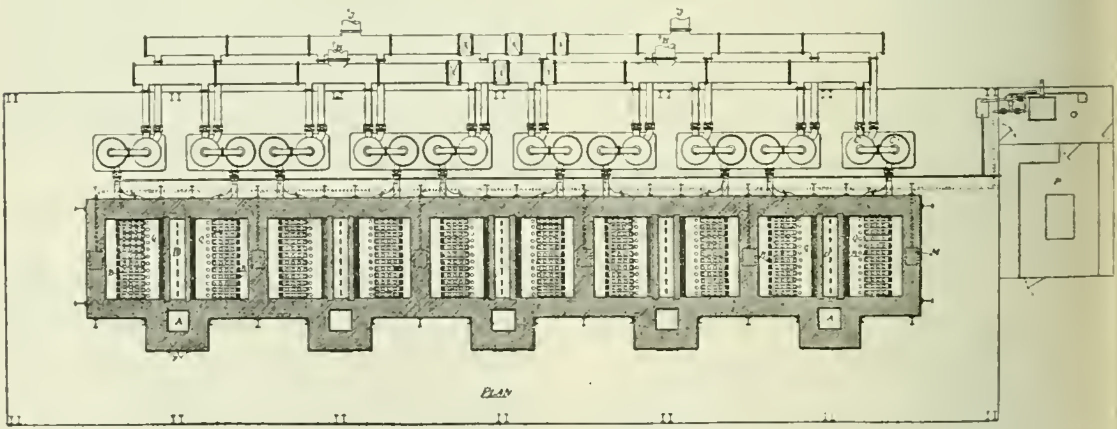


FIG. 1.

Starting from a patent taken out by E. Heard in 1806, many proposals have been made for purifying coal gas by the action of heat, usually in presence of a contact substance, but none of the earlier processes proved successful on the large scale, owing mainly to difficulties in connection with the apparatus or to undue reduction of the illuminating power of the gas. The first successful application of purification by heat on a commercial scale was effected by Hall and Papst in the United States, a plant being put into successful operation in August, 1908, at Portland, Oregon. A pair of superheaters filled with chequer-work as in a water-gas plant, was used, with a gas producer in between. The superheaters were heated alternately by gas from the producer. The gas to be purified was passed through one of the superheaters whilst the other was being heated, and when the first superheater had cooled to such a degree that it was no longer sufficiently effective, the flow of gas was diverted to the second superheater and producer gas led into the first to heat it again to the requisite temperature. With this installation, during twelve months (1909), the sulphur content was reduced from 49·0—68·9 (average 58·83) to 14·2—20·8 (average 16·94) grains per 100 cb. ft., the percentage reduction being 63·21—75·85 (average 71). The total gas treated during the year was 817 million cubic feet, with a maximum of 4 million cb. ft. per day, and the average cost, including fuel, labour, repairs, and investment, was ½d. per 1000 cb. ft. The percentage reduction of sulphur at different temperatures was: 427° C., 20·7; 454°, 36·6; 482°, 50·8; 510°, 57·8; 538°, 62·7; 566°, 66·4; 593°, 68·8; 621°, 71·2; 649°, 72·9; 677°, 74·5; and 704° C., 76·0%.



A Furnace. B. Tubes containing Catalyst C. Heat Interchangers D Combustion Chamber H Gas after Treatment J Gas before Treatment M Chimney
O. Aeration Plant P Test Room Q Heating Chamber.

FIG. 2.

The author's experiments began in 1906, and from 1908 onwards numerous tests of the efficacy of various catalysts under different conditions were carried out. Some of the results (percentage reduction of sulphur) obtained with different contact substances under constant conditions in regard to rate of flow of gas are shown in the curve-diagram (see Fig. 1). For work on a large scale, reduced nickel was found to be the most satisfactory catalyst and the highest temperature which could be used, compatible with the maintenance of the quality of the gas and the durability of the iron container, was 400°—500° C. An essential feature of the process is the preheating of the gas before it enters the reaction tubes containing the catalyst; otherwise such a furnace temperature is required to maintain the catalyst at the requisite temperature that the tubes are speedily destroyed. The plant now installed in the East Greenwich works of the South Metropolitan Gas Company is shown in plan in Fig. 2. It consists of five units each capable of dealing with 3 million cubic feet of gas per day. Each unit comprises a producer, A, and a combustion chamber, D, on either side of which are heating chambers, Q, containing the reaction tubes, B. The gas, freed from hydrogen sulphide, flows through the pipe, J, into the heat interchangers, C, C′ (wrought-iron vessels filled with 3-inch tubes; one efficiently jacketed and the other with bare walls, so that the temperature of the gas can be controlled). The gas is preheated by the waste gases from the heating chambers which flow through the heat-interchangers in the opposite direction. It then passes through the heating chamber and next flows in parallel currents through the reaction tubes, packed with the catalyst, to a collecting main, whence it flows through the heat-interchangers in the opposite direction to the incoming gas, and thence to the secondary purifiers for the removal of hydrogen sulphide. At O is the aerating plant comprising a small gas-engine driving a fan, by means of which air can be passed through the reaction tubes to burn away the deposited carbon. The results obtained on the large scale with this installation have already been given (see this J., 1914, 682).—A. S.

Viscosity of mixtures of mineral oils; Simple method of calculating the ——. E. Molin. Chem.-Zeit., 1914, **38**, 857—859.

The viscosities of mixtures, in different proportions, of a refined Russian oil of sp. gr. 0·912 and viscosity (Engler) 67·4, and an American spindle oil of sp. gr. 0·868 and viscosity 2·5, were determined and from the results a curve was plotted and a table constructed showing the change in viscosity with increasing percentages (by vol.) of the more viscous oil. The curve or table was then used for calculating the viscosity of mixtures of mineral oils of known viscosities, each component oil being regarded as a mixture of the two oils of viscosity 67·4 and 2·5 respectively, in certain proportions as ascertained from the table, and the composition of the original mixture then calculated in terms of these two oils, and the viscosity of such a mixture read from the curve or table. The method proved satisfactory with mixtures of oils of widely different viscosities. The formula proposed by Pyhälä (this J., 1912, 18) gives satisfactory results only in cases where the viscosity of one component is very low (about 1° Engler), or where the viscosities of the two components do not differ widely.—A. S.

Naphthenic acids of high molecular weight in Baku petroleum oil. E. Pyhälä. Z. angew. Chem., 1914, **27**, 407.

The acids in the waste lyes from the refining of Baku machine oils were liberated, washed, dried and distilled *in vacuo*. The distillate was extracted with alcoholic potassium hydroxide, the alcohol evaporated from the extract, and the naphthenic acids liberated from the soap. The product was a light yellow, nearly odourless, and very viscous oil with a neutralisation value of 100. When dissolved in ether, shaken with concentrated hydrochloric acid, and washed with water, it left (after evaporation of the ether) a residue which on fractional distillation yielded the two acids previously described (this J., 1914, 634). Both fractions had the typical naphthenic odour, but hardly perceptible when cold.—C. A. M.

Asphaltum; Navaho ——. T. Rosenthal. Z. angew. Chem., 1914, 27, 422—424.

Navaho-asphaltum is obtained from a viscous crude oil from wells in South California. The crude oil is separated from water and earthy matter and is then heated, to a temperature depending on the hardness desired, in order to remove the lighter oils, the residue of asphaltum being the only product recovered. The asphaltum has a sp. gr. greater than 1 at 25° C., loses 0·1% on heating for 7 hours at 163° C. (compare this J., 1911, 201), and contains: ash 0·2, organic non-bituminous substances 0·3, and bitumens soluble in petroleum-spirit (sp. gr. 0·725) 87·8, in carbon bisulphide, 99·5 and in carbon tetrachloride, 98·5%. It contains no paraffin and only traces of sulphur. Its superiority to some other asphaltums is shown by the following figures:—

Kind of asphaltum.	Bitumen.	Ash.	Organic non-bitumen substances.	Ductility.*
	%	%	%	cm.
Navaho	99·52	0·17	0·31	100
Bermudez	93·88	1·67	4·45	52
Trinidad	57·03	36·49	6·48	37

* See Dow, Proc. Amer. Soc. Testing Materials, 1903, Vol. 3.

It is used, without any addition of fluxing materials, for paving, for insulating and for making roofing sheets. —A. T. L.

Asphaltum: Chemistry and analysis of ——. J. Marcusson. Chem.-Zeit., 1914, **38**, 813—815, 822—823. (See also this J., 1913, 223.)

The author's method of differentiating natural and oil asphaltums (Chem.-Zeit., 1908, 965; compare this J., 1911, 480) has been criticised by Loebell (Chem.-Zeit., 1914, 18) and by Kantorowicz (this J., 1914, 66), but it is pointed out that if petroleum benzine does not precipitate the whole of the asphaltic substances, they will be separated in the subsequent treatment with sulphuric acid. *Saponifiable constituents of natural asphaltums.* On treating asphaltum with benzene, adding alcohol, and titrating the benzene-alcohol extract with alkali, neutralisation values of 15·4 to 2·8 were obtained, the highest being given by Trinidad and Bermuda asphaltums and the lowest by asphaltum meals, in which the acids were partly in combination with lime. Crude petroleum oils and distillation residues gave neutralisation values of less than 1. After purification, bitumens gave lower values than before (*e.g.*, 6·9 as compared with 15·9), this being attributable to the formation of acid anhydrides or lactones during the heating. The examination of "trinascol," or Trinidad crude oil (an intermediate step in the formation of Trinidad asphaltum) also indicated that the saponifiable constituents of natural asphaltums are not fatty or wax esters. A sample of trinascol (a black viscous mass smelling of sulphur compounds) contained 3·9% sulphur, and 0·5% paraffin wax in the oily constituents. The saponification value was 9·4 (Trinidad asphaltum, 34) and the acids separated amounted to 3·1% (Trinidad asphaltum, 13%). The asphaltic acids from Trinidad asphaltum were very similar to the polynaphthenic acids obtained by heating Texas oil for about 70 hours at 120° C., both being nearly insoluble in petroleum benzine.

Acids from—	Acid value.	Saponif. value.	Iodine value.	Sulphur.
				%
Trinidad asphaltum	98·5	120·4	22·4	3·1
Texas oil	89·3	147·0	17·3	1·2

After longer heating at 120° C. the acid value of both asphaltic and petroleum acids decreased (*e.g.*, from 104 to 74), apparently owing to the formation of anhydrides. *Asphaltites* can be readily distinguished from friable petroleum distillation residues by their low oil-content. Petroleum residues contain over 20% of semi-solid oil (unaffected by sulphuric acid) in which is over 2% paraffin wax, whilst the oily portions of asphaltites are fluid and nearly free from paraffin wax. The following results were obtained :—

Asphaltite.	Acid value.	Sulphur.	Oily constituents unaffected by H_2SO_4
	%	%	%
Syrian asphaltum	0·5	8·9	1·4
Gilsonite (Utah)	0·5	0·5	6·7
Grahanite (W. Indies)	0·1	3·7	3·3
Albertite (Nova Scotia)	0·2	0·44	1·7
Manjak (Barbados) ..	2·4	1·5	0·17

Manjak, which is the softest of all asphaltites, is regarded as a transition stage between asphaltum and asphaltite (see also this J., 1913, 646; 1914, 470). *Determination of the melting point of asphaltum*: In determining the dropping point of asphaltum with Ubbelohde's apparatus (this J., 1905, 941), concordant results can only be obtained when the lower opening has a diameter of exactly 3 mm. Barta's modification of the Krämer-Sarnow method of determining the softening point (this J., 1911, 1367) gives lower values than the Ubbelohde method, owing to the pressure of the mercury. Comparative determinations with ceresins showed that the m. pt. (Krämer-Sarnow) was as a rule almost as high as the first signs of fluidity in Ubbelohde's dropping method and the initial m. pt. in a capillary tube, whilst the dropping point was nearly the same as the stage of complete fusion in a capillary tube. For determining the m. pt. of asphaltums the Krämer-Sarnow method should be used for the incipient fusion, and the Ubbelohde method for complete fusion. The differences between the two points ranged from 15 to 20° C. in the case of nine typical samples of natural and oil asphaltums (see also this J., 1914, 470).—C. A. M.

Economy of heat in tar and petroleum distillation. Uhlmann. *See* III.

Application of producer gas to brass foundries. Bulmahn *See* X.

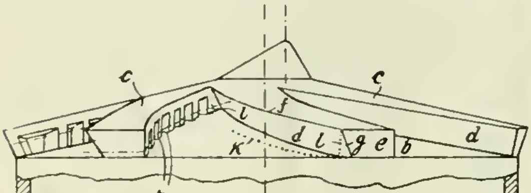
Relation between the structure and composition of organic compounds and their antiseptic properties. Charitschkow *See* XIXb.

Thermal decomposition of methyl alcohol. Bone and Davies *See* XX.

Patents.

Gas generators; Rotary grates for ——. K. Koller, Budapest, Hungary. Eng. Pat. 1692, Jan. 21, 1914. Under Int. Conv., Jan. 22, 1913.

A rotating conical grate, *a*, has curved cutting members, *c*, of which the forward face, *d*, is convex and is inclined at about 45°, so that the space, *f*, *g*, *k*, *l*, is free from vertical pressure and the cut slag in this space can move freely outwards as the grate rotates. The blast orifices are formed in the rear face of the cutting members, as shown at *p*. The grate may be used with a rotary slag pan having curved shearing blades as described in Eng. Pats. 7330 and 17,368 of 1911.—A. T. L.



Ammonia; Process and apparatus for increasing the yield of —— *in the manufacture of gas from solid fuels.* K. P. Sachs. Ger. Pat. 274,011, Dec. 13, 1912.

The gas is withdrawn from the interior of the bed of fuel through perforated tubes provided with a cooling device (cooling coil, water-jacket, or the like). Up to 90% of the total nitrogen of the fuel can be recovered as ammonia. —A. S.

Liquid fuel; Production of combustible gas or vapour [for internal combustion engines] from ——. F. G. L. Biddlecombe, Luton, Beds. Eng. Pat. 10.305, May 1, 1913.

Heavy hydrocarbon fuel, such as paraffin, together with a little air, is drawn by the suction of the engine through a spraying nozzle into a chamber in which partial combustion takes place, the ignition being at first effected by a sparking plug and afterwards maintained by the flame in the chamber. The spraying nozzle may be so formed that the air and oil receive a whirling motion. A further supply of air is admitted to the chamber through an automatic valve. The combustion is incomplete and the products, containing a large quantity of vaporised or gasified fuel, and are mixed with air for use in the engine. —A. T. L.

[Mineral] Oil; Methods of and apparatus for purifying ——. R. B. Ransford, London. From M. E. Shiner, Bayonne, N.J., U.S.A. Eng. Pat. 13,441, June 10, 1913.

The oil is passed successively upwards through three vessels, wherein it meets a descending current of warm or hot water, the water supply being regulated so as to bring the temperature of the oil to 60° F. (15·5° C.). The oil then flows upwards through a settling tank, and through an acid washer, a series of three vessels in which acid is removed by washing with water, a settling tank, an alkali washer, and, finally, through another settling tank. The acid and alkali washers are vertical cylindrical vessels in which the oil flows upwards and the acid or alkali downwards through a series of rotating perforated plates mounted on a vertical shaft. A series of fixed funnel-shaped partitions, arranged alternately with the perforated plates, directs the descending current towards the centres of the plates.—A. T. L.

Lubricants or the like; Manufacture of ——. F. C. Fresenius, Offenbach a/Main, Germany. Eng. Pat. 19,338, Aug. 26, 1913.

Fine pure soot (50% or more) is mixed with mineral or other lubricating oils. The soot is prepared by strongly heating lampblack in the absence of air, and then sifting it and separating the heavier particles by a current of air. —A. T. L.

Coal; Process and apparatus for agglomerating ——. H. Steven, Gilly, Belgium. Eng. Pat. 228, Jan. 5. 1914. Under Int. Conv., Jan. 20, 1913.

See Fr. Pat. 466,420 of 1913; this J., 1914, 635.—T. F. B.

Coke ovens; Regenerative ——. C. Still and C. Wilke, Recklinghausen, Germany. Eng. Pat. 6036, March 10. 1914.

See Ger. Pat. 271,515 of 1913; this J., 1914, 471.—T.F.B

Coke-oven; Horizontal ——. C. Still, Recklinghausen Germany. U.S. Pat. 1,098,188, May 26, 1914. Dat of appl., Jan. 23, 1912.

See Eng. Pat. 1458 of 1912; this J., 1912, 577.—T. F. B

Coke produced in vertical gas-retorts; Means for utilisin the residual heat of ——. H. J. Toogood, Assignor t R. Dempster and Sons, Ltd., Elland. U.S. Pat 1,101,477, June 23, 1914. Date of appl., June 25, 1912

See Eng. Pat. 11,209 of 1912; this J., 1912, 805.—T. F. B

Producer-gas ; Method of and apparatus for generating ——. E. Servais, Luxemburg. U.S. Pat. 1,098,534, June 2, 1914. Date of appl., Feb. 24, 1913.

See Fr. Pat. 453,409 of 1913 ; this J., 1913, 781.—T.F.B.

Producer and regenerator furnace. J. Stewart, Codnor Park, W. Stewart, Motherwell, and R. P. Bethell, Walsall. U.S. Pat. 1,098,991, June 2, 1914. Date of appl., July 14, 1911.

See Eng. Pat. 21,737 of 1910 ; this J., 1911, 1200.—T. F. B.

Producers of inert gases ; Testing and controlling device for ——. C. Martini (M. Martini, Executrix), Assignor to Martini und Hünoke Maschinenbau-Act.-Ges., Berlin. U.S. Pat. 1,099,611, June 9, 1914. Date of appl., Sept. 9, 1909.

See Addition of Aug. 27, 1909, to Fr. Pat. 359,018 of 1905 ; this J., 1910, 547.—T. F. B.

Hydrocarbons ; Process for purifying ——. *Process for the purification of liquid hydrocarbons.* F. Richter, Frankfort on Maine, Germany. U.S. Pats. 1,098,763 and 1,098,764, June 2, 1914. Dates of appl., Nov. 23, 1910, and Sept. 9, 1912.

See Fr. Pat. 421,277 of 1910 and Addition thereto ; his J., 1911, 409 ; 1913, 224.—T. F. B.

Oil ; Method of and apparatus for purifying ——. O. J. Shiner (M. E. Shiner, Executrix), Bayonne, N.J. U.S. Pat. 1,099,622, June 9, 1914. Date of appl., May 27, 1913.

See Eng. Pat. 13,441 of 1913 ; preceding.—T. F. B.

Method of dehydrating fats, oils, hydrocarbons, etc. Ger. Pat. 273,555. *See* XII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Patents.

Heat ; Means for the accumulation and transference of ——. A. H. Lymn, London. Eng. Pat. 12,618, May 30, 1913.

Heating tubes for steam boilers or for other purposes, have a central core of refractory material, and the annular space, through which tho heating gases pass, between he core and the tube, is filled with pieces of refractory material in such a way that the whole filling is locked against accidental displacement. In a modification, he tube itself is filled with shaped, or with shaped and unshaped, pieces of refractory material similarly held in position. The hottest part of the tube may be lined. The blocks forming the lining and the core are keyed to one another by rods. The core may be hollow in order to serve for preheating air and gas for combustion, or for heating boiler feed-water.—A. T. L.

By-products from gases resulting from the dry distillation of coal, etc. ; Process of obtaining ——. G. Hilgenstock, Dahlhausen on Ruhr, Germany. U.S. Pat. 1,099,089, June 2, 1914. Date of appl., June 10, 1909.

See Fr. Pat. 404,569 of 1909 ; this J., 1910, 206.—T. F. B.

Heating ; Process of and apparatus for ——. F. Fischer, Charlottenburg, Germany. U.S. Pat. 1,099,595, June 9, 1914. Date of appl., Oct. 6, 1913.

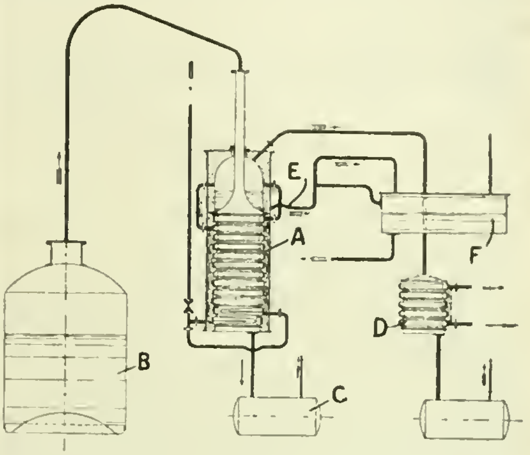
See Fr. Pat. 460,526 of 1913 ; this J., 1914, 90.—T. F. B.

Conducting-filaments ; Process of preparing ——. H. D. Madden, Bloomfield, N.J., and W. G. Houskeeper, Philadelphia, Assignors to Westinghouse Lamp Co. U.S. Pat. 1,099,095, June 2, 1914. Date of appl., March 31, 1909.

See Fr. Pat. 414,257 of 1910 ; this J., 1910, 1195.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Tar and petroleum distillation ; Economy of heat in ——. P. W. Uhlmann. Chem. Apparatur, 1914, 1, 177—179.



Apparatus is described for dehydrating tar or crude oil and distilling the lighter fractions by means of the hot vapours from the still, whereby smaller quantities of coal and of cooling water are required, tho saving of coal being about 2% of the weight of tar or oil distilled. The crude oil or tar circulates upwards in a tortuous path through hollow partitions in tho vessel, A, and is heated by the vapours from the still, B, which pass downwards through A, and are condensed, the middle, heavy and anthracene oils being collected in a tank, C. Owing to tho gradual heating of the tar or crude oil in A, there is very little frothing. The steam and light oil vapours pass from tho top of A to a condenser, D, and the dehydrated tar or oil, freed from its lighter constituents, is run off from the vessel, A, at E, and passed from the tank, F, to the still, B.—A. T. L.

Pitch cancer ; Note on the bases of gasworks coal-tar which are believed to be the predisposing cause of ——, *with special reference to their action on lymphocytes, together with a method for their inactivation. Part I. Auxetic action.* D. Norris. Biochem. J., 1914, 8, 253—260.

According to Ross and Cropper (see this J., 1913, 416) the predisposition to cancer caused by pitch is due to the presence therein of two classes of substances, namely auxetics (mostly amino-compounds), which induce cell-division in white blood cells, and kinetics (including most of the alkaloids) which excite amœboid movements in cells. Experiments by the author show that tho auxetics in coal-tar are bases present in the anthracene fraction (b. pt. 100°—200° C. at 16 mm.). The bases may be separated from the tar by shaking it for 1 hour with twice its volume of 5% hydrochloric acid, allowing to stand overnight, centrifuging, and precipitating the bases from the acid liquor with strong ammonia, care being taken not to add excess. Attempts were made to isolate the bases by fractional crystallisation of the picrates. The most insoluble picrate melted at 199°—201° C. and had the composition, $C_{22}H_{14}O_9N_6$. The free base separated therefrom possessed auxetic activity. Another picrate fraction melted at 161°—162° C., but the quantity was not sufficient for analysis. The auxetic activity of aqueous extracts of tar is rapidly lost on exposure to air and a simple method of rendering the tar inactive in regard to auxetic power consists in heating it to 160° C. and subjecting it to the action of a blast of air or ozonised air (see also Eng. Pat. 11,984 of 1913 ; following.) Another method for rendering the auxetics inactive, viz., treatment with formaldehyde (Robinson, Eng. Pats. 4159 and 10,156 of 1913 ; this J., 1914, 412), is being tried on a practical scale in a briquette works at Cardiff to ascertain whether the treatment is effective in preventing pitch cancer among the workmen.—A. S.

Bromination of benzene and its homologues. Catalytic action of manganese. L. Gay, F. Ducelliez and A. Raynaud. Comptes rend., 1914, **158**, 1804—1806.

Metallic manganese accelerates the action of bromine on benzene and toluene very considerably and is not itself changed in the process if the reagents are dry.—W. H. P.

[*Preparation of anthraquinone, Aniline Black, Indulines etc.*] *Magnesium chloride. II. Its effect on the oxidising action of chlorates and nitrates.* Hofmann and others. *See* IV.

Electrochemical oxidation of aromatic hydrocarbons and phenols. Fichter and Stocker. *See* XI.

Patents.

Tar, tar oils, or pitch; Method of and means for removing deleterious substances from ——. H. C. Ross, Chelsea. Eng. Pat. 11,984, May 22, 1913.

The "auxetics" present in tar, tar oils, or pitch are removed by bringing the substance into intimate contact and spraying it with hot water or hot dilute acid, projecting the mixture on to a plate or plates to effect further division and mixing, then agitating the mixture, and finally allowing it to separate and removing the aqueous liquid. In treating tar, about twice its volume of hot water (at 100° to 212° C.) may be used, whilst when using an acid solution (*e.g.*, 5% sulphuric or hydrochloric acid) half this amount may suffice. The auxetics may be removed or destroyed by passing air or oxygen (which may be ozonised) through the tar or tar product during distillation or at any other convenient stage of manufacture. An apparatus suitable for carrying out the above process is described.—T. F. B.

Arylides of 2.3-[hydr]oxynaphthoic acid and formaldehyde; Manufacture of condensation products from the ——. Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 3312, Feb. 7, 1914. Under Int. Conv., May 17, 1913.

Formaldehyde acts very readily on the arylides of 2.3-hydroxynaphthoic acid in alkaline solution, even at the ordinary temperature, forming products which can be separated from solution by precipitation with acid. The constitution of the new products has not been determined, but they differ from the arylides themselves in being less easily soluble (*e.g.*, in acetone) and they are decomposed by heat. They may be used as azo dyestuff components—T. F. B.

Nitro products from petroleum and tar; Manufacture of ——. A. S. Flexer, Vienna. U.S. Pat. 1,099,976, June 16, 1914. Date of appl., July 21, 1913.

See Fr. Pat. 460,281 of 1913; this J., 1914, 17.—T. F. B.

Arylamides of 2.3-[hydr-]oxynaphthoic acid; Process of making the ——. A. Zitscher, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,101,111, June 23, 1914. Date of appl., Nov. 14, 1913.

See Eng. Pat. 23,732 of 1913; this J., 1914, 70.—T. F. B.

Method of dehydrating fats, oils, hydrocarbons, etc. Ger. Pat. 273,555. *See* XII.

IV.—COLOURING MATTERS AND DYES.

Lokao dyestuff. [*Chinese green.*] A. Rüdiger. Arch. Pharm., 1914, **252**, 165—186.

Lokao contains a blue dyestuff lokaonic acid, $C_{42}H_{46}O_{25}$, in combination with calcium and aluminium. The acid forms unstable ammonium salts and is readily hydrolysed by dilute hydrochloric acid to form rhamnose and a violet dyestuff, lokanic acid, $C_{36}H_{36}O_{21}$. Concentrated potassium hydroxide solution decomposes lokanic acid into phloroglucinol and delokanic acid, $C_{12}H_8O_5$. The latter is a black powder insoluble in water, but forming a cherry-red solution with alkalis. It is decomposed by nitric acid with the formation of oxalic acid and the methyl ether of nitrohydroxybenzoic acid. Lokao is possibly a derivative of flavone.—F. Shdn.

[*Preparation of anthraquinone, Aniline Black, Indulines, etc.*] *Magnesium chloride. II. Its effect on the oxidising action of chlorates and nitrates.* K. A. Hofmann, F. Quoos and O. Schneider. Ber., 1914, **47**, 1991—1999.

The oxidising action of chlorates, nitrates, and nitrites is promoted to a remarkable extent by the presence of large quantities of hydrated magnesium chloride, present in the mother-liquors produced in enormous quantities in the manufacture of potassium salts from carnallite. For example, whilst anhydrous nitrates and chlorates produce only small quantities of anthraquinone when heated with anthracene even at high temperatures, a yield of 18·9 grms. of nearly pure anthraquinone was obtained by heating 20 grms. of anthracene, 23 grms. of sodium nitrate, and 80 grms. of $MgCl_2,6H_2O$ in an open flask; formation of anthraquinone began at about 125° C., and when the temperature reached 145° C., 40 c.c. of water were added, and the temperature then raised gradually to 300° C. The anthraquinone formed an upper layer and was purified by mixing with 5 grms. of magnesia and subliming. A quantitative yield (8·3 grms.) of greenish Aniline Black was obtained by heating a solution of 10 grms. of aniline hydrochloride and 5 grms. of sodium chlorate in 35 c.c. of water with 20 grms. $MgCl_2,6H_2O$ for 2 hours at 90° C.; without magnesium chloride the yield was only 0·5 grm. Indulines and Paraphenylene Blue were obtained in a similar manner from a mixture of aniline and *p*-phenylenediamine hydrochloride. From a mixture of 9 grms. of dimethyl-*p*-phenylenediamine hydrochloride, 10 grms. of α-naphthol, 4 grms. of potassium chlorate, 40 grms. $MgCl_2,6H_2O$, and 10 c.c. of water, a product was obtained which with zinc dust and ammonia gave a vat dyeing indigo-blue shades similar to those obtained with commercial indophenol. A mixture of *p*-toluylenediamin hydrochloride, aniline, *o*-toluidine, potassium chlorate hydrated magnesium chloride, and water gave Safranin and other products insoluble in sodium carbonate solution In the production of induline from aniline, aniline hydrochloride, and aminoazobenzene, the previous preparatio of the last-named may be avoided. For example a coole mixture of 9 grms. of aniline, 32 grms. of aniline hydrochloride, 70 grms. $MgCl_2,6H_2O$, and 50 c.c. of water wa treated with a solution of 7·5 grms. of sodium nitrite i 25 c.c. of water, and after 3 hours at the ordinary temperature, was heated to 120° C. The product consisted chief of alcohol-soluble induline. Phenols and β-naphth can be converted into nitroso-compounds by treatmen in neutral or feebly alkaline solution with sodium nitrit in presence of a large quantity of hydrated magnesiu chloride or sulphate. A yield of oxalic acid correspondin to 7·5 grms. of calcium oxalate was obtained from 12 grm of beechwood sawdust, 80 grms. $MgCl_2,6H_2O$, 10 grms. magnesia, and 17 grms. of sodium chlorate. Oxalic ac was also obtained from molasses at 250°—300° C., considerable quantity of trimethylamine being first form at a lower temperature. The authors conclude from the experiments that the activating influence of magnesiu chloride is not due to hydrolytic dissociation, but probab to its great tendency to complex organic formation.—A.

Influence of artificial organic colouring matters on enzymic hydrolysis of proteins. Diaminovich a Guglialmelli. *See* XIXa.

Patents.

Colouring matters; Manufacture of fast light-proof — N. W. Turkin, Moscow. Eng. Pat. 5737, March 1913.

A colloidal solution of the colouring matter is formed i mass containing Turkey red oil and a salt of an alkali alkaline-earth metal by heating the mixture until solidifies on cooling. The use of basic aluminium acetate is advantageous, also the addition of naphthalene and certain oils and fats containing trimethylamine, cholesterol or triglycerides, these additions improving the fastness to light. All coal tar dyes are suitable for use in the process, and a variety of indifferent materials may be added to the mass. A special diluting varnish made by heating fish oil with naphtha and dissolving the product in naphtha, etc., is used for preparing paints and printing mixtures.—I. B.

Trisazo dyestuffs ; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 17,030, July 24, 1913.

This process relates to the manufacture of dyestuffs of the type, naphtholdisulphonic acid-N_2-P-N_2-naphthylaminesulphonic acid (1.6 or 1.7)-X, where P represents a p-phenylene or substituted *p*-phenylene nucleus and X a further diazotisable amine other than an aminonaphtholsulphonic acid. They may be obtained by combining a compound of the type, -N_2-P-N_2-naphtholdisulphonic acid with 1.6 or 1.7-naphthylaminesulphonic acid, diazotising, and combining with a diazotisable amine as mentioned above, or by combining a compound of the type, -N_2-P-N_2-Clève acid, with a naphtholdisulphonic acid, diazotising, and combining with an amine, or from a compound of the type, -N_2-P-N_2-Clève acid -NO_2 or -NH-acidyl by combining with a naphtholdisulphonic acid, reducing or saponifying, diazotising, and combining with a diazotisable amine. The dyestuffs obtained by this process can be diazotised on the fibre and developed with β-naphthol, producing blue shades fast to washing and light.—T. F. B.

Diazo salts in a solid form ; Method for producing ——. R. B. Ransford, London. From L. Cassella und Co., G. m. b. H., Frankfort on Maine, Germany. Eng. Pat. 23,945, Oct. 22, 1913.

The stability of the solid diazo compounds, obtained by diazotisation in concentrated sulphuric acid and converting the excess of acid into bisulphate, may be considerably increased by adding to the liquid, after diazotisation, magnesia or magnesium carbonate to neutralise the greater part of the acid. For example, 21 kilos. of *p*-nitraniline are mixed with 36·6 kilos. of a mixture of equal parts of nitrosulphuric and sulphuric acids ; when diazotisation is complete, 8 kilos. of magnesia and then 36 kilos. of powdered potassium or sodium sulphate are added. The mass becomes stiff after a short time, and can be ground to an almost colourless, very stable powder.—T. F. B.

Anthracene] dyestuffs ; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co. G. m. b. H., Frankfort-on-Maine, Germany. Eng. Pat. 1443, Jan. 19, 1914.

1-AMINO-2-METHYLANTHRAQUINONE is heated with sulphur to a high temperature in presence of an aromatic amine having at least two amino groups in the molecule. When p-phenylenediamine is the amine used, a product dyeing violet shades is obtained, whilst with benzidine a claret dyestuff is produced. The use of one mol. of the amine to two mols. of the anthraquinone derivative gives especially good results. Instead of aromatic amines, nitro or azo compounds which yield on reduction compounds having at least two amino groups may be used.—T. F. B.

Azo dyes ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,313, Oct. 3, 1913.

The diazo compounds of o-nitraniline or its homologues or derivatives are combined with acetoacetic-anilide-*p*-carboxylic acid. The products are soluble in water and are particularly suitable for preparing lakes, which are pure greenish-yellow in colour, and very fast to oil and to water. The acetoacetic-anilide-*p*-carboxylic acid may be obtained by heating an ester of *p*-aminobenzoic acid with acetoacetic ester and saponifying the resulting ester. —T. F. B.

Vat dyestuffs ; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 3682, Feb. 12, 1914. Addition to Eng. Pat. 19,599, Aug. 27, 1912.

THE condensation products of halogen-quinones and arylamines are treated with sulphur compounds other than those enumerated in Eng. Pats. 19,599 of 1912 and 22,528 of 1913 (see Fr. Pat. 447,592 and Additions thereto, this J., 1913, 226 ; 1914, 247). The following may be used for this purpose :—Hydrosulphites, anhydrides of thiocarbonic acid, thiosulphuric acid or thiosulphates, sulphur alone or in presence of a substance capable of combining with halogen or acid (other than sodium or other metallic sulphide or sulphydrate included in Eng. Pat. 19,599 of 1912), or a sulphur halide. A diluent may be used. Some of these substances give rise to products closely resembling those previously described, whilst in other cases different products are formed. For example, the dyestuffs obtained by the action of a thiosulphate or of sulphur in presence of a substance capable of binding halogen or acid, dye wool olive-grey, greyish-brown, greyish-blue, and brownish-black shades.—T. F. B.

Dyestuffs of the Quinoline Yellow series ; Manufacture of halogenated ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 8577, April 4, 1914.

PHTHALIC acid is condensed with a *m*-halogen-quinaldine or a halogenated quinaldine or a homologue thereof, which contains a halogen or methyl group in the *o*-position to the nitrogen, and the substituted quinophthalones thus formed are sulphonated. The products are faster to light than Quinoline Yellow.—T. F. B.

Pigments ; New compound [3.3′-dinitro-4.4′-diaminobenzophenone] suitable for use in the manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 8690 of 1914, date of appl., Sept. 5, 1913.

4.4′-DICHLOROBENZOPHENONE is nitrated and the product is heated for 10 hours at 150°—160° C. with alcoholic ammonia containing 10% NH_3 ; after crystallisation from *m*-cresol the product melts at 292° C., and is considered to be 3.3′dinitro-4.4′-diaminobenzophenone ; it differs materially from the product obtained by Consonno by nitrating diaminobenzophenone, which melts at 121° C. If 10% aqueous ammonia is used, the diamino compound is obtained mixed with 3.3′-diamino-4-chloro-4-aminobenzophenone.—T. F. B.

Azo dyestuffs for wool ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,700, June 25, 1913.

SEE Ger. Pat. 269,213 of 1912 ; this J., 1914, 247.—T. F. B.

Sulphurised dyes and process of making same. H. Heimann, Dessau, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pats. 1,098,259 and 1,098,260, May 26, 1914. Date of appl., Oct. 16, 1912.

SEE Fr. Pat. 454,782 of 1913 ; this J., 1913, 863.—T. F. B.

Sulphur dyes and process of making same. H. Heimann and P. Virck, Dessau, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,099,039, June 2, 1914. Date of appl., Feb. 26, 1913.

SEE Fr. Pat. 454,782 of 1913 ; this J., 1913, 863.—T. F. B.

Azo dye ; Red ——. H. Jordan and W. Neelmeier, Leverkusen, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,098,388, June 2, 1914. Date of appl., July 22, 1913.

SEE Eng. Pat. 17,322 of 1912 ; this J., 1913, 862.—T. F. B.

Azo dyestuffs ; Yellow ——. P. Volkmann, Leverkusen, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,098,600, June 2, 1914. Date of appl., Aug. 7, 1913.

SEE Eng. Pat. 8415 of 1913 ; this J., 1914, 414.—T. F. B.

Sulphide dyestuffs ; Fast yellow ——. R. Herz, Frankfort, and W. Frohneberg, Fichenheim, Germany, Assignors to Cassella Color Co., New York. U.S. Pat. 1,100,877, June 23, 1914. Date of appl., Feb. 21, 1913.

See Eng. Pats. 22,453 and 29,970 of 1912 ; this J., 1913, 862.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Cellulose ; Action of cuprammonium hydroxide on ——. E. Connerade. Bull. Soc. Chim. Belg., 1914, **28**, 176—186.

A physico-chemical investigation of the action of cuprammonium hydroxide solution on cotton cellulose. From the results it is concluded that cuprammonium solutions made at low temperatures contain a relatively large amount of the colloidal cuprammonium hydroxide and that the solubility of cellulose is proportional to its concentration, the cupric hydroxide as such playing a secondary part in the reaction. The solution of the cellulose appears to be brought about by the fixation of increasing amounts of colloidal cuprammonium hydroxide and water up to a limit of equilibrium between the liquid and solid phases ; the strongly hydrated colloidal complex also fixes ammonia in proportion to its concentration, tending towards stabilisation of the solution. The coagulation of the complex in solution is reversible.—R. G. P.

Cellulose ; Action of concentrated sulphuric acid on ——. S. Tschumanow. Kolloid-Zeits., 1914, **14**. 321—322.

Strips of filter-paper weighing respectively (1) 0·083, (2) 0·1714, (3) 0·3296, (4) 0·654, (5) 1·264, and (6) 2·5913 grms. were each left in contact with 100 c.c. of sulphuric acid of sp. gr. 1·84. After 24 hours there resulted : (1) a clear olive green liquid, (2) a clear dark greenish brown liquid, (3) to (6) dark-coloured liquids ; after 3 days all the solutions were black. 50 c.c. of solution (6) was diluted with 2 litres of water, the precipitate washed free from sulphuric acid, and dried at 100°—112° C. ; it contained : C 62·10, H 5·00, O 32·90%. After remaining for 2½ years in a desiccator over sulphuric acid, solution (6) had set to a gelatinous mass. (See also Sabbatani, this J., 1914, 692.)—A. S.

Nitrocellulose ; Solubility of —— *in ethyl alcohol.* H. Schwarz. Caoutchouc et Guttapercha, 1914, **11**, 7964—7967, 8199—8200 and 8359—8360.

From published data and his own experimental results, the author shows that the solubility of various kinds of nitrocellulose is greatly influenced by the purity and mode of preparation of the nitrocellulose and the purity of the solvent. In particular, while the solubility in boiling absolute alcohol was high, it rapidly decreased when water was present, becoming practically zero for 88% alcohol. Similar results were obtained with cold alcohol. Commercial alcohol gave somewhat higher results probably owing to the impurities present. Experiments are also described showing the influence of the time of nitration of the cellulose. The solubility first rises with increased time of nitration, then oscillates and finally falls.—H. E. P.

Paper pulp in the United States ; New sources of supply of raw material for ——. V. E. Nunez. Papierfab., 1914, **12**, Fest-heft, 41—44.

In 10 years, from 1900 to 1909, the consumption of pulpwood in the United States increased by 100%, the increase in home-grown spruce being 35% and in imported spruce 162%. At present only one-third of the pulp wood consumed in the United States is home-grown and the present supplies in that country will probably be exhausted in 30 years. On the other hand, much progress has been made in the utilisation of other species of wood, which have hitherto been considered inferior for pulp making. Balsam fir has been found to be a fairly satisfactory substitute for spruce in the manufacture of mechanical pulp for news-paper, whilst jack-pine and hemlock yield lower grade mechanical pulp suitable for cheap qualities. Tests are being made with several other varieties of wood available in large quantities in the Western States. The inferior woods are preferably ground in admixture with spruce ; fir wood tends to give a free coarse pulp of inferior colour to that of spruce ; the yield per cord is less owing to the lower density of the wood. In the South, progress has been made in the utilisation of lumber waste ; chiefly from long-leaf pine, for the manufacture of a Kraft-cellulose by the sulphate process. It is estimated that sufficient of this waste is available for the production of 10,000 tons of paper per day. There is also a large supply of stumps of black gum wood (*Nyssa sylvatica*) which yields a short-fibred pulp of the poplar class. Large amounts of Douglas fir are still untouched on the Pacific slope in the North. Of the minor sources of supply of paper-making material, sugar-cane refuse, previously shredded and largely freed from "pith" by the Simmons process is considered the most promising. Fibrous waste from the sisal plantations of Yucatan is also available in substantial quantities and yields paper pulp of excellent quality. Cottonseed hull fibres and flax straw are capable of development in their respective classes. Corn (maize) stalks, saw grass, cotton stalks and many other plants are under investigation but do not promise so well as the materials previously mentioned.—J. F. B.

Sulphite pulp ; Manufacture of ——. A. D. J. Kuhn. Papierfab., 1914, **11**, Fest-heft, 53—60.

The processes and apparatus employed for the treatment and purification of sulphite pulp after it is discharged from the digesters are described, with diagrams. Fou typical modern systems are illustrated. When the contents of the digester are discharged by blowing out unde pressure, the pulp should fall immediately into a ches containing hot water in order to avoid coagulation o resin ; it is washed repeatedly with hot water in th same chest, which is provided with a perforated bottom In the best system, the pulp is not subjected at this stag to the action of a centrifugal pump, which would tend t break up knots, etc., forming splinters ; it is preferabl diluted largely with water and run from the chest over channel containing traps for the coarse underboiled lump and through drum-screens which separate knots an splinters. In this way the hardest portions are remove before the pulp receives any mechanical treatment an the stuff which passes on to the potchers or "separators is sufficiently soft to break down completely with moderat agitation. The subsequent operations comprise screenin through a drum of finer mesh, passage over sand-tabl in a highly dilute form, removal of a portion of the wate straining through fine strainers and running off on presse-pâte or equivalent machine. The sand-tables mu not be so wide as to retard the velocity of the stuff, an bends, which cause eddies, must be avoided. The cleaning of the tables is facilitated by slanting the botto laterally. The cross-bars of the traps may be mount on hinges and swung up for cleaning the table. Fi strainers of all types are employed ; the slits should be narrow as possible and their capacity not over-taxe continuous, regular work gives better results than intmittent operation. The chemical purification is co trolled by determinations of ash and acidity.—J. F. B.

Soda cellulose mills ; Soda recovery plant in ——. Schröder. Chem. App., 1914, **1**, 161—168.

A description of the process and plant employed at German esparto mill, producing 18 tons of cellulose 24 hours from 40 tons of grass, the consumption of so (as Na_2O) being 4·2 tons. The amount of waste (sp. gr. 1·051) from the digesters was 138,000 litres day, giving, when mixed with wash waters, 220,000 lit of feed lye of sp. gr. 1·032 for the evaporators. The stro waste lye from the digesters gave, per 100 c.c., 15 grms. evaporation residue, having the composition : wat, 20·18 ; ash, 25·17, combustible matter, 54·65%.

iluted feed-lye contained 5·06% of combustible matter y weight. Calorimetric determinations showed a value f 2451 Cals. for the evaporation residue, the water being alculated as vapour; this is equivalent to a calorific alue of 4500 Cals. for the combustible matter present. he quantity of combustible matter in the lyes worked ut at 11,455 kilos. per day, equal to 7·98 kilos. per min. he lyes to be evaporated were fed, at a temperature of 0° C., at the rate of 157·75 kilos. of dilute feed-lye per in., to a triple-effect vacuum evaporator and the partally concentrated product was passed forward to a rotary late-evaporator, where it came in contact with the ombustion gases from the incinerating furnace. The late-evaporator consisted of a number of metal plates discs partially immersed in the lye and partially posed to the furnace gases; thus a film of the lye is icked up, evaporated and renewed as the discs revolve. he furnace consisted of two parts: a rotary kiln in hich the evaporation was continued to the flaming oint and a vertical finishing furnace in which the comistion of the coked ash was completed. The draught the latter was so regulated as to burn practically all the rbon without fusing the ash. The total heat developed the furnace was calculated at 43,092 Cals. per min., which, assuming losses of 40%, 25,855 were available r evaporative work in the rotary apparatus. At the te of 580 Cals. required to heat up to boiling point and aporate 1 kilo. of water from the thickened lye delivered om the vacuum pan, it is calculated that 44·58 kilos. of ater per min. were evaporated at the expense of the mbustible matters of the lyes. Adding to this, 13·69 los. per min., as the weight of the residue of evaporation, 7·75—58·27=99·48 kilos. per min. represents the antity of water to be evaporated in the triple-effect cuum plant. This evaporation, including heating up e feed-lye, was effected by a consumption of 20,613 Cals. r min., supplied in the form of exhaust steam at 106° C., d the plant yielded 136·17 kilos. of hot distilled water r min. having a heat value above atmospheric temrature of 8119 Cals. The recovery of soda was at the te of 90%, equal to 6840 kilos. of calcined ash per 24 urs at a total cost, including all charges, of M. 305 out £15).—J. F. B.

per pulp; Terpene by-products in the manufacture of ——. A. Luttringer. Papierfab., 1914, **12**, Fest-heft, 64—67.

E recovery of oil of turpentine and resin as by-products the manufacture of wood pulp by alkaline digestion is ly profitable with timber rich in resin. When chips wood of the ordinary size employed in pulp manufacture steamed, the recovery of oil of turpentine is far from nplete. In the ordinary digestion process pine wood lds about 5 kilos. of crude oil of turpentine per 1000 os. of wood. When this is obtained by the sulphate cess of digestion it is contaminated with dimethyl phide and has a very unpleasant odour. The methyl phide disappears on exposure to the air but oil of pentine is also lost; purification by distillation or by atment with 50% sulphuric acid does not appear to satisfactory in all cases. Stirring in sunlight with the lition of potassium chloride, also treatment with gaseous rogen oxides have been proposed. Dimethyl sulphide, en oxidised by nitric acid, yields a derivative of high ling point, soluble in water and a solvent of nitrolulose. The non-volatile resinous matter remaining in lyes separates out as an oil at a certain stage in the centration of the lyes; it is a commercial article under name of "liquid resin." The method of extracting resins from the wood by volatile solvents before estion does not appear to be profitable. A summary the various patents for extracting the resin by steam lkaline solvents, with a view to combining the recovery resin products and paper-pulp in one operation, is en. One of the most successful processes, operated France, consists in collecting the volatile oils at an ly stage of the digestion process and then subjecting evaporated waste lye, containing the fixed resin, to tructive distillation in closed retorts. It is necessary, vever, to treat wood exceptionally rich in resin.
—J. F. B.

Paper; The compression and density of raw materials for the manufacture of ——. C. Beadle and H. P. Stevens. Chem. News, 1914, **109**, 302—304.

The compression of fibrous raw materials for shipment is limited by three factors: cost of compression, effect of the compression on the subsequent manipulation of the material and the limit of "deadweight." Deadweight corresponds to a density of 56 lb. per cb. ft.—40 cb. ft. per ton, beyond which there is no object in reducing bulk for sea-transport. A very high compression would be detrimental in the case of esparto, since it would break down the structure, creating difficulties in opening out and cleaning the grass. In the case of cottonseed hull fibre, a high compression would have no ill-effect. Esparto bales bulk at the rate of 120 cb. ft. per ton from ordinary presses and 90 cb. ft. from hydraulic presses. Moist mechanical wood pulp averages 40 cb. ft., equivalent to 80 cb. ft. on the dry weight. The highest compression for air-dry sulphite pulp is 50 cb. ft.; with ordinary pressure 65 cb. ft. per ton. Soda pulp is more bulky, showing 80 cb. ft. for kraft pulp. All the wood pulps show fairly wide variations corresponding to variations in the quality of the fibres. *Hedychium coronarium* ranges from 90 cb. ft. for a continuous light baling press down to 33 cb. ft. for the heaviest hydraulic packing. The best way is to pack by the light continuous press as a preliminary operation and then to compress two bales into one by the heavy hydraulic press. When a bulky material has to be compressed with moderate pressure, a higher dry weight per cb. ft. can be obtained by pressing in the moist state, because the fibres are more yielding than when dry. When heavier pressures are employed, however, the moisture in the material maintains it in a swollen condition and causes it to resist extreme compression. With heavy pressing the densest bales are obtained from air-dry material.—J. F. B.

Paper-testing. Strength, bulk and handle. J. F. Briggs. Papierfab., 1914, **12**, Fest-heft, 25—29.

The term "breaking-length" expresses the conception of "specific strength" or strength-units per unit weight of paper. Applying the same principle to the bursting strain test, which is more usually employed in trade circles in England and America, the author proposes the ratio, bursting strain in lb.: demy weight in lb., as an expression of specific strength of the same order as the German breaking length. Similarly, "bulk" may be regarded as specific thickness, *i.e.*, thickness per unit weight of paper and is proportional to specific volume. It is proposed to record "bulk" in terms of the ratio, thickness of 4 plies in 1/1000 of an inch: demy weight in lb. It is argued that the commercial conception of "handle," originally a purely subjective impression, might be recorded numerically as an additive combination of the two factors specific strength and specific thickness, In judging writing papers and fine printings, a third factor comes in, *viz.*: "smartness" of appearance, which however, must remain subjective. Strength, bulk and "smartness" are the primary factors which determine the quality of fine papers and indicate the quality of the materials and the amount of technical skill employed in the manufacture. To a certain extent these factors are mutually inimical and the values obtained are the result of a compromise. In order to obtain the desired degree of "smartness" with papers of heavy substance it is frequently necessary to sacrifice one or both of the factors which combine to create the impression of "handle."—J. F. B.

Balsam fir as a pulp wood. Board of Trade J., June 11, 1914. [T.R.]

Balsam fir, a tree which was considered of little value a few years ago, is now in demand for pulp wood on account of the expansion of the pulp industry and the consequent rise in the price of spruce. Balsam has also begun to take the place of spruce for rough lumber, laths, etc. The chief objection to the use of large amounts of balsam fir in mechanical pulp is that the "pitch" in the wood injures the belts and cylinder faces upon which the pulp is rolled out: this, however, is probably due to grinding balsam under conditions adapted to spruce. The acids used in the manufacture of chemical pulp dissolve the pitch and any amount of balsam may be used, though it is said that too much balsam in the pulp yields a paper lacking in strength. The balsam fir grows in northern New York and Maine, in many parts of New Hampshire and Vermont, and in the swamps of Northern Michigan, Northern Wisconsin and Minnesota. It readily re-afforests cut-over areas, and quickly attains a size suitable for pulp wood.

Patents.

Antiseptic treatment of woollen cloth. D. Humphreys, Stroud. Eng. Pat. 13,408, June 10, 1913.

The cloth after being well washed is treated with a solution of about 1% of phenol "or other coal tar derivative" at 100° to 120° F. (38°—49° C.), squeezed between heavy rollers, dried at a gentle heat and then sprayed with thymol. —J. B.

Silk; Manufacture of ——. E. Graeger and A. Kemmler, Berlin. Eng. Pat. 2213, Jan. 27, 1914. Under Int. Conv., Jan. 28, 1913.

Raw silk, silk waste and cocoons are prepared for spinning into floss "schappe" by treatment first with a hot (60°—70° C.), feebly alkaline solution (*e.g.*, 0·25—0·5% sodium carbonate or 1% borax solution) and then with a solution of tryptic ferments, such as pancreatic preparations or a solution of papayotin, in presence of ammonium salts (0·5—1% NH_4Cl) and 1—3% of a neutral electrolyte such as sodium chloride.—J. F. B.

Flax and jute waste; Process for converting —— *into soft, curled, woolly fibres.* A. Seidel and J. Geisberger. Ger. Pat. 273,881, Dec. 20, 1912.

Flax or jute waste is digested under pressure for 3—4 hours in a lye consisting of urine, sodium carbonate, Turkey red oil soap, and water.—A. S.

Plastic composition [from cellulose esters] and process for making the same. W. A. Beatty, New York. Eng. Pat. 18,499, June 19, 1913.

A cellulose ester (nitrate or acetate) is incorporated with camphor and a condensation product of a ketone and a phenol (*e.g.*, dihydroxydiphenyldimethylmethane, obtained from acetone and phenol) with or without the use of other solid solvents such as camphor substitutes. (See also Eng. Pat. 18,822 of 1912; this J., 1913, 907.)—J. B.

Acetylcelluloses; Manufacture of —— *insoluble in acetic acid and chloroform.* Knoll und Co. Ger. Pat. 273,706, April 29, 1911.

Acetylcelluloses soluble in acetic acid and chloroform are left in contact with suitable catalysers, under such conditions that hydrolysis by water is avoided, until they become insoluble. Other substances may be added to the acetylcellulose before the treatment. For example, a solution of acetylcellulose in glacial acetic acid is treated with sulphuric acid, sulpho-acetic acid, zinc chloride, or the like, until a solid product, insoluble in chloroform and acetic acid, is produced. Or, solid acetylcellulose, in a suitably subdivided form, may be left in contact with benzene, a little sulpho-acetic acid and a solvent for the latter, such as acetic anhydride or acid. The new acetylcelluloses are soluble in formic acid, hydroxy-acids and their esters (*e.g.*, tartaric acid esters), acid derivatives of hydroxy-acids and their esters (*e.g.*, diacetyltartaric acid esters), acid derivatives of glycerol (acetins and chlorhydrins), nitromethane, and acetylenetetrachloride. They can be used for the preparation of artificial threads, films, celluloid, etc.—A. S.

Cellulose or substances containing cellulose; Preparation of solutions of —— *in concentrated hydrochloric acid, capable of being precipitated by water, alcohol, or saline solutions.* R. Willstätter. Ger. Pat. 273,800, May 25, 1913.

Hydrochloric acid of a higher concentration than 30% is used for dissolving cellulose (see also this J., 1913, 822). The solutions may be used in the production of artificial silk, films, etc.—A. S.

Cellulose: Installation for the manufacture of —— *by the indirect boiling process.* E. Morterud. Ger. Pat. 273,860, Aug. 13, 1913.

A central heating installation is used, from which the requisite quantity of heat for effecting the digestion is supplied to each of a number of digestors in turn.—A. S.

Nitrocellulose solutions; Method of spinning —— *for the production of threads, artificial horsehair, films, or the like.* E. Berl and M. Isler. Ger. Pat. 273,936, June 17, 1913.

Threads, films, or the like of collodion, prepared in the usual way from nitrocellulose containing 20—30% H_2O, are coagulated by aqueous alcohol of 25—50% (by vol.) concentration, at a temperature not exceeding the boiling point of ether.—A. S.

Acidylcelluloses; Manufacture of objects [threads] of ——. Knoll und Co. Ger. Pat. 274,260, July 18, 1912.

Solutions of acidylcellulose are precipitated by con centrated saline solutions. For example, a solution o acetylcellulose in glacial acetic acid is squirted into concentrated solution of sodium acetate.—A. S.

Bleaching ligno-cellulose and pecto-cellulose; Processes fo ——. A. R. de Vains and J. F. T. Peterson, Pari Eng. Pat. 19,099, Aug. 22, 1913. Under Int. Conv. Aug. 28, 1912.

See Fr. Pat. 449,497 of 1912; this J., 1913, 482.—T. F.

Binding and impregnating materials made from was sulphite lye. E. Pollacsek, San Bartolomeo, Ital Eng. Pat. 20,460, Sept. 10, 1913.

See Fr. Pat. 462,429 of 1913; this J., 1914, 248.—T. F.

Cuprammonium solutions; Process of producing —— B. Borzykowski, Charlottenburg, Germany. U.S. Pa 1,100,518, June 16, 1914. Date of appl., Nov. 18, 191

See Eng. Pat. 24,996 of 1912; this J., 1913, 283.—T. F.

Cellulose from raw vegetable materials containing cellul fibres; Manufacture of ——. L. Brech and Tyborowski, Warsaw, Russia. U.S. Pat. 1,100,51 June 16, 1914. Date of appl., April 17, 1911.

See Eng. Pat. 5552 of 1911; this J., 1912, 329.—T. F.

Flexible and waterproof material from paper sheets; Ma facture of ——. G. Magnasco, Genoa, Italy. U.S. P. 1,101,029, June 23, 1914. Date of appl., Aug. 14, 19

See Eng. Pat. 18,836 of 1913; this J., 1914, 640.—T. F.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Sorption [of acids by wool]; Kinetics of ——. G. Georgievics and A. Dietl. Z. physik. Chem., 1914, 669—691.

Acids are taken up more rapidly by wool the more centrated the solution, and the influence of concentrat on the velocity of absorption varies for different acid the same way as the quantity *x* (see this J., 1914, 251) be greatest in the case of the mineral acids where *x* ha large value, and least in the case of the monobasic fa acids. For gases, which are taken up by charcoal a velocity practically independent of pressure, *x* is unity the process is pure diffusion. These data support the Georgievics' theory of sorption (*loc. cit.*) as a combinat of diffusion (solution) and adsorption, the former dominating where *x* is low, the latter when it is h In the same group of acids the coefficients connec ırption with concentration follow the same order as those ›nnecting diffusion with concentration, this arrangement ang particularly marked in the case of the fatty acids. he temperature-coefficient for the sorption velocity of etic and of hydrochloric acids is about 1·5, indicating gain that the process is one in which solution rather than emical action prevails, although the coefficient is stinctly higher than those usually found for rates of ffusion. On diluting an acid solution which is in uilibrium with wool, the new equilibrium point is tained almost instantaneously with acetic, oxalic, drochloric and sulphuric acids. The widely expressed inion that adsorption (or sorption) itself is a very rapid ocess is erroneous. The velocity varies from case to se, and in some instances equilibrium is only attained ter weeks of contact.—W. H. P.

lk ; The weighting of —— with substitutes for tin. E. Stern. Z. angew. Chem., 1914, 27, 357—358.

ıe earths of monazite sand, as well as titanium and conium compounds, have been studied with a view their use in weighting silk, and it is concluded that, ilst these compounds could not be used successfully by emselves as substitutes for tin salt, yet when used in njunction with tin, satisfactory results could be obtained. ıe metallic compounds are not considered to be ideal bstances for weighting ; it is suggested that substances alogous in constitution to silk fibroin would be preferle.—T. F. B.

yestuff and fibre ; Labile compounds of —— and their application in dyeing. M. von Iljinsky. Z. angew. Chem., 1914, 27, 356—357.

ıst dyeings can be produced with certain insoluble estuffs by immersing the fibre in an aqueous suspension the dyestuff. For example, cotton is dyed in a few nutes at the ordinary temperature by immersion in a th of acidified water containing 2% of Indanthrene arlet G. in suspension ; when gum or other colloid is ded to the bath, only feeble dyeings are produced, and ese are not fast to water. The process may be applied the dyeing of artificial silk, and is also valuable for use th dyestuffs which do not readily give level shades. nilar adsorption compounds of dye and fibre, termed abile lakes," are formed when the fibre is immersed in an ueous suspension of a mordant dyestuff in presence of a rdant ; the mordant dyestuff can also be applied in is way to fibres already dyed with vat dyestuffs. illiant Alizarin Red lakes are obtained by this method mercerised goods. The insoluble metallic compounds leuco-vat dyestuffs can be applied in a similar manner. m aqueous suspensions, giving dyeings which are t to soaping and rubbing. The fibre may be introced into a bath containing the unreduced dyestuff, netallic (*e.g.*, magnesium) hydroxide, and hydrosulphite, the leuco compound may be prepared first and the tallic salt may be precipitated and formed into a pension.—T. F. B.

Patents.

eing machine ; Piece ——. H. Cochrane, jun., Paisley. Eng. Pat. 13,689, June 13, 1913.

ᴇ machine is provided with two receivers, one on each e of the dye-box, and is equipped with winches and table driving gear, whereby the cloth is carried from receiver to the dye-box and from the latter to the ıer receiver, and *vice versa*, the operation being continued til the required shade is obtained, somewhat after the nner of the dye-jig.—J. B.

iline Black by oxidation in the air ; Dyeing fabrics and ibres with ——. A. E. Vergé, Vincennes, France. Eng. Pat. 18,246, Aug. 11, 1913. Addition to Eng. Pat. 15,668 of July 7, 1913 (this J., 1914, 418).

ᴇ bath is made up of 45 grms. of aniline, 3 grms. of henylenediamine, 35 grms. of hydrochloric acid of Bé. (sp. gr. 1·152), 5 grms. of 90% formic acid, about 12 grms. of copper salts comprising 0—9 grm. of sulphate and 12—3 grms. of acetate, 1—2 grms. of sodium metabisulphite and water to make up 1 litre. An ungreenable black is said to result by leaving the pieces to oxidise in the air for 12 to 24 hours. If necessary the pieces are "finished" by passing through a solution of aniline oil in water, preferably after chroming. (Reference is directed to Eng. Pat. 16,189 of 1907 ; this J., 1908, 851.) —J. B.

Printing ; Colour ——. N. W. Turkin, Moscow. Eng. Pat. 23,129, March 7, 1913.

Colour printing plates are coated with the preparation described in Eng. Pat. 5737 of 1913 (see page 742), or the blocks may be built up of bars consisting of the said preparation. For printing the plates are moistened with a liquid capable of dissolving the composition.—J. B.

Finishing, filling, loading and dressing textile goods. L. Lilienfeld, Vienna. Eng. Pat. 7317, March 23, 1914. Under Int. Conv., April 8, 1913. Addition to Eng. Pat. 25,215 of 1911, dated Nov. 12, 1910. (See this J., 1912, 813, 383.)

The goods are treated with a viscose solution having a content of alkali hydroxide less than, but at least sixtenths of its content of cellulose or hydrocellulose.—J. B.

Starch ; Process for utilising used —— in laundries. M. Brauer. Ger. Pat. 273,311, Aug. 2, 1913. Addition to Ger. Pat. 262,501.

To avoid the use of large settling vessels as described in the chief patent, the waste water holding starch in suspension is introduced, together with clean water, through pipes disposed side by side, into a rapidly rotating centrifuge. —A. S.

Ice colours [on cotton] ; Process of producing ——. A. Winther, A. L. Laska, A. Zitscher, F. Kunert, and E. Acker, Offenbach-on-Maine. Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. U.S. Pat. 1,099,108, June 2, 1914. Date of appl., Oct. 16, 1913.

See Eng. Pat. 17,279 of 1913 ; this J., 1914, 73.—T. F. B.

Dyeing process. J. A. Dominguez, Buenos Aires. U.S. Pat. 1,099,240, June 9, 1914. Date of appl., April 27, 1912.

See Addition of Dec. 13, 1911, to Fr. Pat. 437,020 of 1911 ; this J., 1912, 637.—T. F. B.

Textile fibres ; Apparatus for treating —— with liquids and gases. J., T., and E. Brandwood, Bury. U.S. Pat. 1,101,248, June 23, 1914. Date of appl., July 31, 1913.

See Eng. Pat. 5280 of 1913 ; this J., 1914, 133.—T. F. B.

Reserve effects on textile-fibre ; Production of ——. E. Bentz, Manchester, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,098,145, May 26, 1914. Date of appl., May 20, 1911.

See Eng. Pat. 16,389 of 1910 ; this J., 1911, 889.—T. F. B.

Cotton yarns and fabrics ; The finishing of ——. L. Hermsdorf and B. Teufer, Chemnitz, Saxony. Eng. Pat. 21,940, Sept. 29, 1913. Under Int. Conv., June 20, 1913.

See Fr. Pat. 463,073 of 1913 ; this J., 1914, 248.—T. F. B.

Coating flexible objects of organic origin with metal. R. Rafn and G. E. Schmidmer, Nuremberg, Germany. U.S. Pat. 1,099,934, June 16, 1914. Date of appl., Oct. 16, 1912.

See Eng. Pat. 23,959 of 1912 ; this J., 1913, 654.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Selenious acid in sulphuric acid ; Detection of minute quantities of ——. E. Schmidt. Arch. Pharm., 1914, **252**, 161—165.

A few mgrms. of codeine phosphate are dissolved in 10 c.c. of the sulphuric acid, when a distinct green coloration appears changing to deep blue-green in about 15 mins. if selenious acid be present. The colour can be observed with 1 part of selenious acid in 1,000,000 parts of sulphuric acid.—F. Shdn.

Nitrogen in Norwegian saltpetre [*calcium nitrate*] *; Determination of* ——. N. Busvold. Chem.-Zeit., 1914, **38**, 799—800.

Lunge's nitrometer method gives results accurate to within about +0·13% N, but it is advisable to use an aqueous solution of phosphoric acid instead of water for the dilution, so as to prevent the precipitation of calcium sulphate and dissolve basic mercury sulphate. For greater accuracy Treadwell and Wegelin's alkaline reduction method (Diss., Zürich, 1907) may be used, the reduction flask being connected with the reflux condenser by means of a long tube inclined upwards at an angle of 120°. In this flask are placed 8 grms. of powdered Devarda's alloy, 5 c.c. of alcohol, 50 c.c. of a solution of the saltpetre (25 grms. in 500 c.c.) 50 c.c. of water, and 50 c.c. of sodium hydroxide solution (sp. gr. 1·3). About 20 mins. after the evolution of hydrogen has stopped, the contents of the flask are distilled to about 50 c.c., the distillate being received in standard acid, and the apparatus finally swept out by a current of air. Parallel results should not differ by more than 0·05% N.—C. A. M.

Ammonia, hydrocyanic acid, and cyanogen ; Catalytic combustion of —— *to nitric oxide.* W. Moldenhauer and O. Wehrheim. Z. angew. Chem., 1914, **27**, 334.

Nitrogen combined with carbon (in cyanogen compounds) can be converted into nitric oxide by catalytic combustion, the carbon being at the same time oxidised to the dioxide. Better yields of nitric oxide are obtained by combustion of cyanogen-nitrogen than from ammonia-nitrogen, whilst in the former case the condition of the catalyst and the time of contact of the cyanogen compound with it are not of so much importance as in the combustion of ammonia. The fact that good yields of nitric oxide can be obtained from cyanogen under conditions in which ammonia would be converted only into free nitrogen, indicates that the sensitiveness of the combustion of ammonia is not so much due to the decomposition of nascent nitric oxide as to the direct formation of free nitrogen.—T. F. B.

Bromides ; Detection of ——, *in presence of thiocyanates and ferrocyanides.* I. Guareschi. Z. anal. Chem., 1914, **53**, 490—495.

The reaction previously described for the detection of bromide (this J., 1913, 942) may also be used in detecting traces of bromide in presence of thiocyanate or ferrocyanide ; in these cases the solid or its very concentrated solution is heated with excess of 50% chromic acid solution to gentle boiling. The test is still effective if both chloride and iodide are also present. Bromine was in this way readily detected in mixtures of 0·5 grm. of silver thiocyanate with 0·001 grm. of silver bromide and 0·5 grm. of silver ferrocyanide with 0·005 grm. of silver bromide. Traces of bromine were also recognised by the same method in Prussian blue and ultramarine. It is suggested that in the case of thiocyanates bromocyanogen is first produced and then decomposed in the following manner :

$$6CNBr+12H_2O=6CO_2+6NH_3+6HBr\ ;$$
$$6HBr+2H_2CrO_4=Cr_2O_3+5H_2O+3Br_2.$$

—J. R.

Borates. The system : $BaO—B_2O_3—H_2O$ at 30° C. U. Sborgi. Atti R. Accad. dei Lincei, Roma, 1914, **23**, I., 530—534, 717—721, 854—857.

By the interaction of barium hydroxide and boric acid in aqueous solution under varying conditions, products were obtained of the composition, $BaO,B_2O_3,4H_2O$; $2BaO,3B_2O_3,6H_2O$; and $BaO,3B_2O_3,7H_2O$ respectively and also one in which the ratio $BaO : B_2O_3$ was between 1 : 3 and 2 : 3. These products, together with baryta and boric acid were used in a study of the conditions of equilibrium of the system, BaO-B_2O_3-H_2O, at 30° C. in the same manner as was described previously (this J., 1913, 230, 655). The experimental results are tabulated and indicate that at 30° C. the only compounds formed are the triborate ($BaO,3B_2O_3,xH_2O$) and the metaborate (BaO,B_2O_3,xH_2O). —A. S.

Lead in bismuth subnitrate ; Detection of ——. G. Guérin. J. Pharm. Chim., 1914, **10**, 22—23.

Certain commercial samples of bismuth subnitrate when tested for lead by the method previously described (this J., 1913, 1107) were partially soluble in boiling 5% ammonium nitrate solution, and the filtrate then gave a yellow precipitate with potassium chromate in the absence of lead. Lead chromate is soluble in sodium hydroxide solution, and is reprecipitated by acetic acid, whereas a mixture of bismuth and lead chromates is partially soluble in the alkali and on adding a slight excess of acetic acid to the filtrate only the lead chromate is immediately re-precipitated.—C. A. M.

Iron and chromium nitrides. W. Moldenhauer and F. Groobe. Z. angew. Chem., 1914, **27**, 334.

Finely divided iron, prepared by reduction of the oxide, combines chemically with small quantities of nitroger on heating in presence of the gas for a short time. Th amount of nitrogen combined between 450° and 850° C is about 0·25%. When the heating is prolonged a temperatures above 600°, the amount combined is mucl smaller. It is suggested that a saturated solid solutio of nitride in iron is formed, and that the dissociation tension of the dissolved nitride increases with the time as is known to be the case with chromium nitride. chromium nitride, Cr_2N, has been obtained, togethe with CrN, by the action of nitrogen on chromium. It i soluble in dilute hydrochloric and sulphuric acids (CrN i only decomposed by concentrated sulphuric acid), and i converted into CrN by heating strongly.—T. F. B.

Tungsten ; Preparation and properties of some derivati of pentavalent ——. A. Fischer. Z. angew. Chem 1914, **27**, 336.

The reduction of tungsten hexachloride in ethyl alc holic solution by means of aluminium, in presence of dehydrating agent, results in the production of a hig yield of the green compound of pentavalent tungste $WCl_2(OC_2H_5)_3$; it is decomposed by water, and possess strong reducing power, *e.g.*, for indigo solution. analogous compound, also with reducing properties, h been prepared by replacing the ethyl alcohol by meth alcohol.—T. F. B.

Explosive substance containing arsenic. W. J. Müll Z. angew. Chem., 1914, **27**, 338.

A black substance which exploded on contact with flame or when rubbed with a hard body, was fou deposited on the iron in a lead-lined wrought-iron ves which had contained strongly arsenious, 35% sulphu acid, the lead having been corroded in places. It c tained iron, lead, and arsenic ; the arsenic content increased to 43% on washing with hydrochloric ac —T. F. B.

Radium emanation ; Reduction of carbon monoxide hydrogen under the influence of ——. O. Scheu Comptes rend., 1914, **158**, 1887—1889.

When purified radium emanation is introduced int mixture of carbon monoxide and hydrogen at the ordin temperaturo reduction takes place slowly with the production of water vapour, mothano and a small proportion of other hydrocarbons.—F. Sodn.

Sulphur chloride ; Examination of ——. F. Frank and E. Marckwald. Gummi-Zeit., 1914, **28**, 1580—1581.

The authors suggest that good samples of sulphur chloride should possess a sp. gr. (15° C.) of 1·680 to 1·690 (pure 1·681). When 105 c.c. are distilled, using a standard flask and condenser (of which minute details are given), 95 c.c. should distil within 4°, the first 5 c.c. being rejected. The sample should contain at least 98·8% S_2Cl_2 calculated on the basis of chlorine content determined by the following new method :—10—15 c.c. of nitric acid (sp. gr. 1·5) (containing sufficient silver nitrate for the reaction) are introduced into a small pressure flask of 100 c.c. capacity, having a stopper ground in and secured by a lever. 0·2 to 0·5 grm. of the sample are weighed in a small weighing bottle which is then dropped into the flask. This is shaken till all the sulphur chloride has disappeared, warmed for 20—30 mins. on the waterbath, cooled and opened. The precipitate and glass are collected by means of water, the precipitate dissolved by ammonia, reprecipitated and weighed in a Gooch crucible. This process gives good results, higher than those obtained by the old method.—H. E. P.

Dicyandiamide ; Technical methods of obtaining —— from calcium cyanamide from the standpoint of chemical kinetics. G. Grube and P. Nitsche. Z. angew Chem., 1914, **27**, 368—378.

The method described in a previous paper (this J., 1914, 75) has been tested kinetically, and compared with the ther technical methods for the preparation of dicyanliamide in which ammonia or solid zinc cyanamide are sed as accelerators in solutions of cyanamide. The inc cyanamide method is shown to be mainly a case f heterogeneous catalysis, the reaction velocity being ractically independent of the rate of stirring. The elocity increases more rapidly than the amount of atalyst added. In the authors' method of polymerising alcium cyanamide solutions the rate of formation of icyandiamido is increased by the presence of calcium hloride. A study of comparative yields shows that the ew method is not inferior to the others as a technical rocess for the manufacture of dicyandiamide.—W. H. P.

itrogen ; Absorption of —— by calcium. R. Brandt. Z. angew. Chem., 1914, **27**, 424.

ALCIUM, in pieces weighing 3 to 5 grms., is completely conerted into Ca_3N_2 on heating to 400°—500° C. in nitrogen. he pieces retain their form. The velocity of the reaction ncreases from 300° to 440° C., then decreases and is ero at about 800° C., the melting point of calcium. bove this temperature, the velocity again rises to a onsiderable value.—A. T. L.

Preparation of anthraquinone, Aniline Black, Indulines, etc.] Magnesium chloride. II. Its effect on the oxidising action of chlorates and nitrates. Hofmann and others. *See* IV.

itchblende discovery in India. Morning Post, July 4, 1914. [T.R.]

EPOSITS of pitchblende have been discovered in a pegatite to the east of Banckhap, in the Gaya district of ihar. At present between 8 and 9 cwt. has been raised. amples have been found to contain 83·39% of U_3O_8, and 0 to 315 mgrms. of hydrated radium bromide per metric n.

otash salts in Spain ; Discovery of ——. Board of Trade J., July 9, 1914. [T.R.]

XTENSIVE deposits of potassium sulphate and carbonate ve been discovered near Cordona (40 miles north-west Barcelona). The deposits are of great thickness and gin about 200 feet below the surface.

Sodium nitrate, borax, and phosphate in Chile. Oil, Paint, and Drug Rep., June 22, 1914. [T.R.]

The production of sodium nitrate in Chile during 1913 was valued at nearly £22,000,000, and of borax at over £400,000. A large, rich deposit of phosphate has been found at the mouth of the Huasco River, about 100 miles north of Valparaiso.

Russian chemical industry in 1913. Board of Trade J., June 11, 1914. [T.R.]

The past two years have been favourable for the chemical industry of Russia. A number of works have had to increase their share capital, and in 1913 four new companies were formed with a total capital of £58,500 ; of this amount £50,000 is the capital of a company for the manufacture of soap and stearine. The production of sulphuric acid has increased particularly, following on an increased importation of pyrites from 104,400 tons in 1911 to 142,400 tons in 1913. The imports of other raw materials used in the chemical trade likewise show an increase. The chemical market has remained firm, and, as the home industry has been unable to supply all the demand, there has been a large increase during the past two years in the imports of chemical and pharmaceutical products.

Ammonium sulphate plant at Fushun, China. Board of Trade J., July 2, 1914. [T.R.]

A Mond gas plant is being installed at the Fushun coal mines in Manchuria, with a view to supplying power for use in generating electricity. This plant has been specially designed for the recovery of sulphate of ammonia, Fushun coal being particularly suitable for this purpose, and it is estimated that 250 tons of coal will be gasified per day, and that there will be a daily yield of about 12 tons of sulphate. The present intention is to sell this sulphate in Japan or California.

Patents.

Persulphuric acid and its salts ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,931, Nov. 1, 1913.

See Ger. Pat. 271,642 of 1913 ; this J., 1914, 484. Alloys of tin with aluminium or of either or both of these metals with magnesium, zinc, cadmium, silicon, copper, manganese, etc., may also be used as electrode material in producing persulphuric acid as well as persulphates.
—T. F. B.

Sodium carbonate crystals ; Process for producing ——. M. Spazier, Los Angeles, Cal., U.S.A. Eng. Pat. 29,827, Dec. 27, 1913.

Soda ash is agitated with cold water (*e.g.*, 180 gallons to 600 lb. of ash), the solution exposed to the air, preferably for 70 hours, and the separated crystals drained. A clear granulated product is obtained.—F. Sodn.

Cyanides ; Process for forming ——. J. E. Bucher, Providence, R.I., U.S.A. Eng. Pat. 11,797, Feb. 24, 1913.

See U.S. Pat. 1,094,976 of 1914 ; this J., 1914, 692. The alkali carbonate may be replaced by an alkali or alkaline earth metal or compound. If the metal is used, it may be brought into the reaction in the form of vapour.
—T. F. B.

Silicic acid ; Manufacture of chemically pure soluble ——. Ges. fur Elektro-Osmose m. b. H., Frankfort on Maine, Germany. Eng. Pat. 9237, April 14, 1914. Under Int. Conv., April 14, 1913.

An alkali silicate solution is subjected to the action of an electric current in the anode compartment of a diaphragm cell, the electrodes being perforated sheets lying close against the diaphragm wall, and the diaphragm itself (*e.g.*, of carborundum and corundum as described in

Fr. Pat. 426,072 of 1911; this J., 1911, 942) of such potential that only the alkali migrates through it. The silicic acid obtained is rendered free from other acids by anodic purification, preferably with a diaphragm of parchment paper; it is permanent when properly stored. —F. SODN.

Nitric acid; Manufacture of ——. C. Casman, Bercham, Belgium. Eng. Pat. 11,296, Sept. 5, 1913.

SEE Fr. Pat. 457,800 of 1913; this J., 1913, 1009.—T. F. B.

Hydrochloric acid and potassium bisulphate from potassium chloride and sulphuric acid; Process for the continuous production of dry ——. T. Meyer, Offenbach, and A. Klages, Magdeburg, Germany. U.S. Pat. 1,099,451, June 9, 1914. Date of appl., Jan. 6, 1913.

SEE Ger. Pat. 261,411 of 1911; this J., 1913, 826.—T.F.B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,823, Oct. 31, 1913.

SEE Fr. Pat. 466,303 of 1913; this J., 1914, 645.—T. F. B.

Nitrate of ammonia; Process for the manufacture of ——. J. M. Herschell, London. From Wülfing, Dahl und Co., Barmen, Germany. Eng. Pat. 26,233, Nov. 15, 1913.

SEE Fr. Pat. 465,683 of 1913; this J., 1914, 644.—T. F. B.

Fluoride of sodium and fluoride of aluminium; Method of producing a double compound of ——, *with a simultaneous gaining of colloidal silicic acid.* A. Humann and E. Teisler, Dohna, Saxony. Eng. Pat. 12,626, May 30, 1913.

SEE Fr. Pat. 458,750 of 1913; this J., 1913, 1067.—T. F. B.

Aluminium acetate compounds; Process for the manufacture of ——. S. Sokal, London. From Kalle und Co., Akt.-Ges., Biebrich-on-Rhine, Germany. Eng. Pat. 15,020, June 30, 1913.

SEE Ger. Pat. 272,516 of 1912; this J., 1914, 568.—T. F. B.

Hydrosulphite of sodium; Process for manufacturing —— *based on the expansion of the liquefied sulphur dioxide.* L. Descamps, Lille, France. Eng. Pat. 19,404, Aug. 27, 1913. Under Int. Conv., Aug. 27, 1912.

SEE Fr. Pat. 459,144 of 1912; this J., 1913, 1155.—T. F. B.

Barytes; Method of separating —— *from ores.* C. J. Greenstreet, Webster Groves, Mo. Reissue No. 13,735, May 26, 1914, of U.S. Pat. 1,069,545, Aug. 5, 1913. Date of appl., Jan. 15, 1914.

SEE this J., 1913, 871.—T. F. B.

Iron from liquids; Process of eliminating ——. H. Haekl and H. Bunzel, Heufeld, Germany. U.S. Pat. 1,100,675, June 16, 1914. Date of appl., May 27, 1913.

SEE Fr. Pat. 459,576 of 1913; this J., 1913, 1156.—T. F. B.

Hydrogen peroxide; Production of stable solutions of —— *containing caustic alkali.* G. W. Johnson, London. From Deutsche Gold- und Silber-Scheide-Anstalt, vorm. Roessler, Frankfort-on-Maine, Germany. Eng. Pat. 13,751, June 13, 1913.

SEE Fr. Pat. 460,959 of 1913; this J., 1914, 76.—T. F. B.

Nitrous oxide; Process for the manufacture of ——. C. Torley, Brussels, and O. Matter, Troisdorf, Germany. U.S. Pat. 1,098,305, May 26, 1914. Date of appl., Oct. 21, 1913.

SEE Eng. Pat. 11,828 of 1913; this J., 1913, 867.—T. F. B.

Nitrogen compounds; Process of making ——. O. Frank and O. Fincke, Berlin. U.S. Pat. 1,101,424, June 23, 1914. Date of appl., Feb. 10, 1912.

SEE Fr. Pat. 439,244 of 1912; this J., 1912, 738.—T. F. B.

Graphites; Treatment of ——. E. N. Lainé, Paris. Eng. Pat. 5798, March 7, 1914.

SEE Fr. Pat. 464,642 of 1913; this J., 1914, 550.—T. F. B.

Hydrogen; Process for the preparation of —— *by autocombustion.* G. F. Jaubert, Paris. U.S. Pat. 1,099,446, June 9, 1914. Date of appl., March 1, 1912.

SEE Fr. Pat. 438,021 of 1911; this J., 1912, 536.—T. F. B.

Metal adsorptions; Method for producing ——. B. Schwerin. Assignor to Ges. f. Elektro-Osmose m. b. H., Frankfort-on-Maine, Germany. U.S. Pat. 1,098,176, May 26, 1914. Date of appl., Jan. 4, 1913.

SEE Ger. Pat. 252,372 of 1912; this J., 1912, 1201.—T.F.B.

VIII.—GLASS; CERAMICS.

PATENTS.

Glass plates; Process for making ——. A. W. Mathys, London. From Bicheroux, Lambotte und Co., Ges. m. b. H., Herzogenrath, Germany. Eng. Pat. 9490, April 16, 1914.

THE chilled or irregular edges formed during flattenin are removed from the plate by a cutting device operatin whilst the plate is being rolled.—F. SODN.

Plate-glass; Apparatus for the manufacture of raw —— M. Bicheroux, Assignor to Bicheroux, Lambotte un Co., Ges. m. b. H., Herzogenrath, Germany. U.S. Pat 1,101,392, June 23, 1914. Date of appl., Jan. 20, 191

SEE Eng. Pat. 9490 of 1914; preceding.—T. F. B.

Fireproof materials from quartz and the like; Method producing ——. W. Boehm, Berlin. U.S. Pa 1,099,113, June 2, 1914. Date of appl., Oct. 30, 1913.

SEE Fr. Pat. 463,147 of 1913; this J., 1914, 354.—T. F.

Enamels; Cloudening agent for producing cloudening effe in white —— *and process of producing the same.* Kreidl, Vienna. U.S. Pat. 1,101,455, June 23, 191 Date of appl., March 28, 1912.

SEE Addition of June 6, 1912, to Fr. Pat. 429,665 of 191 this J., 1912, 1181.—T. F. B.

IX.—BUILDING MATERIALS.

Navaho asphaltum. Rosenthal. *See* IIA.

PATENTS.

Wood or cellulose; Process for colouring, preserving, mak fire-resistant, and increasing the mechanical stren of materials composed chiefly of ——. E. Trutz Ger. Pat. 273,481, Feb. 20, 1913.

THE materials are impregnated or coated with solution esters, ester-acids or salts of ester-acids of di- or trit carbonic acids, with or without admixture of other serving or colouring matters.—A. S.

Impregnating wood; Process of ——. M. Wasserma Ger. Pat. 274,303, June 27, 1913.

THE wood is impregnated with a solution of cupr oxide in ammonia and is then steamed. Solutions higher copper content can be used than when the copp employed in the form of cupric oxide.—A. S.

Mortar; Production of a hydraulic —— *free from efflo cence, by the use of a barium salt.* H. Becher. Ger. 273,877, Oct. 29, 1912.

LIME is mixed with sand and barium fluoride and sla hot.—A. S.

ement and the like from the residues resulting from the burning of and extraction of gas from household and street refuse, sewage sludge, and the like ; Process for making ——. J. Elsner, Berlin-Friedenau, Germany. Eng. Pat. 11,876, May 21, 1913.

ee Fr. Pat. 458,551 of 1913 ; this J., 1913, 1158.—T. F. B.

building] *composition and process of manufacturing the same.* A. C. de Caudemberg, Nice, France. Eng. Pat. 27,128, Nov. 25, 1913. Under Int. Conv., Dec. 6, 1912.

e Fr. Pat. 451,648 of 1912 ; this J., 1913, 605. —T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

tinum ; Assay of crude ——. M. Schwitter. Eng. and Min. J., 1914, **97**, 1249—1250.

ENTY-FIVE grms. of the nuggets are digested with 200 c.c. *aqua regia* ($1HNO_3 : 3HCl$) on a water bath for one hour, l then boiled gently for 2 hours. The solution is anted and again boiled to dissolve any finely divided tal in suspension. The *aqua regia* treatment is repeated the residue, and the mixture is diluted with water and wed to settle overnight. The clear solutions are anted, and the last portion filtered, into a graduated 0 c.c. flask, the filter being washed till colourless. *miridium.*—The residue from the acid treatment is scori- l with 10—15 grms. of test lead and enough litharge fill the scorifier. The button is cleaned with as little nmering as possible and dissolved in nitric acid (1 : 3). solution containing lead is filtered, the filter washed from lead, and dried. The osmiridium is separated as pletely as possible from the paper, the latter is burned the ash added to the metal, which is weighed. *tinum.*—25 c.c. of the filtrate are evaporated to dryness, residue heated for 1 hour, with occasional stirring, h 5 c.c. of hydrochloric acid (1 : 9), 20 c.c. of water, and ms. of ammonium chloride, allowed to stand overnight, chloroplatinate filtered off, washed with 20% nonium chloride and ignited, very gently at first, in nnealing cup. The metal contains most of the iridium ; quantity of the latter, if not more than 5%, can be ged with sufficient accuracy from the colour of the roplatinate, 0·2% Ir sufficing to impart a decided red . *Gold.*—The filtrate from the platinum determination eated with 5 grms. of ferrous sulphate, the gold filtered and ignited in an annealing cup. *Palladium.*—The ate is treated with one-fifth of its volume of hydrochloric . and precipitated with 10% potassium iodide solution, ops at a time, till no further black precipitate (PdI_2) s. The liquor is boiled, cooled, and filtered, the ipitate washed with dilute hydrochloric acid (1 : 4) l free from iron, ignited in porcelain in a muffle, then med with a few drops of formic acid to reduce any e, dried, and weighed. *Rhodium.*—The filtrate from palladium is reduced, while hot, with zinc, and the llic precipitate digested for 10 mins. with 25 c.c. of e nitric acid (1 : 3) on a water-bath ; the residue is ed, reduced in hydrogen, and weighed as rhodium ; ntains the last traces of iridium.—W. R. S.

dium, palladium alloys, and hydrogen. A. Sieverts. Z. angew. Chem., 1914, **27**, 337—338.

isotherms and isobars of hydrogen absorption by dium of various forms are similar, but the quantitative ts vary greatly with the nature of the palladium. absorption at atmospheric pressure increases with erature between 100° and 140° C., then decreases ually, and between 700° and the m. pt. (1550° C.) s very little At 1550° the absorptive power of the en metal is lower than that of the solid. At low ures the hydrogen absorption varies with the square of the pressure. The dissociation constant of the lved hydrogen is a maximum at 137° C. and varies between 300° and 800° C. The velocity of absorption of hydrogen by palladium wire increases rapidly with temperature ; above 300° absorption is instantaneous, and at low temperatures it can fall to zero. The absorptive power of commercial palladium wire is in all cases 10 to 20% lower than that of the pure wire ; this is probably due to the presence of platinum and ruthenium, since it is found that palladium-platinum alloys absorb less hydrogen at lower temperatures and higher contents of platinum. On the other hand, silver and gold (which do not dissolve hydrogen) increase the absorptive power of palladium for hydrogen, with increasing amounts of metal, to a maximum ; further addition of silver or gold reduces the absorptive power : in this case, the hydrogen absorption rises with decreasing temperature.—T. F. B.

[*Gold and silver.*] *Precipitation from cyanide solutions.* H. A. Megraw. Eng. and Min. J., 1914, **97**, 1232—1238.

The solution to be precipitated should be quite clear. Four precipitating agents are in use ; the electric current. charcoal, aluminium, and zinc. *Electrolysis* was employed in South Africa for several years. Iron anodes and lead cathodes were used, the deposited metal being stripped off the latter from time to time. By using relatively high current density the metal is precipitated as a sludge or slime which can be wiped from the cathode. Electrolysis regenerates an appreciable amount of cyanide, but the precipitate is hard to melt and contains all the metals taken up by the cyanide liquor. The use of *charcoal* is restricted. That made from soft wood is most efficient ; 100 lb. of charcoal, twice re-burned, will carry 30—40 ozs. of metal, and the ash is easily melted into bullion. The action of charcoal is probably due to occluded gases (this J., 1913, 1014). *Aluminium* has been introduced recently in several mills (this J., 1913, 660). It does not combine with the cyanide as does zinc, and thus regenerates a certain quantity of the salt. *Zinc* is the most generally used precipitant, either in the form of shavings, or better, of dust (this J., 1914, 263). A slight excess of cyanide must be present to prevent precipitation of zinc hydroxide. In cyaniding old amalgamation tailings, mercury is dissolved to a large extent and almost entirely precipitated by zinc ; it may be recovered by retorting the precipitate. Zinc-shavings are usually screened in recovering the values, so as to remove the coarser metal which is returned to the precipitation boxes. The finer portion (60- to 80-mesh) is generally treated with acid, the residue constituting high-grade material which is added to the undersize from the finer screens. Zinc-dust precipitate only requires filter-pressing before melting down (this J., 1914, 423).—W. R. S.

Copper ; Oxidation and reduction of ——. J. Joannis. Comptes rend., 1914, **158**, 1801—1804.

The velocity of reduction of copper oxide by hydrogen is practically constant over a considerable range of pressure ; that of the oxidation of copper by oxygen diminishes rapidly from the beginning of the reaction. The diminution is not caused by the fall in pressure but by the layer of solid oxide which interferes with further reaction.—W. H. P.

Metals ; Colouring ——. *IV. Colouring copper grey-black with permanganate solution.* E. Groschuff. Deutsche Mechan.-Zeit., 1913, 233—239. Chem. Zentr., 1914, **1**, 2123—2124. (See also this J., 1910, 1312 ; 1913, 538.)

Copper and heavily copper-plated articles can be coloured grey-black by treatment for 10—15 mins. at 100° C. in a solution of 12 grms. $CuSO_4.5H_2O$ and 1·5 grms. $KMnO_4$ in 100 c.c. H_2O. Passive copper and copper which has been treated with boiling sodium hydroxide solution cannot be coloured in this way. Red brass castings and tombac may be coloured in a somewhat similar way. Brass is coloured grey-black but the coating does not adhere well. Zinc becomes covered with a firmly adherent shiny black coating. Tin, aluminium, lead, and tin- and aluminium-bronzes are not coloured satisfactorily.—A. S.

Copper and copper alloys; Colouring —— brown by copper sulphate solutions. E. Groschuff. Das Metall, 1914, 37—38. Chem. Zentr., 1914, 1, 2124.

Metallic copper when treated with a boiling solution of 12 grms. $CuSO_4,5H_2O$ in 100 c.c. H_2O, becomes covered with a dull violet grey coating consisting of a layer of brown cuprous oxide and a superimposed deposit of a greenish basic copper salt. This greenish deposit may be masked by coating with Japan lac, greasing with vaseline, wax, etc., and a fine reddish brown to chocolate brown colour is thus obtained. The copper surface must be free from traces of fat or oxide. The colour may be modified by varying the duration of immersion in the solution and by suitable after-treatment (see also preceding abstract). A thicker, more yellowish brown colour, without any dull bluish tinge, is obtained if potassium or sodium chlorate be added to the solution. Copper alloys, such as tombac, red brass, brass, and aluminium-bronze, may be coloured in a similar manner. A dull copper-red to reddish brown colour is obtained on tin-bronze. Soft solder is not coloured and does not interfere with the colouring of copper soldered therewith.—A. S.

Reduction by hydrogen of copper and nickel oxides in presence of a dehydrating agent. E. Berger. Comptes rend., 1914, **158**, 1798—1801.

The reduction of copper and nickel oxides is greatly accelerated when a dehydrating agent (anhydrous baryta) is present to absorb the water as it is produced. The velocity curve for copper oxide at 100° C. shows first an irregular delay before the reaction begins and then a steady reduction to the metal without any sign of an intermediate stage. The curves for nickel oxide at 182° C. and 209° C. both indicate the existence of Ni_2O.—W. H. P.

Copper and nickel; Hardness and modulus of elasticity of isomorphous mixtures of ——. N. Kurnakow and J. Rapke. J. Russ. Phys.-Chem. Ges., 1914, **46**, 380—394. Z. anorg. Chem., 1914, **87**, 269—282.

The hardness of Cu-Ni-alloys, a continuous series of solid solutions, was determined by the Brinell method, using a ball of 9·52 mm. diam. and a load of 485 kilos. The modulus of elasticity was determined by Lermantow's method (Chowlson, Lehrbuch der Physik, I., 703). The results were as follows :—

Ni, %	0	10	20	30	39·7	45·6	59·0	72·0	80	89·4	1
Hardness, kilos. per sq. mm.	32·4	43·8	54·1	66·1	72·1	81·3	77·3	65·2	74·8	62·3	6
Modulus of elasticity, kilos. per sq. mm.	11,110	11,948	12,590	13,492	14,569	14,855	16,710	17,150	18,849	18,182	20,

It may be deduced from the relaxation theory of Clerk-Maxwell that the hardness of a solid is proportional to the product of the modulus of elasticity and the time of relaxation (time required for equalisation of internal strains), and hence that an increase of hardness may be due to an increase of the modulus of elasticity, or of the time of relaxation, or of both. In the case of Cu-Ni-alloys the increased hardness must be due to increase in the time of relaxation, for the modulus of elasticity can be calculated from the values for the component metals, whereas the curve representing the hardness passes through a maximum. In the case of brass, bronze, steel and other copper and iron alloys also, increased hardness is due to increase in the time of relaxation. Hardened steel, for instance, has a lower modulus of elasticity than soft iron. A substance is more brittle the greater its time of relaxation. It is suggested that manganese-nickel- and other special steels may belong to the class of alloys in which increased hardness is due to increase in the modulus of elasticity. Alloys belonging to this class are of great practical importance because increased hardness is not accompanied by any considerable increase of brittleness.

In the preparation of the copper-nickel alloys it was found necessary to add a quantity of manganese equal to 1·6—1·8% of the weight of the nickel in order to obtain alloys in which no cracks were developed on rolling.—A. S.

Brass foundries; Application of producer gas to ——. E. Bulmahn. Trans. Amer. Inst. Metals, 1914, 7, 288—31

The use of producer gas for melting brass, for drying core and for power purposes in the brass foundry is advocate It is essential that the gas be free from tar. At t Langsenkamp-Wheeler Brass Works, Indiania, installation of four Westinghouse double-zone sucti producers, each having a capacity of 500 lb. of coal per ho has been in operation for 4 years with satisfactory resul In the double-zone producer, the raw fuel (bitumino coal) is carbonised in the upper section and the residu incandescent coke converted into gas in the lower secti The gas is drawn off between the two sections and serv to generate steam in a vaporiser arranged around the t of the lower section: it is free from tar and is ready use after passing through a wet coke scrubber and a d scrubber. The gas has a calorific value 110—115 B.Th.U. per cb. ft. and in order to obt the required temperature in the furnace (vi 2500°—2600° F., 1370°—1430° C.), both the gas a air are preheated by the waste gases from the furna Curves are given showing the relative cost of produ gas compared with ordinary lighting gas and with fuel. In melting red brass with producer gas the loss metal was reduced to 0·75—1%.—A. S.

Alloys; Electrolytic separation of —— and their meta graphic and mechanical investigation. III. Attempts produce zirconium-, aluminium-, antimony- and chromi bronzes. R. Kremann, J. Lorber, and R. Ma Monatsh. Chem., 1914, **35**, 581—601.

Attempts to deposit zirconium electrolytically eit alone or alloyed with mercury or copper were unsuccess From a bath containing zirconium oxychloride (with of iron as impurity) and copper sulphate an alloy obtained which left a residue insoluble in nitric acid. this proved to be iron in a very resistant (passive) condit Similar results were obtained with aluminium, the deposi copper containing a rather large percentage of cupr oxide as well as a trace of iron. When purified alumini sulphate was used no iron separated. Antimony-bro were obtained from baths containing tartar emetic. T differed considerably in character from the correspon tin-bronzes, showing a much smaller tendency to f solid solutions. The photomicrographs showed q distinctly the existence of two constituents. M containing 2·22% Cr and 2·2% O was obtained fro bath containing copper and chromium salts; possibly chromium was present as hydroxide.—W. H. P.

Zinc blende and lead sulphide; Rate of solution of — in dilute sulphuric acid. F. Rosenkränzer. Z. an Chem., 1914, **87**, 319—334.

Weighed quantities, usually 10 grms., of powd mineral, in grades composed of particles of 1·13, 0·90 0·75 mm. diam. respectively were agitated at cons temperature in a stoppered bottle containing a kn volume of dilute sulphuric acid (1·25, 0·125 or 0·0125%) practically no air. The small amount of hydr sulphide formed was measured at suitable intervals by methylene blue colorimetric method (this J., 1914, The amounts obtained were seldom more than a mgrms., but the results showed clearly that the amou hydrogen sulphide formed depended upon the tim reaction, the concentration of the acid, the area of particles of mineral, and the actual quantity of mi present, and was independent of the amount of agita Four different types of blende and one of galena were and although each mineral had its own rate of sol the temperature coefficient of the reaction was the sam

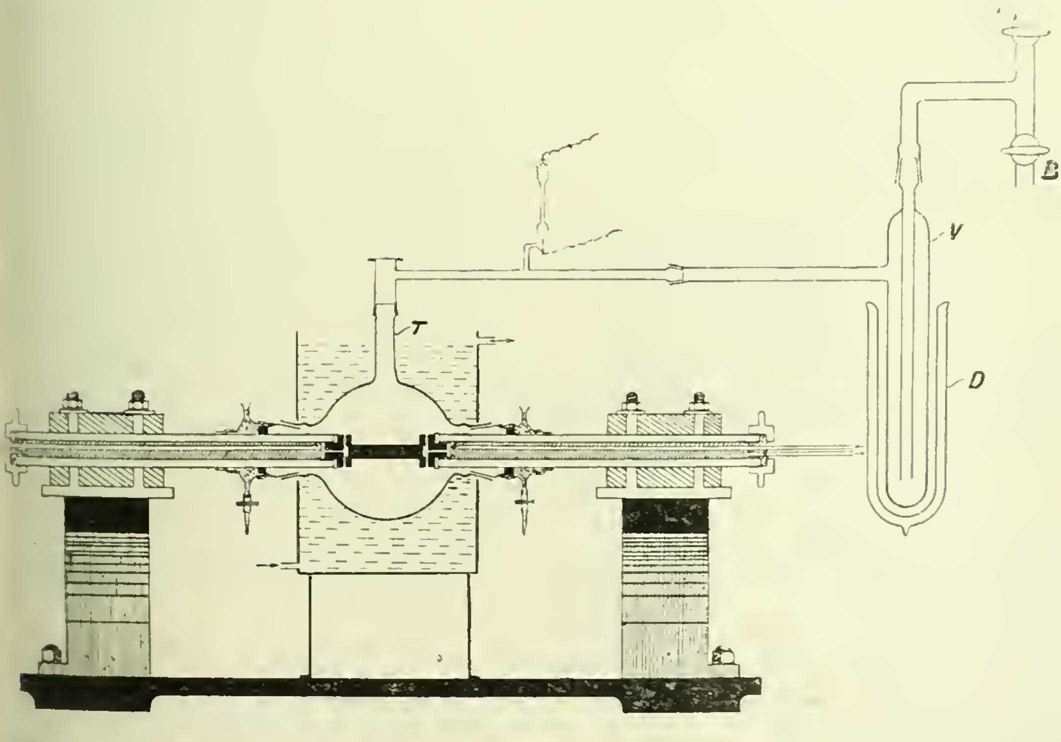
. In heterogeneous reactions the determining factor is ally diffusion, the velocity being primarily determined the diffusion coefficient of the soluble reagent. In the sent case, however, the diffusion appears to be much re rapid than the preliminary reaction at the surface ich therefore determines the velocity of the whole cess.—W. H. P.

tals: Velocity of solution of —— in acids. I. Zinc. M. Centnerszwer and J. Sachs. Z. physik. Chem., 1914, 87, 692—762.

so which has been previously corroded so as to expose its ucture dissolves in acids more readily than the polished tal and hence the rate of solution of polished zinc reases steadily from the time of immersion up to a ximum. If a piece of metal which has been treated h 2N hydrochloric acid until this maximum is reached, hen immersed in fresh acid the velocity falls steadily, process of solution following the law of Boguski . the velocity of reaction is proportional to the face exposed and also to the concentration of the d). Sulphuric acid dissolves zinc more slowly than drochloric acid when the solutions compared have the ne hydrogen-ion concentration, suggestive of a specific ion of the anion of the acid upon the metal. Zinc tes prepared from the same casting dissolve with erent velocities owing to differences in crystal habit. the zinc is rubbed with emery paper before immersion the acid its rate of solution is much greater than when s polished with sand or filed. Treatment with emery o eliminates the "induction period" and the maximum ocity is attained at once. The finer the grain of the ery the more active the plate becomes. Another thod of "activating" the metal is to treat it with ine solution. The "black precipitate" which is med on the surface of metallic zinc during its solution acid accelerates the process of solution; when it is noved the velocity diminishes considerably. When c which has been made active is allowed to stand in the it loses some of its activity; in distilled water the ivity is retained for a long time. Metal which has once n active and allowed to become passive is more difficult to make active again than fresh metal. Rapidly cooled zinc has a longer "period of induction" than the slowly cooled metal, but after etching its surface it dissolves with the same velocity. The period of induction of slowly cooled metal is increased by heating at 400° C. for some time. The authors explain the phenomena observed on the assumption that ordinary chemically pure zinc is in the passive state and that the increase in the rate of solution is caused by activation of the metal. They also elaborate a general theory of passivity, based on the conception of the Helmholtz double layer, and including explanations of the influence of foreign metals and of mechanical and chemical treatment of the surface on solubility, the period of induction, the periodic fluctuations which often occur in the rate of solution, the passivifying of metals by oxidising agents and by polarisation, the corrosion of iron and other metals, the activation of metals by hydrogen, the specific influence of different electrolytes, and overvoltage.—W. H. P.

High temperatures; Special methods for the production of —— and the behaviour of certain metals, oxides and carbides. E. Tiede and E. Birnbräuer. Z. anorg. Chem., 1914, 87, 129—168.

The furnaces used in the work were the cathode ray furnace previously described and illustrated (this J., 1913, 796) and a modification of the Fischer and Tiede furnace (this J., 1911, 963) as illustrated in the figure. The heating element was a carbon boat held between the copper electrodes. Tungsten was so reactive at high temperatures that it could not often be used. The apparatus was first exhausted as far as possible by a Gaede oil pump connected with A and then a high vacuum was produced by a Gaede mercury pump connected with B. The very high vacuum was maintained by the use of rubber rings between the glass and the metal which are cooled by means of mercury (represented by dots in the figure). The temperatures were usually measured by means of the Holborn-Kurlbaum optical pyrometer, and are therefore only approximate above 2000° C. The results obtained with the various metals, oxides, etc., investigated are summarised in the



following tables. The point at which evaporation commenced was determined by the appearance of a sublimate on the glass bulb.

Oxide.	Temperature of volatilisation.	Melting point.	Colour of melt and sublimate.	Furnace used.	Remarks.
BeO	—	about 2400°	white like porcelain	Cathode ray	Evaporated just before melting.
MgO	about 2000°	did not melt	—	Both furnaces	Dissociated into its elements.
CaO	1690°	do.	—	Cathode ray	———
Al_2O_3	1750°	1890°	colourless, glassy	do.	Tendency for melt to crystallise.
La_2O_3	2000°	about 2000°	clear yellow melt	do.	Dissociated forming lower oxide.
ZrO_2	—	2430°	white opaque melt	do.	Evaporated just before melting and dissociated into its elements.
SnO_2	—	did not melt	—	do.	Dissociated forming lower oxide.
SnO	red heat	do.	black sublimate	do.	———
CeO_2	1875°	do.	transparent sublimate in crucible	do.	———
ThO_2	about 2000°	2000°	white opaque sublimate	do.	———
V_2O_5	did not evaporate	did not melt	—	do.	Dissociated probably to VO_2.
V_2O_3	red heat	do.	blue-black sublimate	do.	———
Ta_2O_5	did not evaporate	do.	—	do.	———
MnO	—	1650°	black	do.	Melt crystallised.

Charge of furnace.	Temperature at which volatilisation commenced.	Melting point.	Temperature of visible ebullition.	Furnace used.	Remarks.
Copper	960°	1085°	2000°	Resistance	In a carbon boat.
Silver	850°	968°	1950°	do.	do.
Gold	970°	1060°	2100°	do.	do.
Boron	—	2200°	—	Cathode ray	Impurities distilled out of the elemen before melting point determined.
Silicon	1350°	1350°	—	do.	
Tin	880°	—	—	Resistance	In carbon boat.
Tantalum	2200°	2475°	—	do.	Metal itself used as heating element.
Chromium	—	1420°		Cathode ray	Purified like B and Si.
Tungsten	2390°	—		Resistance	Metal itself used as heating element
Manganese	—	1290°	—	do	In a magnesia boat placed inside t carbon one.

In resistance furnace.

Oxide	Temperature of reduction by carbon.	Remarks.
BeO	2400°	Carbide volatilised.
MgO	—	Oxide dissociated into elements, the metal being highly pyrophoric.
CaO	1540°	Carbide dissociated at 800°.
Al_2O_3	1800°	Carbide volatilised.
B_2O_3	2400°	Carbide sublimed in metallic fibres.
MnO	1100°	Carbide dissociated at 1550°.
UO_2	1600°	Carbide volatilised.

N.B.—Of the resulting carbides, that of calcium dissociated at 800° C. in either furnace; SiC volatilised at 1650° C. in the resistance furnace, being dissociated into its elements; UC_2 melted at 2200° in the resistance furnace, and at 2260° C. in the cathode ray furnace, yielding a white, metallic, pyrophoric melt.

—W. H. P.

Cerium-iron alloys; Analysis of pyrophoric ——. H. Arnold. Z. anal. Chem., 1914, **53**, 496—503.

The alloy (0·5 to 1 grm.) is covered with water and dissolved in bromohydrochloric acid. If antimony is present potassium chloride (0·5 grm.) must be added before eliminating the silica and the temperature during this process must be carefully regulated. After eliminating the silica tartaric acid (3 to 5 grms.) is added and the solution poured into concentrated ammonia (50 c.c.). Ammonium sulphide solution (15 to 30 c.c.) is gradually added at about 60° C., with vigorous stirring. The precipitate of sulphides of iron, copper and zinc (aluminium remains in solution) is kept on the water-bath for about 2 hours with stirring, then filtered off and washed five or six times with warm water containing a little ammonia, ammonium sulphide and ammonium tartrate, with exclusion of air. (In presence of manganese a somewhat modified treatment is necessary at this stage, the iron is removed by extraction with ether from hydrochloric acid solution as described in this J., 1892, 940, and the oth metals are separated by known methods.) The ignit precipitate (treatment with nitric acid is necessary wh zinc is present) is dissolved in hydrochloric acid; the copp is precipitated and determined in 4% acid solution wi hydrogen sulphide and the iron with ammonia. If, ho ever, iron only is to be determined the sulphide precipita is dissolved forthwith in hydrochloric acid with t addition of a little potassium chlorate, and a volumet method applied. For determining cerium the filtr from the sulphide precipitate is kept on the water-bath two hours, evaporated to small bulk, treated for one h on the sand-bath in a round-bottomed Jena flask wi concentrated hydrochloric acid (10 c.c.) and potassi chlorate (2 grms.) in order to destroy the tartaric ac evaporated to dryness, and the residue heated for half- hour with concentrated hydrochloric acid (10 c.c.) a potassium chlorate (1 grm.). From the dilute acid solut of the residue the cerium is then precipitated in usual way by oxalic acid. The oxalate precipitate m if necessary, be freed from antimony and alumini by successive treatment with hydrogen sulphide a ammonia, the oxalic acid being first destroyed by the act of nitric acid.—J. R.

Tungsten in Bolivia. G. W. Wepfer. Eng. and Min. 1914, **97**, 1251—1252.

There are known at present approximately 90 depo of tungsten ores, the most important of which are situa in the departments of La Paz and Potosi. Exports w estimated at $89,932 (about £18,480) in 1911, and $114, (about £23,600) in 1912. The crushed ore is concentra on tables. Wolfram concentrates containing tin calcined and subjected to magnetic separation. So times silver occurs in the tungsten or tin ores.—W. R

Thermoelectric method for determining the purity of platinum ware. Burgess and Sale. *See* XXIII.

PATENTS.

Alloys; Manufacture of —— especially from metals of widely different melting points. A. Mauser. Ger. Pat. 274,137, Jan. 15, 1913.

THE metal or metals of lower melting point are melted, and those of higher melting point, in the form of powder, are injected under pressure, by a blast or the like, below the surface of the molten metal. In this way lead can be alloyed with up to 30% W, and lead, tin, zinc, and other alloys, not hitherto obtainable, can be prepared.—A. S.

Blast-furnace for the smelting of iron and other ores. T. B. Rogerson, Tollcross, Assignor to The Clyde Furnace Co. ("B"), Ltd., Glasgow. U.S. Pat. 1,099,666, June 9, 1914. Date of appl., Dec. 4, 1912.

SEE Eng. Pat. 10,399 of 1912; this J., 1913, 607.—T. F. B.

Tool-steel; High-speed ——. R. Becker, Crefeld, Germany. U.S. Pats. 1,099,531 and 1,099,532, June 9, 1914. Date of appl., Oct. 7, 1913.

SEE Eng. Pat. 27,838 of 1912; this J., 1913, 430.—T. F. B.

Metals; Decarburising ——. J. E. Bucher, Providence, R.I., U.S.A. Eng. Pat. 4667, Feb. 24, 1913.

SEE Fr. Pat. 459,853 of 1913; this J., 1913, 1159.—T. F. B.

Ore; Process of reducing —— to metal. J. A. McLarty, Toronto. Eng. Pat. 16,277, July 15, 1913.

SEE U.S. Pat. 1,079,788 of 1913; this J., 1914, 31.—T. F. B

Zinc; Process and apparatus for the extraction of metallic —— from its ores. E. F Côte and P. R. Pierron, Lyons, France. Eng. Pat. 17,874, Aug. 5, 1913.

SEE Fr. Pat. 458,149 of 1912; this J., 1913, 1073.—T. F. B.

Zinc and other similar metals; Process of and apparatus for producing ——. H. Specketer, Griesheim on Maine, Germany. U.S. Pat. 1,099,211, June 9, 1914. Date of appl., May 6, 1912.

SEE Eng. Pat. 10,349 of 1912; this J., 1912, 1082.—T. F. B.

Zinc from its ores; Process for the recovery of ——. A. Roitzheim, Düren, Germany. U.S. Pat. 1,100,490, June 16, 1914. Date of appl., Aug. 28, 1911.

SEE Eng. Pat. 19,587 of 1911; this J., 1912, 994.—T. F. B.

Calcining, desulphurising, agglomerating, and sintering ores and like material. F. D. Weeks, Salida, Colo., Assignor to Dwight and Lloyd Sintering Co., New York. Reissue No. 13,758, June 23, 1914, of U.S. Pat. 916,903, March 30, 1909. Date of appl., Aug. 9, 1910.

SEE this J., 1909, 479.—T. F. B.

Ores; Furnace for roasting, smelting, or otherwise treating ——. E. Buchholtz, Harrow, Assignor to Oil-Flame Furnace Co., Ltd., London. U.S. Pat. 1,100,711, June 23, 1914. Date of appl., April 10, 1913.

SEE Eng. Pats. 10,564 and 27,531 of 1912; this J., 1913, 14.—T. F. B.

Antimony and arsenic ores; Method of treating ——. A. Trifonoff and D. Gardner, St. Petersburg. U.S. Pat. 1,097,897, May 26, 1914. Date of appl., May 31, 1911.

SEE Fr. Pat. 429,411 of 1911; this J., 1911, 1220.—T. F. B.

Metal surfaces; Cleaning ——. C. H. Thompson, Stourbridge. U.S. Pat. 1,098,338, May 26, 1914. Date of appl., May 20, 1913.

SEE Fr. Pat. 458,524 of 1913; this J., 1913, 1074.—T. F. B.

Furnace [open-hearth]. F. Siemens, Berlin. U.S. Pat. 1,098,985, June 2, 1914. Date of appl., June 13, 1912.

SEE Eng. Pat. 10,824 of 1912; this J., 1912, 972.—T. F. B.

Ores; Concentration of ——. H. H. Greenway, Melbourne, Assignor to Minerals Separation, Ltd., London. U.S. Pat. 1,099,699, June 9, 1914. Date of appl., June 30, 1911.

SEE Eng. Pat. 18,943 of 1910; this J., 1911, 1219.—T. F. B.

Metals; Method of joining unlike ——. W. D. Coolidge, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,101,062, June 23, 1914. Date of appl., March 20, 1912.

SEE Eng. Pat. 10,338 of 1912; this J., 1913, 755.—T. F. B.

Metallic alloy and process of manufacture thereof. H. O. Ormiston, Rockdale, N.S.W. U.S. Pat. 1,101,089, June 23, 1914. Date of appl., Feb. 11, 1913.

SEE Fr. Pat. 455,617 of 1913; this J., 1913, 981.—T. F. B.

Copper and nickel; Extraction of —— particularly from low-grade ores and products. W. Borchers, Aachen, Germany, and H. Pedersen, Trondhjem, Norway. U.S. Pat. 1,101,115, June 23, 1914. Date of appl., June 5, 1912.

SEE Ger. Pat. 248,802 of 1911; this J., 1912, 933.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Aromatic hydrocarbons and phenols; Electrochemical oxidation of ——. F. Fichter and R. Stocker. Ber., 1914, **47**, 2003—2019.

THE electrolytic oxidation of benzene in sulphuric acid in presence of a platinium anode gave quinone as the main product, the chemical efficiency of the current being 5·3%. Maleic acid was obtained as a by-product. With a lead dioxide anode the chief products were quinone and quinol, and the efficiency was 21·3%. Under the latter conditions, using phenol instead of benzene, it was possible to increase the efficiency to 34·02% by suitably adjusting the conditions; in this case the quinone was completely reduced to quinol by means of sulphur dioxide. By reducing phenol in sulphuric acid with a platinised platinum cathode until the phenol completely disappeared, a yield of 3 grms. of cyclohexanol was obtained from 5 grms. of phenol. From this, by electrolytic oxidation in sodium carbonate solution with an anode of platinum gauze and using three times the theoretically requisite amount of current, 2·5 grms. of cyclohexanone was obtained, in addition to a small quantity of maleic acid. Toluene on electrolytic oxidation yielded toluquinone, toluquinol, phenol, quinol and benzaldehyde. o-Cresol gave toluquinol; *p*-cresol gave phenol and quinol; *p*-xylene gave small amounts of *p*-toluic aldehyde and various other oxidation products; and thymol yielded thymoquinol and other substances. Benzene and phenol thus give rise to identical end-products when oxidised electrolytically, the primary product from benzene being phenol itself. The action of anodic oxygen resembles that of hydrogen peroxide in converting nuclear —H into —OH. The authors compare these results, obtained with direct currents, to those obtained by Drechsel with alternating currents (J. prakt. Chem., 1884, [2] **29**, 229; 1886, **34**, 135; 1888, **38**, 65).—J. R.

Influence of a continuous electric current on the absorption of nutritive substances by plants. Chouchak. *See* XVI.

PATENTS.

Furnace; Electric —— with rotary flame for the treatment of gases and vapours. I. Moscicki, Lemberg, Austria. Eng. Pat. 13,250, June 7, 1913.

SEE Fr. Pat. 458,636 of 1913; this J., 1913, 1076.—T. F. B.

Furnaces; Electric shaft ——. W. N. Crafts, Oberlin, Ohio, U.S.A. Eng. Pat. 18,073, Aug. 8, 1913.

See U.S. Pats. 1,069,923 and 1,070,017 of 1913; this J., 1913, 915.—T. F. B.

Electrolytic cell. C. P. Townsend, Washington, and E. A. Sperry, Cleveland, Assignors to Hooker Electrochemical Co., New York. U.S. Pat. 1,097,826, May 26, 1914. Date of appl., Dec. 5, 1903.

See Fr. Pat. 345,871 of 1904; this J., 1905, 33.—T. F. B.

Electric battery. E. Achenbach, Hamburg, Germany. U.S. Pat. 1,098,606, June 2, 1914. Date of appl., Feb. 6, 1913.

See Eng. Pat. 29,847 of 1912; this J., 1913, 611.—T. F. B.

Manufacture of chemically pure, soluble silicic acid. Eng Pat. 9237. *See* VII.

XII.—FATS; OILS; WAXES.

Coconut oil; Glycerides of ——. A. Bömer. Chem.-Zeit., 1914, **38**, 844.

The composition of coconut oil was determined by distilling the oil in a high vacuum, followed by fractional extraction of the distillate and residue with acetone. The distillate was found to consist, in quantity equal to three-quarters of the original oil, of caprylolauromyristin, m. pt. 13°—15° C. There was also present myristodilaurin, m. pt. 33° C., and a smaller amount of laurodimyristin, m. pt. 37°—38° C. The distillation residue contained, besides the glycerides of oleic acid, which were not further examined, palmitodimyristin m. pt. 45° C. The insoluble portion of the distillation residue melted at 55° C. and was composed of impure stearodipalmitin. No indication was obtained of the presence in the oil of glycerides containing caproic or capric acids.—J. A.

Whale and other marine oils; Constants of ——. J. Lund. Seifensieder-Zeit., 1914, **41**, 414—415, 443—444.

The following results were obtained on examining sixteen different samples of commercial whale oil :—

	Saponif. value.	Iodine value.	Weight of 1 litre at 15° C.	Refractive index at 40° C.
			grms.	
Average	193·1	132·3	923·8	1·4679
Lowest	190·2	108·0	921·8	1·4659
Highest	197·0	161·7	927·3	1·4713

Other oils gave results as under :—

	Free fatty acids.	Saponif. value.	Iodine value (Wijs.)	Weight of litre at 15°C.	Refractive index (40° C.).
Japan fish oil ..	6·30	186·2	—	—	—
Do.	11·50	185·0	112·7	918·4	1·4659
Sea elephant oil	1·70	189·4	124·2	921·5	—
Do.	0·76	190·0	130·9	922·3	—
Do.	0·80	191·4	134·9	923·4	1·4684
Herring oil refined	0·00	184·5	137·4	922·4	—
Do. light ..	2·93	184·0	—	923·3	—
Do. dark ..	14·10	185·0	—	—	—
Seal oil	5·00	190·4	144·0	923·7	—
Cod liver oil ..	0·50	183·0	166·1	927·1	—
Do.	0·50	184·0	167·8	926·8	—
Menhaden oil ..	1·70	191·2	173·5	930·5	—
Do.	6·80	191·0	185·0	931·0	—

—J. A.

Insoluble bromide value of oils; Determination of ——. A. Gemmell. Analyst, 1914, **39**, 297—308.

The amounts of insoluble bromide obtained by the method of Hehner and Mitchell (this J., 1899, 77), and the modifications of Procter (this J., 1906, 798) and Sutcliffe (this J., 1914, 147) were found to vary with the quantities of oil and solvent used. The most concordant results (within 1 or 2%) were obtained by dissolving 2 grms. of the oil in 18 c.c. of ether and 2 c.c. of glacial acetic acid, and slowly adding a cooled mixture of 19 c.c. of ether and 1 c.c. of bromine. The varying quantities of bromine in the precipitates indicated that they consisted of mixtures of tetra- and hexa-bromo-glycerides in different proportions, and that the low percentage of bromine was not caused by the presence of a mixed glyceride. More concordant results were obtained by brominating the fatty acids than by brominating the glycerides, while the precipitates contained about 62·1% Br as compared with the theoretical 63·36% in linolenic hexabromide. The fatty acids from 5 grms. of the oil were dissolved in 100 c.c. of ether, and portions of 20 c.c. were mixed with 2 c.c. of glacial acetic acid, chilled in ice-water, brominated, and allowed to stand, and the insoluble bromides washed thrice in the flasks with 5 c.c. of cooled ether, transferred to weighed papers, dried and weighed. In this way the following results were obtained :—Raw linseed oils (7 samples), 32·60 to 37·65%; boiled linseed oils (6), 25·95 to 33·90%; soya bean oil, 4·10; rape oil, 2·35; walnut oil, 3·00% and tung oil, nil. Marine animal oils also gave concordant results, which were less affected by the solubility factor than in the case of vegetable oils. The percentage of bromine varied from 67 to 68·5% as against 70·96% required for $C_{17}H_{26}O_2Br_8$. Cod liver oil, 35·20; whale oil, 21·70; brown whale oil, 25·80; menhaden oil, 51·70; shark-liver oil, 17·70 and sperm oil 1·70%. No definite relationship could be traced between the iodine values and the percentages of insoluble bromides.—C. A. M.

Fat hardening [hydrogenation]; Osmium dioxide as a catalyser in ——. W. Normann and F. Schick. Arch. Pharm., 1914, **252**, 208—210. (See this J., 1913, 296.)

When unsaturated oils such as cottonseed or linseed oil are heated to 100° C. or over with osmium tetroxide the latter is reduced to the metallic condition, and it is the metal which acts as hydrogen-carrier in the hydrogenation of oils in presence of osmium dioxide.—F. Shdn.

Soya bean and oil trade of Dairen. Board of Trade J., July 9, 1914. [T.R.]

The export of soya beans from Dairen decreased slightly in 1913, owing to the demands of the local mills. These mills, 50 in number, consume about 450,000 tons of beans annually, producing over 50,000 tons of oil. The exports of bean cake amounted to 555,428 tons in 1913, compared with 469,089 tons in 1912: over 80% of this was sent to Japan, for use there or for transshipment to the United States. The exports of bean oil in 1913 increased by about 3000 tons; the export to Japan fell from 10,889 tons in 1912 to 3964 tons, and the export to China increased to 22,487 tons; heavy freight rates and high prices contributed to curtail the exports. An experimental mill has been erected at Dairen, in which the oil is to be extracted by benzine.

Soap making in Japan. Bd. of Trade J., July 9, 1914. [T.R.]

Soap, which prior to the imposition of the new Japanese tariff rates used to be imported to the extent of about £90,000 a year, was responsible last year for only £35,000, of which £19,000 was perfumed. The consumption of soap is increasing fairly rapidly, but the domestic production has advanced in an even greater proportion. A large British company's works are responsible for a big share of this production, but there are also several Japanese works making soap on a small scale. A great part of this is toilet soap, especially "floating" soap. Exports of toilet soap to China in 1913 were valued at £140,000 (compared with £26,000 in the preceding year), to which may be added £25,000 worth of soap sent to Formosa and Corea.

"*Acid clay*" [*oil decoloriser*] *in Japan.* Board of Trade J., July 9, 1914. [T.R.]

Large deposits of "acid clay" have been found in Echigo Province. The material resembles fuller's earth and is used for decolorising and deodorising oils. The price is about £3 per ton f.o.b. Yokohama, and about 1000 tons a month can be produced.

Suitability of hardened [*hydrogenated*] *fats for human food.* Lehmann. *See* XIXa.

Fat extractor. Stokes. *See* XXIII.

Patents.

Metallic catalysers for use in the hydrogenisation of oils and fats. J. G. Byrom, Heaton Chapel. Eng. Pat. 13,382, June 10, 1913.

solution of the salt of a metal (*e.g.* nickel sulphate) is reated with a solution of an alkali silicate, and the recipitate dried, and, if desired, reduced in a current f hydrogen. Catalytic agents thus prepared retain heir activity longer than the usual agents, and may also e used as filtering media after the hydrogenation of the at.—C. A. M.

ats, oils, hydrocarbons, and similar liquids ; Method of dehydrating ——. A. Hering. Ger. Pat. 273,555, Jan. 28, 1913.

he oil or the like is circulated through a heated receptacle y a steam pump. The oil is heated by means of hot ater and the pump is operated by low-pressure steam. —A. S.

earine from oleine ; Apparatus for separating ——. E. Böhm. Ger. Pat. 273,617, Feb. 21, 1913.

he mixture of stearine and oleine is introduced into a lindrical vessel having a conical bottom and provided ith a cooling jacket. Inside the vessel is a screw-agitator, e outer edge of which touches the wall of the vessel, hilst the inner edge does not extend to the central shaft. e stearine separated by cooling sinks in the free space tween the screw blades and the central shaft and is en carried upwards by the slowly rotating screw. An iform mixture of oleine and crystalline stearine is tained which can be readily separated by filtration. —A. S.

ood oil ; Process of preventing —— from coagulating under the influence of heat. A. Beringer, Charlottenburg, Germany. Eng. Pat. 21,725, Sept. 26, 1913. Under Int. Conv., Sept. 26, 1912.

e Ger. Pat. 261,403 of 1912 ; this J., 1913, 834.—T.F.B.

nufacture of lubricants or the like. Eng. Pat. 19,338. *See* IIa.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

llac ; Contributions to the examination of bleached ——. I. Wolff. Chem. Rev. Fett. Ind., 1914, **21**, 159—161. See also this J., 1914, 91.)

e following results were obtained in examining 65 ples of bleached shellac : Acid value 40—65 (two ples 70 and 76) ; saponif. value 200 to 250 (two ples 268 and 275) ; iodine value (Wijs) 4—10. Bleached llac always contains combined chlorine, and the sence of combined chlorine in resin mixtures may be sidered as an indication of the presence of bleached shellac. Free mineral acid may be present and acts injuriously on lacquered metal surfaces. It may be determined by dissolving 1—2 grms. of shellac in neutral alcohol, carefully diluting by shaking with 300—400 c.c. of water, and titrating with standard alkali till yellow if any red colour is produced with aminoazobenzene. A number of samples examined contained no free mineral acid, but some of these samples still discoloured brass ; it was found that if phenolphthalein were added to the liquid in which free mineral acids had been estimated as above and the liquid was then titrated with standard alkali till a red colour was produced, the acid value so obtained did not exceed 30 in the case of those samples suitable for lacquering brass, while unsuitable samples gave acid values more nearly approaching the acid value determined in alcoholic solution in the usual way, viz., 59—62.—R. G. P.

Terpene by-products in the manufacture of paper pulp. Luttringer. *See* V.

Patents.

Paints and printing colours ; Manufacture of ——. N. W. Turkin, Moscow. Eng. Pat. 23,128, March 7, 1913.

The colouring matter produced according to Eng. Pat. 5737 of 1913 (see page 742) is diluted with a carrier made by heating a resin and an animal fat and dissolving the product in naphtha, etc., a low-melting resin being used for the manufacture of artists' colours. For making printing colours animal fats, naphthalene, resins or small quantities of glucose are added to the mixture of dyestuff, Turkey red oil and alkali or alkaline earth metal salt before it is heated. After heating till the mass solidifies on cooling, the product is boiled with a fluid resin mixture made by boiling an animal fat and resin with a solvent, *e.g.* alcohol. —J. B.

White lead ; Method of making ——. A. S. Ramage, Assignor to The Chemical Development Co., Buffalo. U.S. Pat. 1,097,672, May 26, 1914. Date of appl., Sept. 12, 1913.

See Eng. Pat. 17,857 of 1913 ; this J., 1914, 149.—T. F. B.

Enamel lacquer or varnish. J. W. Aylsworth, Assignor to Condensite Co. of America, East Orange, N.J. U.S. Pat. 1,098,608, June 2, 1914. Date of appl., Feb. 11, 1910.

See Eng. Pat. 3497 of 1911 ; this J., 1912, 347.—T. F. B.

Resinous condensation products and process of making the same. W. C. Arsem, Schenectady, Assignor to General Electric Co., New York. U.S. Pats. 1,098,776 and 1,098,777, June 2, 1914. Dates of appl., Sept. 12, 1912, and July 25, 1913.

See Eng. Pat. 24,254 of 1912 ; this J., 1914, 92.—T. F. B.

Rosin solutions : Process of preparing ——. H. Graf, Assignor to G. Sommer, Reval, Russia. U.S. Pat. 1,099,438, June 9, 1914. Date of appl., Nov. 18, 1911.

See Eng. Pat. 20,189 of 1911 ; this J., 1912, 917.—T. F. B.

Manufacture of fast light-proof colouring matters. Eng. Pat. 5737. *See* IV.

New compound [*3.3′-dinitro-4.4′-diaminobenzophenone*] *suitable for use in the manufacture of pigments.* Eng. Pat. 8690. *See* IV.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Vulcanised rubber ; Swelling of ——. F. Kirchhof. Kolloidchem. Beihefte, 1914, 6, 1—22.

The degree of swelling of vulcanised rubber in a given medium (petroleum benzine, benzene, carbon bisulphide, carbon tetrachloride, chloro-derivatives of hydrocarbons) is different from that of raw rubber and depends primarily upon the degree of vulcanisation. The different media exhibit specific "swelling powers" which run parallel with their "solvent powers." The author expresses the quantity of liquid taken up when the swelling is at a maximum (Qu_{max}) as an exponential function of the specific gravity of the swelling medium: $Qu_{max}=K.S^x$, where S is 100 times the specific gravity and x is termed the "specific swelling exponent." The values of x for a number of liquids are: petroleum benzine, 1·206; oil of turpentine, 1·410; benzene, 1·735; carbon bisulphide, 1·754; trichloroethylene, 2·157; tetrachloroethane, 2·060; carbon tetrachloride, 1·784; pentachloroethane, 1·939. The total swelling is the sum of the imbibition (capillary absorption) and solution swelling, the latter being from 10 to 100 times greater than the former and being a function of the chemical character of the swelling medium. When vulcanised rubber is exposed to the vapour of the swelling medium, the only process is that of solution swelling, and a condition of equilibrium between the rubber and the vapour is established, which depends primarily upon the chemical nature of the swelling medium and is independent of the degree of vulcanisation. Swelling is accelerated by rise of temperature and proceeds more rapidly in the case of rubber which has not previously been extracted with acetone. There is a definite relation between the degree of swelling of vulcanised rubber and the vulcanisation coefficient

$$\left(\frac{\%\ \text{combined S in acetone-extracted rubber} \times 100}{\%\ C_{10}H_{16}}\right)$$

and between the latter and the extensibility, whence swelling may be regarded as extension of the rubber by the swelling medium. For example, $Qu.K^{\varepsilon}=k$ (constant), where Qu represents the volume percentage of swelling medium absorbed, K is the vulcanisation coefficient, and ε is an exponent which depends upon the nature of the swelling medium. For maximum swelling (24 hours) the values of k and ε for different media are: benzine, k 1225, ε 0·916; benzene k, 1386, ε 0·645; carbon bisulphide, k 1590, ε 0·71; carbon tetrachloride, k 3490, ε 1·016; and the vulcanisation coefficients calculated by means of the formula given above differ by only about 0·1—0·2 from those determined chemically. This is in agreement with the view that the whole of the sulphur not extracted by acetone is chemically combined. The relation between vulcanisation coefficient (K) and extensibility (D) is shown by the formula: $D.K^{\eta}=k$ (constant), where D represents the extension as a percentage of the original length, and η is an exponent which varies according to the load applied. For different loads the calculated values of k and η are given as:—5 kilos. per sq. cm., $k=285$, $\eta=0{\cdot}590$; 10 kilos. per sq. cm., $k=377$, $\eta=0{\cdot}356$; 20 kilos. per sq. cm., $k=449$, $\eta=0{\cdot}195$; and with the aid of these constants, the vulcanisation coefficient can be calculated from the observed extension. The whole of the experiments were made with samples (vulcanisation coefficients 1·2, 2·0, 3·5, 4·4, and 6·4 respectively) prepared by vulcanising for different lengths of time a mixture of 100 parts of plantation Para rubber and 12·5 parts of sulphur. (See also Caspari, this J., 1913, 1041.)—A. S.

Examination of sulphur chloride. Frank and Marckwald. *See* VII.

Physical constants of isoprene. Harries. *See* XX.

New method of preparing erythrene from derivatives of ethyl ether. Ostromysslenski and Kielbasinski. *See* XX.

PATENTS.

Latex; Treatment of [addition of preservative to] ——. S. C. Davidson, Belfast. Eng. Pats. 13,438, June 10, and 20,183, Sept. 6, 1913, and 764, Jan. 10, 1914. (See also this J., 1913, 98, 799.)

CRESOLS, cresylic acid or the higher tar acids are employed, preferably to creosote or carbolic acid, in the process described in the earlier patent (*loc. cit.*). For example:—Cresylic acid (108) or higher tar acids (120 parts) are dissolved in a solution of sodium hydroxide (40) or potassium hydroxide (56) in water (120 parts). To each 100 parts of "alkalised cresol" 1 part (or more) of liver of sulphur (or other alkali sulphide or polysulphide) dissolved in 15 parts (or proportionately more) of water may be added; and to each 100 parts of alkalised cresol, with or without added sulphide, 5 parts or more of 20—40% formaldehyde may be added. 1—5% of any of the above three mixtures either diluted or undiluted may be stirred into the latex. The latex is allowed to stand for 24 hrs., and after diluting with warm water, if necessary, is coagulated by the addition of 0·25—0·5% sulphuric acid (or other suitable acid). The "alkalised cresol" may be added at the same time as the acid coagulant.—E. W. L.

Rubber latex; Treatment [coagulation] of ——. A. E. Berry and A. Boake, Roberts and Co., Ltd., Stratford, Essex. Eng. Pat. 16,728, July 21, 1913.

IMMEDIATE coagulation of rubber latex is effected, and oxidation, darkening and the development of bacteria inhibited, by the addition of 0·1% of a freshly prepared, 5% aqueous solution of sulphur dioxide.—E. W. L.

Rubber; Process for incorporating albumin with ——. W. Esch. Ger. Pat. 273,482, Nov. 22, 1912.

AN albumin paste prepared with lime, magnesia, or the like, is incorporated with the rubber, and the product is treated with reagents (*e.g.* smoke or tannin solution) capable of rendering insoluble both the albumin and the lime or magnesia.—A. S.

Caoutchouc; Process for improving the properties of synthetic ——. J. Ephraim. Ger. Pat. 273,774, April 1, 1913.

STICKY or impure synthetic caoutchouc is mixed with sulphur (0·5—10%), with or without addition of oxygen- or nitrogen-compounds (*e.g.* sugars, naphthol, naphthylamine, rosin, coal tar, etc.), and heated to 110°—140° C. in absence of air, the heating being discontinued (*e.g.* after ¾—1½ hours) before the characteristic vulcanisation takes place. The physical properties of the caoutchouc are greatly improved, and foreign hydrocarbons can afterwards be easily removed by treatment with steam or by extraction; the treated caoutchouc is not sticky, can be easily dried by heating at 40° C. in a vacuum for 1—4 hours, and is not affected by exposure to the air.—A. S

Vulcanisation of natural or artificial caoutchouc; Proces for promoting the ——. P. A. Newton, London. Fron Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,777, June 2, 1913.

SEE Ger. Pat. 269,512 of 1913; this J., 1914, 365.—T. F. B

Caoutchouc; Treatment of products resembling or relate to ——. J. Y. Johnson, London. From Badisch Anilin und Soda Fabrik, Ludwigshafen on Rhine Germany. Eng. Pat. 12,815, June 2, 1913.

SEE Fr. Pat. 463,437 of 1913; this J., 1914, 365.—T. F. P

Rubber composition and its production. J. W. Aylswort East Orange, Assignor to Halogen Products Co., Wes Orange, N.J. U.S. Pat. 1,098,609, June 2, 191 Date of appl., April 18, 1912.

SEE Eng. Pat. 8757 of 1913; this J., 1914, 94.—T. F. B.

Rubber compounds; Manufacture of ——. L. Coliardo West Bromwich. U.S. Pat. 1,098,882, June 2, 191 Date of appl., Jan. 20, 1913.

SEE Eng. Pat. 1599 of 1912; this J., 1913, 498.—T. F.

Rubber; Process for the manufacture of a substance resembli natural ——. R. Weissgerber and K. Keller, Assigno to Ges. f. Teerverwertung m. b. H., Duisburg-Meideric Germany. U.S. Pat. 1,099,107, June 2, 1914. Da of appl., Aug. 8, 1912.

SEE Ger. Pat. 248,178 of 1911; this J., 1912, 939.—T. F.

XV.—LEATHER; BONE; HORN; GLUE.

Gallic acid; Derivatives of ——. E. Schwenk. J. prakt. Chem., 1914, **90**, 53—60.

Attempts were made to prepare hexahydroxydiphenyldicarboxylic acid, which should yield ellagic acid by elimination of water, by boiling gallic acid and also its methyl ester with ferric chloride in aqueous solution and in glacial acetic acid. The ester gave a 20% yield of ellagic acid, but the gallic acid was unaffected. Methyl gallate on boiling for 3 hours with acetic anhydride gave triacetylmethylgallate crystallising in fine rhombs, m. pt. 120°—122° C. The corresponding ethyl ester also crystallises in well-formed rhombs, m. pt. 123°—125° C. The methyl ester of dibromogallic acid sinters at 155° C., and melts at 160°—161° C., which is considerably higher than previously recorded. On boiling with excess of acetic anhydride, it yields triacetyldibromomethyl gallate, which crystallises in white rhombs, m. pt. 150°—152° C.—T. C.

Leather; Definition of adulterated or loaded ——. *Union of South Africa.* Board of Trade J., July 2, 1914. [T.R.]

The definition of "adulterated or loaded leather" has been revised, and now reads as follows: " 'Adulterated or loaded leather' shall mean leather (other than chrome and other mineral and combination leathers) that contains more than 3% of mineral ash, or more than 2% of glucoses and dextrinoids, or any organic matters, other than pure tannins, fats, oils, wax and stearine, that are essential to the manufacture of leather. Chrome and other mineral and combination leathers shall not, however, have added thereto, or be loaded with, barium, lead or tin compounds, or magnesium sulphate, or sodium sulphate."

Patents.

Leather; Manufacture of ——. Anhydrat-Lederwerke A.-G. Ger. Pat. 273,652, Dec. 15, 1911.

Hides or skins are dehydrated by means of a suitable liquid, *e.g.* alcohol (see Fr. Pat. 427,614 of 1911; this J., 1911, 1129), and then, either directly or after a preliminary tanning process, are treated with a fused mass, consisting of artificial asphaltum (petroleum pitch), paraffin, ceresin, or the like, or mixtures thereof, having a melting point higher than the temperature to which the leather is to be subjected. The dehydrated hide or dried chrome leather may be impregnated with an anhydrous solvent of the asphaltum or the like, or with a solution of a tanning material in an anhydrous solvent which is also a solvent of the asphaltum, before immersion in the latter. Preferably the dehydrated skin or chrome leather is treated in a solution of natural or artificial asphaltum or rosin and then in a fused mixture of petroleum pitch of high-melting point with boiled linseed oil or petroleum pitch of low melting point.—A. S.

Chrome leather; Manufacture of ——. Anhydrat-Lederwerke A.-G. Ger. Pat. 274,418, Aug. 16, 1912. Addition to Ger. Pat. 273,652.

The leather as it comes from the tanning bath, and without being fat-liquored, is dehydrated by immersion in alcohol, acetone, or the like, and can then be further treated as desired, *e.g.* according to the process described in the chief patent (see preceding abstract). The finished leather is specially suitable for the manufacture of protective bands for automobile tyres, which can be fixed to the rubber by the vulcanisation process without being first extracted with a fat-solvent as is necessary in the case of ordinary chrome-leather.—A. S.

Chrome tanning; Process of ——. F. Hirsch. Ger. Pat. 274,549, Oct. 18, 1913. Addition to Ger. Pat. 271,585.

A stoichiometrical mixture of sodium sulphite or bisulphite and an aluminium salt, without addition of acid, is used instead of the aluminium bisulphite specified in the chief patent (this J., 1914, 559) for reducing the chromic acid or its salts.—A. S.

Tanning extracts; Process of making ——. M. Hamel. Grünau, Germany. U.S. Pat. 1,098,318, May 26, 1914. Date of appl., July 13, 1909.

See Fr. Pat. 405,110 of 1909; this J., 1910, 227.—T. F. B.

Leather and the like; Method of subjecting lacquered —— to the light treatment. A. Junghans, Schramberg, Germany. U.S. Pat. 1,099,378, June 9, 1914. Date of appl., Feb. 24, 1912.

See Eng. Pat. 10,971 of 1912; this J., 1912, 691.—T. F. B.

Gelatin; Manufacture of ——. H. Bunzel, Heufeld, Germany. Eng. Pat. 24,135, Oct. 24, 1913. Under Int. Conv., Oct. 28, 1912.

See Fr. Pat. 460,611 of 1913; this J., 1914, 95.—T. F. B.

XVI.—SOILS; FERTILISERS.

Nitrification and denitrification; Influence of organic matter on —— in arable soils. C. Barthel. Meddelande No. 83 från Centralanstalten för försöksväsendet på Jordbruksområdot, Stockholm, 1913. Biedermann's Zentr., 1914, **43**, 372—373.

In the presence of certain easily soluble organic nitrogen compounds (*e.g.* peptones, amides), nitrification does not take place till the organic matter is entirely destroyed. Certain non-nitrogenous substances (*e.g.* dextrose) have also a distinct retarding influence on nitrification even when present only in small quantities, although they assist denitrification. Organic matter which is not readily soluble has no great influence.—W. H. P.

Soil micro-organisms; Action of mineral fertilisers on some ——. C. Lumia. Atti R. Accad. dei Lincei, Roma, 1914, **23**, I., 738—746.

A definite quantity of bakers' yeast was added to tubes containing a nutrient solution in some cases free from potassium and phosphorus compounds and in others containing definite quantities of one or other or both of these. The tubes were inverted over mercury in a thermostat at 28° C. and the volume of carbon dioxide produced was observed. The results are tabulated. In absence of potassium compounds or of phosphate the yeast was practically inactive. In presence of potassium sulphate, mono-, di-, and tri-calcium phosphates had a favourable action nearly identical with that of dipotassium phosphate. Basic slag also gave favourable results. Superphosphate impeded the fermentation owing to its content of free acid, but gave good results in presence of calcium carbonate. Potassium chloride behaved similarly to potassium sulphate, but finely-ground leucite, in presence of tricalcium phosphate was inactive. It is suggested that experiments of the kind described would furnish useful information as to the comparative availability of insoluble constituents of fertilisers and soils.—A. S.

Absorption of nutritive substances by plants; Influence of a continuous electric current on the ——. Chouchak. Comptes rend., 1914, **158**, 1907—1910.

Small plants of wheat were carefully washed, threaded on platinum wires, and placed in a weak solution of certain nutritive salts in such a manner that a small continuous electric current could be passed through the plants and the solution. The absorption of either the cation or the anion of ammonium phosphate or nitrate, and potassium nitrate from solutions containing 1 to 3 mgrms. of the salt per litre was accelerated by a current of 0·5 to 250 micro-ampères.—F. Shdn.

Manures; Duration of action of ——. A. D. Hall. J. Roy. Agric. Soc. Eng., 1913. J. Board Agric., 1914, **21**, 242—243.

The results of long-continued experiments upon the Little Hoos Field, Rothamsted, show that among nitrogenous fertilisers, ammonium compounds and sodium nitrate have no perceptible action after the first year ; Peruvian guano, rape-cake and similar fertilisers containing proteins produce a slight effect after the first year and none after the second ; and fertilisers of the wool, hair, and bone class are slow-acting and non-wasting, their effect persisting for at least four years. In the case of farmyard manure, nitrogenous compounds derived from the consumption of cakes and other concentrated feeding stuffs have no effect after the second year, but compounds derived from straw and the undigested residues of coarse fodders, such as hay, have an appreciable value for at least four years. It is suggested that, especially on rich soils, it would be advantageous to grow a "catch crop" before the winter, so that residues of active nitrogenous fertilisers, otherwise wasted, would be converted into insoluble plant material to be subsequently ploughed into the soil.—A. S.

Lime and magnesia in the nutrition of plants ; Action of ——. E. Haselhoff. Landw. Jahrbb., 1913, **45**, 609—633. Chem. Zentr., 1914, **1**, 2068.

The results of pot experiments, extending over 3 years, with barley, beans, grass and mustard on soils of various kinds, were in agreement with field trials, and showed that Loew's hypothesis that for every kind of plant there is a definite ratio of lime to magnesia necessary to obtain the maximum yield, is not of general application.—A. S.

Phosphate in basic slag ; The Wagner test as a measure of the availability of the ——. H. E. Jones. J. Board Agric., 1914, **21**, 201—206.

The results obtained in the Wagner method of determining the citric-soluble phosphate represent a condition of equilibrium. If the solution be removed and the residue again treated with citric acid, a further quantity of phosphate is dissolved, and by repeating the extractions practically the whole of the phosphate can be dissolved. When basic slag is used as a fertiliser the dissolved phosphate is removed from the sphere of reaction, passing into the plant by osmosis, and solution of the phosphate goes on continuously. Field trials were made with a sample of mineral phosphate and with two slags having widely differing contents of citric-soluble phosphate. The view that the content of citric-soluble phosphate is a better measure of the value of a slag than the content of total phosphate is confirmed, but the results with the mineral phosphate suggest that the amount of phosphate dissolved in two or three successive extractions is a better measure of the availability than the amount dissolved in a single extraction as in the Wagner test. —A. S.

Superphosphate and basic slag ; Influence of the granular condition of —— *on their manurial action.* Miknowski-Pomorski. Z. landw. Versuchswesen in Oesterr., 1913, **16**, 1044. Biedermann's Zentr., 1914, **43**, 401—402.

When superphosphate is made into granules, 2 mm. in diam., by means of plaster of Paris or agar agar, its manurial value is not diminished, and in certain conditions is improved. The depth of its position in the experimental vessel is of more importance than the size of grain. Basic slag has a less pronounced action when the granules are enlarged.—W. H. P.

Barley ; Influence of potassium and phosphoric acid on the quality of brewing ——. L. Schül. Landw. Jahrbb., 1914, **45**, 641—712. Chem. Zentr., 1914, **1**, 2068.

It is concluded from the results of manurial experiments that to obtain barley of good quality, the nitrogen supplied must be at a minimum, and this is attained most surely by using an excess of potash and phosphatic fertilisers and no nitrogenous substances. Maximum yield of crop and highest quality are not compatible. Hence in some cases it is advisable to apply nitrogenous fertilisers to increase the yield. This can be done, up to a certain limit, without notably depreciating the quality.—A. S.

Purchase and use of liver of sulphur. See XIXb.

Patents.

Ammonio-fixing material for stables, privies, and the like ; Manufacture of an ——. J. F. Sacher. Ger. Pat. 272,531, June 26, 1913.

The material is prepared by treating sawdust or other cellulosic substances, with or without addition of ashes, sand, slag, or the like, with bisulphates or waste sulphuric acid, and to prevent any injurious action of the material on the walls, fittings, etc., of the stables, or on the cattle, it is mixed with organic substances insoluble in water, *e.g.*, oils, fats, resins, tar, or the like.—A. S.

Fertiliser rich in nitrogen ; Manufacture of a stable, neutral ——. V. Zelasko. Ger. Pat. 273,111, April 30, 1911.

The waste gases from the manufacture of sulphuric acid, containing about : N 95, O 4, H_2O 0·12, N_2O_5 (oxides of nitrogen) 0·8, and SO_2 0·01%, are led over molten calcium carbide in a rotary kiln, a muffle, or a furnace heated electrically by radiation. The furnace-charge and the gases pass through the furnace in opposite directions, and the free lime in the reaction product serves to dry the gases. The product (crude calcium cyanamide) contains no free lime, this having been converted by the acid constituents of the gases into nitrate and other salts.—A. S.

XVII.—SUGARS ; STARCHES ; GUMS.

Starch ; Changes in phosphorus content in the modification and diastatic hydrolysis of ——. *Studies on vegetable colloids. IV.* M. Samec. Kolloidchem. Beihefte, 1914, **6**, 23—54.

In previous communications evidence was given in favour of the hypothesis that starch is composed, at least in part, of a carbohydrate-phosphoric acid complex, corresponding to the amylopectin of Maquenne and Roux (see this J., 1913, 102, 954). By treatment with potassium hydroxide, the author has now separated starch into two parts, one richer in phosphorus and the other nearly free from that element. 100 grms. of air-dried starch suspended in 1 litre of water were treated with 9 litres of potassium hydroxide solution, the total concentration of alkali in the mixture being $1\cdot25.10^{-1}N$. After 1 hour, the mixture was made slightly acid with dilute sulphuric acid, diluted with 30 litres of water, allowed to stand for 24 hours, the liquid siphoned off, the residual amylopectin washed five times by agitating with water and siphoning off the clear liquid after settling, and then for 3 weeks in a slow current of water under toluene. The mixed wash-liquors were concentrated to 750 c.c. and this solution and also the amylopectin were dialysed for 2 months in presence of toluene, then evaporated to dryness and the residues dried at 105° C. The amylopectin (0·185% P_2O_5) was a transparent mass resembling gum arabic. The other constituent (amyloses) was a white powder (0·007% P_2O_5). 100 grms. of air-dried starch (13% H_2O) yielded 38 grms. of amyloses and 49 grms. of amylopectin. No liberation of phosphoric acid appears to take place in the diastatic hydrolysis of starch. All of the dextrins produced have the properties of electronegative colloids and contain combined phosphoric acid which is liberated on boiling with water.—A. S.

Starch granules : Action of diastase on ——. *I.* J. L. Baker and H. F. E. Hulton. Chem. Soc. Trans., 1914, **105**, 1529—1536.

The products of the action of precipitated malt diastase on granules of barley starch at the ordinary temperature, are found to be much more complex than previously supposed (cp. Brown and Morris, Chem. Soc. Trans., 1890, **57**, 510 ; 1901, **79**, 1085). Thus, conversion products possessing the constants of maltose were found to contain a dextrin of molecular weight exceeding 1500 and with R [cupric reducing power expressed as per cent. of maltose] =11·7 and $[\alpha]_{D\ 3\cdot9}=177\cdot6$; one or more dextrins of molecular weight similar to that of maltose ; maltose, and, after prolonged reaction, a small quantity of dextrose probably derived from the dextrins of low molecular weight (cp. Ling, this J., 1903, 1204). The amount of starch dissolved varies; as much as 80% was converted during a long period of digestion at 30° C.—L. E.

Determination of mannitol. Smit. *See* XXIII.

Patents.

Starch: Process for improving the binding properties of soluble ——. F. Mirow. Ger. Pat. 273,235, April 20, 1913.

Soluble starch is treated with aqueous chloric or bromic acid for a long time at the ordinary temperature or for a shorter time at a higher temperature.—A. S.

Sugar solutions; Process for purifying and decolorising ——. F. Tiemann, Berlin. U.S. Pat. 1,101,156, June 23, 1914. Date of appl., April 15, 1913.

See Ger. Pat. 265,030 of 1912; this J., 1913, 1123.—T. F. B.

Wood or other cellulose material: Conversion of —— *into glucose and other soluble and insoluble carbohydrates.* A. Classen, Aachen, Germany. U.S. Pat. 1,101,061, June 23, 1914. Date of appl., Nov. 11, 1912.

See Fr. Pat. 448,496 of 1912; this J., 1913, 441.—T. F. B.

Manufacture of betaine salts [*from molasses, etc.*]. Eng. Pat. 2923. *See* XX.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Cultivation of pure —— *on the practical scale.* C. Engelhard. Z. ges. Brauw., 1914, **37**, 345—347.

The original Copenhagen apparatus is used, and the method differs from those commonly employed in that hot wort is run direct from the copper, under sterile conditions, into the apparatus without being boiled a second time prior to use; and after discharge of the yeast crop from the fermentation cylinder, the residue of yeast in the cylinder is used for pitching a fresh charge of wort. Since the wort employed for the cultivation is not boiled after it has left the copper, its composition is identical with that of the brewery wort. Two fermentation cylinders are used, so that one can be cleaned and repaired without interruption of the work. The method has been successfully and continuously employed for 8 years in a Swiss brewery.—L. E.

Enzymes of washed zymin and dried yeast (*Lebedeff*). *III. Peroxydase, catalase, invertase, and maltase.* A. Harden and S. S. Zilva. Biochem. J., 1914, **8**, 217—226. (See also this J., 1914, 658.)

Peroxydase. Fresh English brewery yeast gave the peroxydase reaction with *p*-phenylenediamine and hydrogen peroxide. The reaction was not given by yeast which had been dried for 17 hours at 37° C., or by dried Munich yeast (Schroder), but in both cases the dried yeast regained its peroxydase activity on washing. The washings inhibited the peroxydase activity of milk as well as that of yeast. The action of the inhibiting agent, which prevented the reaction in the case of dried yeast, increased in a higher proportion than that of the peroxydase as the amount of yeast was increased. Tyrosinase and oxydase could not be detected in any of the specimens of yeast. *Catalase.* The activity of the catalase of dried Munich yeast was not affected by washing. *Invertase and maltase.* The maltase-activity of zymin and dried Munich yeast was not affected by washing at ordinary temperature, but the invertase-activity was diminished. —A. S.

Micro-organisms (*lactic ferment*); *Lack of hereditary accommodation of* —— *in feebly nutritive media.* C. Richet. Comptes rend., 1914, **158**, 1749—1753.

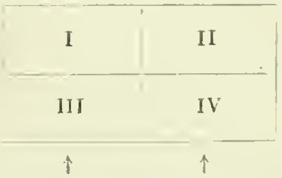
It has been shown previously that by cultivating the lactic ferment in presence of poisons (*e.g.*, thallium salts) a strain can be obtained which although less active than a normal strain in normal milk, is much more active in milk containing thallium. It is now shown that this accommodation does not take place in media deficient in food. When the ferment grows in milk diluted with water containing lactose a weakened strain results which is much less active than the normal form whether the conditions of nutrition are good or bad.—W. H. P.

Wort boiling; Chemistry of pressure ——. E. Moufang. J. Inst. Brew., 1914, **20**, 378—397.

Among the advantages claimed for the boiling of worts under pressure are, saving of about 33% of fuel and 5—10% of hops, better (more complete) "break" of the wort, cleaner fermentations, and as regards the beer, greater brilliance, improved fining capacity, increased stability and head-retaining power, and rounder and fuller flavour. The author studied the effect of superheating on various constituents of wort. Neutral sugar solutions are darkened and this is also true of worts; the effect is much intensified by alkalis but lessened by acids. The fermentability of maltose, lævulose and dextrose is somewhat diminished, whereas that of sucrose and dextrin is increased. The acidity of worts is increased whilst their content of proteins and phosphorus is diminished. Superheating promotes certain qualitative changes in the hop constituents which enhance the bitterness and acidity of the wort.—J. H. L.

Wort and beer; Colorimetric method for the determination of acids in ——. H. Lüers. Z. ges. Brauw., 1914, **37**, 334—337.

The method eliminates the disturbing influence of the colour of malt liquors during their titration with alkali in presence of phenolphthalein. Four similar tall cylindrical glass vessels, each of 50—100 c.c. capacity, are placed together, thus:—



I. contains distilled water, and II. a standard colour solution of some permanent dyestuff, of which the tint corresponds exactly with that of a 1/15-mol. solution of disodium phosphate treated with 5 c.c. of phenolphthalein solution (0·5 grm. of the solid in 500 c.c. of alcohol and 500 c.c. of water) per 50 c.c. III. and IV. contain each 50 c.c. of the liquid to be titrated, mixed respectively with 5 c.c. of the phenolphthalein solution and 5 c.c. of water. The liquid in III. is titrated with alkali (about the same volume being added to IV. also) until the same tint is observed on looking through the right and the left pairs of vessels.—J. H. L.

Beer; Torula producing a pine-apple flavour in ——. E. R. Moritz. J. Inst. Brew., 1914, **20**, 338—342.

Cases of the occurrence of a pine-apple odour on brewery fermentations, followed usually by a similar flavour in the beer, have been observed from time to time. The affection is, as a rule, first perceptible as a "beery" odour which becomes in turn reminiscent of pine-apple or peardrops, honey and finally raw sugar. A non-sporulating yeast, isolated from a sample of refrigerator wort was found to produce similar effects. This "pine-apple torula," cultivated in wort, forms cells 4—12μ by 2—3½ μ. Like many wild yeasts of the brewery, it is a large reproducer but a very small attenuator. The production of odour and of alcohol is practically the same at 65° as at 55° F. (18·3° and 12·8° C.) but reproduction is much greater at the higher temperature. Antiseptics in the proportions usual in brewery practice have little effect; hopping restricts its development somewhat and this is probably the reason why mild ales are more liable to be infected than pale ales. It assimilates dextrose more readily than other sugars and does not invert sucrose. When once the organism has a footing in a brewing little can be done to inhibit its action, and the best remedy is to ascertain and eliminate the sources of infection, which are most frequently stagnant grains in proximity to wort and fermentations, and malt dust and malt-house contamination.—J. H. L.

Wines; Investigations on the white —— of South Africa: an œnological study. H. T. Brown. J. Inst. Brew., 1914, 20, 345—375.

Statistics are given relating to the imports of wines from Cape Colony to the United Kingdom from 1857 to the present time. The value of the annual imports at present is £1000—£2000, representing only about 2% of the value prior to 1860, when the heavy preference given to Colonial as compared with foreign wines was discontinued. The wines formerly imported were mainly highly fortified products of the type of port and sherry. Of the light unfortified wines of to-day the red varieties are much more satisfactory and uniform in quality than the white wines, as the former require less skill in the making, and are much less sensitive to certain diseases. The white wines of the Cape are peculiarly liable to *casse* or turbidity, accompanied or preceded by an increase in the colour of the wine, a more or less pronounced bitter flavour, and a very characteristic earthy odour or *terroir*. The malady, which possesses the general character of *casse ferrique* (see Lagatu, this J., 1897, 751) is not of biological origin, but is conditioned by purely chemical changes. The essential conditions for its appearance are access of oxygen, the presence of iron salts which act as carriers of oxygen, and the presence of certain oxidisable substances of the wine, notably tannic acid. A mere trace of iron, such as may be extracted during filtration through asbestos or decolorisation with animal black, suffices, by alternate oxidation and reduction, to produce a large cumulative effect when the supply of free oxygen is not limited and sufficient time is given. The *casse* itself consists of a colloidal combination of iron with products derived from the limited oxidation of tannin and certain proteins, and it may be distinctly perceptible when amounting to only a few mgrms. per litre. At ordinary temperatures the whole of the oxidised products do not separate from a wine which has undergone *casse*, and a distinct improvement in the flavour and colour of the wine may be effected by chilling for some days at 31°—32° F. (0° C.) and filtering cold. Addition of sulphurous acid (potassium metabisulphite), even within the limits allowed by the Adulteration Act of the Union, 1913 (200 mgrms. per litre for dry wines, and 357 mgrms. for others), has a marked effect in preventing *casse* and in restoring faulty wines to their original state. Citric acid diminishes the tendency of a wine towards *casse*, but tartaric acid has little effect. Addition of tannin to white wines is deprecated, and in order to prevent its presence in more than a trace, it is advisable to effect a rapid separation of the juice from the skins and a judicious cutting off of the "press wine" from the bulk. Fining with isinglass or egg white, or better still, filtration, is preferable to the tannin-gelatin process of fining. Further means of guarding against *casse* are quick fermentation with selected yeasts and well controlled by attemperation, cold storage and maturation of the wine, and the avoidance of residual air in the bottles. Several tests are described by which the tendency of samples of wine to develop *casse* may be compared:—(1) Treatment with "10-vol." hydrogen peroxide at the rate of 10 c.c. per litre; most wines will show enhanced colour or turbidity within 6—7 hours, and faulty samples within a few minutes. (2) Treatment with 0·2 c.c. of a 2% solution of ferrous sulphate per 100 c.c.; a satisfactory sample may show no turbidity for 14 days. (3) Ten c.c. of the wine are treated with 0·5 c.c. of $N/10$ sodium hydroxide solution in such a manner that the latter sinks in the wine and forms a separate layer. At the junction of the two liquids, *i.e.*, at the zone of neutrality, there is a more or less purple ring below which is a zone varying in colour from straw yellow to a very dark sherry colour. The intensity of the colour of these two zones corresponds to the tendency of the wine to undergo *casse*. There appears to be no connection between the presence of oxydases in wine, and the *casse ferrique*. The grape contains, in quantities differing according to the variety, an oxydase (peroxydase) which occurs in the inner cells of the epidermis, and in the vascular bundles underlying the skin and those connecting the pips with the stalk. Freshly expressed grape juice contains no oxydase, but the oxydase reaction (with benzidine and hydrogen peroxide) appears when the juice has been in contact with the skins for a short time. Juice which contains a considerable quantity of oxydase has a tendency to become brown on exposure to air. This is particularly notable with the White French variety of grape which is specially rich in oxydases. The so-called "light" wines of S. Africa are much higher in alcoholic strength than the average European wines of a similar class, owing to the higher gravity and sugar content of the must before fermentation, dilution being forbidden by law. This in itself appears to favour *casse* in the white wines, and certainly detracts from their value as beverages for general table use. The author is convinced that a dilution of the must to about the gravity of the musts of the light European wines would tend to improve the character of the South African wines and that the prohibition of this dilution by law and of the addition of citric acid are directly detrimental to the quality of most of the wine produced there.—J. H. L.

Wine; Determination of lactic acid in —— by W. Möslinger's barium chloride method. W. I. Baragiola and O. Schuppli. Z. Unters. Nahr. Genussm., 1914, 27, 841—881.

The serious errors shown to be inherent in Möslinger's method are, to a great extent, eliminated in the following modified method:—A mixture of 25 c.c. of the wine and 25 c.c. of water is distilled to half its volume and then steam distilled until a total of 200 c.c. of distillate has passed over; the distilling flask is fitted with a special dephlegmating device (see von Babo and E. Mach, Kellerwirtschaft, 1910, 628). The distillation residue is rinsed into a dish with water, treated with 5 c.c. of a 10% solution of barium chloride, and neutralised with a hot saturated solution of barium hydroxide; if the presence of lactic anhydride is suspected, 2—4 c.c. of a cold saturated solution of barium hydroxide are now added, the whole is heated for 10 mins. on the water-bath, and made neutral, with hydrochloric acid, to azolitmin paper. The neutral solution is concentrated to 10—15 c.c., being kept neutral during evaporation; it is then rinsed with a small quantity of hot water into a graduated cylinder, made up to 25 c.c., cooled, and treated, whilst being vigorously shaken, with 95—96% alcohol. The solution is made up to 100 c.c. with 95—96% alcohol, left overnight, and again made up to 100 c.c. with alcohol, and filtered; 75 c.c. of the filtrate are treated with 25 c.c. of a 5% solution of sodium sulphate, shaken, left for about 15 mins., and filtered; 75 c.c. of this second filtrate are evaporated and incinerated in a platinum dish, the alkalinity of the ash then being determined. If the alkalinity corresponds to a c.c. of $N/1$ solution, the wine contains $(a \times 6{\cdot}4)$ grms. of lactic acid per litre. In the case of wines to which known quantities of lactic acid had been added, 84—100% of the added acid was found by the above method, whilst only 57—68% was found by Möslinger's original method.
—L. E.

Influence of potassium and phosphoric acid on the quality of brewing barley. Schül. *See* XVI.

Curative action of autolysed yeast against avian polyneuritis. Cooper. *See* XX.

Determination of mannitol. Smit. *See* XXIII.

Patent.

Sterilisation of water, vinegar, and other liquids by means of bromine. Ger. Pat. 273,959. *See* XIXb.

XIXa.—FOODS.

Hardened [hydrogenated] fats; Suitability of —— for human food. K. B. Lehmann. Chem.-Zeit., 1914, 38, 798—799.

Commercial samples of hydrogenated arachis, sesamé and cottonseed oils contained from 0·07 to 6 mgrms. Ni per kilo. Feeding experiments with these fats were made upon animals and human beings for periods up to six months without any ill effects being felt or observed. —C. A. M.

Rice grains; Disintegration of —— by means of alkali. F. J. Warth and D. B. Darabsett. Agric. Research Inst., Bull. No. 38, 1914, pp. 1—8, with seven photographic plates.

The quality of rice grains, and the differences between various kinds of rice, may be demonstrated, to some extent, by their behaviour when immersed in alkali solution. The degree of attack, as shown by diffusion, disintegration and gelatinisation, is best observed when the grains are placed for 24 hours in potassium hydroxide solutions varying in strength from 1·0 to 1·25%. The tests must be made on the polished grains, and, provided that the outer coat of the grains has been removed, the effect of the alkali is independent of the extent of the polishing and is governed by the quality of the grain and the nature of the starch it contains. The method may also be used for distinguishing quality in paddy, but in the case of wheat grains the action of the alkali does not show the marked differences that it reveals with rices. (See also this J., 1914, 433.)—W. P. S.

Castor seeds; Detection of ——. G. D. Lander and J. J. Geake. Analyst, 1914, **39**, 292—295.

Active ricin is detected by incubating 2 grms. of the material with 40 c.c. of 0·9% salt solution for 1 hour at 37° C., allowing the mixture to stand overnight, and then centrifuging it for an hour at 3800 revolutions per min One c.c. of the clear liquid is made to form a layer ver about 0·1 c.c. of antiricin serum, and in the presence f ricin a zone developing after 12 hours into a precipitate s obtained. As a confirmatory test well-washed blood orpuscles suspended in physiological salt solution are reated with the extract. Agglutination is rapidly hown with the mixture consisting of 10% castor seed nd 90% linseed, but is less pronounced with smaller roportions of castor seed. Proof that ricin is the agglutinting agent is obtained by mixing equal quantities of ormal serum and antiricin serum with equal quantities of he extract from the seeds, and adding to each the same mount of the blood-corpuscle suspension. Inhibition of gglutination in the antiricin mixture indicates the presence f ricin.—C. A. M.

offee; On a new method of removing injurious substances from ——. J. Görbing. Z. öffentl. Chem., 1914, **20**, 202—216, 222—229.

ubstances having an injurious effect on certain ndividuals are produced when coffee berries are roasted, ut may be eliminated by coating the raw berries with ay and removing the coating subsequently from the asted berries. The clay removed from the berries ntains considerable quantities of reducing substances d fat.—W. P. S.

olouring matters; Influence of artificial organic —— on the enzymic hydrolysis of proteins. H. Damianovich and L. Guglialmelli. Rev. Gén. Mat. Col., 1914, **18**, 161—165.

ntinuing previous work (this J., 1911, 644) on the fluence of dyestuffs on the digestion of albumin by psin in an acid medium, the effect of varying concentrations of the dyestuffs was studied. Acid dyestuffs d a powerful inhibitive action even at great dilution, e effect of picric acid, for instance, being perceptible at a ncentration of only 0·0001%. The action increased th the concentration of the dyestuff and was always companied by a staining of the albumin; in some cases, r example with Ponceau 2R, Erythrosine, Chloramine llow, Congo Red, etc., a precipitate was produced. Basic dyestuffs were, in general, without action, but in some cases (*e.g.* Methylene Blue) had an accelerating effect in the more concentrated solutions. In similar experiments on the effect of dyestuffs on the digestion of casein by pancreatin in an alkaline medium, the results were, on the whole, with certain exceptions in the more dilute solutions, the reverse of those observed in the digestion of albumin by pepsin in an acid medium, *i.e.*, the basic dyestuffs exerted an inhibitive action and the acid dyestuffs were inactive.—A. S.

Patents.

Food products [pectinous substances]. H. Wade, London. From R. Douglas, Rochester, N.Y., U.S.A. Eng. Pat. 12,439, May 28, 1913.

Vegetable substances or fruits, preferably apples, are pressed in order to remove saccharine juices and the pulp is then extracted under pressure with hot water containing 0·1% of tartaric acid. The extract, after being evaporated to a syrupy consistence, forms a jelly when mixed with sugar and water.—W. P. S.

Flour, meal, offals, bran, grain, or like material; Treatment of ——. E. Samuelson, Banbury, Oxford, and J. Backhouse, Bootle, Lancs. Eng. Pat. 16,230, July 15, 1913.

The flour or other material is introduced into the lower part of a vertical chamber of circular cross-section provided with beaters attached to a rotating central shaft. The beaters cause the flour to rise in the chamber in the form of a cloud. A spray of liquid or liquid-laden air is introduced tangentially into the chamber, and the treated flour is discharged through an opening at the upper part. —W. P. S.

Pasteurised milk; Process for utilising the heat of ——. A. Domke. Ger. Pat. 273,388, May 14, 1913.

Before passing to the heat-interchanger in which it serves to preheat the cold milk, the hot pasteurised milk is led through a small apparatus in which it serves to pasteurise the cream.—A. S.

Buttermilk; Preparation of —— which can be preserved for a long time. R. Suwelack. Ger. Pat. 273,628, Jan. 30, 1913.

Fresh buttermilk is heated for some time at not below 85° C., with vigorous agitation, then rendered homogeneous by forcing it, under a pressure of about 250 atmospheres, through narrow tubes against a hard surface, and after being cooled and freed from air, is enclosed in air-tight vessels.—A. S.

Food [fruit] products. R. Douglas, New York. Eng. Pat. 19,192, Aug. 23, 1913.

See Fr. Pat. 462,045 of 1913; this J., 1914, 215.—T. F. B.

Cocoa and chocolate substances; Art of roasting ——. F. E. F. Neumann, Wandsbek, Germany. Eng. Pat. 13,861, June 16, 1913.

See Fr. Pat. 463,325 of 1913; this J., 1914, 371.—T.F.B.

Protein compounds obtained from fish; Soluble —— and process of making the same. R. Adler, Assignor to Naamlooze Vennootschap Algem. Uitvinding Exploitatie Maatsch., Amsterdam. U.S. Pat. 1,101,513, June 23, 1914. Date of appl., Oct. 2, 1913.

See Eng. Pat. 7700 of 1913; this J., 1913, 957.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Antiseptic properties; Relation between the structure and composition of organic compounds and their ——. K. Charitschkow. J. Russ. Phys.-Chem. Ges., 1914, 46, 70—76. Chem. Zentr., 1914, 1, 2196.

In experiments made with *Penicillium glaucum*, with the object of determining the suitability of various petroleum products for the impregnation of railway sleepers, it was found that Russian petroleum has no antiseptic properties, apart from those associated with small quantities of phenolic substances present therein. Naphthenic acids formed from petroleum by oxidation, and also their copper and zinc salts, are, on the other hand, powerful antiseptics. In the author's view only those organic compounds which are chemically active possess antiseptic properties, and the activity of the naphthenic acids is attributed to the presence of a five-membered ring in the molecule.—A. S.

Liver of sulphur ; Purchase and use of ——. J. Board Agric., 1914, **21**, 236—241.

Assuming that the fungicidal value of liver of sulphur is due to sulphur in the form of sulphides (hydrosulphide, sulphide, and polysulphide) (compare Foreman, this J., 1911, 150), the results of analyses in the Government Laboratory, of a large number of samples of different origin show that the quality of the commercial product varies very widely and that there is no connection between the price and the fungicidal value. The content of sulphide-sulphur decreases rapidly when liver of sulphur (solid or solution) is exposed to the air. The solid should preferably be packed in containers of small capacity (½ to 1 lb.) and the solution should either be prepared just before use or kept in full, tightly-corked bottles.—A. S.

Patents.

Furnaces [; Destructor ——]. T. W. Atterbury, New York, and P. W. Matthews, Wheeling, W. Va., U.S.A. Eng. Pat. 14,862, June 27, 1913. Under Int. Conv., July 5, 1912.

Four sets of trough-shaped grates are mounted on a horizontal drum, which is rotated at intervals, so that each grate occupies four positions successively. In the first position it receives a charge of refuse pushed in sideways by a ram, and hot combustion gases are passed through it to dry the refuse. The grate next comes into position two (the uppermost) and the dried refuse is burned. In the third position, air is passed through the grate to cool the ashes, and is subsequently used for burning the refuse in position two. On turning into position four (the lowermost) the cooled ashes are dropped on to a moving band conveyor.—W. H. C.

Water, vinegar, and other liquids ; Process for the sterilisation of —— *by means of bromine.* M. Riegel. Ger. Pat. 273,959, Sept. 17, 1913. Addition to Ger. Pat. 272,271.

After the treatment, as described in the chief patent (this J., 1914, 564), the bromine is removed by treatment with the calculated quantity of calcium sulphite or bisulphite.—A. S.

Boiler-feed water ; Process for purifying ——. N. Tikhomiroff. Ger. Pat. 274,351, Dec. 29, 1912.

The water after being mixed with the softening agent is forced through spraying nozzles disposed in a chamber through which the waste-gases from the boiler-furnace are passed. A series of such chambers is used, the water from each being collected in a receptacle or one compartment of a receptacle, whence it passes to a pump which forces it through the spraying nozzles in the preceding chamber or compartment.—A. S.

Water softening or purifying substance and process of obtaining same. P. de Brünn, Düsseldorf, Germany. Eng. Pat. 5783, March 8, 1913. Under Int. Conv., Sept. 27, 1912.

See Fr. Pat. 455,391 of 1913 ; this J., 1913, 958.—T. F. B.

Water ; Process for heating and purifying or softening ——. C. Erith, London. U.S. Pat. 1,099,433, June 9, 1914. Date of appl., March 20, 1911.

See Eng. Pat. 24,992 of 1910 ; this J., 1911, 570.—T. F. B.

Water ; Means for softening ——. H. J. Wheaton, Spondon. U.S. Pat. 1,100,803, June 23, 1914. Date of appl., Feb. 7, 1914.

See Eng. Pat. 4188 of 1913 ; this J., 1914, 216.—T. F. B.

Sewage ; Centrifugal apparatus for treating ——.
Bromet, F. Thorman, and H. C. Wood, Tadcaste
U.S. Pat. 1,098,554, June 2, 1914. Date of app
May 19, 1913.

See Eng. Pats. 22,836 and 25,578 of 1912 ; this J., 191
839.—T. F. B.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Ipecacuanha ; Alkaloids of ——. F. H. Carr and F.
Pyman. Chem. Soc. Trans., 1914, **105**, 1591—16
(See also this J., 1914, 610, and 1911, 1332.)

The three alkaloids emetine, cephaeline and psychotri
were obtained from the drug by Paul and Cownle
method, carefully purified, and the crystalline sa
characterised. The empirical formulæ are : emeti
$C_{29}H_{40}O_4N_2$; cephaeline $C_{28}H_{38}O_4N_2$; and psychotri
$C_{28}H_{36}O_4N_2$. Syntheses proved that psychotrine+H
cephaeline, and cephaeline+CH_2=emetine. When hyd
lysed by means of hydrochloric acid at 135°—140°
emetine and cephaeline both yielded the noremet
hydrochloride, $C_{25}H_{32}O_4N_2,2HCl$, melting at 240° C. w
decomposition. Emetine and cephaeline are second
tertiary, whilst psychotrine is a ditertiary base. Wh
emetine and benzoic anhydride were heated on the wa
bath benzoylemetine $C_{29}H_{39}O_4N_2.CO.C_6H_5$, was p
duced ; it crystallised from absolute alcohol in wh
prismatic needles, m. pt. 185°—186° C. On reducti
psychotrine yielded two isomeric bases, cephaeline a
*iso*cephaeline, the latter crystallising from alcohol
ether in clear plates, melting at 159°—160° C., and w
$[\alpha]_D = -71{\cdot}8°$ in chloroform. When treated with sodi
methyl sulphate and sodium amyloxide, the hydro
group of cephaeline was methylated with the format
of emetine. With methyl sulphate and sodium methoxi
on the other hand, methylation of the imino group t
place, principally with the formation of N-methylcephael
m. pt. 194°—195° C. and $[\alpha]_D = -48{\cdot}7°$ in chlorofo
N-methylemetine (hydrobromide m. pt 210°—230°
and a little emetine. The composition of the alkal
is therefore : psychotrine $C_{25}H_{26}(OCH_3)_3(OH)$
cephaeline $C_{25}H_{27}(OCH_3)_3(OH)(NH)N$; emet
$C_{25}H_{27}(OCH_3)_4(NH)N$. Emetine hydrochloride after
ing with ferric chloride solution gave a scarlet rubreme
hydrochloride soluble in chloroform, which when
dried had the composition, $C_{29}H_{32}O_4N_2,HCl$, and me
at 127°—128° C. with decomposition. After oxidi
with permanganate in acetone, emetine yielded a li
6.7-dimethoxy*iso*quinoline-1-carboxylic acid. The a
loids are considered to be derivatives of *iso*quinol
—F. Shd

Brucine ; Interaction between nitric acid and ——
presence of metallic nitrates. E. H. Rennie and A
Dawkins. Chem. Soc. Trans., 1914, **105**, 1487—149

The nitrates of sodium, potassium, cæsium, rubidi
and strontium accelerate the production of the rose
coloration due to the interaction of nitric acid and bru
the effect increasing with increasing concentration of
nitrate. The reaction is apparently due to the pres
of nitrous acid, as no colour is produced if urea is ad
to the nitric acid. The general results are similar to t
given by nitric acid and copper in the presence of met
nitrates (this J., 1908, 746 ; 1911, 751), but no retar
effects were observed as in experiments with copper.
—R. G.

Berberine and its determination. E. Richter. Arch. Pha
1914, **252**, 192—205.

The alcoholic extract of *Berberis* bark represe
4 grms. of the drug, or an equivalent amount of
tincture, is evaporated to dryness, dissolved in w
and 10 c.c. of 15% sodium hydroxide solution ad
The whole is shaken with 80 grms. of ether for 10

mins. and 1 grm. of powdered tragacanth added. 40 grms. of the ethereal solution are treated with 10 c.c. of $N/10$ solution of picrolonic acid (nitrophenylmethylisonitroso-pyrazolone), and the precipitate of berberine picrolonate collected, washed with a little ether and alcohol and dried at 110 C. The weight obtained multiplied by 0·561 gives the equivalent amount of berberine. (See this J., 1907, 1252.)—F. Shdn.

N-Demethylocodeine. O. Diels and E. Fischer. Ber.' 1914, **47,** 2043—2047.

odeine dissolved in acetone was treated at the ordinary emperature with the dimethyl ester of azodicarboxylic cid. The condensation product was warmed on the ater bath with $N/1$ hydrochloric acid and gave N-lemethylocodeine, $C_{17}H_{19}O_3N$, the dimethyl ester of ydrazodicarboxylic acid and formaldehyde. The codeine st the methyl group attached to the nitrogen. emethylocodeine crystallised from acetone in small exagonal leaflets m. pt. 185° C., gave a hydrochloride lecomposing at 314° C., and a diacetyl derivative rystallising from absolute alcohol in flat transparent rystals, m. pt. 176°—178° C.—F. Shdn.

aphnandra micrantha; Alkaloids of ——. F. L. Pyman. Chem. Soc. Trans., 1914, **105,** 1679—1687.

he bark of *Daphnandra micrantha* Benth., grown near risbane, contains over 6% of total alkaloids. Three ew alkaloids were isolated. Daphnandrine, $C_{36}H_{38}O_6N_2$, is e most abundant. It is dibasic, contains three methoxyl roups and one N-methyl group, and is non-phenolic. rystallised from chloroform it forms colourless needles, . pt. 280° C. and has $[a]_D = +474·7°$ for the dried base the same solvent. Micranthine, $C_{36}H_{32}O_6N_2$, is also on-phenolic, contains one methoxyl group and one methyl group and is dibasic. The base crystallises om chloroform in colourless needles, m. pt. 196° C. aphnoline, $C_{34}H_{34}O_6N_2$ or $C_{35}H_{36}O_6N_2$, is dibasic, and ntains a phenolic hydroxyl group, two methoxyl groups d one N-methyl group. After crystallising from cohol or chloroform it melts between 190° and 215° C. d has $[a]_D = +459°$ in chloroform.—F. Shdn.

arbaloin into β-barbaloin; New method of transforming ——. E. Léger. Comptes rend., 1914, **158,** 1903—1905.

hen barbaloin was heated to 100° C. with acetic hydride and sodium acetate, a penta-acetylbarbaloin as produced. After hydrolysing by means of alkali, mixture of barbaloin and β-barbaloin was obtained, om which the two substances were separated by means the insolubility of the former in chloroform and methyl cohol.—F. Shdn.

dinene from Daniella thurifera. W. Lenz. Ber., 1914, **47,** 1989—1991.

dark brown balsam obtained in E. Africa from *Daniella urifera* Benn. (*Leguminosae*) yielded about 23% of oil distillation with steam, leaving behind a soft resin. The was found to contain a considerable proportion of dinene.—F. Shdn.

ast; Curative action of autolysed —— against avian polyneuritis. E. A. Cooper. Biochem. J., 1914, **8,** 250—252.

e liquid obtained by autolysis of brewers' yeast, for ample for 36—48 hours at 35°—36° C., possesses as rked curative properties against avian polyneuritis the original yeast, and 10 times the minimum curing e has no toxic action. The liquid retains its curative wer for at least 8 weeks, and as air-dried yeast is still ive even after storage for 2 years, and can be autolysed er storing for 4 months, the method described is an xpensive one for preparing a non-toxic solution suitable the oral treatment of human beri-beri.—A. S.

Essential oils; Constituents of ——. Galbanum oil. Syntheses in the sesquiterpene and diterpene series. F. W. Semmler and K. G. Jonas. Ber., 1914, **47,** 2068—2082.

A specimen of galbanum oil with the following characters: b pt. 55°—195° C. at 15 mm, $n_D = 1·49395$ at 25 C., $a_D = +8°$ at 25° C., and sp. gr. 0·9353, was found to contain pinene, cadinene, nopinene, myrcene, a terpene derivative, $C_{10}H_{16}O$, and a new sesquiterpene alcohol, $C_{15}H_{26}O$. The terpene derivative boiled at 105°—115° C. at 15 mm., had the sp. gr. 0·951 at 20° C., $n_D = 1·4918$ and $a_D = +6°$; it appeared to be a readily enolisable ketone. The tertiary sesquiterpene alcohol, cadinol, boiled at 155°—165° C. at 15 mm., had the sp gr. 0·9720 at 20° C., $n_D = 1·50702$, and $a_D = +22°$ C. The characters of the acetate were: b. pt. 160°—170° C. at 9 mm., $n_D = 1·49870$ at 19° C., sp. gr. 0·9916 at 19° C., $a_D = +14°$ at 19° C. Cadinol was readily dehydrated by means of potassium bisulphate, etc., yielding a hydrocarbon, which gave cadinene dihydrochloride, m. pt. 117°—118° C., after treatment with hydrochloric acid. Cadinene regenerated from the dihydrochloride and that prepared by dehydrating cadinol were reduced by means of platinum and hydrogen and the products compared. Octahydro-α-camphorene (this J., 1913, 379) boiled at 183°—186° C. at 14 mm., had $n_D = 1·46001$, sp. gr. 0·8331 at 20° C., and was optically inactive. After myrcene had been polymerised by means of hydrochloric acid and the hydrochloric acid split off again, a bicyclic diterpene, iso-α-camphorene, was obtained, with the characters: b. pt. 193°—197° C. at 19 mm., $n_D = 1·50300$, sp. gr. 0·9029 at 21° C., and optically inactive. Reduction by means of platinum and hydrogen gave rise to a hexahydro-derivative. When heated in a sealed tube with anhydrous oxalic acid, linalool yielded α-camphorene, whilst citronellal gave an oxide, $C_{20}H_{34}O$. The latter boiled at 190°—200° C. at 17 mm., and had the sp. gr. 0·9193 at 20° C., $n_D = 1·49156$ and $a_D = +4°$. It was converted into a compound, $C_{20}H_{38}O$, by reduction with platinum and hydrogen. Cycloisoprenemyrcene (this J., 1913, 624) is monocyclic, for when reduced with platinum and hydrogen it yielded a hexahydro-derivative, $C_{15}H_{30}$, with the following characters: b. pt. 133°—135° C. at 15 mm., $n_D = 1·45497$, sp. gr. 0·8245 and optically inactive. When α- and β-phellandrene were heated with isoprene in a sealed tube, a bicyclic sesquiterpene was produced. Limonene and isoprene could be condensed to a monocyclic sesquiterpene by treatment with ethylsulphuric acid between —10° and —18° C. Pinene and sabinene when heated in a sealed tube with glacial acetic acid and sulphuric acid yielded a monocyclic sesquiterpene.
—F. Shdn.

Essential oils; Analysis of [determination of esters in] ——. Béhal. Bull. Soc. Chim., 1914, **15,** 306—308, 565—568.

A source of error in the determination of the esters in essential oils by saponification is due to the fact that in the presence of alcoholic alkali the esters are decomposed so as to give the ester of lowest molecular weight and liberate the alcohol of higher molecular weight. For instance menthyl formate in alcoholic potassium hydroxide gives ethyl formate and geraniol, and when benzyl benzoate is warmed with the same reagent the odour of ethyl benzoate is easily perceptible. Owing to the ready volatility of these lower esters, losses occur during the saponification which can be prevented by heating the mixture in a closed vessel in a water bath. Formic acid is present in many essential oils, particularly in Algerian geranium oil.—F. Shdn.

Essential oils; Vanillin hydrochloric acid reaction for ——. J. Cerdeiras. Pharm. Zentralb., 1914, 340. Perfum. and Essent. Oil Rec., 1914, **5,** 265.

A fresh solution of 0·5 grm. of vanillin in a little alcohol is made up to 100 grms. with hydrochloric acid of sp. gr. 1·10 at 15° C. One drop of the oil is added to 5 c.c. of the reagent, the whole shaken and allowed to stand for 15 mins. in the dark, when it is heated for 5 mins. in boiling water, cooled and shaken with chloroform. The colour reactions observed during these three operations can be compared with those produced by known oils. A table of the colorations obtained for a number of oils is given. —F. Shdn.

Shō-Gyū and Yu-Ju oils. K. Nagai. Perfum. and Essent. Oil Rec., 1914, 5, 244—249.

The Shō-Gyū tree, probably identical with the "black camphor" tree, grows to a height of 40—50 feet in continuous belts of forest at an altitude of 5000 to 6500 feet in Formosa. The wood is distilled locally and a yield of 1·3 to 3·0% of oil can be obtained. Several samples examined were colourless or light yellow and had the following characters: sp. gr. 0·900 to 1·031; optical rotation +7·75° to +34·45°; refractive index 1·4750 to 1·5023 at 20°—25° C.; soluble in an equal volume of 80% alcohol at 30° C.; acid value 0·1 to 0·76; ester value 0·0 to 2·4; total alcohol by acetylation (10 grms. oil, 10 grms. acetic anhydride, 2 grms. sodium acetate, 2 hrs. acetylation, 2 hrs. saponification) 13—40%. The following constituents were identified: formaldehyde in very small amount, sabinene, dipentene, a-terpinene, terpineol-4, geraniol, citronellol, safrol, eugenol, cadinene and linalool.

Yu-Ju oil is obtained from the so-called "oil-tree" indigenous to Southern Formosa, and is closely allied to camphor oil. In external form the tree is identical with *Cinnamomum camphora*, but the two can be readily distinguished by the odour of a shaving taken from the root. An average yield of 3—4% of essential oil can be obtained from the Yu-Ju tree. The oils examined were light yellow or golden in colour, although brown oils are occasionally met with. The characters are: sp. gr. 0·942 to 0·967 at 15° C.; optical rotation +18·8° to +30·8°; refractive index 1·4756 to 1·4856 at 20° C. The following constituents were identified: furfural in small quantity; a- and β-pinene; camphene; dipentene; cineol in considerable quantities; a-terpineol; safrol; eugenol, and a blue oil boiling between 275° and 290° C. A considerable quantity of camphor could be obtained by fractionating the oil and cooling, although this oil contains less camphor and more cineol than camphor oil.—F. Shdn.

Cymbopogon coloratus, Stapf; Oil of —— from Fiji. Bull. Imp. Inst., 1914, **12**, 48—50.

The leaves are stated (Bull. No. 6, 1913, Dept. Agric. Fiji) to yield about 0·35% of volatile oil, equivalent to about 29 lb. per acre. The oil has been examined by Goulding and Earl (Chem. Soc. Proc., 1914, 30, 10) who find that the principal odorous constituent is citral, 40%; it also contains geraniol, 23% in the free state and 10% as geranyl acetate. About 7·5% of terpenes are present, probably containing *l*-limonene, together with small amounts of free acetic acid and phenols; a solid tasteless and odourless phenol was isolated. A small consignment of the oil sold at 2d. per oz. in London (Jan. 1913), with Cochin lemongrass oil at 4¼d. per oz. and Ceylon citronella oil at 1s. 6½d. to 1s. 8d. per oz.—R. G. P.

Terpenes; Synthetic hydrocarbons allied to ——. W. N. Haworth and A. W. Fyfe. Chem. Soc. Trans., 1914, **105**, 1659—1671.

Certain ketones of the *cyclo*hexene series were condensed with ethyl sodiocyanoacetate, the acid thereby produced subjected to distillation in order to eliminate carbon dioxide, and the resulting ketone treated with magnesium methyl iodide. The ketones were converted into carbinols by the Grignard reaction and water eliminated from the latter by means of oxalic acid to obtain higher homologues of the terpenes. In this way two optically active hydrocarbons were prepared from *d*-1-methyl*cyclo*hexan-3-one, viz., *d*-1-methyl-3-dimethylvinyl-Δ^3-*cyclo*hexene and *d*-1-methyl-3-dimethylvinyl-Δ^2-*cyclo*hexene. The former boiled at 190°—191° C., had $n_D = 1·4793$, sp. gr. 0·8445 at 15°/4° C., and $[a]_D = +63·9°$. The latter hydrocarbon boiled at 192°—193° C., had $n_D = 1·4802$, sp. gr. 0·8531 at 15°/4° C., and $[a]_D = +54·8°$. 1-Dimethylvinyl-Δ^1 *cyclo*hexene was prepared by a similar series of reactions and had the characters: b. pt. 172°—173° C., $n_D = 1·4854$, and sp. gr. 0·8537 at 20°/4° C.—F, Shdn.

Thujone and thujamenthone. The direct conversion of one into the other. M. Godchot. Comptes rend., 1914, **158**, 1807—1808.

Thujone in the presence of hydrogen and nickel at 175°—180° C. is readily transformed into thujamenthone. The trimethylene ring under these conditions is readily reduced and broken, while the cyclopentane ring remains quite stable.—W. H. P.

Quinol; Colour reaction of —— in the solid state. Maldiney. Comptes rend., 1914, **158**, 1782—1783.

Solid quinol and potassium carbonate rubbed togethe give a chracteristic deep blue coloration. Sodium carbonate gives only a dirty mauve colour after long trituration, and ammonium and lithium carbonates have nc effect. Water destroys the colour, giving a yellow solution; alcohol and ammonia have the same effect. Ethe gradually destroys the colour without dissolving th product while chloroform and benzene have no action No other photographic developer has been found t resemble quinol in this respect.—W. H. P.

Isoprene; Physical constants of ——. C. Harries. Ber 1914, **47**, 1999—2003.

Two preparations of synthetical isoprene obtaine respectively, from the Elberfelde Farbenfabrik (A) and tl Badische Anilin- und Sodafabrik (B) after careful fractiontion were practically identical in boiling-point, specil gravity and elementary composition. The optical co stants, however, showed marked differences, from whi it is concluded that the specimen (B) either contain impurities or else consisted of a physically isomeric isopren The following constants are quoted for pure isopren b.pt. 33·75—34·0° C. at 762 mm.; $D_4^{16·5} = 0·6867$; $n_d^{16·5}$ 1·42617.—J. R.

Erythrene; New method of preparing —— from derivati of ethyl ether. J. Ostromysslenski and S. Kielbasins J. Russ. Phys.-Chem. Ges., 1914, **46**, 123—133. Che Zentr., 1914, **1**, 2155.

Monochloroethyl ether, $CH_3.CH(Cl).O.C_2H_5$, b. 92°—95° C., gives yields of up to 20% of erythrene wl heated to 350° C. in presence of alumina or barium chlori The catalyst, however, soon becomes inactive, owing the deposition of reaction products thereon. Sim results are obtained with acetal, $CH_3.CH(OC_2H_5).O.C_2$ and with this compound, in presence of alumina, a yi of up to 16% of erythrene can be obtained at the ordin temperature. The yield is not affected by the nat of the containing vessel or by diminishing the pressu —A. S

Methyl alcohol; Thermal decomposition of ——. W Bone and H. Davies. Chem. Soc. Trans., 1914, 1 1691—1696.

After heating for 10 mins. to 650° C. the vapour of me alcohol was converted into a mixture of carbon monox methane and hydrogen. During the decomposition carbon was deposited, nor could either acetylene ethylene be detected in the products. At 1000° C. decomposition was almost instantaneous without deposition of carbon or formation of acetylene or ethyl The gaseous products consisted principally of ca monoxide and hydrogen with a little methane and a t of carbon dioxide.—F. Shdn.

Patents.

6-*Hydroxy-2-piperonylquinoline-4-carboxylic acid; M facture of ——.* Chem. Fabr. auf Actien (verm Schering), Berlin. Eng. Pat. 15,482, July 4, Under Int. Conv., July 8, 1912. Addition to Eng. 15,481 of 1913.

An alcoholic solution of *p*-aminophenol is boiled an alcoholic solution of piperonal and pyroracemic The precipitated 6-hydroxy-2-piperonylquinoline- boxylic acid is purified through its sodium salt.—F. S *liphatic hydrocarbons from poly-methylenes or mixtures containing the same ; Manufacture of* ——. F. Sommer, Vienna. Eng. Pat 19,972, Sept. 1, 1913. Under Int. Conv., Sept. 24, 1912.

ON-SATURATED hydiocarbons are produced by dis- illation by the "cracking" process from polymethylenes r mixtures containing the same, and are then converted ito saturated aliphatic hydrocarbons by reduction.
—F. Shdn.

atty acids containing arsenic or phosphorus ; Process for producing iron salts of ——. F. Heinemann, Berlin. Eng. Pat. 29,741, Dec. 24, 1913. Under Int. Conv., Jan. 2, 1913. Addition to Eng. Pat. 18,732 of 1912, dated Nov. 29, 1911 (this J., 1913, 109).

ATTY acids containing arsenic or phosphorus, obtained treating fatty acids of the acetylene series with tri- logen derivatives of arsenic or phosphorus, are con- rted into iron salts by treating them or their salts th solutions of basic or neutral iron salts. For instance loro-arsenobehenolic acid dissolved in methyl alcohol neutralised with alcoholic soda-lye and mixed with an oholic solution of ferric chloride. Or the alcoholic ution of the acid may be added to a solution of iron tate or *liquor ferri oxychlorati* (German Pharmacopœia) ed with alcohol. The resulting iron salts are reddish wn powders insoluble in water or alcohol.—F. Shdn.

rapeutical agents in the treatment of tuberculosis and yphilis ; Process of manufacturing compounds suitable s ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 1837, an. 23, 1914. Under Int. Conv., Jan. 24, 1913.

IPOUNDS for use in treating tuberculosis and syphilis are luced by treating gold cyanide with a salt of an organic , particularly 1-phenyl-2.3-dimethyl-4-amino-5-pyrazo- or its alkyl derivatives. By this means the gold nide is protected from immediate reduction.—T. F. B.

ine salts ; Manufacture of ——. Act.-Ges. f. Anilin- br., Treptow, Germany. Eng. Pat. 2923, Feb. 4, 914. Under Int. Conv., Oct. 16, 1913. Addition to ng. Pat. 2813 of 1914, date of appl., May 7, 1913 (see is J., 1914, 658).

ASSES, exhausted molasses, or other residue from the sugar factory is rendered feebly acid with hydrochloric and then evaporated in a vacuum at a temperature naterially above 60° C. until crystals begin to separate. ffect a more rapid separation, the evaporated solution be mixed with a further quantity of concentrated ochloric acid, after which the mass is cooled. The ion obtained in this way is free from humic sub- es, and deposits betaine hydrochloride mixed chiefly inorganic salts.—T. F. B.

s of phenol homologues halogenised in the side chain ; cess for the preparation of ——. Dr. Schmitz und Ges. m. b. H., Düsseldorf, Germany. Eng. Pat. 3, Feb. 5, 1914. Under Int. Conv., April 10, 1913.

GENS can be introduced into the side chain of esters enol homologues by treating the esters with halogens eir equivalent in presence of light, preferably from ce of light rich in ultra-violet rays, and at the ordinary rature or below 100° C. The esters may be dissolved rbon tetrachloride or other suitable solvent. In cases it is advisable to use a halogen carrier *ple :* 10·2 kilos. of chlorine are introduced into a on of 18 kilos. of *o*-cresol carbonate in carbon hloride, under the influence of rays from a mercury- r lamp ; the temperature is kept at about 25°—30° C. loro-*o*-cresol carbonate is obtained in the form oil. By carrying out the chlorination of the solid carbonate in presence of a small quantity of phos- pentachloride, ω-trichloro-*o*-cresol carbonate is ed.—T. F. B.

Mercury ; A preparation of —— *for therapeutic purposes.* Dr. Bayer és Tarsa, Budapest. Eng. Pat. 11,392, May 14, 1913. Under Int. Conv., June 28, 1912.

See Ger. Pats. 267,411 and 267,412 of 1912 ; this J., 1914, 220. The products may be dissolved in alkali.—T. F. B.

Aromatic mercury compounds ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 2314, Jan. 28, 1914. Under Int. Conv., Jan. 29, 1913.

See Ger. Pat. 272,289 of 1913 ; this J., 1914, 568.—T. F. B.

Propylene from acetylene and methane ; Production of ——. A. Heinemann, London. Eng. Pat. 12,365, May 27, 1913.

See Fr. Pat. 458,397 of 1913 ; this J., 1913, 1086.—T. F. B.

Isoprene ; Process for manufacturing synthetic ——. C. K. F. L. Gross, Christiania. U.S. Pat. 1,099,498, June 9, 1914. Date of appl., June 12, 1913.

See Fr. Pat. 459,988 of 1913 ; this J., 1913, 1129.—T. F. B.

Glycerine ; Process for the synthetic production of ——. A. Heinemann, London. Eng. Pat. 12,366, May 27, 1913.

See Fr. Pat. 458,398 of 1913 ; this J., 1913, 1086.—T. F. B.

Esters and ethers of ethylidene glycol and vinyl alcohol ; Manufacture of ——. Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 14,246, June 19, 1913. Under Int. Conv., June 21, 1912.

See U.S. Pat. 1,084,581 of 1914 ; this J., 1914, 219.—T.F.B.

Bismuth salt of gallocarboxylic acid ; Manufacture of the ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,715, July 21, 1913.

See Ger. Pat. 268,932 of 1912 ; this J., 1914, 277.—T. F. B.

Compounds containing residues of sulphophenol-ortho-carboxylic acids or their transformation products ; Process for producing ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,854, Oct. 9, 1913.

See Fr. Pat. 466,236 of 1913 ; this J. 1914, 637.—T. F. B.

Diaryl ethers ; Process for the formation of ——. L. Ostermann, Hamburg, Germany. U.S. Pat. 1,099,761, June 9, 1914. Date of appl., May 21, 1913.

See Eng. Pat. 9797 of 1913 ; this J., 1914, 102.—T. F. B.

Polyarseno compounds and process of making same. P. Ehrlich and A. Bertheim, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,100,720, June 23, 1914. Date of appl., July 16, 1913.

See Eng. Pat. 14,409 of 1913 ; this J., 1913, 1030.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Quinol ; Modification of the developing power of —— *by introduction of substituents into the aromatic nucleus.* A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1914, 5, 181—184.

The introduction of halogen groups into the quinol nucleus results in an increase of developing power both in caustic alkali and in alkali carbonate solution ; bromine is more active in this respect than chlorine. Similarly the methyl group increases the developing power. On the other hand, the introduction of nitro or sulphonic groups causes a considerable decrease of developing power, dinitroquinol possessing no developing properties. When a halogen group and a sulphonic group are present together in the quinol nucleus, products are obtained which are more active than quinolsulphonic acid but less active than quinol itself, whatever may be the relative positions of the substituent groups.—T. F. B.

Quinone and sodium sulphite. J Pinnow. J. prakt. Chem., 1914, **89**, 536—546.

The chief product of the reaction between quinone and neutral sodium sulphite is quinolmonosulphonate of sodium: small quantities of quinol and hydroxyquinone or their derivatives are also formed. The velocity of these reactions is very great, and they do not appear to be connected with the gradual increase of colour of the sulphite-quinone solution. A partial reaction takes place between quinone and quinolmonosulphonate, with the formation of quinonesulphonate and quinol; the quinonesulphonate reacts with sulphite to produce quinoldisulphonate. The formation of quinonesulphonate and quinoldisulphonate can be promoted by adding acetic acid to the quinone solution or by increasing the concentration of the sulphite. Only very small amounts of sulphuric acid are formed during the reaction between quinone and neutral sulphite (see also this J., 1913, 214, 451; 1914, 161).—T. F. B.

Colour reaction of quinol in the solid state. Maldiney. *See* XX.

XXII.—EXPLOSIVES ; MATCHES.

Explosion of nitroglycerin; Circumstances attending an —— which occurred in a cordite stove at the factory of Messrs. Curtis's and Harvey, Ltd., at Cliffe, Kent, on April 29, 1914. Major A. Coningham, H.M. Inspector of Explosives. [Cd. 7453].

The building in which the explosion occurred was an empty cordite stove with three brick walls and a framework of wood in front. The inner side of the framework was lined with matchboarding, and the outer with corrugated iron sheets. The interior of the compartment was lined throughout with sheets of zinc soldered together. There was a space of about 4 ins. between the matchboard lining and the corrugated iron sheets. A workman, who lost his life, was engaged in removing the corrugated iron sheets from the front of the building. The wooden moulding at the top of the corrugated iron sheets had first to be removed, and the asphalt on the platform then chipped from the cement for about 2 ins., so as to enable the sheets to be taken away. Whilst doing this the chisel must have struck some nitroglycerin which exploded, and communicated the explosion to a small accumulation of nitroglycerin, probably ½ lb. to 2 lb., which had collected on the floor quartering and in the spaces between this and the corrugations of the galvanised iron sheets. During the process of drying cordite acetone vapour, carrying nitroglycerin, must have found its way through some small crack, or hole, in the zinc lining of the stove, and condensed on the cold surface of the corrugated iron sheets. The acetone would then evaporate, leaving nitroglycerin to trickle down, and, in the course of time, accumulate at the bottom of the iron sheets. Twenty-six such stoves had previously been dealt with in a similar manner, but in no case had any nitroglycerin been found in the hollow space of the wall. It is considered that it would be well, in the future, if, when repairs or alterations have to be carried out on the wall of a cordite stove of this nature, to deal with it as if there was an accumulation of nitroglycerin at the bottom of the space between the lining and the outer sheeting of the wall. In some cases the nitroglycerin might be dissolved and floated off by pouring, or injecting, acetone into the space, but the disadvantage of this method would be that the acetone, evaporating off, would leave the nitroglycerin deposited somewhere else. A preferable method would be to destroy the nitroglycerin *in situ* by an alcoholic solution of sodium hydroxide. There has been a tendency in recent years to avoid, as far as possible, the use of separate linings in building of this nature, and, in the modern stoves erected by the company, this has been effected by a facing of neat cement on the walls.—G. W. McD.

Fulminic and hydrazoic acids; New salts of —— an the explosive properties of fulminates and azides. L Wöhler and F. Martin. Z. angew. Chem., 1914, 27 335—336.

Anhydrous fulminates of K, Ca, Sr, Ba, Mn^{II}, Zn, Te and Cd have been prepared by treating mercury or silve fulminate with the requisite amalgam under methyl alcoho and precipitating the salt by means of ether. The highl explosive cuprous salt was obtained in aqueous solution it explodes with a sharp report, like all the fulminate with the exception of the manganese and mercury salt The alkali and alkaline earth salts are sensitive to moistu and to carbon dioxide. New azides of Mn^{II}, Zn, ar Co^{II} were obtained from the carbonates and ethereal az imide; the cobaltous salt contains water; all these azid are hygroscopic and readily hydrolysed. The cobalto salt is most sensitive to friction, but the manganese s detonates sharply. The initial explosive action of t fulminates and azides was compared by observing t amount of inflammable matter necessary for detonatio the fulminates were placed in the following order, Ag, C Cu^{I}, Tl, Hg^{II}, and the azides, Cd, Ag, Pb, Cu^{I}, Hg^{I}, T The sensitiveness to shock per unit of striking surface all the fulminates and azides was measured; when t thickness of the mass of substance tested was increas the sensitiveness to shock diminished in the case of the fulminates and the azides of Tl, Zn, Mn, and Cu^{I} increased with the azides of Pb, Ag, and Hg^{I}, and remai unchanged with cadmium azide. It thus appears that measurement of the sensitiveness to shock of only thickness of substance can give quite an erroneous indi tion of its character. The temperature of detonation of salts were also measured; in this respect thalleus fulm ate is the most sensitive (detonation at 110°) followed the fulminates of Hg^{II}, Ag, Cu^{I}, Cd, and Mn; the alkali earth and alkali salts begin with Ca (195°) followed Sr, Ba, Na, and K (237°). The azides are placed in following order:—Co (148°), Ba, Ca, Sr, (169°), Cu^{I}, Mn, Hg^{I}, Zn, Cd, Ag, Tl, Pb (327° C.).—T. F. B.

Explosives; Production of —— in the United States du 1912. A. H. Fay. U.S. Bureau of Mines. Techn Paper 69.

The total production of explosives in the United St during 1912, according to the figures compiled, 489,393,131 pounds, or 244,696 short tons. This duction is segregated as follows:—Black pow 230,233,369 pounds; "high" explosives (dyna nitroglycerin, dynalite, guncotton, etc.) other than missible explosives, 234,469,492 pounds; and permis explosives, 24,630,270 pounds. The total productio tabulated by States and by kinds of explosives. An table shows the total output of coal, with the correspon amount of explosives used in its production. The am of coal produced per pound of explosive varied from ton in the group represented by Arkansas, Oklahoma Texas to 5·82 tons in Maryland and Virginia: 133 were killed in coal mines by explosives during 1912 134 in 1911. In 1902 11,300 lb. of permissible explo were used in coal mining, whereas in 1912 the qua so used was 18,150,618 lb. The total amount of e sives used for the production of coal in 1912 was 2[illegible]6,14 lb. The use of permissible explosives in coal minin had gratifying results, and few, if any, serious acci can be attributed directly to their use. In 1912 three-fourths of the permissible explosives manufac were used for coal mining. The reports of manufact of fireworks and of ammunition are not included.

Limits of inflammability of methane. Leprince-Ri et. *See* IIa.

Solubility of nitrocellulose in ethyl alcohol. Schwarz. *See* V.

Explosive substance containing arsenic. Müller. *See* VII.

PATENTS.

Fuse compositions containing phosphorus; Manufacture of ——. Deutsche Waffen- und Munitionsfabriken. Ger. Pat. 274,000, Nov. 29, 1912.

THE phosphorus is mixed with a binding medium and with water, spirit, oil or the like, so as to form a viscous mass capable of drying like a paint. This is applied either to the inner surface of the cap or the like which is to receive the fuse composition, to the outer surface of the fuse composition, or to the inner side of a layer used as a cover for the fuse composition; or it may be rolled out into a sheet and itself used as a covering layer.—A. S.

Gunpowder; Process of preparing progressive ——. W. Eberlein, Brunswick, Germany. U.S. Pat. 1,098,237, May 26, 1914. Date of appl., Dec. 15, 1911.

SEE Fr. Pat. 437,714 of 1911; this J., 1912, 558.—T. F. B.

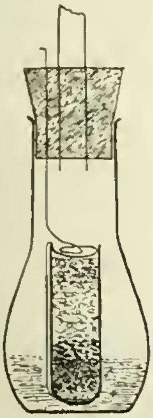
XXIII.—ANALYTICAL PROCESSES.

Platinum ware; Thermoelectric method for the determination of the purity of ——. G. K. Burgess and P. D. Sale. J. Washington Acad. Sci., 1914, **4**, 282—288.

THE index of purity is the thermoelectric force of the platinum ware against pure platinum at a known temperature. The most common impurity is iridium and all other metals usually associated with platinum affect the E.M.F. in the same direction as iridium. It is possible therefore for many purposes to represent the impurity as if it were all iridium. If a crucible is being tested two fine pieces of Heraeus normal thermoelement platinum are arc-soldered to it at opposite sides of the rim. They are then connected through a millivoltmeter. One is heated by a small flame and the other kept cool by an air blast. The temperature of the hot junction is measured on the same millivoltmeter by means of a platinum-rhodium thermocouple wire soldered near the same point. A commutator in the voltmeter circuit enables readings o be made for the temperature and then immediately for he E.M.F. of pure platinum against the alloy. By comparison with standard data the percentage of iridium equivalent to the impurity may be obtained.—W. H. P.

Fat extractor. G A. Stokes. Analyst, 1914, **39**, 295.

THE material to be extracted is placed in a fat-free paper himble, which is attached to the cork of the flask by means of a wire (see fig.). Above the material is placed otton-wool, which is held down by a spring bent in the ire. After extraction has proceeded for some time the wire is raised so as bring the thimble into the neck of the flask, where the extraction is completed.—C. A. M.



Platinum; Detection of —— *by means of stannous chloride.* E. Langstein and P. H. Prausnitz. Chem.-Zeit., 1914, **38**, 802.

STANNOUS chloride gives a blood-red coloration (gold-brown in very dilute solutions) with solutions of platinum chloride, and the colouring matter can be extracted with ether (Wöhler, Chem.-Zeit., 1907, 938). The test is very sensitive and is not given by iridium, palladium, gold or iron. Humic substances, however, and filter paper give similar reactions after treatment with *aqua regia*, and the test is only conclusive of platinum, when the filter paper has been completely incinerated and when any humic substances present have been destroyed (*e.g.* by fusion with pyrosulphate) prior to extraction with *aqua regia*. —C. A. M.

Mannitol; The methods for the quantitative determination of ——. J. Smit. Z. anal. Chem., 1914, **53**, 473—490.

THE various methods described for the determination of mannitol are reviewed. The following new method is recommended: To 50 c.c. of the solution contained in a 100 c.c. stoppered bottle, 25 c.c. of $4N$-sodium hydroxide and 25 c.c. of copper sulphate solution containing 125 grms. of the hydrated salt per litre are added, the whole is shaken well for a few seconds only and allowed to settle during 12 hours at the ordinary temperature. 25 c.c. of the clear liquid are withdrawn, treated with 10 c.c. of 30% potassium iodide solution and 10 c.c. of 25% sulphuric acid, and titrated with $N/10$-sodium thiosulphate. The quantity of mannitol corresponding to the number of c.c. of thiosulphate used is ascertained from the following table:—

$N/10$ $Na_2S_2O_3$ used per 25 c.c. of solution.	Mannitol in 100 c.c. of solution.	$N/10$ $Na_2S_2O_3$ used per 25 c.c. of solution.	Mannitol in 100 c.c. of solution.	$N/10$ $Na_2S_2O_3$ used per 25 c.c. of solution.	Mannitol in 100 c.c. of solution.
c.c.	mgrms.	c.c.	mgrms.	c.c.	mgrms.
0·25	0·0	9	310·7	20	659·7
0·5	8·3	10	344·4	21	691·9
1·0	27·4	11	378·1	22	724·1
1·5	47·8	12	410·8	23	756·6
2·0	68·0	13	441·6	24	789·6
2·5	88·0	14	472·4	25	822·6
3·0	107·1	15	503·1	26	855·6
4·0	142·8	16	534·4	27	888·6
5	176·7	17	565·6	28	930·9
6	210·0	18	596·9	29	992·4
7	243·3	19	628·1	29 1	1000
8	277·0				

Before applying the method it is necessary to remove any ammonium compounds, amino-acids, sugars, hydroxy-acids, or polyhydric alcohols which may be present.—J. R.

Colour reactions of organic compounds with trichloroacetic acid [and tetranitromethane]. K. Charitschkow. J. Russ. Phys.-Chem. Ges., 1914, **46**, 76—78. Chem. Zentr., 1914, **1**, 2202—2203.

TRICHLOROACETIC acid and tetranitromethane, which give colour reactions with cholesterol, give analogous reactions with a large number of compounds having a double linkage in the molecule, especially cyclic compounds. Colorations are obtained, for instance, with crude petroleum, solar oil, turpentine, menthene, terebenthene, phenanthrene, mesitylene (?), rosin, rosin oil, and oleic acid. Benzene hydrocarbons and low-boiling unsaturated compounds of the aliphatic series do not give colorations.—A. S.

Chemistry and analysis of asphaltum. Marcusson. *See* IIA.

Detection of minute quantities of selenious acid in sulphuric acid. Schmidt. *See* VII.

Determination of nitrogen in Norwegian saltpetre [calcium nitrate]. Busvold. *See* VII.

Detection of bromides in presence of thiocyanates and ferrocyanides. Guareschi. *See* VII.

Detection of lead in bismuth subnitrate. Guérin. *See* VII.

Examination of sulphur chloride. Frank and Marckwald. *See* VII.

Assay of crude platinum. Schwitter. *See* X.

Analysis of pyrophoric cerium-iron alloys. Arnold. *See* X.

Determination of the insoluble bromide value of oils. Gemmell. *See* XII.

Examination of bleached shellac. Wolff. *See* XIII.

Colorimetric method for the determination of acids in wort and beer. Lüers. *See* XVIII.

Determination of lactic acid in wine. Baragiola and Schuppli. *See* XVIII.

Detection of castor seeds. Lander and Geake. *See* XIXa.

Interaction between nitric acid and brucine in presence of metallic nitrates. Rennie and Dawkins. *See* XX.

Berberine and its determination. Richter. *See* XX.

Analysis of [determination of esters in] essential oils. Béhal. *See* XX.

Vanillin hydrochloric acid reaction for essential oils. Cerdeiras. *See* XX.

Colour reaction of quinol in the solid state. Maldiney. *See* XX.

Mechanism of oxidation processes. III. [Determination of saligenin.] Wieland. *See* XXIV.

Patent.

Density of gases; Method of, and apparatus for, determining the ——. K. Bomhard, Charlottenburg, and G. König, Berlin-Südende, Germany. Eng. Pat. 4628, Feb. 23, 1914. Under Int. Conv., Feb. 22, 1913.

See Ger. Pat. 269,862 of 1913; this J., 1914, 336.—T. F. B.

Air; Apparatus for ascertaining the degree of purity of ——. J. C. y Leon, Madrid. U.S. Pat. 1,101,400, June 23, 1914. Date of appl., Feb. 13, 1913.

See Eng. Pat. 4141 of 1913; this J., 1913, 961.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Trituration; Reactions by ——. L. H. Parker. Chem. Soc. Trans., 1914, **105**, 1504—1516.

Carefully dried mixtures of mercuric chloride and potassium iodide, lead nitrate and potassium iodide, lead chloride and potassium iodide, potassium bichromate and silver nitrate, copper sulphate and potassium ferrocyanide, lead acetate and potassium bichromate, and sodium carbonate and barium sulphate were triturated by means of a mortar and pestle contained in a closed desiccator. Interaction took place on trituration in every case, the results confirming those of Perman (Chem. News, 1903, **88**, 197; this J., 1907, 759), who found that dry salts may be left in contact without interaction, but that grinding frequently caused reaction to take place. It seems probable that interaction is caused by fusion of the salts due to trituration.—R. G. P.

Tin selenides; Thermo-electric power of ——. H. Pélabon. Comptes rend., 1914, **158**, 1897—1900.

SnSe forms a couple with platinum in which the current goes from the platinum towards the selenide across the hot junction. With temperatures of 0° and 100° C., the potential difference is —0·033 volt, and for temperatures of 0° and 580° C. it is —0·2 volt. $SnSe_2$ gives values of the same magnitude but of opposite sign up to 600° C. —F. Shdn.

Inositol; Synthesis of natural ——. H. Wieland and R. S. Wishart. Ber., 1914, **47**, 2082—2085.

A fairly good yield of inositol is obtained by hydrogenating hexahydroxybenzene suspended in water in presence of palladium black, at 50°—55°C.—L. E.

Methyl-glucosides; Structures of the two ——, and note on a third. E. Fischer. Ber., 1914, **47**, 1980—1989.

Nef's suggestion (see this J., 1914, 366) that α- and β-methyl-glucosides are structural- and not stereoisomerides is contested. A third isomeride, obtained as a syrup during the preparation of the other two, is described. This substance, or possible mixture of stereoisomerides, "γ-methyl-glucoside," was purified by distillation under reduced pressure. It differs from the isomeric crystalline substances in its behaviour towards emulsin, the yeast enzymes and dilute acids: the last-named agents effect its hydrolysis with extreme ease, this property being probably connected with the structure of the lactone ring.—J. R.

Oxidation processes; Mechanism of ——. III. [Determination of saligenin.] H. Wieland. Ber., 1914, **47**, 2085—2111.

In continuation of previous work (this J., 1913, 1132) evidence is brought forward to show that in the three aldehyde reactions which are accelerated by unboiled milk, viz., conversion of two mols. of aldehyde into one each of acid and alcohol, oxidation to the acid by molecular oxygen, and oxidation by methylene blue, with reduction of the latter to its leuco-compound, the acceleration is not due to three distinct enzymes, namely a mutase, an oxydase, and a reductase respectively, but to a single enzyme, which is a dehydrase. In the conversion of two mols. of aldehyde into one each of acid and alcohol, it is considered that 1 mol. of the aldehyde is converted into the hydrate, and this is then dehydrogenated under the catalytic influence of the dehydrase, a second mol. of the aldehyde, in its anhydride form, acting as hydrogen-acceptor: $R.CH(OH)_2+R.CH:O\rightarrow R.CO.OH+R.CH_2OH$.

It is shown incidentally that if saligenin in 0·4% aqueous solution be treated with a slight excess of 0·2—0·3*N* bromine solution, and after 20 seconds a few drops o potassium iodide solution be added, and the liberated iodine titrated with *N*/10 thiosulphate, although tribromophenol is formed in addition to dibromosaligenin, th results are quite concordant, a constant quantity of 5·3 equivalents Br being consumed per mol. of saligenin, s that the reaction can be used for quantitative purposes —A. S.

Book Received.

Journal of the Institution of Petroleum Technologists and Record of Transactions. Vol. 1 Part 1. Published by the Institution, 17, Gracechurc Street, London, E.C. Price 5s.

The first number of this Journal occupies 94 pages $8\frac{3}{8}$ by $5\frac{3}{8}$ ins.; following the official and editorial notice is an account of the Inaugural Meeting held on March 3rd 1914, containing the address by the President (Sir Boverto Redwood, Bart.), and papers by Sir Thomas Holland Mr. E. H. C. Craig, and Prof. V. B. Lewes. The last par of the volume contains the Memorandum and Articles c Association, By-laws and Regulations, and a list c Honorary Members, Members, Associate Member Students, and Associates.

Journal of the Society of Chemical Industry.

No. 15, Vol. XXXIII. AUGUST 15, 1914. No. 15, Vol. XXXIII.

Liverpool Section.

Meeting held at the University on Wednesday, April 10th, 1912.

MR. ARTHUR CAREY IN THE CHAIR.

THE CATALYTIC REDUCTION OF OLEIC ACID AND COTTONSEED OIL BY MEANS OF HYDROGEN IN PRESENCE OF FINELY DIVIDED NICKEL.

BY T. W. A. SHAW, M.SC.

In recent years several patents have been taken out for the reduction of unsaturated oils by hydrogen in the presence of metal catalysts (chiefly nickel). Very little has, however, been published as to quantitative yield, exact conditions, etc. The following experiments were undertaken to determine the yield, under definite conditions, in the reduction of :—

(a) Oleic acid vapour in a stream of hydrogen under reduced pressure.

(b) Liquid oleic acid by hydrogen under various high pressures.

(c) Cottonseed oil by hydrogen under various high ressures.

The experiments on oleic acid vapour were suggested y the method of reduction (*i.e.*, in the vapour state) nployed by Sabatier and Senderens.

As oleic acid on distillation at ordinary pressure decomoses, the whole process has to be carried out under duced pressure. To this end the following apparatus as devised and used. (Fig. 1.)

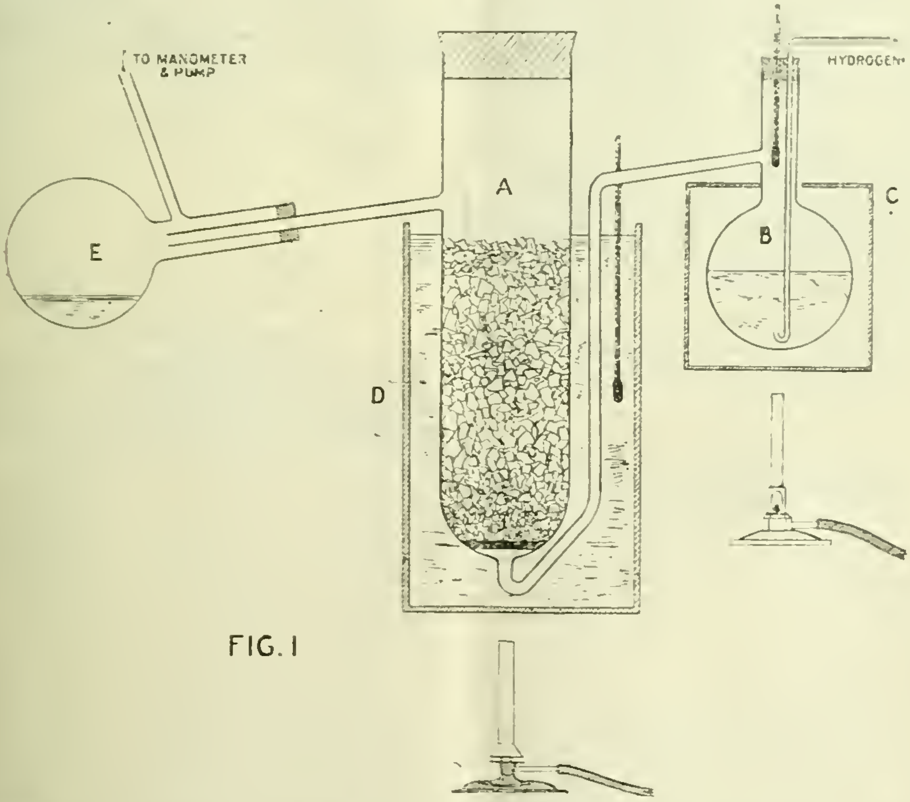


FIG. 1

A is a glass tower containing the catalyst. Its diameter is about 5·5 cms. and the length of the catalytic column is about 30 cms.

The catalyst was made in the following manner: Pumice stone broken into pieces about as large as a pea, and sifted so as to remove from it any fine dust, was placed in a Buchner funnel connected with a filter pump, and a strong solution of nickel nitrate was slowly drawn through it several times until it was practically all absorbed. This solution was generally made by dissolving about 200 grms. of nickel nitrate in its own weight of water. When the soaking was complete the pumice was placed in a muffle furnace and heated to a dull red heat, thereby converting the nitrate into oxide. The pumice with its coating of oxide was again soaked in the nitrate solution and ignited, so as to ensure a large quantity of catalyst. This was then placed in the tower, A, and reduced in a current of hydrogen at a temperature of about 300° C. The heating was effected by immersing the tower in a tall copper cylindrical oil-bath, D, which contained an oil which could be readily heated up to 350° C. to 400° C. if such a temperature were required. The reduction is complete in about two to three hours and its completion is shown by no more moisture collecting in the delivery tube from A. In all these experiments about 300 grms. of the broken pumice was used and after the above treatment about 40 grms. of nickel was deposited on it. The oleic acid was contained in the distilling flask, B, which was sealed on to the tower, and into which a tube passed through which hydrogen could be delivered into the apparatus.

The hydrogen used was generated by means of a Kipp apparatus, and was purified by passing through wash-bottles containing silver nitrate and strong sulphuric acid and also through a U-tube containing small pieces of solid potash, as it is well known that the activity of a metal catalyst can be very greatly diminished and even completely suppressed if there are in the hydrogen even minute traces of certain substances such as arsenic.

The distilling flask containing the oleic acid was heated in an asbestos air-oven, C. The delivery tube from the glass tower fitted into a receiver, E, which was connected through a manometer to a water pump. The pressure could be easily adjusted to the required value by regulating the amount of hydrogen which was passing through and the rate at which the pump was working. The temperature of the oil-bath was so arranged that it was always kept a few degrees higher than the boiling point of tho oleic acid. It was generally kept at a temperature of about 300° C. to ensure that the catalyst was never in contact with liquid oleic acid but only with the vapour, as any oleic acid condensing after distillation, was again vapourised on passing down the tube leading into the bottom of the catalytic tower. The product of the reaction distilled out of the tower and condensed in the receiver, E.

The amount of reduction that had taken place was estimated by determining the iodine value of the resulting product by Wijs's modification of Hübl's method: 0·3 to 0·4 grm. of the substance, as a rule, was dissolved in 10 c.c. of chloroform and to this was added 25 c.c. of the iodine solution. The mean of several determinations gave 79 as the iodine value of the oleic acid which was being used.

The following are the results obtained in the distillation of oleic acid through the catalytic tower under varying pressures. Firstly, distillations were carried out at a pressure of 100 mm. The resulting product had an iodine value of 75. This figure was obtained as mean of three separate distillations and corresponds to a reduction of about 5%. As a check on this figure, a 5% solution of stearic acid in oleic acid was made and its iodine value was determined and found to be the same as above, viz., 75.

In order to see if any further reduction could be obtained the 5% reduced product was redistilled over the catalyst at the same pressure as previously. On determining the iodine value of the product obtained as the result of this redistillation, it was again found to be about 75, showing that no further reduction had occurred. Another redistillation of this substance again caused no change in the iodine value and consequently no change in the amount reduced.

It was thought that possibly this result was due to the catalyst having become poisoned through some cause or another and lost its activity, but on distillation of a fresh portion of oleic acid over it, a reduction of 5% was again obtained.

Distillations were next carried out at a pressure of 150 mm. Two separate distillations at this pressure gave products having iodine values of 70 and 68 respectively, which is equivalent to about 14% reduction of the oleic acid. These products on redistillation gave iodine values of about 67, which is nearly identical with the preceding ones and is equivalent to a reduction of about 15%. Identical phenomena were observed on distillation at a pressure of 200 mm. Here the reduction was about 20%, and redistillation again did not cause further reduction.

These results appeared to point to the existence of an equilibrium in the vapour between stearic acid, oleic acid, and hydrogen, and that the amount of reduction obtained, which varied from pressure to pressure but was constant at any one particular pressure, was the equilibrium amount of stearic acid under those particular conditions. If this were so it should be possible by distilling stearic acid over the catalyst to cause it to decompose into oleic acid and hydrogen until the quantities produced were the equilibrium quantities under those particular conditions. To test this, stearic acid was placed in the distilling flask and distilled over the catalyst in precisely the same manner that the oleic acid had been distilled, freshly made catalyst being used. Both before and after distillation the iodine value of the stearic acid used was found to be zero, no iodine at all being absorbed. Another distillation of the same substance failed to cause it to have any appreciable iodine value. The result of these distillations showed that none of the stearic acid had been converted into oleic acid and seemed to preclude the idea of an equilibrium.

The next thought that suggested itself to explain the fact that no further reduction takes place on repeated distillation, was that on redistilling the partially reduced product, fractional distillation took place and oleic acid only distilled over and was reduced to the same extent as previously, consequently the resulting product appeared not to have altered in any way. It does not appear, however, that this supplies the true explanation, as on redistillation by far the larger portion of the liquid was distilled over out of the flask into the catalytic tower, and also the boiling point of stearic acid does not differ by more than a degree or so from that of oleic acid.

If this phenomenon is due to neither of these causes it is difficult to explain it, but the fact most certainly remains that repeated distillations at any one particular pressure did not cause any change in the amount of oleic acid reduced after the first distillation.

Experiments were then carried out to determine how the amount of reduction in the liquid phase at atmospheric pressure varied with the length of time the substance was in contact with the catalyst. The same apparatus was used as before. The oleic acid was distilled into the tower under reduced pressure, the temperature of the oil-bath being kept too low for the oleic acid to distil out again. When as much oleic acid had been distilled in as was required the pressure was raised to atmospheric by allowing more hydrogen to come in and gradually turning the pump off. The temperature of the oil-bath was then raised to about 275° C., and at certain intervals of time small quantities were distilled out by reducing the pressure, and their iodine values were determined. After each distillation the pressure was again raised to atmospheric and the heating continued, hydrogen passing through the apparatus all the time. The following were the results obtained:—

Portion distilled after heating for—	Iodine value.	M. pt.
2 hours	67	23° C.
3½ hours	62	33° C.
5 hours	60	37° C.
9 hours	46*	50° C.

* This is equivalent to a reduction of about 45%.

Experiments under pressure.

Experiments were next carried out at pressures considerably greater than atmospheric, as it appeared quit feasible that at very high pressures the reduction coul be carried out at considerably lower temperatures an thus in the case of unsaturated glycerides the possibilit of decomposition would be removed.

The first few experiments were of a preliminary natur The apparatus used was a steel pressure cylinder whic had been tested up to a pressure of 300 atmospheres an to which a pressure gauge and a gas cylinder could attached. In order to be able to exhaust the cylinder its air before the hydrogen was compressed in, a thre way valve was designed and made, and was connect between the reaction cylinder and the gas cylinder. Wh the valve was open the reaction cylinder could be co nected to the pump and exhausted. After exhaustion w completed the valve was closed, and the reaction cylind was only connected with the gas cylinder, and hydrog to the desired pressure could then be passed into it. T catalyst, which was made as before, was contained in glass tube about 6 cm. in diameter and 30 cm. long, whi just slipped into the cylinder. A certain quantity of ol acid was poured on to the catalyst, the cylinder co screwed on and the various other gas-tight connectio made as quickly as possible, the apparatus then evacuat and hydrogen to the desired pressure passed in. T cylinder was then heated in an oil-bath to the desi temperature for a certain length of time.

The following are some of the experimental results Pressure in reaction cylinder, 50 atmospheres. Tempe ture of reaction cylinder, 250° C. The pressure fell in first ½ hour to 47 atmospheres and remained constant that figure for over 3 hours. The cylinder was then ope and the tube containing catalyst and oil removed, and its contents transferred to a distilling vessel the same as had been previously used for the experiments under reduced pressure, the only difference being that the sealed-on distilling flask, not now being required, had been cut out. The oil was then distilled out from the catalyst under reduced pressure; the iodine values of the products obtained in two experiments under these conditions were 67·2 and 66·9.

The great disadvantage of using the apparatus in this manner was that the oil had to be poured over the catalyst all at once, and rapidly falling to the bottom of the vessel collected there and consequently only a very imperfect contact between the oil, catalyst, and hydrogen was obtained, so in the final state the apparatus was modified in such a way as to allow the oil to be fed over the catalyst as slowly as possible.

The cover of the cylinder was drilled through, and a smaller cylinder, acting as a high pressure oil feeder, attached to it through a high pressure valve. The thread on the spindle of the latter was such that a very delicate regulation of the flow of liquid could be obtained. The upper vessel was connected through a T-piece and three-way valve to a hydrogen cylinder, a pressure gauge, and an exhaust pump (as in the case of the reaction-vessel). Both oil feeder and reaction vessel could therefore be separately and independently exhausted and filled with hydrogen to any desired pressure. The construction will be evident from the accompanying figure (Fig. 2).

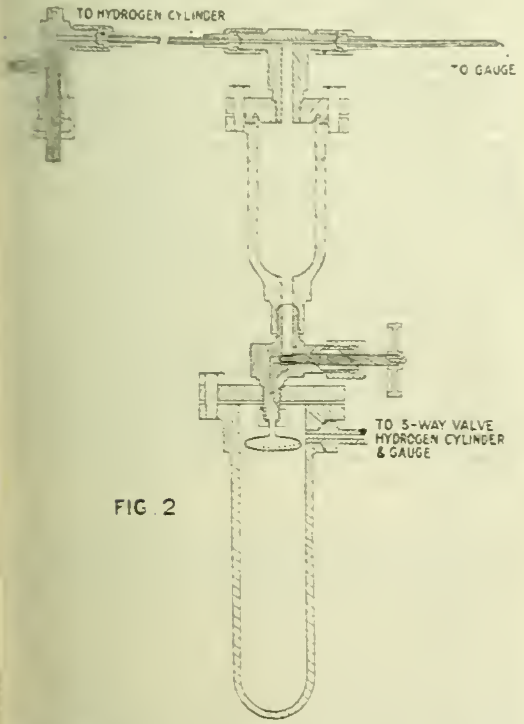


FIG. 2

The experiments were carried out as follows:—The atalyst, contained in the wide glass tube, was placed in he lower cylinder and the oil in the upper one. The pparatus was then screwed together.

Both cylinders were now exhausted, washed out with ydrogen, and then filled with hydrogen to the desired essures, the pressure in the oil-feeder being always several mospheres higher than that in the reaction-vessel in der to force the oil into the latter. The lower cylinder as heated in the oil-bath to the desired temperature, the hole apparatus being suspended from a pulley by means which it could be raised or lowered. Before running e oil in, the catalyst was usually heated in hydrogen at few atmospheres' pressure for an hour or so, to sure complete reduction to metallic nickel. This hydrogen was then pumped out and hydrogen up to the pressure required for the experiment run in. Everything being ready the spindle was turned slightly and oil allowed to run very slowly over the catalyst through a suitable sprinkling device. It was, of course, necessary to know the rate at which the oil was being delivered from the top cylinder, and owing to the high pressures being used it was impossible to have anything in the nature of a glass gauge which would show the level of the liquid in the upper cylinder. This difficulty was readily overcome however, as, the volume of the upper cylinder and the volume of oleic acid in it being known, a consideration of the reduction of pressure indicated by its gauge enables the amount of oil run out to be determined.

A concrete illustration will explain this. The volume of the upper cylinder was approximately 300 c.c., and the volume of oleic acid taken was 240 c.c. Therefore the original gas space was 60 c.c.

It is required to deliver the oil completely from the upper to the lower cylinder in 6 hours, *i.e.*, at the rate of 40 c.c. per hour. The original pressure in the upper cylinder was 70 atmospheres and in the lower 50 atmospheres. The gas volume at the end of half an hour when 20 c.c. have been delivered is 80 c.c. and the pressure registered by the gauge attached to the upper cylinder will be $70 \times \frac{60}{80}$, or 52·5 atmospheres. Consequently all that has to be done to ensure the oil being delivered at that particular rate during the first ½ hour is to see that the pressure drops steadily from 70 atmospheres to 52·5 atmospheres in ½ hour. This can readily be done by manipulating the spindle so as to allow less or more oil to run out as the case may be. As the pressure in upper cylinder has always to be greater than the pressure in the lower cylinder it is necessary at this stage to fill up again to 70 atmospheres. The gas volume is now 80 c.c. at a pressure of 70 atmospheres. At the end of the next ½ hour when another 20 c.c. will have run out the pressure will be $70 \times \frac{80}{100}$, or 56 atmospheres. The cylinder is filled up again to 70 atmospheres and the process repeated.

In this way the pressures, corresponding to an outflow of oil at this rate at intervals of time during the 6 hours can be calculated and by manipulating the spindle it is arranged that these calculated pressures are obtained.

The following are a whole series of pressures calculated for the delivery of 240 c.c. in 6 hours.

Pressures after ½ hr. $= 70 \times \frac{60}{80} = 52·5$ atmospheres.
" 1 " $= 70 \times \frac{80}{100} = 56$ "
" 1½ " $= 70 \times \frac{100}{120} = 58·3$ "
" 2 " $= 70 \times \frac{120}{140} = 60$ "
" 3 " $= 70 \times \frac{140}{180} = 54·4$ "
" 4 " $= 70 \times \frac{180}{220} = 57·3$ "
" 5 " $= 70 \times \frac{220}{260} = 59·2$ "
" 6 " $= 70 \times \frac{260}{300} = 60·6$ "

A series of experiments under the following conditions were made: Pressure in upper cylinder 70 atmospheres. Pressure in lower cylinder 50 atmospheres. Temperature of lower cylinder 150° C. Time of delivery of oil from upper to lower cylinder was 6 hours. After the reaction the contents of the lower cylinder were transferred to the distilling vessel and distilled; the iodine values of the products of two experiments came out as 82·4 and 83·2, the iodine value of the original oleic acid used in this series of experiments being 84·5, so that very little reduction had taken place.

Two more experiments were then carried out at a temperature of 250° C. The iodine value in each case was 81, so that in all these experiments the amount of reduction of the oleic acid occurring was considerably less than would be expected.

In all these experiments a brass rose soldered on to the lower part of the upper cylinder had been used as a sprinkler for the oil, and it was thought that possibly something had been dissolved out of this brass sprinkler and that this had had a poisoning effect on the catalyst, so it was cut out altogether and a glass sprinkler substituted.

An experiment carried out under the same conditions of temperature and pressure, gave now a product which had an iodine value of 52 which is equivalent to a reduction of 35%, so it appeared certain that some ingredient either of the brass or of the solder had poisoned the catalyst in the previous experiment. It is scarcely likely that the substance having an poisoning effect would be the zinc out of the brass as it would have no tendency at all to deposit on the nickel, neither would it be the copper, as copper itself acts as a hydrogenizing catalyst like nickel; it might, however, be the lead or tin out of the solder both of which are lower down the electro-motive series than nickel and would deposit on it.

A series of experiments were made and the following were the results obtained:—

(1) Pressure in lower cylinder, 50 atmospheres. Temperature of lower cylinder 250° C. Time of delivery of oleic acid from upper to lower cylinder was 6 hours. Iodine value of resulting reduced product was 52, which is equivalent to a reduction of about 35%.

(2) Pressure in lower cylinder, 25 atmospheres. Temperature of lower cylinder, 250° C. Time of delivery of oleic acid was 6 hours. Iodine value of resulting product was 64, equivalent to a reduction of about 20%.

(3) Pressure in lower cylinder, 5 atmospheres. Temperature of lower cylinder, 250° C. Time of delivery of oleic acid was 6 hours. Iodine value of resulting product was 77, equivalent to a reduction of about 4%.

From the above results it will be seen that increase of pressure causes an increase in the amount of reduction, the other factors, temperature, etc., remaining the same.

A few experiments were also carried out with cottonseed oil. The temperature at which the reduction was carried out was in this case 200° C. and the result showed a very considerable reduction of the glyceride. At the two pressures of 25 atmospheres and 50 atmospheres a reduction of over 50% of the glyceride occurred and a hard product was obtained having a melting point of about 50° C.

In conclusion I wish to thank Professor Donnan for his ever-ready assistance and advice, and also Dr. Harger for the kind loan of some of the pressure apparatus.

New York Section.

Meeting held at Rumford Hall, Chemists' Building, on Friday, May 22, 1914.

MR. G. W. THOMPSON IN THE CHAIR.

FERROSILICON AND ITS DANGERS.

BY CHARLES E. PELLEW.

In the spring of 1913 I was requested by the Secretary of the American Association for Labour Legislation to look into the dangers connected with ferrosilicon. I was informed that abroad it was generally believed that its transportation was extremely dangerous when the percentage of silicon was from 30 to 70%, and that stringent regulations had been established by at least one foreign government with regard to its transportation.

I was also informed that the Seventh Delegates' meeting of the International Association for Labour Legislation in 1912, in addition to adopting a set of principles for submission to the various governments on the methods of handling ferrosilicon, had also resolved that:—

"Further inquiries ought to be made into the question of whether ferrosilicon containing less than 30% or more than 70% of silicon involves a risk of poisoning or not, and into the possibility of prohibiting the manufacture of ferrosilicon containing from 30 to 70% of silicon."

This is the inquiry which I was requested to prosecute. My investigations, including a careful examination of the literature of the subject, personal inquiries at the offices of insurance and transportation companies, as well as visits to all of the principal works in the United States and Canada, have led me to conclusions radically different from those apparently accepted for years in Europe.

History of ferrosilicon.

For a long time it has been known that iron was capable of combining with different percentages of silicon, and in 1895, Moissan published in the Comptes Rendus a description of a true silicide of iron, prepared by electricity and also in a muffle furnace, consisting of 80% of iron and 20% of silicon, corresponding to the formula, Fe_3Si (see this J., 1896, 115). It was soon discovered that similar compounds, with varying proportions of iron and silicon, could be made without much difficulty in the electric furnace, but they were of little more than theoretical interest until, about 1902, it was found that these alloys of iron and silicon could be used to great advantage in the manufacture of steel. For many years one of the great problems in the steel industry was how to diminish and, if possible, avoid entirely the blowholes and pipes that were formed when steel, whether open hearth or Bessemer, was poured from the ladles into the large ingot moulds. It was often necessary to cut off 20 or 25% of the upper parts of the ingots before perfectly sound metal was reached. It was found that the addition of quite small amounts, say from ¾ to 1% of ferrosilicon, to the steel while in the ladle, evolved a great deal of heat from the combustion of the silicon. This not only thinned the metal considerably, but at the same time absorbed the oxygen dissolved in the steel, with the result that, on pouring into the moulds, perfectly solid ingots resulted with no blowholes at all. This very important discovery at once made ferrosilicon a valuable article of commerce and an essential factor in the stee industry of every part of the world. During the last few years another use has been found for it in the cast iron industry. Experts are using it more and more each year in foundry practice, sometimes to produce specia high silicon castings for use in electrical work; sometime to increase the fluidity of iron in castings; and sometime to substitute silicon for some of the combined carbon in th iron, thus enabling them to produce grey castings from white iron, by treatment in the ladle. As yet the deman for ferrosilicon from this source is not large as compared t that of the steel industry, but it is rapidly growing i importance.

Varieties and preparation of ferrosilicon.

The ferrosilicon of commerce is divided into two distinc varieties, differing not only in chemical composition, bu also in the method of manufacture. Low grade ferrosilicon containing not over 15% of silicon, is made in the blas furnace and, in fact, may be considered as a speci grade of pig iron. It is not very easy to make and, as th value of the product lies in the amount of silicon presen it is evident that it is very expensive to transport. T low percentage of silicon interferes greatly with its u as a fuel in the steel industry, and to some extent foundry work, and its manufacture is gradually dying ou

The ferrosilicon that is of so much importance to th world, nowadays, is the so-called "high grade" materia running from 15 or 20 up to 90% or more of silicon, whi can be made only in the electric furnace. The raw materia for its manufacture consist of (1) *iron*, in the form of scr iron, scrap steel, or iron ore; (2) *silica*, either quar sand, or sandstone; and (3) *reducing material;* commor either anthracite or coke, but occasionally, for the sa of great purity, charcoal, or oil coke. These materia in proper proportions, are melted together in a sim electric furnace, and the molten product, mixed with little slag, is drawn off at intervals, allowed to cool, brok into lumps, and stored or shipped.

Properties of ferrosilicon.

These, of course, vary with the comparative percentages of iron and silicon, and also, to some extent, with the requirements of the consumers. The steel men wish their ferrosilicon to be in lumps, containing a large proportion of silicon and yet not too light. If in powder or fine pieces it causes a tremendous ebullition when thrown into the almost white hot steel in the ladle, and a varying amount of the ferrosilicon is carried away in the fumes—causing a waste of valuable material, and at the same time introducing a condition of uncertainty about the composition of the finished product. If the silicon percentage is too low, much of the heat of combustion of the silicon is wasted in melting the accompanying iron. On the other hand, the specific gravity of silicon is less than one-third that of iron; and therefore, if the silicon is too high, the material may be so light as to swim on the top of the steel kettle and not distribute its heat and its materials uniformly.

Accordingly, the demand of the steel industry, in the United States and also abroad, is for large solid lumps containing not far from 50% of silicon. Another explanation, by the way, for this preference for the "so-called 50% grade," was given by Dr. Copeman in his elaborate report on ferrosilicon made in 1909 to the Local Government Board, in England.[*] He stated that the only reason for the employment of this grade that he had been able to learn, was "found in the facility its use affords to the workman in calculating the quantity of silicon required as an addition to any particular bath of metal." This would seem rather a reflection upon the education and intelligence of the European steel workers. Furnace men do frequently insist on having the composition of important raw materials kept as uniform as possible, so that they do not have continually to alter their charges. But it is surely unusual to have that composition kept at any particular percentage for the sake of saving some office clerk a few minutes' simple calculation.

In foundry practice the requirements are somewhat different, for the ferrosilicon is usually added in a powdered or granular form to the molten metal as it runs from the cupola into the casting pot. So the lumps so necessary for the steel men must be crushed into fine pieces before the iron men can use them. When not hampered by excessive cost, they prefer the percentage of silicon as high as possible, for often they must add silicon in considerable quantities, to get tho required composition in their finished iron, and if they used low grade ferrosilicon they would never be able to melt such a mass of solid material at the comparatively low temperature of the iron coming from the cupola.

It is claimed, further, by some manufacturers that the most economical output of their electric furnaces is ferrosilicon running near the 50% grade. When it gets much above this, they say that the extra expense of production makes each unit of silicon more costly to the consumer, a reason which, if true and not simply imaginary is undoubtedly the most conclusive one for making this the standard grade of the material all over the world.

Preparation.

The discovery of the valuable properties of ferrosilicon, and the resulting demand for it, happened to coincide with the collapse of the "boom" in the manufacture of calcium carbide. For two or three years around 1900 the anticipations that acetylene would speedily replace coal gas and water-gas as an illuminant on a large as well as a small scale, had induced engineers to put up electrical furnaces, large and small, wherever cheap water power could be obtained. When the demand for calcium carbide suddenly dropped, a great number of the small electric plants all over Europe, in Savoy, Switzerland, the Tyrol, Norway, Sweden, and even in Bosnia, turned with eagerness to the new industry, and began to put ferrosilicon on the market in large quantities.

The price at first was high, $110 or so a ton (calculated on the 50% grade), and, encouraged by this and by the duty of $4 a ton, the Electro-Metallurgical Company, of Niagara Falls, started to manufacture it in 1907, and have continued ever since, making on an average not far from 15,000 tons a year. Works were also started by the same company at Kanawha Falls, West Virginia, but the drop in the price of ferrosilicon to less than $60 a ton in 1909, and to $51·50 (f.o.b. Pittsburg) in 1911, due to keen competition, made these works unnecessary. In 1908 the Electro Metals Company started their works at Welland, Ontario, obtaining their power from the Canadian Falls at Niagara, and producing some 7000 or 8000 tons a year. This is consumed largely in Canada, but considerable quantities are shipped from there into the United States to the almost complete exclusion of European ferrosilicon. At present it is estimated that the average consumption of ferrosilicon in the United States is from 18,000 to 20,000 tons a year, of which 3000 to 4000 tons are imported from Canada. Nine-tenths or more of this material is of the 50% grade, and during the past year, 1913 to 1914, the average price, at Pittsburg, was about $71 a ton.

Dangers connected with ferrosilicon.

A short time after the introduction of ferrosilicon into commerce it was reported as being distinctly dangerous, not so much to those engaged in manufacturing it, as to those employed in handling and transporting it.

A. Dangers of explosion.—In January, 1904, an explosion occurred, at Liverpool, in a cargo of ferrosilicon from Trieste which had been standing on the dock for some four weeks. The material had been shipped in iron drums and while these were being placed in a warehouse two of them exploded violently. It was supposed that the trouble was due to pent up gases, and so, to save further accidents, the ferrosilicon was transferred into wooden barrels with holes bored in the top. But, ten days afterward, when one of these was being handled, it also exploded, shattering the barrel and severely injuring the workmen. A very careful investigation of the whole matter was made by two Government officers, Dr. Dupré, Chemical Adviser to the Home Office, and Capt. Lloyd, His Majesty's Inspector of Explosives, and their report is given in full in the Journal of the Iron and Steel Institute for May 5th, 1904 (see this J., 1904, 622). They reported that the explosions, in their opinion, were due to the combustion of an inflammable gas, mainly consisting of phosphoretted hydrogen. At the end of their report they pointed out the possibility of very serious accidents resulting from this condition of affairs and urged everybody who had to store or handle ferrosilicon to be fully alive to its possible dangers, "and, by keeping it in a dry and thoroughly well-ventilated place, prevent the accumulation of inflammable gas as far as possible." At the same time analyses were published, made by W. Watson Gody, showing the percentage of silicon to be from 53·80 to 59·40, and proving the presence of small quantities of both calcium and phosphorus, 0·14% and 0·056% respectively, and also of 0·218% carbon. He said also, that besides phosphoretted hydrogen in the gases from the casks, he found acetylene and arseniuretted hydrogen in small quantities.

While these explosions were the only ones publicly mentioned at this time, it was found a few years later that at about this period, *i.e.*, 1903 to 1904, one of the great English steel companies had been getting 50% ferrosilicon from the Continent, in iron drums, and that when they were opened with crowbars, almost every other one produced an explosion. These, however, were not as a rule violent, and no workmen were injured.

The explanation was probably as follows. As previously mentioned, during the first few years the ferrosilicon industry was an after-growth of the declining calcium carbide trade. The factories were small, situated in the mountain districts of Europe, and the same furnaces were frequently used alternately for the one or the other product, according to the temporary demand, without any real pains being taken to clean out the hearths or to keep the raw materials distinct. Accordingly early analyses show the presence of calcium in quite large amounts (*e.g.*, in 6 samples of ferrosilicon analysed in 1901, the calcium ran from 0·79 to 14·4%), associated with both carbon and phosphorus. If the iron drums, in which the material was shipped, were perfectly tight, and if it were perfectly dry to start with, no damage would be done, but if the material were packed while wet, or if the drums were old and leaky, and the contents got damp, then enough acetylene and phosphoretted hydrogen would be produced to form an explosive mixture with the air, which might be ignited by sparks from tools, or even from friction of pieces of ferrosilicon on each other. Under ordinary conditions the amounts of this gas would not be enough to cause serious trouble. But in the Liverpool case enough moisture was absorbed through the packages by the three weeks' exposure on the docks, in December, to accumulate a bursting charge.

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[*] Copeman's Report, p. 109.

Several suggestions were made in the report with a view to avoid further explosions, such as (1) to fill the drums with high flash-test paraffin oil, which would keep both air and moisture away from the ferrosilicon, and, at the same time not be liable, itself, to ignition; (2) to pack the ferrosilicon, dry, in watertight drums, free from any water: (3) to keep the material wet for several days before shipping it, so that any gases should escape before it was packed for transportation. As far as I can find not one of these suggestions was generally adopted. But very possibly owing to the wide interest excited by these explosions, the packing of ferrosilicon in tight iron drums seems to have been largely if not entirely abandoned, and, as the manufacturers, at the same time, have learned the importance of keeping their product free from calcium carbide, no further explosions have been reported.

B. Dangers from poisoning.—To this change in the methods of packing is perhaps due the fact that, not very long afterwards, cases began to be reported of serious illness and even of death, where people were exposed to fumes arising from wet ferrosilicon.

1. "*Vaderland.*"—The first of these to be reported occurred in January, 1905, on the S.S. Vaderland, bound from Antwerp to New York, with 72 cabin and 951 steerage passengers, and an assorted cargo. When New York was reached after a very rough voyage, the officers reported some 50 cases of illness in the steerage, and 10 deaths, while another died on board ship, two days after reaching port. The ship was sent back to Quarantine and held there, while the passengers were taken to Hoffman's Island, and kept under careful supervision. The ship's doctor reported the cause of deaths as "acute pulmonary congestion and pneumonia." Autopsy by the health officer of the port indicated "pneumonia complicated by nephritis." The passengers themselves made charges against the steamship company of bad food, improper sleeping accommodation, and insufficient ventilation. The officers, on the other hand, pointed out that the passengers, mostly Hungarian field hands, came on board in poor physical condition, underfed and very poorly clothed, and had suffered greatly from seasickness, while the sea had been so high that they had been kept below hatches almost all the way.

The symptoms, both at sea and in port, did not correspond exactly with those of pneumonia, and, after landing, the cases rapidly improved. But for the first few days additional interest was excited by the suggestion, widely spread by the press, that the trouble was due to an outbreak of "pneumonic plague," a rare and extremely deadly variety of the well-known bubonic plague, where the infection attacks the throat. Some 250 of the patients, who seemed to be perfectly well, and had not been in close quarters with the sick, had been allowed to land before this suggestion of "plague" had been made, and much trouble and annoyance resulted from trying to collect these all again, and get them back under observation. Finally, after some weeks of careful inquiry, it was decided that the trouble was caused by the evolution of poisonous gases from 591 barrels of high-grade ferrosilicon, stored in the hold immediately below the steerage quarters.

2. *Keadby canal boat.*—In October, 1905, an English doctor found a family on a canal boat seriously ill from some unknown cause. The two children died, and the parents suffered severely, but recovered. A peculiar and very pronounced smell was noticeable in the cabin, and, on examination, five tons of high grade ferrosilicon packed in boxes was found in the cargo. On analysis, the ferrosilicon showed the presence of 7% calcium and 1½% carbon (phosphorus not determined); and it was shown that the weather was wet, and that it had been necessary to cover the cargo with sail cloths, to protect it from the rain. The coroner's jury attributed the deaths to poisonous fumes arising from the ferrosilicon, and reported their conclusions to the Board of Trade.

3. *Rhine canal boat.*—In March, 1906, two children died on a German canal boat, and their parents, who stayed on deck most of the time, suffered severely from headache and giddiness. On investigation it was found that besides other cargo, the boat was carrying 750 tons of high grade ferrosilicon, which was being brought down the Rhine from Switzerland to go to Essen. The cabin occupied by this family was directly above the hold containing the ferrosilicon, and it was believed that the gases had been drawn up through the under deck, by an updraught caused by lighting a stove in the cabin. The case was carefully investigated by Dr. Lehnkening of Duisberg, where the family were treated, and in his report he refers to four other cases where illness and death had occurred on Rhine cargo boats, caused in each instance by fumes from ferrosilicon in the cargo.

4. *Swedish steamship "Olaf Wyjk."*—In February, 1907, a Swedish steamer from Gothenberg, with six passengers aboard, arrived at Antwerp after a three days' passage. Four of the passengers died on the way, and the captain, stewardess, some of the crew, and the two remaining passengers were made seriously ill, but recovered.

One of the passengers was a well-known Russian revolutionist, escaped from Russia, and ordered out of Sweden upon the demand of the Russian Government. His deat under these strange conditions created great excitement among the Socialists in Sweden and elsewhere, wh practically accused the two Governments of contriving a deliberate murder. A thorough investigation wa accordingly started in both Stockholm and Antwerp, an after several months' work the chemical and medical expert who were interested in the case showed conclusively tha the trouble was caused by the presence of 15 tons of 50 ferrosilicon, stored in the hold just underneath the sleepin quarters of passengers and crew.

They showed that under the influence of the damp air i the hold, aided by the friction due to the motion of th ship, this ferrosilicon produced large quantities of poisonou gases, composed of 95% phosphoretted hydrogen and 5 arseniuretted hydrogen.

5. *Swedish ship "Uleaborg."*—In May, 1908, whil this ship was sailing from Stockholm to St. Petersbur nearly all the crew and the second class passengers we taken seriously ill, and two of them died. The illness w traced to the gases evolved from some 45 tons of ferr silicon in the hold.

6. *English keel "Harry."*—In October, 1908, this bo was carrying goods on the canal to Sheffield, when th captain and mate died, and a woman was taken dangerous ill, but recovered. In the cargo was a shipment of barrels marked "scrap iron," which, on investigatio found to be high-grade ferrosilicon, on its way fro Antwerp to Sheffield. In a suit for damages brought lat by the widow against the shippers, it was proved in cou that this was the cause of death.

7. *Other English canal boats.*—About this time, appeared in a later investigation, other cases of poisoni took place on canal boats carrying ferrosilicon to Sheffiel In one of these two boys, and in another two children, we made seriously ill, but recovered, while a dog that was the same cabin for a greater length of time, died.

8. *English steamship "Ashton."*—The last of this seri of accidents, which impressed on the authorities all o the world the possible dangers of ferrosilicon, occurred December, 1908. On the 24 hours' trip of an Engli steamer from Antwerp to Grimsby, all the emigra passengers aboard, fortunately this time only five number, died some hours before reaching port.

The British authorities at once started a most ri investigation, and it was soon shown that the deat were caused by poisonous fumes, mainly consisting phosphoretted hydrogen, evolved from about nine t of high-grade ferrosilicon, stored in the hold immediat under the emigrants' quarters.

After this accident the British Government took up the matter seriously. A committee, consisting of Dr. Copeman, Medical Inspector of the Local Government Board, Mr. Bennett, a Government Inspector of Factories, and Dr. Hake, was appointed to make a thorough investigation of the whole subject, and in 1909 their report was printed, as a "Yellow Book" of 115 pages, forming a supplement to the 38th Annual Report of the Local Government Board.

British Government report on ferrosilicon.

This elaborate and carefully prepared report not only takes up the properties, uses and dangers of ferrosilicon, but gives the result of conferences with manufacturers of ferrosilicon on the Continent as well as with importers and users of it in Sheffield. It describes the action taken by manufacturers and transport companies in Europe to prevent accidents from it, as far as possible, and mentions the official orders and regulations on the subject in England and other countries.

For our purposes the most important part of the document is Dr. Wilson Hake's report on the chemical investigation of ferrosilicon, upon which are chiefly based the conclusions and recommendations with which the committee closes its investigation.

Chemical report on ferrosilicon.

This covers the physical as well as chemical examination of 64 samples of ferrosilicon obtained from English and foreign manufacturers, and varying in composition from 4 to 96% of silicon.

As impurities to be met with in commercial ferrosilicon the committee mentions *calcium phosphide*, due to the reduction of calcium phosphate (phosphate of lime) commonly present in the quartz and coal of the raw materials. This material is readily decomposed by moisture, forming lime and the extremely poisonous phosphoretted hydrogen, and it is mentioned as the source of the latter gas in the poisonous fumes.

Arsenic is sometimes present, probably derived from the same raw materials, in the form of calcium arsenide, which, when acted on by water, is the source of the arseniuretted hydrogen sometimes recognised in the fumes.

Calcium carbide was commonly found in the earlier specimens of ferrosilicon made in carelessly cleaned carbide furnaces, but is now rarely if ever found. In moisture this evolves acetylene, a gas which is not poisonous, but is inflammable, and, when mixed with air, is explosive. The whole report shows conclusively that the poisonous properties are due to the evolution of phosphoretted hydrogen by the action of water upon calcium phosphide, existing as an impurity in the ferrosilicon. Special apparatus was designed by Dr. Hake, for the purpose of determining the least amount of this gas that could be produced from these samples. And he makes careful mention on page 84 that, when any gas had been evolved by the action of water upon one of the samples, the contents of the flask were *invariably* alkaline to litmus, and that the water used contained *free lime.*

Influence of silicon percentage on evolution of poisonous gases.

While recognising that the dangers of ferrosilicon were due to the impurities present, and especially to phosphide of calcium, the committee seems to have made up its mind from the very beginning that these impurities were unavoidable, and they concentrated their efforts in attempting to trace a relationship between the percentage of silicon, in the different samples they examined, and the evolution of phosphoretted hydrogen.

In every case of poisoning that has been reported the ferrosilicon was high grade, and when analysis had been made, the amount of silicon had been reported as between 50 and 60%. This committee noticed that there was a great difference in the physical condition of the different samples which they examined. When freshly made, ferrosilicon is in the form of a solid mass, with metallic lustre, not very different from some varieties of cast iron, ferromanganese, and other iron alloys. This is particularly the case with the low-grade ferrosilicon, which is practically nothing more than a highly silicious pig iron. The very high grade material, 70, 80, and 90 or 95% of silicon, is also, while light, very dense and solid. But the intermediate grades, they found, are apt to be more or less porous and loose in structure, and on standing, show a marked tendency to disintegrate, and break down into powder.

With this disintegrating property, they also found an increased evolution of poisonous gas, which they attributed to the large surface of material exposed to dampness. And Dr. Hake gives as his general conclusion, based upon his examination of the 64 samples examined by him, "that these might be classified in three groups, viz. :—

"Class I., 10 to 30% silicon, containing practically no poisonous impurities, and not liable to spontaneous disintegration.

"Class II., 70 to 96% silicon, not entirely free from poisonous impurities, but also not liable to disintegrate spontaneously.

"Class III., 35 to 60% silicon, containing, in most instances, a considerable proportion of poisonous impurities, and in addition being more or less liable to spontaneous disintegration."

This conclusion about the dangerous influence of certain percentages of silicon was further emphasised in the elaborate and highly technical report, contained in the same "Yellow Book," upon the "composition and structure of ferrosilicon," by Mr. Bennett. He closed his paper with the following statement—"The amount of gases given off by different grades of ferrosilicon depends not only on the impurities present in the materials used in the electric furnaces, but also on the physical properties of the alloys, in consequence of which, in certain cases, access of moisture is afforded to a much larger extent of surface."

The final conclusion of the committee was that it was impossible to control the poisonous properties of ferrosilicon by any care with regard to pure raw materials: that practically all ferrosilicon of the 50% grade was liable to give off poisonous gases when exposed to moisture; that low grade ferrosilicon (10 to 15%) did not evolve these gases, even in the presence of moisture; that certain grades of electric furnace ferrosilicon were practically quite innocuous, these grades being 30% and under, and probably, though not so certainly, 70% and over.

Therefore, in view of the fact that the dangerous grades were apparently not essential in the iron and steel industry, except perhaps for making basic steel, they advised "that the production of this alloy of grades ranging between these percentages should be discontinued in the future."

They also urged the iron and steel men who used ferrosilicon to assist by limiting their orders to the safe grades, and they suggested the following regulations, which were officially adopted by the Board of Trade.

Board of Trade Regulations.

1. That the ferrosilicon should be broken into pieces of the size usually sold, and stored in the works, exposed to air, for at least a month before shipment.
2. Each package to be marked in bold letters, with the name and percentage grade of the material; the name of works where produced, the date manufactured, and the date of shipment.
3. Its carriage on passenger ships to be prohibited. On cargo vessels it should be stored on deck, or in well-ventilated holds, separated from quarters of the crew by air-tight bulkheads.
4. The same rules to apply to river and canal barges as to sea-going vessels.
5. Storage places for ferrosilicon at docks or at works where used, to have free access of air, and to be away from work-rooms, mess-rooms, offices, etc.

Further regulations with regard to ferrosilicon.

As a result of this very thorough and elaborate government investigation, the attention of iron and steel men and of shipping agents, all over the world, was called to the dangerous properties of ferrosilicon. In France a committee of manufacturers studied the whole matter very thoroughly and in their report, which appeared soon after the English "Yellow Book," they confirmed the conclusions reached in the latter. Everywhere in Europe it was conceded that the grades between 30 and 70% were dangerous, and must be manufactured, transported, and used as little as possible.

The United States still persisted in calling for these grades, and it was found very difficult to supply them. Some manufactures tried shipping it in lumps carefully coated with paraffin, to protect it from moisture, to the great annoyance of the steel workmen who had to shovel it into the melting pots. Others proposed using tight iron barrels filled in with low flash point paraffin oil.

Later Board of Trade Regulations.

In July, 1912, the British Board of Trade issued an order, which took the place of their previous orders on ferrosilicon, issued in September, 1907, March, 1909, and February, 1910, and which is still, I believe, in force. In this shippers were warned that the carriage of ferrosilicon between 30 and 70% was highly dangerous, and was prohibited on both cargo and passenger vessels. Above and below that grade, it could be carried on deck, on either passenger or cargo boats, if broken in pieces and stood for a month before shipment and packed in strong wooden cases pierced with holes on each side and properly labelled; when carried on a deck with sleeping accommodation it must be separated from the nearest cabin by clear space of at least six feet.

On cargo vessels it might also, after complying with the above conditions, be carried in adequately ventilated places under deck; but it must then be separated by air-tight bulkheads from any quarter occupied by crew and from any food-stuff or other cargo liable to be damaged by poisonous fumes.

United States Regulations.

In this country the government authorities issued much simpler orders on the subject. On February 24th, 1912, the Register of the Treasury Department at Washington, issued an order in which he "holds ferrosilicon to be a dangerous article, not transportable on passenger vessels."

A letter dated March 1st, 1912, received by one of the great trans-atlantic steamship companies, from the Department of Commerce and Labour, contains the following ruling. "The matter of whether ferrosilicon, packed in casks, may be transported on steamers carrying passengers, having been under consideration by the Department under date of February 24th, 1912, File No. 47911, this Bureau advised the Collector of Customs, at New York, that 'in the existing condition of the law, therefore, as I understand it, the transportation of ferrosilicon *in any form* on steamers carrying passengers is unauthorised.'"

Steamship companies' rulings.

Besides these government orders, the different transportation companies have adopted special rules and regulations of their own upon the subject of carrying ferrosilicon, these applying not only to the importation of it, but also to its exportation, and, in some cases at least, covering a strangely wide range of articles.

As far as can be learned by careful inquiry these rules have not been due to any action on the part of insurance agents. At the office of the Board of Marine Underwriters of New York, in the spring of 1914, neither the secretary nor any of his staff had ever heard of any danger of any sort connected with the transportation of ferrosilicon, and positively refused to believe that there was anything at all unusual connected with it. A few months earlier a friend in the office of a large underwriting house obtained, in a few minutes, over the telephone, an offer of insurance for a large lot of ferrosilicon, from Antwerp to New York, at the rate of 25 cents per $100.

It was a very different question, however, when it came to asking for transportation for this same material from the various steamship companies. All of them refused to take it, absolutely, on cargo as well as passenger vessels, and he was assured that the only way to bring it over would be by a special arrangement with some "tramp" cargo-boat.

At many of the offices reference was made to a book, "Dangerous Goods" published in Antwerp, 1910, by Dr. Julius Aeby, consulting chemist to one of the great trans-atlantic lines. On page 172 is the following:— "Ferrosilicon—solid—may give off poisonous and explosive gases (arseniuretted and phosphoretted hydrogen). Has been the cause of several accidents with mortal issue. It seems that the brands containing 15% silicon, or less, are not dangerous."

But, not content with this, on pages 166 to 171 inclusive, and 173 and 174, are the references to the following:— "Ferro-chrome-nickel; ferro-manganese-silicon; ferro-manganese; ferro-molybdenum; ferro-phosphorus; ferro-tungsten; and ferro-vanadium." Each one of these eight different alloys, produced in different parts of the word, and of great importance in many different branches of the steel and iron industry, is carefully included in this standard Reference Book on Dangerous Goods with one and the same statement made about each of them: "Ascertain if it does not show the same danger as ferrosilicon."

Silicon metal.

To show how far this scare, originating in the accidents caused by ferro-silicon, has spread so as to interfere with the ordinary rules governing transportation, the officers of one of the great transatlantic lines showed me some interesting correspondence on the subject of silicon metal.

In the autumn of 1909 the Carborundum Company of Niagara Falls had an order from the continent for some of this material, and wrote a careful letter to the steamship company to see if they would transport it for them. They explained that the material was made from pure glass sand and pure coke, was extremely resistant to all sorts of outside influences, such as air, heat, moisture, acids, etc., and they sent them samples, for examination, with the accompanying analysis, as follows: silicon, 92·56, iron, 3·09, aluminium, 2·75, carbon, 1·60.

This letter, with sample and analysis, was forwarded to Dr. Aeby, and in November, 1909, his answer arrived, as follows: "As in the case of all products manufacture by the electric current, this metal contains traces o carburet, phosphorus and arsenic, and in view of th accidents which this silicon metal has caused, you wil readily understand that I do not care to give you a *absolute guaranty* of this metal being 'not dangerous.'

"It is particularly impossible to base an opinion on few grams only, whether a quantity of several tons wil stand the movements of a vessel.

"As, however, the metal is very hard, and these trace are so small, I think there is no great risk in carryin it, especially if the manufacturer guarantees its inoffensiv ness.

"Yours truly," etc.

As a result of this report the shipment was refused.

What is the real cause of danger in ferrosilicon?

After studying carefully all the published informatio I could obtain on the subject of the poisonous properti of ferrosilicon, it seemed to me that one important par of the problem had not had sufficient attention given to i

The English investigators seem to have assumed th the dangerous constituents were a necessary part of a commercial ferrosilicon, and that the only thing th could do was to find out what were the conditions und which these supposedly necessary impurities could do t least harm.

This, however, is not the case. In perfectly pu ferrosilicon, consisting solely of iron and silicon, just in the silicon metal mentioned above, consisting solely silicon, iron, aluminium and carbon, there is absolute nothing which can give rise to any poisonous gases.

Surely, therefore, the simplest and most scienti way of attacking this problem is to find out first of a what the dangerous constituents really are—and then see if, by the natural laws of trade, if possible, and if no by regulations and legislation, these dangerous co stituents cannot be kept out of the commercial article.

The dangerous constituents.

There is no question, after looking over the evidence, that the poisonous gases evolved from ferrosilicon are composed always of phosphoretted hydrogen, with occasionally small amounts of arseniuretted hydrogen.

Now phosphoretted hydrogen can only be found in the presence of phosphorus; and, to give off this gas under the influence of moisture, the phosphorus must be combined with calcium in the form of *calcium phosphide*.

The presence of phosphorus, alone, in ferrosilicon would not be objectionable. Cast iron used for delicate casting, often contains 1% or more of phosphorus, and yet we do not hear of cooks being poisoned by sitting near the kitchen stoves on a damp day. Ferro-phosphorus is now being made with over 25% of phosphorus in it, and no reports have come in about its giving off poisonous fumes.

But every chemist knows that calcium phosphide in the presence of water gives off phosphoretted hydrogen. Even, as before mentioned, in the Yellow Book notice is taken of the presence of lime (calcium hydroxide) in the water in every experiment where this gas was evolved from a sample of ferrosilicon.

With regard to the arseniuretted hydrogen the case is much the same. Unless arsenic is present, and present in some combination, such as calcium arsenide, which will decompose when acted on by water, no arseniuretted hydrogen can be evolved. And the disintegration of the ferrosilicon, so strongly dwelt upon in the Yellow Book as a cause of danger, is probably due to the presence of these unstable calcium compounds in the impure ferrosilicon rather than to the particular percentage of silicon present.

If these suggestions are correct, it would naturally follow that, to prevent accidents from the shipment and use of ferrosilicon, the first thing to do is to keep out of the material the impurities—phosphorus, arsenic, and especially calcium—which are responsible for the evolution of the poisonous gases, and that only in case this is impossible is it important to pay attention to the question of the silicon content.

Experience of ferrosilicon manufacturers in the United States.

That this method of avoiding accidents is not impossible is shown by what has been thus far accomplished in America. In 1907, when the Electro-Metallurgical Company began to make ferrosilicon at Niagara Falls, they entered a market already controlled by cheap foreign competitors, who at once began to cut prices, so as to force them out of the business. Very sagaciously, they met this competition by supplying a particularly acceptable article, rather than by cheapening the price at the xpense of quality.

The steel people, as before stated, needed their ferrolicon in the form of solid lumps, of uniform composition, ontaining not very far from 50% silicon. It was of little r no importance to them if they got 60% or even higher, rovided the price per unit was the same, and the percentage d not vary more than 1 or 2% from one lot to another. ut it was of great importance to them to have it in lump rm, and they had been frequently bothered by the uropean ferrosilicon disintegrating, on the long journey, efore it reached them.

Influence of silicon percentage upon disintegration.

As a result of several years' close study of the disitegration problem from a practical standpoint, the iagara Falls people differ widely from the English comission as regards the importance of the percentage of licon. Their experience has shown them that there is n undoubted tendency to disintegrate in the grades pproaching 50%. This is most marked a little higher on e scale, the worst grade of all being, in their opinion, om 55 to 57% of silicon.

This disintegration does not take place at all, they clare, even at this point, without the presence of phosorus and calcium, as is shown by the perfect condition, ter months and years, of numerous samples of this oduct. But small amounts of impurities which would t affect the harder and more resistant grades, of, say, % and over, or 30% and under, would cause the 50% ade speedily to fall to pieces.

To avoid this disintegration, therefore, and without any particular thought of danger to workmen or handlers, a matter which at that time was barely coming into notice, the Niagara people decided to make the greatest efforts to use pure raw materials, and particularly to avoid the presence of phosphorus and later of lime. Instead of scrap iron or of iron ore, both of which are liable to contain much phosphorus, they used steel scrap, which is practically free from it. For fuel they used only the very best and purest metallurgical coke, and for the silicon they hunted far and near and finally bought a quarry for themselves, of an extremely pure grade of quartzite, instead of buying at much less expense in the open market.

Ever since they started they have kept the percentage of phosphorus in their product below 0·03%, with the most satisfactory results. I have been unable to find that a single case has ever been reported of poisoning or explosion, in connection with ferrosilicon in America, since the landing of the s.s. Vaderland, in 1905. Since they began to produce it in Niagara Falls, no case of poisoning, they declare, has occurred at the works; and careful inquiry from the offices of the United States Steel Company, and from freight agents connected with land and water transportation on and near the Great Lakes, has failed to disclose records of any trouble connected with its shipment or use.

Much the same record holds good with regard to the disintegration. For seven years the Electro-Metallurgical Company have been manufacturing and selling from 10,000 to 15,000 tons a year. This material has been stored in the open air for weeks, sometimes for months before shipment. It has been packed in packages not air-tight, and shipped, without special precaution to avoid dampness, for long distances on land and water, and stored for indefinite periods before using and yet, although of the particular 50% grade, which the European investigators have found so liable to disintegrate, this has remained in lump form until used.

Specimens of every batch have been kept at their office in Niagara from the time the Company started, and these, too, show no signs of disintegration.

On one occasion, however, they did have some trouble. They started to use a new brand of coke, equally low in phosphorus with that they had been in the habit of using, and, after standing for a few days in the open air, the ferrosilicon made with this began to crumble and break down. They at once investigated the matter, and found that while there was no increase in phosphorus, the ash of the new coke showed a much greater percentage of calcium than the former fuel, and on cutting this out the trouble was at once remedied.

As a rule the calcium in both ash and silicon, being due probably to the presence of calcium phosphate, had varied in proportion with the phosphorus present. But this case put them on their guard, and since then they guard against the presence of calcium even more carefully than phosphorus.

Similar experience of Canadian manufacturers.

The Electro-Metals Company, which started their works at Welland, Ontario, a couple of years after the Niagara Falls people began, were sufficiently intelligent to work out the problem in the same way. They could not find sufficient market for their output in Canada, and when shipping into the United States, had to compete with the United States product, and face the tariff, as well, at first of $4 a ton, then, in 1909, changed to 20% *ad valorem*, and later reduced to 15%.

They could not possibly compete by means of an inferior product. And so they, too, from the time they started, have taken the greatest pains to use pure raw materials, free from phosphorus and calcium. They use roasted Rio Tinto ore instead of the scrap steel successfully used by the Niagara people. But they take the same precautions with regard to their fuel and silica, and obtain equally satisfactory results, with a 50% product. They have never had any trouble with either poisonous gases or disintegration, and they ship their ferrosilicon, after standing in the factory yard, in loose barrels or even in burlap bags, without any danger of losing any in the form of dust or powder on the way, and without any complaints from their customers of its arrival in powdered form.

They informed me that the only experience of the action of phosphorus and calcium which they could report was that one of their customers, probably a cast iron man, wished his ferrosilicon in granules, not in lumps. And, to avoid the trouble of fitting up a crusher for his particular order they ran out a batch for him once or twice a year, containing some phosphide of calcium. This is stored, separately, in the yard, and wetted down or exposed to rain, with the result that in a few days' time it falls into powder.

I was interested to learn that the Canadians, too, had been touched by the attitude of the shipping authorities. A considerable order for ferrosilicon recently came to them from Japan, not only important in itself, but of considerable interest as possibly the starting point for a valuable export business. Unfortunately, on account of transportation restrictions, it proved to be impossible to ship it there, and the order had to be cancelled.

Conclusion.

As a result, therefore, of all the information that I have been able to gather, it seems to me that it would be a decided mistake for the United States to follow the foreign regulations with regard to the manufacture and shipment of ferrosilicon, based upon the supposition that the grades commonly used (containing between 30 and 70% of silicon) are necessarily dangerous. It seems to me that this supposition is distinctly erroneous, and that the danger attaching to much of the foreign ferrosilicon has been due, not to the percentage of silicon, but to the presence of avoidable impurities—phosphorus, arsenic, and especially calcium.

In the United States and Canada the natural laws o trade have in this particular instance brought about, a satisfactorily as government regulations could do, the us of pure materials and the production of a safe and stabl article. And, in my opinion, it is greatly to be regrette that the export of this pure ferrosilicon is hampered b foreign regulations based, I must conclude, upon insufficien investigation.

THE CHEMISTRY OF PINE OIL

BY MAXIMILIAN TOCH.

(This J., 1914, pp. 576-578).

ERRATA.

P. 576, col. 2, line 7 from bottom—for "1 in." rea "1 foot."

P. 577, col. 2, line 19 from bottom—for "jelly" rea "colloid."

P. 578, col. 1, for the bottom sp. gr. "0·9583" in col. of "Analyses of Pine Oil," read "0·9383."

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

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I.—GENERAL PLANT; MACHINERY.

Patents.

Separation of liquid suspensions. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 13,465, June 10, 1913.

The liquid, *e.g.*, oil containing drops of water in suspension, is passed through a metal tube, provided on the outside with a number of discharge points, into the lower part of a cylinder of glass or other dielectric material coated on the outside with metal. The oil returns upwards through the annular space between the tube and the cylinder, and is subjected to electric discharges produced by connecting the metal tube and the outer metallic coating with a source of alternating current of about 15,000 volts. The separated water sinks to the bottom and is discharged, whilst the purified oil flows away from the top of the cylinder. —W. H. C.

Furnace; Regenerative ——. J. Reuleaux, Assignor to A. Laughlin, Pittsburgh, Pa. U.S. Pat. 1,098,171, May 26, 1914; date of appl., Oct. 23, 1913.

A descending flue from the furnace opens laterally into a slag and dust pocket in a regenerative chamber. A passage, which may be subdivided into narrow channels, rises from the pocket, and leads to chequer-work through which the waste gases then descend.—O. E. M.

Kiln and heater; Combination ——. C. D. Allan, Chicago, Ill. U.S. Pat 1,099,632, June 9, 1914; date of appl., Dec. 26, 1913.

The stack extending above the inner crown of the kiln, is surrounded by an enclosed tubular water heater, with which it communicates by adjustable openings, and has a damper at the top. A chamber in two compartments with an adjustable port between them and opening into the heater and the stack, which may be separated by annular space, may be placed at one end of the heater. —O. E. M.

Dryer; Rotary ——. W. E. Prindle, Manitowoc, Wi U.S. Pat. 1,098,402, June 2, 1914; date of appl., Ap 23, 1913.

Hot air is drawn from a chamber surrounding the fe end of an outer shell through a concentric inner shell the unenclosed end of the outer shell, and back throu the annulus, containing the material to be dried, betwe the shells.—O. E. M.

Dryer [for purified air]. J. C. Fleming, Boston, Ma U.S. Pat. 1,099,122, June 2, 1914; date of appl., Ja 22, 1913.

Air is passed through a purifying liquid, and through dryer containing animal charcoal packed between in and outer perforated walls within a casing. The charc may be heated.—O. E. M.

Clarifying liquids and thickening pulps; Apparatus ——. H. B. Lowden, Assignor to Colorado Iron Wo Co., Denver, Colo. U.S. Pat. 1,098,812, June 2, 191 date of appl., Dec. 27, 1912.

In a settling and separating tank the solids are moved t submerged outlet by a rake which is raised at the end a lowered at the beginning of its working stroke and actua from above by connections surrounded by partitions wh prevent agitation of the supernatant liquid.—O. E. M

Pulps; Apparatus for thickening ——. J. E. Rothw Butte, Mont., Assignor to Colorado Iron Works Denver, Colo. U.S Pat. 1,099,396, June 9, 1914; d of appl., Sept. 18, 1913.

The thickened pulp is raised by a pump or air lift from bottom of a tank to a receptacle which, through adjusta openings, delivers part of it for use and returns the ex to a space enclosed by a partition within the tank.—O. E

Evaporating and concentrating apparatus [for caustic liquors]. H. K. Moore, Berlin, N.H. U.S. Pat. 1,098,825, June 2, 1914; date of appl., Dec. 12, 1910.

THE caustic liquor is pumped through a series of exhausted evaporators, the lower ends of which are in the form of inverted cones and which have submerged vertical tubes passing through, and heated by, the condenser attached to the next evaporator. The last evaporator is steam-heated.—O. E. M.

Abrasives to grinding apparatus; Method of applying ——. H. K. Hitchcock, Tarentum, Pa. U.S. Pat. 1,099,366, June 9, 1914; date of appl., July 31, 1911. Renewed Mar. 27, 1914.

THE abrasive material for grinding machines is fed in a mass into the top of a hopper with sides converging downwards and provided with an outlet at the bottom. A stream of water is injected into the hopper from below and slowly and uniformly carries the abrading material in suspension from the hopper to the grinding machine. —W. C. H.

Filtering slimes; Process of and apparatus for ——. C. Butters, Oakland, Cal. U.S. Pats. 1,100,217, June 16, 1914; date of appl., May 26, 1913; 1,100,218 and 1,100,219, June 16, 1914; date of appl., June 11, 1913; 1,000,220, June 16, 1914; date of appl., June 14, 1913; 1,100,221 and 1,100,222, June 16, 1914; date of appl., Oct. 18, 1913 and 1,100,223, June 16, 1914; date of appl., Oct. 22, 1913.

A SUCTION filter-leaf is provided with an air-escape valve, a water-supply pipe and a liquid-pressure equalising valve, o that after the cake has been formed, water can be admitted into the interior of the filter-frame to saturate he filtering medium and discharge the cake.—W. H. C.

iltering slimes; Apparatus for ——. W. A. Stedman, Wonder, Nev., Assignor to The Butters Patent Vacuum Filter Co. U.S. Pat. 1,100,267, June 16, 1914; date of appl., Aug. 13, 1913.

HE fabric bag forming the filtering medium and stretched n the frame of a suction filtering leaf is made open cross the bottom and is closed by the suction during ltration.—W. H. C.

acuum: Producing and maintaining a high ——. F. M. Meyer, Osnabrück, Assignor to Sudfelt und Co., Melle, Germany. U.S. Pat. 1,100,694, June 16, 1914; date of appl., Dec. 16, 1913.

UCTION is induced by a jet of gas, which is not condensed, a pipe joining two vessels, the second of which is onnected with a suction exhaust.—O. E. M.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

ethane; Inflammability of mixtures of —— and various gases. Leprince-Ringuet. Comptes rend., 1914, **158**, 1999—2001. (See this J., 1914, 737.)

HE upper and lower limits of inflammability were etermined for mixtures containing methane and oxygen the constant proportions, CH_4+2O_2, and also varying unts of nitrogen, carbon dioxide, and water vapour. he effect of added nitrogen was to lower the upper and ise the lower limit until the two coincided at a point rresponding to the composition: (CH_4+2O_2), 20·1, 79·9%. The effect of carbon dioxide was similar ut of different magnitude, 0·56 vol. of carbon dioxide ving an effect approximately equal to that of 1 vol. nitrogen. The effect of water vapour could also be presented in a similar manner, so that if the mixture, mperature, and humidity were known, all necessary cts as to the inflammability could be deduced from a gle diagram.—W. H. P.

Ammonia and hydrogen cyanide; Formation of —— in the distillation of coal. O. Simmersbach. Stahl und Eisen, 1914, **34**, 1153—1159 and 1209—1213.

USING different coals the author studied the distribution of nitrogen between coke, tar, ammonia, hydrogen cyanide and free nitrogen in the gas, at varying distillation temperatures. He also carried out experiments on the decomposition of ammonia in contact with coke at various temperatures, into its elements and to form hydrogen cyanide. In the distillation of coal the formation of ammonia occurs mainly at a temperature higher than that at which coking takes place. The temperature of maximum ammonia formation is not the same for all coals, but varies between 800° and 900° C. The thermal decomposition of ammonia, which in the case of the pure gas starts at about 750° and is very rapid at 800° C., is not appreciable below 900° C. in the conditions of dilution obtained during the distillation of coal. The hydrogen cyanide formed in distillation increases with the amount of ammonia and with rise of temperature, although when pure ammonia is heated with coke it reaches a maximum at 900° C. The hydrogen cyanide obtained is usually about 1·2% of the total nitrogen in the coal and 5% of the ammonia formed. Water vapour reduces the cyanide yield, and improves that of ammonia, while high velocity of the gas has the reverse effect. The degree of subdivision of the coal has not much effect on the ammonia yield or on the temperature at which the best yield is obtained.—W. H. P.

Naphthenic acids; Behaviour of —— in the refining of kerosene oil. E. Pyhälä. Petroleum, 1914, **9**, 1506—1507.

RUSSIAN kerosene distillates of various origin contained 0·2 to 0·9% naphthenic acids. On refining the distillates with sulphuric acid about 30% of the naphthenic acids were sulphonated and dissolved. Naphthenic acids separated from refined kerosene had neutralisation value 294·9 and contained 0·77% S, whilst those separated from the ordinary waste lyes had neutralisation value 260·6 and contained 0·31% S. Naphthenic acids from kerosene distillates which had not been chemically treated had neutralisation value 230 and contained 0·1% S. When these were sulphonated the neutralisation value was increased to 240 and the S-content to 3·64%, and they yielded metal salts of different character from those given by the other naphthenic acids. The disagreeable odour increased with the degree of sulphonation, and this supported the view (Z. angew. Chem., 1904, 616) that sulphur compounds are the cause of the bad odour. —C. A. M.

Gas analyses by fractional distillation at low temperatures. Burrell and Seibert. *See* XXIII.

PATENTS.

Fuel of high calorific value; Continuous process for treating by steam and converting moist organic matter of vegetable origin into ——. J. Anderson, Charkoff and J. Hippius, St. Petersburg, Russia. Eng. Pat. 13,924, June 16, 1913.

DISINTEGRATED peat, moist sawdust, etc., is heated to 160°—180° C. in a closed vessel by high-pressure steam, fresh material being continuously introduced at the top and treated material discharged from the bottom into a low-pressure cooler, where it is cooled by blowing air or any gas other than steam through it. From the cooler the treated material passes to the pressing and briquetting plant. The warm gases and the steam given off from the cooler are passed through the incoming raw material in a preheater.—W. H. C.

Coal-slimes; Drying ——. H. Brune and H. Horst, Assignors to E. Abresch, Neustadt-on-the-Hardt, Germany. U.S. Pat. 1,100,710, June 23, 1914; date of appl., Oct. 28, 1912.

COKE breeze is mixed with the coal slimes, and the mixture is briquetted without the use of a binder by a slowly increasing pressure.—A. T. L.

Waste from coal-mining and from coking installations; Utilisation of —— by mixing with coal sludge. C. Hilgenstock. Ger. Pat. 274,163, Nov. 6, 1913. Addition to Ger. Pat. 272,852.

In carrying out the process described in the chief patent (this J., 1914, 636), the heavier non-combustible material is deposited before the lighter coal dust, so that an upper layer suitable for gas-making and a lower worthless layer are obtained. According to the present patent, this separation into valuable and worthless products is aided by using waste poor in coal to form the lower, and waste rich in coal the upper part of the filtering bed.—A. S.

Coke; Process for the production of strong metallurgical —— as free as possible from sulphur. L. Franck. Ger. Pat. 274,853, April 12, 1912.

Phosphorite. phosphatic chalk, apatite, vivianite, or other form of calcium phosphate, is added to the coal before coking.—A. S.

Retort furnaces for the manufacture of coal gas, etc.; Heating of ——. Dessauer Vertikal-Ofen-Ges. m. b. H., Berlin. Eng. Pats. 7338 and 7466, Mar. 23 and Mar. 24, 1914. Under Int. Conv., April 14, and Nov. 1, 1913.

(1) In a furnace arranged for heating at will with coal-gas or producer-gas, a small quantity of producer-gas is always used with the coal-gas in order to keep the producer and the adjoining conduits hot enough to enable heating with producer-gas to be resumed without delay. To prevent an excessive production of gas when the doors of the producer are removed for clinkering, the supply of coal-gas may be reduced at the time, or the conduits leading producer-gas to the furnace may be throttled, or they may be always of a suitably restricted area. (2) To prevent the production of luminous flames while the furnace is being heated with coal-gas, the gas is passed through incandescent fuel in the producer, being admitted to the producer at a point above the grate.—A. T. L.

Coke-oven or gas-furnace. W. Feicks, Bloomfield, N.J. U.S. Pat. 1,098,374, June 2, 1914; date of appl., Jan. 3, 1912.

The charging orifice in the top of a coke-oven or furnace is surrounded by a seal, and a charging hopper adapted to be brought over the orifice, is lowered so as to make an air-tight joint in the seal, whereupon further movement of the lowering mechanism opens the hopper valve. —A. T. L.

Coal-gas; Apparatus for manufacture of ——. R. C. Congdon, Atlanta, Ga. U.S. Pat. 1,099,639, June 9, 1914; date of appl., March 14, 1914.

A number of superposed horizontal retorts are connected with a single vertical pipe leading to a seal-box above the setting. The retorts can be disconnected from the gas up-take by means of hinged valves within the pipe, and liquor is passed down the pipe and on to the valves in order to keep them clean.—A. T. L.

Gas producer. J. F. Guggolz, Teague, Tex. U.S. Pat. 1,097,715, May 26, 1914; date of appl., April 2, 1912.

The producer comprises an inclined cylindrical casing having a grate which is parallel with the axis and is supported on transverse partitions. These partitions divide the space beneath the grate into an air-supply chamber at the upper part and a gas-outlet chamber at the lower part of the length of the producer casing, so that the gases pass first upwards and then downwards through the fuel. The fuel enters the producer chamber from a vertical cylindrical extension at the upper end. —A. T. L.

Gas producer. E. A. W. Jefferies and J. R. George, Assignors to Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,097,757, May 26, 1914; date of appl., Dec. 1, 1910.

The lower end of the producer casing is formed by a water-jacketed metal wall, which is sealed in water in the ash-pan. Radial stirring arms which rotate about a vertical axis are arranged within the lower end of the casing, and the outer ends of these arms are attached to an inclined annular band, the upper edge of which extends behind a conical shield attached to the inner metal wall of the producer casing.—A. T. L.

Gas producer. H. F. Smith, Lexington, Ohio. U.S. Pat. 1,098,059, May 26, 1914; date of appl., Sept. 20, 1912

The producer comprises a rectangular casing with an inclined grate arranged along each of the longer sides A gas-outlet chamber extends centrally across the top of the producer parallel with the longer sides, and fue is fed into the producer at both sides of this chamber The grate-bars run perpendicularly to the length of th grate and are oscillated by cams so as to work the fue towards the middle of the producer. A separate ash-pi with separate blast supply is arranged beneath eac grate.—A. T. L.

Gas: Apparatus for generating ——. F. D. Shaw Chicago, Ill.. Assignor to Shaw Kiln Co., Atlanta, Ga U.S. Pat. 1,098,412, June 2, 1914; date of appl Feb. 18, 1910.

Liquid fuel is burned in a pan arranged in a recess ope to the atmosphere in the outer wall of a kiln. A pe forated tubular member depending from the top of th recess and extending downwards into the pan, leads to combustion-chamber, from which the hot gases pass int the kiln.—A. T. L.

Gas producer. A. J. Bassett, Assignor to Sharp-Basse Gas Producer Co., Milwaukee, Wis. U.S. Pat. 1,098,8 June 2, 1914; date of appl., Sept. 29, 1913.

The producer casing forms a jacket which is divid into three superposed chambers by means of two pe forated rings. Air is admitted to the top chamber, mix with steam generated in an evaporating pan in the midd chamber, and is led from the bottom chamber to the spa beneath the grate.—A. T. L.

Gas-generator: Cupola ——. H. Koppers, Essen-on-th Ruhr, Germany, Assignor to H. Koppers Co., Chicag Ill. U.S. Pat. 1,099,257, June 9, 1914; date of app Oct. 28, 1913.

A rotating gas-outlet pipe, extending vertically dow wards and arranged axially within the upper part of t producer, is flared outwards at the lower end which provided with parabolic bars for levelling the fuel so to form a paraboloidal cavity beneath the mouth of t gas-outlet pipe.—A. T. L.

Gas washer. T. W. Stone, Assignor to The Western G Construction Co., Fort Wayne, Ind. U.S. Pat. 1,098,1 May 26, 1914; date of appl., Oct. 4, 1911.

The washer comprises a casing containing the washi liquor, and two or more fixed bells, the lower edges which are sealed in the liquor, the gas being introdu into these bells and bubbling beneath their lower ed and through the liquor. Perforated plates, incli downwards and outwards, are attached to the outer wa of the bells, so as to mix the gases more thoroughly w the liquor as they pass up through it. These plates successively wider and have finer perforations, from lowest to the uppermost.—A. T. L.

Motor spirit similar to petrol; Manufacture of ——. T. Franke, London. Eng. Pats. 13,261, June 7, 15,459, July 4, 1913.

Peat tar is fractionally distilled and the distillat treated with oxidising and condensing substances (peroxides, persulphates and zinc chloride, alumini choride, etc.) to resinfy and precipitate the homolog of phenol. The treated material is again fractionally tilled and the high-boiling residue is heated to 300 under a suitable pressure in the presence of catal agents (pyrophoric iron, nickel, chromium, or platin to crack the heavy oil and form more motor spiri —W. H. C.

Oily substances; Fractional distillation of ——. H. Koppers, Essen on the Ruhr, Germany, Assignor to H. Koppers Co., Chicago, Ill. U.S. Pat. 1,098,734, June 2, 1914; date of appl., July 8, 1913.

In a steam-heated still the steam-trap is controlled by the pressure of the oil-vapour.—O. E. M.

Aluminium chloride [from residues from the treatment of petroleum oils]; Manufacture of ——. A. M. McAfee, Bayonne, N.J. U.S. Pat. 1,099,096, June 2, 1914; date of appl., Feb. 12, 1914.

Residues obtained in the treatment of petroleum oils ith aluminium chloride, are heated to remove oil, then eated to a higher temperature to carbonise residual rganic matter, and treated with chlorine or a gas conaining chlorine.—A. S

Lighting and heating gas or hydrogen; Process and apparatus for the manufacture of ——. Berlin-Anhaltische Maschinenbau-Akt.-Ges., Berlin. Eng Pat. 2054, Jan. 26, 1914. Under Int. Conv., Jan. 27, 1913.

See Ger. Pat. 267,944 of 1913; this J., 1914, 190.—T. F. B.

etermination of inflammable (reactive) substances in gaseous mixtures. Ger. Pat. 273,980. *See* XXIII.

roducing acetic acid and alcohol from coal, lignite, etc. Ger. Pat. 275,049. *See* XX.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

eat; Utilisation of [removing moisture from] ——. T. Rigby and G. W. Andrew, Dumfries, and Wetcarbonizing Ltd., London. Eng. Pat. 5873, March 10, 1913.

mall quantities of acid are added to the peat before bmitting it to the processes described in Eng. Pats. 7,610 of 1911 (this J., 1912, 1171) and/or 17,427 of 1912 his J., 1913, 1099) in order to facilitate the separation the water and reduce the loss of nitrogen.—W. H. C.

istillation of carbonaceous substances. H. Clarke, London, and J. T. Carmichael, Barking. Eng. Pat. 29,714, July 24, 1913.

ow-grade coals are prevented from caking on dis-llation in vertical retorts, by being mixed with either e solid residue of the process or other infusible material non-caking coal. A heated current of steam or other s containing hydrogen is passed through the mass to crease the yield of oils.—W. H. C.

r from hot distillation gases; Process and apparatus for recovery of ——. W. Strommenger, Cologne, Germany. Eng. Pat. 19,955, Sept. 3, 1913. Under Int. Conv., Sept. 28, 1912.

e Fr. Pat. 461,956 of 1913; this J., 1914, 245.—T. F. B.

ducing acetic acid and alcohol from coal, lignite, etc. Ger. Pat. 275,049. *See* XX.

III.—TAR AND TAR PRODUCTS.

Patents.

Bromo-2-aminoanthraquinone; Process for preparing ——. W. Junghans. Ger. Pat. 273,809, Nov. 17, 1911.

Aminoanthraquinone is treated with one mol. of mine in presence of an organic diluent, with or without lition of water. The bromine atom enters the 3-ution.—T. F. B.

β-Bromo-aminoanthraquinones; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 275,299, Feb. 24, 1912.

Bromo-aminoanthraquinones in which at least one β-position *ortho* to the amino group is unoccupied, are heated alone or with sulphuric acid, phosphoric acid, zinc chloride, etc., to a temperature favourable to the migration of the bromine atom (*e.g.*, 160° to 240° C.).—T. F. B.

Anthraquinone derivatives; Process for preparing ——. R. Scholl. Ger. Pat. 274,783, April 12, 1913.

Dianthraquinonyl derivatives which contain in each anthraquinone nucleus at least one hydroxyl group in an *o*-position to the dianthraquinonyl linkage, are heated to high temperatures alone or in presence of a condensing agent. One mol. of water is eliminated, with the formation of a furane derivative.—T. F. B.

Anthraquinone derivative; Process for preparing an ——. R. Scholl. Ger. Pat. 274,784, April 12, 1913.

Alizarin or one of its salts is dissolved in a solution of potassium hydroxide and treated with a hypochlorite or with chlorine. Two alizarin molecules are thus united, with the loss of two hydrogen atoms, to form tetrahydroxydianthraquinonyl.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Diphthalylacridone. A. Eckert and O. Halla. Monatsh. Chem., 1914, 35, 755—763.

On condensing 1-amino-2-carboxyanthraquinone with 2-chloroanthraquinone, water is eliminated and a diphthalylacridone is obtained. The product is the 1.2.5.6-derivative, since it can be synthesised from an anthraquinone 2-halogen derivative where the 3-position is already occupied. It is a red crystalline substance soluble in sulphuric acid. When reprecipitated by water it is deposited in the amorphous form, and then readily forms a vat from which cotton is dyed reddish-yellow, changing into bluish-violet on exposure to air. The 3.4.6.7-diphthalylacridone (see Ullmann and Dasgupta, this J., 1914, 305) can be prepared by a similar method, using 1- instead of 2-chloroanthraquinone. Using 1-amino-2-methylanthraquinone and 2-chloroanthraquinone the product is 2-methyl-1.2′-dianthrimide. When this is fused with lead oxide and potash as described in Ger. Pat. 192,436, a substance is obtained the properties of which are quite different from those of the 1.2.5.6-diphthalylacridone.
—W. H. P.

Patents.

[Azo] dyestuffs capable of being developed; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 273,280, Jan. 8, and 273,934, May 17, 1913.

(1) A diazo compound of an aminodiarylsulphone, aminodiarylsulphoxide, or aminodiaryl sulphide is combined with an alkylbenzylanilinesulphonic acid. The dyestuffs thus obtained dye wool level yellow to reddish-orange shades, which are faster to washing and to fulling than those produced by other dyestuffs derived from alkylbenzylanilinesulphonic acids. The aminodiarylsulphones are described in Fr. Pat. 441,044 (see this J., 1912, 809), whilst the aminosulphoxides and aminosulphides may be obtained by condensing aromatic sulphinic acids with aromatic bases. (2) A diazotised mononitro- or acidylamino-arylacidyl derivative of an aromatic diaminosulphonic acid is combined with a pyrazolone or pyrazolonecarboxylic acid derived from an aminothiazole derivative, and the nitro group is reduced or the acidylamino group saponified. Thus, the dyestuff obtained by reducing the compound formed by combining diazotised *m*-nitrobenzoyl-*p*-phenylenediaminesulphonic acid with the pyrazolone from a dehydrothiotoluidinesulphonic acid, is a yellow

product, distinguished by its affinity for cotton fibre ; when it is diazotised on the fibre and developed with β-naphthol, reddish-yellow shades are produced.—T. F. B.

Azo dyestuffs ; Process for preparing ——. Farbenfabr. vorm F. Bayer und Co. Ger. Pats. 274,081 and 274,082, March 12, 1913.

(1) DIAZO or tetrazo compounds, or the intermediate products obtained by combining a tetrazo compound with one mol. of an azo dyestuff component, are combined with aminonaphthols or their sulphonic acids in which the amino group has been substituted with a sulpho-*o*-hydroxycarboxyl group. These substances are obtained by condensing *o*-hydroxycarboxylic acid sulphochlorides with aminonaphthols or their sulphonic acids. (2) The products obtained by condensing the sulphochloride of 2-naphthol-1-carboxylic acid with ammonia, amines, phenols, aminophenols, aminonaphthols, or their sulphonic or carboxylic acids or other derivatives, are used as azo dyestuff components. The carboxyl group may be eliminated if desired.—T. F. B.

Quinizarin-β-carboxylic acid ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 273.341, April 20, 1913.

THE methyl group of β-methylquinizarin is oxidised to the carboxyl group by treatment with nitrosylsulphuric acid in sulphuric acid solution. preferably in presence of boric acid. The product may be used as a lake or mordant dyestuff.—T. F. B.

Indigoid dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 274,299, Feb. 19, 1910.

DERIVATIVES of 2.3-diketodihydro-1-thionaphthene or its products substituted in the benzene ring, in which the 2-keto-oxygen atom adjacent to the sulphur atom is replaced by an arylido group, are condensed with α-anthrol and its derivatives which are unsubstituted in the *o*-position to the hydroxyl group. The products dye full, clear, fast violet shades.—T. F. B.

Indigo, its homologues or substitution products ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 273,340, June 11, 1913.

o-AMINOACETOPHENONE, or one of its homologues or nucleus-substitution products, is heated with sulphur, with or without addition of a solvent or diluent, such as a high-boiling hydrocarbon or quinoline.—T. F. B.

Gallocyanines and their leuco-derivatives ; Process for preparing condensation products of ——. Farbwerke vorm. L. Durand, Huguenin und Co. Ger. Pat. 273,685, June 11, 1913. Addition to Ger. Pat. 189,940.

GALLOCYANINES are intimately mixed with aromatic diamines which contain at least one free amino group, with or without addition of a diluent and at the ordinary temperature ; the resulting products may then be converted into their leuco-compounds. When the components are only allowed to react for a short time in presence of a diluent, products soluble in aqueous sodium carbonate are obtained, with the carboxyl group of the original gallocyanine intact ; a longer period of reaction results in the elimination of the carboxyl group, with the formation of products insoluble in sodium carbonate solution.—T. F. B

Basic dyestuffs ; Process for preparing ——. L. Cassella und Co. Ger. Pat. 274.358, Jan. 9, 1913.

TETRA-ALKYLDIAMINOXANTHONIUM chlorides are treated with cyanides, and the products, which have no tinctorial properties, are oxidised to produce basic dyestuffs.
—T. F. B.

[Azo] dyestuffs ; Manufacture of yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 15,163, July 1, 1913. Under Int. Conv., July 1, 1912.

SEE Fr. Pat. 459,468 of 1913 ; this J., 1913, 1101.—T. F. B

Dyestuffs of the anthraquinone series ; Process for producing ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany Eng. Pat. 22,911, Oct. 10, 1913.

SEE Fr. Pat. 465,069 of 1913 ; this J., 1914, 475.—T. F. B

1.2.4-*Purpurine-3-carboxylic acid ; Process for producin* ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld Germany. Eng. Pat. 22,980, Dec 11, 1913. Additio to Eng. Pat. 29,506 of 1912, dated Dec. 27, 1911.

SEE Ger. Pat. 272,301 of 1913 ; this J., 1914, 545.—T. F. B

Azo dyestuffs ; Process for producing ——. Farbenfab vorm. F. Bayer und Co., Elberfeld, Germany. Eng Pat. 3796, Feb. 13, 1914. Under Int. Conv., March 1 1913.

SEE Ger. Pats. 274,081 and 274,082 of 1913 ; preceding.
—T. F. B.

Vat [indigoid] dyestuffs. W. Bauer. Vohwinkel, and Herre and R. Meyer, Assignors to Farbenfabr. vorm. Bayer und Co., Elberfeld, Germany. U.S. Pa 1,101,778, June 30, 1914. Date of appl., June 20, 191

SEE Ger. Pat. 273,536 of 1912 ; this J., 1914, 639.—T. F.

Substantive [azo] dyestuffs. J. Turner and H. Dea Assignors to Read Holliday and Sons, Ltd., Hudder field. U.S. Pat. 1,099,676, June 9, 1914. Date appl., April 25, 1913.

SEE Fr. Pat. 455,802 of 1913 ; this J., 1913, 938.—T. F.

Azo dyestuffs. O. Günther. Leverküsen, and A. Za Opladen. Germany, Assignors to Synthetic Patents C New York. U.S. Pat. 1,101,739, June 30, 1914. Da of appl., Nov. 7, 1913.

SEE Ger. Pat. 268,792 of 1912 ; this J., 1914, 195.—T. F.

Triphenylmethane dye ; Yellowish-green ——. M. Weil Elberfeld. Germany, Assignor to Synthetic Patents C New York. U.S. Pat. 1,101,770, June 30, 1914. Da of appl.. July 17, 1913.

SEE Fr. Pat. 461,810 of 1913 ; this J., 1914, 195.—T. F.

Sulphurised dyes and process of making same. O. Scha enberg and W. Herzberg, Schöneberg, Assignor to Ac Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,102,171, June 1914. Date of appl., Feb. 26, 1912.

SEE Fr. Pat. 432,440 of 1911 ; this J., 1912, 119.—T. F.

Preparing pigment colours. Ger. Pat. 273,342. *See* XI

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Wood for pulp ; Chemical evaluation of ——. M. Griffin. J. Ind. Eng. Chem., 1914, 6, 560—561.

THE cellulose in 24 samples of mixed spruce and bals fir from Montmorency, Canada, was determined by Cr and Bevan's chlorination method. The samples were obtained by quarter-sawing the piece of wood to be tested and planing thin shavings from the face of the quarter. No relation could be detected between the lensity of annual ring growth (number of rings per inch) and the sp. gr., or between the sp. gr. and yield of pulp. The yields of pulp ranged from 41·6 to 59·0% on the wood lried at 100° C., or from 901 to 1533 lb. per cord. The sults show the advisability of valuing wood for pulp nanufacture on the basis of the yield actually obtainable n a representative sample.—A. S.

Mercerisation as judged by the action of caustic soda upon regenerated cellulose. Beadle and Stevens. *See* VI.

PATENTS.

abrics; Treatment of —— for imparting wear-resisting, abrading and the like qualities. E. R. S. Lloyd, Hove, Sussex. Eng. Pat. 17,643, Aug. 1, 1913.

HE fabric is impregnated with a compound of lime and asein preferably by immersing it first in a finely levigated ilk of lime and then in a solution of cheese or casein sodium bicarbonate.—J. F. B.

d [sulphite] lyes; Method of and apparatus for neutralising ——. P. G. Ekström, Harnäs, Sweden. U.S. Pats. 1,098,561 and 1,098,562, June 2, 1914; date of appl., Feb. 24, 1912.

ULPHITE lyes and other liquids obtained by boiling llulosic materials with acid liquids, are neutralised ith a heavy solid neutralising agent preparatory to rther treatment for the production of alcohol. The lid neutralising agent is added to the liquor in a vessel rovided with a conical bottom, at the apex of which is nozzle having helical passages. Air under pressure is pplied to the nozzle, whereby a spiral jet of air, entraining e solid reagent, is forced upwards through the liquor. he neutralised liquor is drawn off near the surface through phon-pipe supported by a float. Water under pressure ay be forced through the nozzle, when desired, to sh the bottom of the vessel, the flush water being drawn through a pipe in axial alignment with the nozzle.—A. S.

nts for cellulose; Process for preparing ——. M. Wassermann. Ger. Pat. 274,658, Jan. 10, 1913.

UPROUS oxide is mixed with ammonium chloride and solved in ammonia at a low temperature, and caustic tash or soda solution is added until a bright blue ecipitate forms; this dissolves comparatively slowly in cold, and is separated from the liquid, which is used a solvent for cellulose.—T. F. B.

stic masses for artificial silk and other shaped articles; Process for preparing ——. H. Timpe. Ger. Pat. 275,016, Oct. 5, 1913.

BOUT 2% of alkali (*e.g.*, sodium hydroxide) is added to lk, and the albumin is precipitated from the filtered lution by means of dilute acid, washed, and dissolved in alkali; this solution is allowed to stand for about hours at 18°—20° C., and dilute acid is added, whereupon viscous mass is precipitated, which becomes elastic hen heated and can be drawn out into long, thin filaments: these are finally rendered insoluble by treatment th formaldehyde, a chromium salt, etc. Especially d results are obtained if about ¼% of hydrogen peroxide lution is added to the alkaline solution before pretation.—T. F. B.

n-soap sizing composition. J. A. De Cew, Montreal. U.S. Pat. 1,099,168, June 9, 1914; date of appl., June 13, 1912.

OSIN is boiled with a proportion of alkali less than that quired for complete saponification (*e.g.*, less than 16% sodium carbonate) and tannin is added to the product. —J. F. B.

Paper; Method and apparatus for making ——. L. B. Buchanan, Woburn, Mass. U.S. Pat. 1,101,725, June 30, 1914; date of appl., May 1, 1913.

ON a Fourdrinier machine the wire is held slack and deflected downwards to form a curved surface. Immediately in front of the breast-roll, it is deflected with a steep inclination so that the stuff on the wire acquires a rapid acceleration under the influence of gravity as it moves forward. Further on, when the velocity of the stuff approximates that of the moving wire, the angle of curvature is gradually diminished and ultimately motion is imparted to the stuff wholly by the wire.—J. F. B.

Cork-substitutes; Method of making ——. W. Sanger, Orange, N.J. U.S. Pat. 1,101,965, June 30, 1914; date of appl., April 26, 1912.

A SUBSTITUTE for cork is made by soaking wood in hot water, impregnating it with concentrated hydrochloric acid heated at successively higher temperatures, removing all the acid and boiling the product in a solution of glycerin. —J. F. B.

Process of and apparatus for making sulphite liquor and for blowing acid gases. U.S. Pats. 1,097,781 to 1,097,785. *See* VII.

Process of making sulphite liquor. U.S. Pat. 1,099,565. *See* VII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Bleaching; Theory of ——. S. H. Higgins. J. Soc. Dyers and Col., 1914, 30, 257—261. (See also this J., 1913, 350, 359, 1064, 1153.)

BROWN linen cloth was submitted to the action of a dilute solution of bleaching powder and the rate of reaction determined by periodic titration of the liquor. The reaction was found to be unimolecular, the speed of reaction being proportional to the active mass of hypochlorite present. The same mathematical relationship held good when either lime water or a small quantity of hydrochloric acid was added to the bath, and again when the experiments were made on indigo dyed on bleached cotton. The difference between chlorine and hypochlorous acid was strikingly shown by the strong bleaching action of a solution of bleaching powder to which boric acid had been added in order to form free hypochlorous acid and the comparatively weak effect of a solution to which the corresponding amount of hydrochloric acid had been added, in which case free chlorine was present. The author concludes that bleaching powder owes its action to the hypochlorous acid in solution, formed by hydrolysis of the hypochlorite, the bleaching being a process of direct oxidation due to the easily removable oxygen of the hypochlorous acid. Hydrolysis would be hindered by addition of hydroxyl ions to the solution, and in agreement with this, addition of sodium carbonate or bicarbonate, lime or caustic soda had the effect of diminishing the bleaching power. The gradual addition of hydrochloric acid on the other hand caused a gradual increase in bleaching power owing to the added hydrions aiding hydrolysis of the hypochlorite. The addition of an excess of caustic soda did not entirely inhibit bleaching action, and it is concluded that there is still an appreciable amount of hydrolysis to free hypochlorous acid even when excess of alkali is present.—J. B.

Mercerisation as judged by the action of caustic soda upon regenerated cellulose. C. Beadle and H. P. Stevens. J. Soc. Dyers and Col., 1914, 30, 244—249.

UP to a certain point increasing concentration of caustic soda causes a gradual increase in the hydration of regenerated cellulose, and after this point a gradual decrease. This maximum advances as the temperature is increased.

The addition of sodium chloride to the lye suppresses these variations. The maximum absorption of caustic soda by the fibre varies in a similar way, taking place at increasing concentrations as the temperature advances. Here the addition of salt causes a general advance in the absorption for each temperature as the concentration increases. Curves for constant concentration and varying temperature show that hydration increases as the temperature decreases, *i.e.*, raising the temperature causes dehydration. This effect is noticed also when caustic soda is added to viscose solutions, small quantities of alkali causing the solution to become thinner whilst stronger alkali salts out the viscose. At 5° C. the maximum hydration of regenerated cellulose is effected by a lye containing 9% NaOH, whilst for the maximum (chemical) mercerisation of cotton, a concentration of 17½% NaOH is required. The difference between the two materials is rather of degree than of kind, however, and may be ascribed to the protecting cuticle of the cotton, which resists the natural swelling of the cellulose substance until the pressure is sufficient to burst the covering. The two materials are alike in that maximum mercerisation corresponds with maximum absorption of alkali; within certain limits the absorption of alkali increases as the temperature decreases; brine has a retarding effect; mercerisation reaches a maximum with a definite concentration of lye; and there is no evidence of a definite sodium-cellulose compound as suggested by Gladstone.—J. B.

Perborate of sodium; Application of —— [in printing]. E. Trepka. Rev. Gén. Mat. Col., 1914, **18**, 193.

THE streaks, produced in printing Logwood Black on tissues, may be completely removed by the use of sodium perborate, without injury to the other colours. The activity of the perborate may be increased by the addition of alkali compounds, preferably sodium phosphate.—B. N.

Malt extract; Determination of ——. W. P. Dreaper. J. Soc Dyers and Col., 1914, **30**, 255—257.

A MODIFICATION of the original method (this J., 1913, 598), the farina solution being padded into the cloth by passing through rollers, and the solution being of such strength that the cloth contains only 2·5% of starch (dry). Errors due to the presence of moisture are avoided by estimating the moisture in the cloth at the time of the assay by drying at 100°—102° C. The treated samples are also dried at this temperature. The treated samples are preferably wrung by hand and not in a cloth. Drying is effected first in a porcelain dish, then in a weighing tube. Blank experiments under these conditions showed no loss of starch. The present procedure is as follows: Pieces of starched cloth (2—3 grms.) are immersed in the malt extract solution of standard strength. The ratio of cloth to solution should be 1 : 200. The time of immersion may vary from 5 to 10 mins., provided it is the same in all cases. The temperature may be the standard one of 40° C. or that used in practice. If the amount of starch removed varies greatly from 1·5—1·8% it will be better to vary the strength of the solution in a second assay. A correction of 0·2% may be made on account of loss of starch due to water alone. The total starch on the cloth is determined by treating it with malt extract at 40° C. for one hour with constant stirring, drying at 100°—102° C. and weighing. Objections to this method on the grounds of variations in conditions, etc., due to the "personal equation," were shown to be invalid, since what is required in the textile industry is simply a comparison of value for starch-removing purposes. Such minor differences were insignificant in view of the extraordinary variations observed between the different extracts at present on the market. It was stated that two samples of extract might easily vary as much as 50% in their rate of action on gelatinised starch in solution or on a fabric.—J. B.

PATENTS.

Bleaching [straw, fibres, etc.]. J. L. Frenay, Luton, Beds. Eng. Pat. 13,753, June 13, 1913.

As a preliminary to bleaching, the material is steeped in a bath containing about 3 lb. of a hydrosulphite compound *e.g.*, "blankit B.A.S.F." and 9 lb. of sodium pyrophosphate per 140 galls. The material is then "cleared" in a bath of dilute sulphuric acid and bleached in the usual manner. —J. F. B.

Posser machines for disinfecting, washing, starching, dyeing, etc. R. C. Fritz, Liverpool. Eng. Pat. 21,979, Sept. 30, 1913.

IN a washing or laundering machine a perforated posser is reciprocated within a vessel so as to compress and release alternately the articles under treatment. A smaller non-perforated element acts on the more central perforations of the posser as an opening and closing disc-valve. The vessel is provided with a curved perforated false-bottom to afford flexibility in the compression-stroke. The posser is operated by a cranked shaft and connecting rods passing through glands in the cover and is connected with the operating rod by a hinge and locking sleeve, so that it may be deflected to give access to the vessel.—J. F. B.

Dyeings; Process for producing fast ——. L. Cassella un Co. G. m. b. H. Ger. Pat. 273,312, March 19, 1913.

FIBRES are dyed, padded, or printed with diazotisabl dyestuffs or with suitable colourless amino-compound which are then diazotised and combined with *m*-diamino benzidine. The dyeings produced are faster to light tha those obtained when β-naphthol, *m*-toluylenediamine, an similar "developers" are used.—T. F. B.

Turkey-red dyeing; Process for ——. J. Graf. Ger. Pa 274,867, Sept. 13, 1912.

THE raw or boiled out goods are passed through a bat of soluble oil or soap and treated with a salt such as a acetate, formate, or lactate, especially of an alkali, alkalin earth, or tin, as well as with a chlorine compound of ti which will fix the soluble fat on the fibre and act as fixing agent for the mordant; the goods are now wrur out and mordanted, without drying, in a strongly bas solution of alum or an aluminium salt, and, again witho drying, dyed and finished in the usual manner. Th process reduces considerably the time necessary for tl treatment, without prejudice to the fastness or beauty the shade.—T. F. B.

Yarn; Arrangement for treating ropes of —— with a liqu contained in a trough. H. Hablützel, Zürich, Switz land. U.S. Pat. 1,100,729, June 23, 1914. Date appl., July 28, 1913.

SEE Fr. Pat. 460,829 of 1913; this J., 1914, 73.—T. F.

Printing plate. J. W. Aylsworth, East Orange, Assig to Condensite Co. of America, Glen Ridge, N.J. U Pat. 1,098,610, June 2, 1914. Date of appl., Oct. 1913.

SEE Eng. Pat. 12,659 of 1911; this J., 1912, 918.—T. F.

Pile-yarn for coloured velvets; Process for produc weighted ——. P. Schmid, Basle, Switzerland. U Pat. 1,102,088, June 30, 1914. Date of appl., Dec. 1911.

SEE Fr. Pat. 435,155 of 1910; this J., 1912, 330.—T. F.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphur in soluble sulphates; An improvement of the bar sulphate determination of —— when sodium salts present. W. A. Turner. Amer. J. Sci., 1914, **38**, 41—

ERROR due to the inclusion of unconverted alkali sulp and of barium chloride in the barium sulphate precipit may be obviated in the case of sodium salts by the previous precipitation of the metal as chloride from a concentrated aqueous solution by the addition of 5 vols. of concentrated hydrochloric acid, and filtration through asbestos. The precipitate is washed with the concentrated acid, the filtrate and washings are evaporated to dryness, dissolved in a small quantity of dilute hydrochloric acid, again filtered to remove traces of silica, then diluted to 350 c.c., and precipitated with barium chloride in the usual way. Since the method is not so successful in presence of potassium salts, sodium peroxide should be substituted for potassium nitrate in those sulphur determinations where a preliminary fusion is necessary.—G. F. M.

Cobalt and nickel; Bromination of —— in the presence of ethyl ether. F. Ducelliez and A. Raynaud. Comptes rend., 1914 **158**, 2002—2003.

Nickel and cobalt both combine readily at the ordinary temperature with dry bromine in the presence of ether, forming $NiBr_2.C_4H_{10}O$ (yellow) and $CoBr_2.C_4H_{10}O$ (green) respectively. These products are readily decomposed by heat yielding the anhydrous bromides.—W. H. P.

Yttrium from yttrium earths; Separation of ——. II. H. C. Holden and C. James. J. Amer. Chem. Soc., 1914, **36**, 1418—1423. (See this J., 1914, 482.)

Fractional precipitation with sodium nitrite is more efficient and cheaper than the phosphate or chromate method for separating yttrium from other rare earth metals, though it is not very effective for separating erbium from yttrium.—L. E.

opper oxide; Catalytic influence of —— on the combination of oxygen and hydrogen. J. Joannis. Comptes rend., 1914, **159**, 64—67. (See also this J., 1914, 254.)

At 300° C. iron does not act as a catalyst towards hydrogen nd oxygen, being simply oxidised. Copper at 200° C. as t 300° C. is first oxidised, the oxide then acting as catalyst. opper oxide at 300° C. brings about practically complete ombination. The tension of the water vapour produced ppears to play an important part in the catalysis.—T. St.

rconium hydroxide; Adsorption by ——. E. Wedekind and H. Rheinboldt. Ber., 1914, **47**, 2142—2150.

elatinous zirconium hydroxide was prepared by treating cold saturated solution of zirconium oxychloride with mmonia, and purifying the precipitate by washing and alysing. The product in the form of a paste possessed nsiderable adsorptive power. Boric and phosphoric ids were adsorbed in accordance with the general lsorption equation, the quantity adsorbed at first increasing with the concentration, but later tending to proach a constant value. In the cases of iodine (in tassium iodide solution) and ammonia, also, the amount sorbed increased with the concentration of the solution, it no indication of approximation to a constant value as observed even when a large excess was used. Coloured lloidal solutions, *e.g.* of ferric hydroxide, molybdenum ue, etc., were rapidly decolorised when shaken with the conium hydroxide paste. Iodine-starch solution was so immediately decolorised; the zirconium hydroxide was loured a deep blue, which was destroyed on heating but -appeared on cooling. Congo Red—a typical colloid estuff—was readily adsorbed by zirconium hydroxide, t Safranine, which is a true salt, was not adsorbed. The ie "Congo-acid" formed a blue adsorption-compound th zirconium hydroxide; on warming, this was converted o the red salt, thus furnishing a case of chemical comation preceded by adsorption (compare Bayliss, this J., 11, 1093).—A. S.

dal cuprous oxide. C. Paal and A. Dexheimer. Ber., 1914, **47**, 2195—2199.

olloidal cupric oxide solution, prepared as described viously (this J., 1906, 534), was converted quantitatively into cuprous oxide on warming with an aqueous solution of hydroxylamine. The cuprous oxide sol was a clear orange to yellowish red liquid when viewed by transmitted light and on exposure to air was oxidised to cupric oxide. When evaporated rapidly in a vacuum it yielded a brittle greenish-yellow to greenish-black solid, much less easily oxidised than the liquid hydrosol, and capable of again yielding the latter on treatment with water. Products containing from 7·58 to 34·17 % Cu_2O were prepared. The cuprous oxide sol was relatively stable towards electrolytes. A solution of the solid product in a small quantity of water remained clear on mixing with several times its volume of alcohol.—A. S.

Colloidal nickelous hydroxide. C. Paal and G. Brunjes. Ber., 1914, **47**, 2200—2202.

Nickelous hydroxide sols were prepared by a method used previously (this J., 1902, 994, 995; 1906, 534) for the preparation of other colloidal hydroxides and oxides of heavy metals, nickel sulphate solution being added to a solution of sodium protalbinate or lysalbinate and the precipitate produced dissolved in dilute sodium hydroxide solution.—A. S.

Reduction of oxides of heavy metals. Catalytic actions of colloidal metals of the platinum group. X. C. Paal. Ber., 1914, **47**, 2202—2216.

Colloidal cupric hydroxide and nickelous hydroxide (see preceding abstract) can be reduced to the corresponding colloidal metals by hydrogen in presence of colloidal palladium as catalyst. Freshly precipitated hydroxides of copper and nickel, suspended in water, can be reduced in a similar manner, but not the hydroxides of cobalt and lead. It is advantageous to add sodium protalbinate to the mixture before reduction, in order to increase the stability of the metal hydrosols produced. When treated in a similar manner ammonium chromate was reduced to colloidal chromium hydroxide, ammonium vanadate to colloidal vanadium trihydroxide, and ammonium molybdate to colloidal molybdenum tetrahydroxide, whilst ammonium tungstate remained unaffected.—A. S.

Non-metallic elements; Positive ions from ——. I. Precipitation of metals from solutions of their salts by yellow phosphorus. R. M. Bird and S. H. Diggs. J. Amer. Chem. Soc., 1914, **36**, 1382—1392.

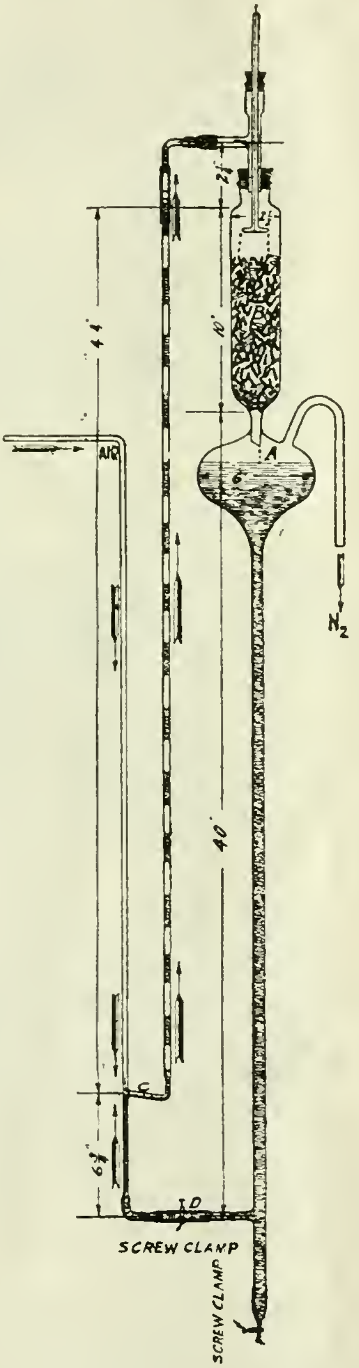
The essential reaction that occurs when phosphorus is immersed in a solution of copper sulphate (cp. Straub, this J., 1903, 1045; Tauchert, this J., 1913, 139) is as follows:— $5CuSO_4+2P+8H_2O=5Cu+5H_2SO_4+2H_3PO_4$. In displacing copper and certain other metals from their salts, phosphorus, like the metallic elements, first passes into solution as a positively charged ion, and the chief distinction between the metals and the so-called non-metals is considered to consist in the tendency of the compounds of the non-metals to be hydrolysed, and ionisation of the products. The E.M.F. between phosphorus and copper appears to be at least 0·35 volt. Amorphous carbon, amorphous boron, crystalline silicon, antimony and arsenic displace silver from solution.—L. E.

Phosphorus; Two new modifications of ——. P. W. Bridgman. J. Amer. Chem. Soc., 1914, **36**, 1344—1363.

Ordinary white phosphorus is converted into another modification—white phosphorus II.—at about —76·9° C. under atmospheric pressure, the change being reversible; the crystalline form of the product is probably hexagonal. A second modification—black phosphorus—is irreversibly formed by heating white phosphorus to 200° C. under a pressure of 12,000 kilos. per sq. cm. Black phosphorus has a density of 2·691, is not spontaneously inflammable, and is a fairly good conductor of heat and electricity. It has a lower vapour pressure and probably a somewhat higher melting point than red phosphorus; red and black phosphorus appear to yield identical liquids when melted. —L. E.

Nitrogen-generator. C. Van Brunt. J. Amer. Chem. Soc., 1914, **36**, 1448—1450.

An apparatus (see fig.) for producing oxygen-free nitrogen from air comprises a reservoir, A, containing a mixture of equal volumes of a saturated solution of commercial ammonium carbonate and ammonia of sp. gr. 0·93. The liquid flows from A at a rate controlled by the screw-clamp, D, and encounters a current of air at the branch, C, which should slope as shown. The fall-tube from A must be long enough to give a pressure at C such that the volume of solution carried up is at least equal to that of the accompanying air without danger of the latter backing up into A. The air-liquid mixture is discharged over the glass bell in the top of B and descends through the column of copper clippings in B. The air now freed from oxygen is dried and freed from ammonia with dilute sulphuric acid. The air current serves to insure the continuous circulation of the liquid through the apparatus.—L. E.



Manganese sulphide and the determination of manganese. Villiers. *See* XXIII.

Patents.

Sulphuric anhydride; Manufacture of——by the contact process.—A. Classen. Ger. Pat. 274,345, Feb. 14, 1913.

Metallic chromium or Cr-Fe, V-Fe, Mo-Fe (50—60% Mo), Si-Mn-Fe, or Si-Al-Mn-Fe alloys, which are resistant to contact-poisons, are used as catalysts at 400°—550° C. —A. S.

Sulphuric acid; Process for obtaining normal sulphate and —— from bisulphate. Metallbank und Metallurgische Ges. A.-G. and H. Klencke. Ger. Pat. 274,873, Aug. 20, 1912.

The bisulphate is decomposed and the resulting normal sulphate melted by the direct action of fire-gases flowing in a direction opposite to that of the charge. The hearth of the reaction chamber is cooled externally so that a relatively thick layer of the charge is solidified thereon, and at one end tap-holes are provided at different heights for drawing off the fused sulphate. The fire-gases enter the chamber at this end, through a vertical channel and strike directly downwards on to the charge; the outlet channel for the highly concentrated sulphuric acid vapours is at the opposite end. The roof of the reaction chamber is provided with longitudinal and transverse projecting ribs to divert the fire-gases from the sides of the chamber towards the middle.—A. S.

Ammonia; Production of mixtures of nitrogen and hydrogen suitable for the manufacture of——. J. Weise. Wiesbaden, and F. Rieche, Oestrich, Assignors to R. Koepp und Co., Chem. Fabr., Oestrich-on-Rhine, Germany. U.S. Pat. 1,098,139, May 26, 1914; date of appl., Jan. 26, 1914.

An alkali, such as caustic soda, is treated with a compressed gaseous mixture containing nitrogen and carbon monoxide, the latter reacting with the alkali to yield formate. The residual nitrogen is maintained unde pressure and is mixed with hydrogen obtained by heatin the formate.—A. S.

Chemical reactions between solid substances and gases high temperatures; Effecting ——. [Production calcium cyanamide or cyanides.] W. P. Dreaper, Londo Eng. Pat. 12,927, June 4, 1913.

In the manufacture of calcium cyanamide or of cyanid by passing nitrogen or ammonia over suitable soli materials, gaseous fuel is burned in surface combustic apparatus, and the heat communicated indirectly, radiation or otherwise, to the solid material. The was combustion gases are utilised as a source of nitrog or for heating boilers.—W. H. C.

Calcium carbide; Process of crushing and grinding —— W. S. Landis, Niagara Falls, Ontario, Assignor American Cyanamid Co., Nashville, Tenn. U.S. P 1,100,582, June 16, 1914; date of appl., June 7, 1913.

To prevent explosions and lessen the "weathering" calcium carbide and the losses incidental thereto, t material is crushed, ground, conveyed, and stored in atmosphere of pure nitrogen at a pressure above that the atmosphere.—A. S.

Magnesium carbonate; Manufacture of basic ——. Silbermann, Rähnitz, Saxony. Eng. Pat. 18,594, A 15, 1913. Under Int. Conv., Aug. 15, 1912.

Solutions of magnesium salts, such as the waste liqu from the manufacture of potassium salts, are precipita at a high temperature (above 40° C.), by solutions of pa carbonated ammonia or of ammonia and ammoni carbonate, the density of the product being regula by adjusting the ratio between free hydroxyl and carb acid of the precipitating medium and by varying temperature and dilution of the solution. The reac products should not remain in contact longer tha necessary.—F. Sodn.

Magnesium chloride present in potash salts; Process removing —— by lixiviation with alcohols. E. Kr geb. Köwing. Ger. Pat. 273,890, April 16, 1 Addition to Ger. Pat. 260,141.

The residue left after removal of the magnesium chlo as described in the chief patent (this J., 1913, 69 heated in a suitable apparatus so as to distil off adh alcohol. The hot material is then transferred dir to the apparatus in which the potassium salts are diss from it.—A. S.

Sulphite liquor ; (1) *Process of and* (2 *and* 5) *apparatus for making* ——. (3) *Process of and* (4) *apparatus for blowing acid gases.* R. B. Wolf, Berlin, N.H., Assignor to Burgess Sulphite Fibre Co., Portland, Me. U.S. Pats. 1,097,781 to 1,097,785, May 26, 1914 ; dates of appl., (1 and 2) Nov. 17, 1909, (3) Jan. 28, 1911, and (4 and 5) July 13, 1911.

(1) GAS containing sulphur dioxide is forced into absorption apparatus in which it is treated on the counter-current principle with a basic liquid, and unabsorbed gas is exposed to an absorbing liquid in the presence of a carbonate, such as limestone. Liquid carrying a base partly in solution, (*e.g.*, milk of lime) is added to the gas as it enters the blower and is subsequently allowed to separate from the gas and passed to the main body of basic liquid, as is also the liquor from the carbonate treatment. (2) Apparatus for producing sulphur dioxide is connected with a cooler and series of absorption tanks fitted with agitators and communicating with a tank for the supply of lime-water to the system on the counter-current principle. A gas blower into which alkali may be introduced is located between the cooler and the absorption system, and means are provided for the production of bisulphite and sulphurous acid by absorption of sulphur dioxide from the excess gas and for conducting the liquors and those separating in the blower, to the lime tank. (3) A neutralising agent added to the gas as it enters the blower, causes an inactive coating to be deposited on the parts of the blower. (4) A blower containing impellers and connected with a tank from which it receives a supply of neutralising agent, is provided with means for the separation of liquid and gas, including a trap with bent foot having an agitator therein. Means are also provided for conducting the liquor to a tank, from which it is pumped back into the trap to secure circulation. (5) Apparatus f the type described under 2 above, includes a tower having a carbonated basic filling, means for introducing absorbing iquid for sulphur dioxide at the top and excess of gas from he absorption system at the bottom of the tower, and or delivering liquor from the tower to the basic liquor tank. —F. SODN.

Sulphite liquor ; Process of making ——. H. K. Moore and R. B. Wolf, Berlin, N.H. U.S. Pat. 1,099,565, June 9, 1914 ; date of appl., Dec. 31, 1913.

HE products of combustion of a sulphur-bearing substance re cooled so as to condense products less volatile than ulphur dioxide, and the residual sulphur dioxide is passed ontinuously through a mixing apparatus, milk of lime, ooled to about 32° F. (0° C.) being passed through the pparatus in the opposite direction. The mixer is cooled o a constant predetermined temperature, and calcium sulphite solution containing a constant proportion f free sulphurous acid, is withdrawn continuously as it rms.—A. S.

odium bisulphite ; Stable crystalline —— *and process of producing same.* H. Howard, Boston, Mass. U.S. Pat. 1,099,177, June 9, 1914 ; date of appl., Sept. 6, 1912.

ULPHUR dioxide is passed through a heated solution ontaining sodium bisulphite until crystals separate. he crystals are removed, dried and cooled. They are e from water of crystallisation, stable, and non-liquescent. The unabsorbed sulphur dioxide is absorbed an alkaline solution, which is subsequently mixed with e mother liquor from the crystals, and the whole again ated with sulphur dioxide.—A. S.

rborates ; Process of dehydrating ——. O. Liebknecht, Frankfort-on-Maine, Germany, Assignor to Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 1,098,740, June 2, 1914 ; date of appl., Nov. 15, 1912.

CRYSTALLISED perborate (such as sodium perborate) heated, preferably at 50°—70° C., in the presence of an ohol.—F. SODN.

Oxidising agents [*sodium perborate*] ; *Stabilised* —— W. E. Kemmerich, Mulheim-on-Rhine, Germany. U.S. Pat. 1,101,449, June 23, 1914 ; date of appl., Jan. 16, 1914.

A SOLUTION containing about 2% of sodium perborate and a small quantity of a stabilising colloid, *e.g.*, 0·1% of gelatin.—A. S.

Perborates ; Manufacture of ——. G. A. Hempel, Ger. Pat. 274,347, April 19, 1913.

SOLUTIONS of borates, such as are obtained for example in the manufacture of borax or boric acid, are treated with gaseous hydrogen peroxide, *e.g.*, with the vapours evolved on distilling per-acids.—A. S.

Phosphoric acid and compounds of the same ; Process of and apparatus for making ——. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,100,639, June 16, 1914 ; date of appl., Feb. 17, 1914.

A MIXTURE of phosphate rock with silicious and carbonaceous materials is treated in a shaft furnace with a blast of hot air or of enriched air or oxygen, whereby the carbonaceous material is burnt and part of the phosphorus is eliminated. The charge is then transferred to an electric furnace, with addition of a further quantity of silicious and carbonaceous materials, if necessary, and heated to a higher temperature to eliminate the remainder of the phosphorus. The volatilised phosphoric anhydride is condensed.—A. S.

Phosphates, silicates (monazite sand), etc. ; Process for the decomposition of radioactive ——. E. Ebler. Ger. Pat. 274,781, Feb. 28, 1913.

THE phosphate, silicate, or the like is mixed with a metallic reducing agent, *e.g.*, magnesium, calcium, or aluminium, which when ignited, will reduce the substance, without application of external heat. Phosphides, silicides, or the like, readily soluble in dilute acid, are formed, and on treatment with acid most of the phosphorus is removed in the form of hydrogen phosphides, whereby the subsequent extraction of the thorium is greatly facilitated.—A. S.

Arsenate of lead ; Process of making ——. H. H. Dow and E. O. Barstow, Assignors to The Dow Chem. Co., Midland, Mich. U.S. Pat. 1,100,673, June 16, 1914 ; date of appl., June 10, 1911.

A SOLUTION of a soluble acid arsenate (of sodium, for example), to which sodium carbonate or other alkali is added, in amount preferably equivalent to the hydrogen present in the arsenate, is treated with a solution of lead chloride, and the precipitate formed is separated, to obtain a paste of the desired consistence.—F. SODN.

Arsenate of lead ; Method of manufacturing ——. E. O. Barstow, Assignor to The Dow Chem. Co., Midland, Mich. U.S. Pat. 1,100,686, June 16, 1914 ; date of appl., June 10, 1911.

A SOLUBLE arsenate is treated with an acid (such as hydrochloric acid) forming with lead, or other metal concerned, a salt more soluble than the arsenate, and the resulting solution is mixed with lead oxide or other suitable compound.—F. SODN.

Mesothorium and radium ; Process of obtaining salts of —— *from thorium-bearing minerals.* B. Keetman and F. Jost, Assignors to Deutsche Gasglühlicht Akt.-Ges. (Auerges), Berlin, Germany. U.S. Pat. 1,100,743 June 23, 1914 ; date of appl., Feb. 15, 1912.

IN the production of thorium from thorium-bearing minerals, the latter are treated with barium salts and with concentrated sulphuric acid, water is added to form a slimy or muddy product, and this is treated with a further large quantity of water to which is added a quantity of barium salts sufficient to render the radioactive substances (mesothorium and radium) quite insoluble —A. S.

Radium, mesothorium, thorium, and other radioactive substances ; Method of treating sulphates, especially sulphate mixtures containing ——. E. Ebler. Ger. Pat. 274,874, Feb. 28, 1913.

The mixture of sulphates is mixed with calcium hydride, and ignited at one spot, without external application of heat. The reaction proceeds throughout the mass, the sulphates being reduced to sulphides. The reaction product is lixiviated with weak acid solutions, especially dilute hydrochloric acid. The hydrogen produced in the reaction burns outside the mass and protects the sulphides from oxidation.—A. S.

Hypochlorite bleaching liquors from chlorine and alkali solutions ; Continuous production of ——. Deutsche Solvaywerke A.-G. Ger. Pats. 273,795, Jan. 28, 1912, and 274,871, March 16, 1913.

(1) Chlorine gas and alkali solution are introduced continuously into a quantity of hypochlorite bleaching solution, and a corresponding quantity of the solution is continuously withdrawn. (2) An apparatus for carrying out the process consists of a coil of tubing placed in a cooling vessel, chlorine and alkali being introduced to the coil at the lower end and hypochlorite solution withdrawn at the upper end.—A. S.

Oxides and similar compounds of tin ; Process for converting —— into soluble compounds. Chem. Fabr. von der Linde m. b. H. and G. von der Linde. Ger. Pat. 274,045, Oct. 5, 1912.

Oxides or hydroxides of tin are converted into soluble compounds by treatment with stannic or stannous chloride or mixtures of the same. The method is especially suitable for the treatment of so-called "tin pastes" (chiefly oxides and hydroxides of tin) obtained as a by-product in silk weighting processes. For example, 10 kilos. of "tin paste" are heated to 70°—80° C. with 20 kilos. of stannic chloride, an excess of tin added, and the whole evaporated in presence of hydrochloric acid. Impurities are precipitated, and the resulting stannous chloride may be separated from any ferric chloride also present by crystallisation.—A. S.

Chlorate ; Process for removing bromate from ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 274,471, March 18, 1913.

A solution of the chlorate is treated with a sulphide of an alkali or alkaline-earth metal, whereby bromate is rapidly decomposed, whilst the chlorate is practically unaffected. The stability of the chlorate is increased by the removal of bromate.—A. S.

Dissolving apparatus for potassium chloride. C. Lührig's Nachf. F. Gröppel. Ger. Pat. 274,473, Dec. 20, 1912.

A tubular filter is suspended in the dissolving vessel so that it is surrounded by the material which is being dissolved ; the latter moves gradually downwards, whilst the solution flows upwards. The filter can be moved vertically up and down, so as to regulate the concentration of the filtered solution drawn off. Or, the filter may be in the form of a jacket enclosing the dissolving vessel.—A.S.

Ozone ; Process for the construction or lining of apparatus, vessels, etc., resistant to ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 274,872, June 17, 1913.

Ferrochrome containing at least 25% Cr and little or no carbon is used. It resists the action of ozone and of nitric oxide and peroxide.—A. S.

Nitric acid ; Process of concentrating dilute ——. Salpetersäure-Industrie-Ges. m. b. H., Cologne, Germany. Eng. Pat. 18,113, Aug. 8, 1913. Under Int. Conv., Aug. 24, 1912.

See U.S. Pat. 1,074,287 of 1913; this J., 1913, 1009.—T.F.B.

Distilling acids ; Means for ——. W. Hof, Frankfort on Maine, Germany. U.S. Pat. 1,099,368, June 9, 1914. Date of appl., Sept. 29, 1913.

See Fr. Pat. 463,208 of 1913 ; this J., 1914, 421.—T. F. B.

Hydrosulphites ; Production of anhydrous —— from aqueous hydrosulphite solutions. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 14,424, June 21, 1913.

See Fr. Pat. 460,610 of 1913 ; this J., 1914, 76.—T. F. B.

Sulphur and sulphates from sulphites ; Process of producing ——. C. Hanson, Wiesdorf, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,101,740, June 30, 1914. Date of appl., Jan. 17, 1913.

See Ger. Pat. 264,920 of 1912 ; this J., 1913, 1068.—T. F. B.

Method of and apparatus for electrolysing liquids [brine]. U.S. Pat. 1,100,290. *See* XI.

Gas-analysis apparatus for the treatment of gases with measured quantities of a liquid reagent. Ger. Pat. 273,726. *See* XXIII.

VIII.—GLASS ; CERAMICS.

Tellurium as colouring agent in soda-lime silicate glass P. Fenaroli. Chem.-Zeit., 1914, **38**, 873—874.

Tellurium, like sulphur and selenium (see this J., 1912 1033 ; 1914, 201), acts as a colouring agent in glass onl under reducing conditions, in which case it may be presen as a colloidal solution of the element, causing blue o brown colorations, or as a polytelluride which yields a re glass. In the blue glasses the colloidal particles ar larger than in the brown. The absorption spectrum of th red glasses corresponds to that of aqueous solutions polytellurides, with a characteristic maximum betwee 480 and 490 μμ. Comparing the members of the sulphu family, the author concludes that in combination with a alkali metal their staining power tends from yellow to re with increasing atomic weight ; that they form colloid solutions in glass more easily as the metallic character the element increases, the analogy between selenium ar tellurium being greater in this than between sulphur ar either ; and that none of them colour glass under oxidisi conditions.—H. H. S.

Selenium glasses. O. N. Witt and Fränkel. Sprechsa 1914, **47**, 444—445.

Referring to Fenaroli's work (this J., 1912, 1033 ; 191 201 ; and preceding abstract), a knowledge of the colloid nature of the colouring agent is regarded as less importa than the proportion of selenium introduced to that whi actually stains. The total selenium present was estimat by the amount of iodine it liberated from potassium iodi after the glass had been treated with hydrofluoric ac The chromogenic selenium was estimated colorimetrica by comparison with a colloidal solution obtained reducing selenium dioxide with gelatin and phospho acid. The figures obtained were : selenium introduc 0·0262 ; Se found, 0·021 ; chromogenic Se, 0·0016%- proportion of 100 : 8. Temperature influences the col obtained ; at 620° C. a selenium glass was rendered colo less, but returned to its original tint on cooling. In glas containing potash, the colour tends to brown the m basic the composition. If potash be completely repla by soda, a selenium glass is colourless. The maxim content of selenium in alkali-lime glasses is said to 0·06%, volatilisation taking place above this limit. alkali-lead glasses a much higher content is possible ow to the formation of lead selenide which colours the g dark brown. As selenium in the free state begins volatilise at 120° C. it should be introduced as selenite selenate. In the subsequent discussion, the use of selen as a colouring agent in the ceramic industry was rec mended.—H. H. S.

IX.—BUILDING MATERIALS.

Gypsum ; Dehydration of ——. C. Gaudefroy. Comptes rend., 1914, **158**, 2006—2008.

The second stage in the dehydration of gypsum, viz., the formation of soluble anhydrite from the hemihydrate, $2CaSO_4.H_2O$, is reversible and the reason why widely varying temperatures have been given for the complete dehydration of gypsum, is that the results vary according to the amount of water vapour in the oven. The anhydride can be obtained readily at 110° C. under suitable conditions, but cannot be obtained directly from gypsum without the intermediate formation of hemihydrate. (See also Gallo, this J., 1914, 694).—W. H. P.

Patents.

Brick ; Process for the burning of ——. G. D. Herrold, Fresno, Cal. U.S. Pat. 1,098,625, June 2, 1914 ; date of appl., Oct. 13, 1913.

Bricks, arranged in rows, are subjected to a burning heat, confined by the rows, and the exposed faces of the bricks are glazed by means of a flame which is moved across the faces of the bricks.—W. C. H.

[Refractory] Protective coating ; Article with ——. S. H. Fleming, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,098,794, June 2, 1914 ; date of appl., Oct. 29, 1912.

Refractory articles are coated with a layer of rutile and carbon and heated in the absence of air to change the ayer into titanium carbide and then heated in an atmosphere of nitrogen to form titanium nitride.—W. C. H.

ement-waterproofing compound ; Set-adjusting ——. C. Ellis, Montclair, N.J. U.S. Pat. 1,099,974, June 16, 1914 ; date of appl., Aug. 6, 1912.

A mixture of basic calcium stearate and sodium aluminate n such proportions that the set-retarding effect of the ormer is equalled by the set-accelerating effect of the atter. The stearic acid is approximately 25% of the otal lime content. The composition is substantially free rom fatty grease, excess fat, glycerin and other hygroscopic ubstances ; it can be ground to a fine powder, and when xposed to atmospheric moisture remains in the form of a ne non-caking powder which can be readily mixed with ry cement.—W. C. H.

oloured-cement product and process of producing the same. H. A. Gardner, Washington, D.C. U.S. Pat. 1,100,129, June 16, 1914 ; date of appl., Feb. 18, 1913.

non-hydrous paste consisting of a pigment and an asaponifiable oil, which serves as a protective vehicle, mixed with Portland cement or the like to colour it. —W. C. H.

ement goods ; Process for producing smooth, glossy, or glazed coating on ——. A. Weithaler, Karlsruhe, Germany. U.S. Pat. 1,101,823, June 30, 1914. Date of appl., April 11, 1910.

ee Eng. Pat. 3423 of 1910 ; this J., 1910, 1159.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

on: Effect of titanium on the magnetic properties of ——. K. P. Applegate. Rensselaer Polytech. Inst., New York. Eng. and Sci. Series, No. 5.

he permeability of pure Swedish charcoal iron was creased, and the hysteresis slightly diminished, by small ounts (less than 1%) of titanium ; larger quantities reased the hysteresis loss. When commercial titanium alloys were used in place of pure titanium, metal of inferior magnetic quality was produced. The hysteresis losses of titanium steels were higher than those of the present standard steels, and the maximum induction and the permeability were considerably higher than those of silicon steel (Si 3·5—4·5%) or pure iron.—W. E. F. P.

Steels ; The speed of transformation of —— when heated, and the specific electrical resistance of iron. A. Portevin. Comptes rend., 1914, **159**, 51—53.

Steel bars were heated in salt baths at 750° C. and 900° C. for varying lengths of time, quenched, and the increase in resistance measured. The passing of carbon into solid solution was not instantaneous but took 10 to 20 mins. after the steel had acquired the requisite temperature. Steel with C 0·88% gave a greater increase in resistance on quenching from 900° C. than from 750° C. The specific resistance of pure iron obtained by extrapolation was 9·3 microhms at 20° C.—T. St.

[Steel] Neumann lines ; Formation of ——. (1) Matweieff, (2) A. Portevin and J. Durand. Rev. Mét., 1914, **11**, 766—779.

(1) The formation of "Neumann lines" is considered to be due to twinning induced by friction (scratching) of emery grains along the edges of cleavage planes of crystals during the polishing of the metal. The lines indicate the orientation of the grains and the direction of corrosion, and occur in relief upon the surface of the metal, forming Widmanstaettian figures upon individual grains. (2) The lines are regarded as the result of twinning due to pressure. Micrographic evidence is given to show that, as indicated by Osmond and Cartaud (this J., 1906, 761) the Neumann lamellæ occurring in any given grain are parallel to not more than 6 planes corresponding to the crystalline orientation of the grain itself ; and that the lines are hollows and not ridges as stated by Matweieff.—W. E. F. P.

Nickel steels ; Specific volumes of ——. P. Chevenard. Comptes rend., 1914, **159**, 53—56.

The specific volumes of iron-nickel alloys at 750° C., 0° C. and —273° C. were calculated from dilatation curves obtained for the range —195° C. to 750° C., and the densities determined at the ordinary temperature. The amplitude of the irreversible transformation (peculiar to the alloys with a nickel content lower than that of Fe_2Ni) is proportional to the content of free iron in the alloy.—T. St.

Alloys ; Electrolytic separation of —— and their metallographic and mechanical investigation. V. Iron-nickel alloys deposited at high temperatures from sulphate baths. R. Kremann and R. Maas. Monatsh. Chem., 1914, **35**, 731—753. (See also this J., 1914, 553, 752.)

Experiments were carried out at 75° C. and the results compared with those obtained at ordinary temperatures (this J., 1914, 28). The higher temperature caused an enormous increase in the nickel content of the deposit when the other conditions were not varied. As at ordinary temperature the effect of increasing the nickel content of the electrolyte was first rapidly to increase that of the deposit and then, after a maximum, slowly to diminish it. Potassium oxalate and citric acid both increased the percentage of nickel in the deposit. The effect of citric acid was similar to that of increasing nickel concentration, *i.e.*, it was reversed after a certain point where a maximum was reached. A disadvantage of the higher temperature was that to obtain alloys with less than 70—80% Ni, it was necessary to work with such low Ni concentrations in the electrolyte, that the composition of the deposit was abnormally sensitive to slight variations in the composition of the electrolyte. The high temperature deposits were in general harder and it is concluded that solid solutions were formed to a greater extent, and that hydrogen content is not the predominating factor in the production of hardness. The metallographic investigation again revealed the concentric structure observed with the low-temperature deposits. Electromotive study of the deposits showed that the alloys, when first produced, were in a passive condition; they reached the normal potential only after long immersion in ferrous sulphate solution.—W. H. P.

Alloys; Electrolytic separation of —— and their mechanical and metallographic investigation. IV. The separation of iron-magnesium alloys from aqueous solution. R. Kremann and J. Lorher. Monatsh. Chem., 1914, **35**, 603—634. (See also this J., 1914, 28, 553, 752.)

The electrolytes used contained ferrous sulphate and magnesium chloride in varying concentrations, with in some instances the addition of potassium chloride. The cathode deposit at various current densities from various electrolytes was analysed for iron and magnesium, the difference being attributed to oxygen. The deposits consisted of metallic iron and in certain cases of a solid solution or compound of iron and magnesium, together with ferrous hydroxide and possibly magnesium hydroxide. The evidence for the existence of the combination of iron and magnesium was strengthened by the results of the metallographic investigations and by the measurements of hardness and E.M.F.'s against ferrous and magnesium sulphates. The existence of hydroxides, especially in the deposits from electrolytes poor in magnesium was evident, because the current yield would frequently have been over 100%, if the deposit were assumed to be entirely metallic. In certain cases the deposits were readily oxidised in air with evolution of heat, and were pyrophoric at slightly elevated temperatures. This phenomenon was probably due to the combined effects of ferrous hydroxide, finely divided iron and the iron-magnesium alloy.—W. H. P.

Gold; Contribution to the chemistry of ——. II. Auto-reduction as a factor in the precipitation of metallic gold. V. Lenher. J. Amer. Chem. Soc., 1914, **36**, 1423—1426. (See this J., 1913, 599.)

Gold salts undergo auto-reduction to metallic gold in presence of various metallic peroxides; the metal is also precipitated by manganous salts in neutral or alkaline solution and by cerous hydroxide in alkaline solution, manganese and cerium dioxides being formed in the respective cases. The presence of gold in manganese deposits may be due to two different reactions. In one case free chlorine, produced by the action of an oxidised manganese deposit on a chloride solution containing free acid, dissolves gold; the solution of gold and manganese is stable, whilst acid, but deposits gold and manganese dioxide when neutralised, *e.g.*, with limestone. Or, again, the gold in manganese deposits adjacent to other gold deposits may be formed entirely by auto-reduction of gold from solution by manganese dioxide.—L. E.

Silver; Electrical resistance of pure ——; molten and solid. E. F. Northrup. J. Franklin Inst., 1914, **178**, 85—87. (See also this J., 1914, 141, 264, 357 and 358.)

The curve showing the change of resistance with temperature is very slightly convex toward the temperature axis from 20° C. to the m. pt. In the process of melting the resistance is approximately doubled and then increases in a perfectly linear manner with rise of temperature. The following values may be quoted (microhms per cm^3.): 20° C., 1·659; 60°, 1·900; 960·5° (solid), 8·4; 960·5° (liquid), 16·6; 1340°, 21·01.—W. H. P.

Copper-nickel-manganese alloys. Electrical resistance and temperature coefficient of ——. G. L. Gray. Rensselaer Polytech. Inst., Eng. and Sci. Series No. 4.

The addition of manganese to an alloy of copper and nickel at any concentration usually increases the electrical resistance. The curve of temperature coefficients for these alloys is of the same general shape as the curve of conductivities, and an increase of resistance is usually accompanied by a decrease of temperature coefficient. The curves indicate that the alloy composed of Cu 55, Ni 45, and Mn 15 parts has a specific resistance of about 70 microhms per c.c., and practically no temperature coefficient at 20° C. It is thus a much better resistor than any of those usually employed in precision apparatus.—W. H. P.

Type-metal; Cause of the oxidation of ——. S. Zinberg. Z. angew. Chem., 1914, **27**, 436—437. (See also this J., 1914, 317.)

A type metal containing Pb 80·3, Sb 19·21 and As 0·39%, when placed in river water, was unacted on, but was rapidly attacked by distilled water; after three days 0·6% had been oxidised and corresponding amounts of lead and antimony were found in the water. Experiments with lead shavings gave similar results. It is concluded that water or water vapour is the active agent in the oxidation of type-metal which contains about 80% Pb. Metal containing only about 72% Pb was quite unacted on under the experimental conditions.—J. H. J.

Metals; Influence of time in rapid deformations of ——. G. Charpy and A. Cornu. Comptes rend., 1914, **158**, 1969—1973.

In testing metals by shock, variation in the time of deformation from $\frac{1}{1000}$ to $\frac{1}{100}$ of a second did not produce any appreciable variation in the work absorbed by the rupture.—W. H. P.

Reduction of oxides of heavy metals. Catalytic actions of colloidal metals of the platinum group. X. Paal. *See* VII.

Patents.

[*Iron and steel*]. *Ingots and other castings; Process for casting ——.* F. Melaun, Berlin. Eng. Pat. 8490, Apr. 10, 1913.

Compound ingots are cast by pouring, one after the other, two (or more) different kinds of metal into one vertical mould, the second metal being added before the upper portion of the first has solidified.—W. E. F. P.

Iron and other metals; Manufacture of ——. A. E. Bourcoud, London. Eng. Pat. 12,960, June 4, 1913.

In cyclic processes for the manufacture of iron and other metals (see Eng. Pats. 21,069 of 1905, 21,770 of 1906, and 676 of 1910; this J., 1906, 1152; 1907, 928; 1911, 629), leakage of gas at the heating stoves is obviated by placing the circulator together with the regenerator and desulphuriser entirely between the outlet of the heating stov corresponding to the regenerator and the inlet of th heating stove corresponding to the metallurgical furnace By this arrangement the pressure in the stoves may b kept approximately atmospheric whatever the position o the circulator relatively to the regenerator an desulphuriser.—T. St.

Case-hardening compound. A. O. Blaich, Chicago, Il U.S. Pat. 1,100,008, June 16, 1914; date of app Oct. 18, 1913.

An intimate mixture of charred tan bark 85, a sodiu salt 5, and calcium carbonate 10 parts, obtained b impregnating the bark with an infusion of the oth materials.—T. St.

Armour-plates; Process of treating ——. A. F. Mitche Pittsburgh, and W. H. Jones, Munhall, Pa., Assigno to Carnegie Steel Co., Pittsburgh, Pa. U.S. Pa 1,100,193, June 16, 1914; date of appl., March 2 1910.

The high-carbon surface of a plate in which the carb gradually diminishes from one face, is decarburised to point sufficient to cause it to retain a certain hardne when the plate is hardened. In an example illustrat the carbon content in a 6 in. plate starts from 0·10% the face to a maximum of 0·85% at a depth of ¾ in., fa to 0·41% at 2 in. depth, and then remains constant. —T. St.

[*Manganese-*] *Steel; Method of making ——.* W. Nichols, Chicago Heights, Ill. U.S. Pat. 1,100,9 June 23, 1914; date of appl., Feb. 25, 1914.

Manganese-steel is made by mixing in a comm receptacle decarbonised iron 55, manganese steel scr containing Mn about 12%, 37, and 80% ferromanganese 8 parts. The components are melted separately, and heated, the iron to about 1650° C., the steel scrap to about 1400° C., and the ferromanganese to about 1350° C., just prior to mixing.—T. St.

Ferromanganese; Melting ——. E. Humbert, Chicago, Ill. U.S. Pat. 1,101,551, June 30, 1914; date of appl., July 18, 1913.

Ferromanganese is maintained molten in an electric furnace of the electrode type, solid alloy being added to replace metal, as this is tapped. A comparatively thick layer of carbonaceous material on the bath and surrounding the ends of the electrodes, serves to avoid excessive variations in voltage when the surface is agitated, to protect the metal from the air, and, by its partial consumption, keep up the temperature of the bath.—T. St.

[*Iron*]. *Metal alloys; Producing* ——. L. Goldmerstein, New York. U.S. Pat. 1,098,346, May 26, 1914; date of appl., Jan. 17, 1913.

To a bath of molten metal (iron) containing an impurity, a metallic fluoride is added which is dissociated at the temperature of the bath; the impurity is thus removed (as fluoride) and an alloy of the two metals produced.
—W. E. F. P.

Copper; Process for obaining adhesive coatings of —— upon iron and steel. S. O. Cowper-Coles, London. Eng. Pat. 25,393, Nov. 6, 1913.

Iron or steel is cleansed, rendered passive by dipping in oncentrated nitric acid or by other means, washed, and ransferred to an electrolytic copper-depositing tank in which the anode and cathode are already connected up in the electric circuit. The electrolyte is prepared by heating an aqueous solution of potassium cyanide nearly to boiling, dding copper sulphite, heating the solution to boiling, llowing to cool, filtering and diluting. An alternative lectrolyte is composed of copper carbonate dissolved n potassium cyanide solution to which sodium bisulphite s added. The copper is deposited at about 60° C., with a current density of about 3 amps. per sq. ft. of cathode urface, and the steel or iron is subsequently removed, horoughly washed, and immediately transferred to a opper sulphate depositing tank in which it is allowed to emain until the copper coating has attained the desired hickness.—T. St.

Zinc-lead ores; Treatment of ——.] *Solutions; Apparatus for making and filtering* ——, *applicable in the extraction of metals from ores and for like purposes.* P. C. C. Isherwood, Bushey Heath, Herts. Eng. Pat. 6413, Mar. 15, 1913.

A closed, rotary cylinder is divided by a longitudinal artition into two similar compartments each having a lter-plate parallel to the partition. Openings are proided in the cylinder wall for charging and discharging each ompartment, and for removing the solution from the paces between the filter-plates; and provision is made or introducing high-pressure steam into each compartment.—W. E. F. P.

inc blende and other metalliferous constituents; Separation of —— from ore concentrates and slimes by flotation or granulation. E. J. Horwood, Broken Hill, New South Wales. Eng. Pat. 28,604, Dec. 11, 1913. Under Int. Conv., Dec. 12, 1912.

RE or sulphide material is prepared for the roasting peration which renders sulphides other than zinc sulphide ncapable of flotation (Eng. Pat. 1789 of 1909; this J., 910, 285, and Fr. Pat. 399,272 of 1909; this J., 1909, 2) by washing thoroughly with clean water to remove l soluble salts. This treatment results in reduced xidation of zinc during roasting, the possibility of otation at a lower temperature, and cleaner separation zinc from the other minerals present.—T. St.

Sulphides; Process for the separation of metallic —— from gangue and apparatus therefor. L. Bradford, Broken Hill, New South Wales, Assignor to Minerals Separation Ltd., London. U.S. Pat. 1,101,506, June 23, 1914; date of appl., March 11, 1912.

The ground ore is mixed with slightly acidulated water to form a flowing pulp, heated, and treated with a further quantity of acid to cause gas to be evolved. Air is then introduced and the whole subjected to violent agitation; the pulp is run off and the floating material separated.
—T. St.

Sulphide ores; Flotation process for the concentration of —— by means of oil and nascent gases. Tellus A.-G. für Bergbau und Hüttenindustrie. Ger. Pat. 274,002, March 2, 1913. Addition to Ger. Pat 273,266 (this J., 1914, 698).

The mixture of ore pulp and oil, etc., is fed on to a distributing cone which delivers it on to the surface of a mass of water. The distributor is in the form of a double cone, the portion tapering downwards being below the surface of the water and having a central opening communicating with radial passages through which dilute acid is delivered under pressure just below the surface of the water. In a modified form the acid-distributing device is separate from the distributing cone for the ore pulp.—A. S.

Lead, zinc, and copper ores; Preparation of very finely-divided —— for an oil-flotation process. K. A. H. Wolf. Ger. Pat. 274,530, Nov. 5, 1911.

The very finely ground ore is intimately mixed with an equal weight of water in a vessel provided with a mechanical agitator to which also compressed air is supplied. The ore pulp is treated with dilute sulphuric acid in the known manner, then intimately mixed with oil, and transferred to spitzkasten.—A. S.

Tungsten metal bodies; Manufacture of ——. C. Gladitz, London. Eng. Pat. 12,421, May 28, 1913.

Fluffy tungsten powder (see Eng. Pat. 27,859 of 1912; this J., 1914, 204) is mixed with a small quantity (5% to 25%) of tungsten powder of larger grain, and the mixture compressed into bars which are heated to 2650° C. by an alternating current, a liquid resistance being used so that the temperature can be raised and lowered gradually. The bars so formed are extremely ductile and can, by cold hammering, be reduced by 10% of their section. The larger crystalline variety of tungsten, the function of which is to provide nuclei for the growth of larger crystals in the compressed bar, is formed from the fluffy variety by heating or compressing or by simultaneously compressing and heating, then grinding and sifting to obtain clusters of a size suitable for use as nuclei.—T. St.

Ores; Dressing of ——. C. Vautin, London. Eng. Pats. 14,428 and 15,304, June 21, and July 2, 1913.

Crushed ore having particles of substantially uniform size is fed into a vertical cylindrical vessel with a conical bottom. Fluid such as air or water is introduced by tangential injectors so that it rotates rapidly within the cylinder about the vertical axis. The heavier particles of the ore are thus caused to move towards the centre, and are run off by a pipe at the bottom. The lighter particles are drawn off by suction through a number of vertical tubes arranged concentrically with and near the cylinder wall.—T. St.

Copper or nickel; Compound for use in welding joints in ——. C. Canzler and R. Samesreuther, Düren, Germany. Eng. Pat. 21,012, Sept. 17, 1913. Under Int. Conv., Sept. 30, 1912.

Copper containing P 0·04 to 0·5% is combined with 2 to 5% of Ag, Cd, or Bi, or more than one of these metals, and the compound in the form of wire is used for welding copper or nickel joints.—T. St

Copper ; Method of welding ——. E. E. Reigle. Assignor to J. Zajic, Baltimore, Md. U.S. Pat. 1,098,404, June 2, 1914 ; date of appl., March 10, 1914.

The metal is kept for 2 hours in a boiling solution of potassium chlorate and then welded as usual.—W. E. F. P.

Copper ; Process for separating —— from nickel and cobalt. V. Hybinette, Fredericktown, Mo. U.S. Pat. 1,098,443, June 2, 1914 ; date of appl., July 11, 1907. Renewed Nov. 2, 1911.

Sulphide ores or concentration products are roasted and subjected to magnetic separation. The concentrates, after having part of the sulphur removed, if necessary, by roasting, are smelted into a matte, which is then roasted, and leached with dilute sulphuric acid, whereby a solution is obtained containing principally copper.—T. St.

[*Copper*] *Metalliferous materials ; Art of treating* ——. H. B. Hovland, Duluth, and G. B. Frankforter, Minneapolis, Minn. U.S. Pat. 1,098,668, June 2, 1914 ; date of appl., Dec. 12, 1913.

Dry copper-containing material is treated with dry hydrogen sulphide without the application of heat.—T. St.

[*Copper*] *Smelting and briquetting process.* B. T. Colley, Raneagua, Chile. U.S. Pat. 1,098,883, June 2, 1914 ; date of appl., Dec. 15, 1911.

Finely-divided, pyritic copper ore is roasted to convert FeS_2 into FeS, mixed with plaster of Paris (5%), and the mixture briquetted and smelted as usual.—W. E. F. P.

Bismuth ; Proces for separating —— from copper. W. Thum, Hammond, Ind., Assignor to United States Metals Refining Co., New York. U.S. Pat. 1,098,854, June 2, 1914 ; date of appl., Sept. 17, 1910.

The mixture of bismuth and copper is oxidised, reduced to a fine state, and smelted with an excess of carbon and sodium sulphate. The resulting crude bismuth and copper matte are separated, and the former oxidised and again smelted with a suitable sulphur compound.—T. St.

Furnace for treating molten metals ; Single- or multi-phase electric [*induction*] ——. P. Lescure, Dombrowa, Russia. Eng. Pat. 3291, Feb. 7, 1914. Under Int. Conv., Feb. 7, 1913.

The secondary winding, constituted by the metal to be treated, is formed of several spirals surrounding the magnetic current circuit, and is also prolonged as an outer circuit in the form of a vertical passage, the latter being provided with a tapping hole. Each of the phases has a superposed chamber containing the metal, one end of the spiral and the vertical passage being in communication with the chamber, and the latter is furnished with a cover so that the furnace may be fed and the contents stirred. The secondary channel is arranged in the refractory material of the furnace, one half of the channel being formed of easily replaced tiles, which may or may not be provided with ribs for dividing the channel forming the winding into one or several longitudinal channels.—B. N.

Furnace ; Electrical —— for the reduction of copper and other ores. W. H. Hampton, New York, Assignor to The Conley Electric Furnace Co., Wilmington, Del. U.S. Pat. 1,100,972, June 23, 1914 ; date of appl., Oct. 7, 1913.

The furnace comprises an upper shaft portion and a hearth, and between the two are several small circular shafts having hopper-like entrances ; the combined area of these shafts is materially smaller than that of the common shaft above. Electrical resistance heaters are disposed in the walls of the large and smaller shafts.—B. N.

Furnace ; Ore-roasting ——. W. F. Murphy, Iowa City. U.S. Pat. 1,099,309, June 9, 1914 ; date of appl., Feb. 11, 1911.

The base or hearth of the roasting chamber is formed by the upper part of an endless conveyor to which the ore is supplied by a similar device disposed at a higher level in the apparatus.—W. E. F. P.

Rabbles and rabble-arm for metallurgical furnaces. U. Wedge, Ardmore, Pa. U.S. Pat. 1,100,461, June 16, 1914, date of appl., Dec. 27, 1912.

A series of chambered rabbles project from the under side of a hollow rabble arm, and are connected by a series of chambered ribs crossing over the back of the arm. The outermost rabble communicates with the interior of the arm, and the innermost rabble with a discharge outlet. Circulating water thus passes outwards through the arm and back through the rabbles.—T. St.

Stirring device for mechanical roasting furnaces. Metallbank und Metallurgische Ges. A.-G. Ger. Pat. 273,942, April 8, 1913. Addition to Ger Pat. 268,602.

The stirrer-arms are fixed to the axis by bolts. The bolt passes through a tubular member fixed inside the arm and is provided with a collar fitting in an enlarged portion of the tube, and held therein by a cap screwed on over the open end of the tube. When the bolt is screwed in one direction, the collar presses against this cap and holds the stirrer-arm in place, whilst when screwed in the other direction, the collar presses against the opposite end of the enlarged portion of the tube and forces the stirrer-arm off its seating.—A. S.

Alkali metals and alkali metal compounds ; Electrolytic manufacture of ——. E. A. Ashcroft, London. Eng. Pat. 10,980, May 4, 1914.

The electrolyte in the second cell consists of a fused mixture of alkali hydroxide and alkali cyanide, with o without other salts (see Eng. Pats. 1001, 1002, 1003, 100 of 1912 and 25,144 of 1913 ; this J., 1913, 199).—B. N.

[*Gold and silver*]. *Ores ; Process for treating cyanidabl —— containing deleterious slimes.* W. E. Darrew Sutter Creek, Cal. U.S. Pat. 1,098,020, May 26, 1914 date of appl., Mar. 11, 1914.

The slimes are separated from the ore and "treated t remove graphite and other deleterious colloidal sub stances."—W. E. F. P.

Alloy. C. P. Van Gundy, Catonsville. Md. U.S. Pat 1,098,137, May 26, 1914 ; date of appl., Dec. 8, 1913.

An alloy of Al 85—87 (preferably 86·5), Zn 9—11 (9·7 Pb 2—4 (2·5), and Cu 1—3 (1·3)%.—A. S.

Aluminium alloy. W. A. McAdams, Bay Shore, N.Y U.S. Pat. 1,099,561, June 9, 1914 ; date of appl Feb. 11, 1913.

An alloy of Al 100, Cu 5, and Ag 2 parts.—A. S.

Alloy. R. R. Graf, Highlandtown, Md., Assignor t F. E. Welsh, jun., Baltimore, Md. U.S. Pat. 1,101,53 June 30, 1914 ; date of appl., Nov. 5, 1913.

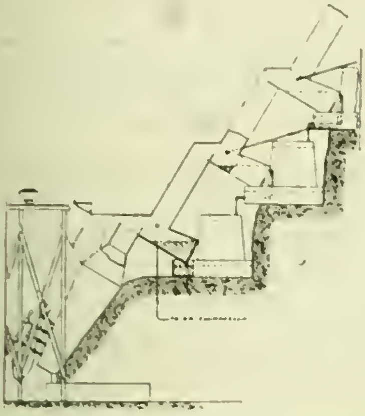
An alloy of Pt 45, Au 15, Ag 25, and Cu 15%.—T. St.

Vanadium and uranium minerals ; Process for treati so-called carnotite and associated and similar —— H. N. McCoy, Chicago, Ill. U.S. Pat. 1,098,28 May 26, 1914 ; date of appl., Mar. 16, 1914.

The finely divided ore is heated with sulphuric ac to about 300° C. to produce a mass which solidifies cooling ; the latter is leached with water to recov vanadium and uranium, and the insoluble resid "treated for the concentration of its radium content."
—W. E. F. P.

Smelter-fumes ; Device for treating ——. O. V. Blom, Fresno, Cal. U.S. Pat. 1,098,611, June 2, 1914 ; date of appl., Apr. 7, 1913.

An inclined conduit (see fig.) arranged in steps, and having upon its under side a number of projecting receptacles one at the base of each step). each of which communicates ith a separate adjacent vessel by means of a door in the ower, and a pipe at the upper, part of the end wall. —W. E. F. P.



letals ; Process of reducing and separating —— from their ores. J. M. McCormack, Assignor to G. A. McCormack, D. R. Williams, J. Constable, and F. L. Brown, Reno, Nev. U.S. Pat. 1,099,388, June 9, 1914 ; date of appl., April 22, 1913.

ARBONATE, oxide and sulphide ores are broken up and bjected to the direct contact of a single flame of a mperature sufficient to reduce and cause incipient sion of the ores, whereby the contained metals are mpletely reduced to commercially pure metal.—T. St.

lectrometallurgical products : Treating ——. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,099,674, June 9, 1914 ; date of appl., Sept. 17, 1910.

HE carbides and silicides, existing as impurities in elecometallurgical products used for abrasive or refractory rposes, are removed by treating the products with lorine under the action of heat and pressure.—B. N.

tals or alloys ; Process of casting from volatilisable ——. W. D. Hall, Oak Park, Ill. U.S. Pat. 1,100,132, June 16, 1914 ; date of appl., July 9, 1913.

casting volatilisable metals or alloys in refractory permeable moulds. the molten metal is introduced into e mould at a point substantially level with the highest int of the casting chamber. Gases due to volatilisation thus at all times liberated in the unfilled portion of the ting chamber, and being able to escape, do not cause w-holes or other imperfections in the casting.—T. St.

tal-precipitating device. F. A. Ross, Spokane, Wash., Assignor to Chalmers and Williams, Inc., Chicago Heights, Ill. U.S. Pat. 1,101,569, June 30, 1914 ; ate of appl., Sept. 4, 1913.

PERFORATED cylinder mounted on a hollow perforated ft revolves within a tank, the cylinder being partly d with loose metallic precipitant in a finely divided te. The metal-bearing solution enters the tank below bottom of the cylinder, and passes out through the tral shaft.—T. St.

s rich in alkaline-earth carbonates ; Extraction of —— h bisulphate solutions. W. Günther. Ger. Pat. .426, Oct. 4, 1912.

round ore is treated with a slight excess of bisulphate tion, and the mixture agitated to facilitate evolution of the liberated carbon dioxide. The liquor is drawn off and may be brought into contact with a fresh charge of ore to neutralise the excess of acid. The dissolved metals are precipitated in any suitable manner, and the bisulphate solution regenerated by addition of sulphuric acid or of normal sulphate as required. Various modifications to suit particular kinds of ores and according to the final products desired are described.—A. S.

Metal alloys : Production of ——. L. Goldmerstein, New York. Eng. Pat. 7103, March 25, 1913.

See U.S. Pat. 1,098,346 of 1914 ; preceding.—T. F. B.

Metals, particularly aluminium ; Process for the protection and ornamentation of ——. J. Tronel, Berlin. Eng. Pat. 11,717, May 20, 1913. Under Int. Conv., May 20, 1912.

See Ger. Pat. 273,498 of 1912 ; this J , 1914, 700.—T. F. B.

Tungsten and tungsten alloy ; Process of producing filaments or wire of ——. E. A. Krüger, Altmark, Germany. Eng. Pat. 16,066, July 11, 1913.

See Fr. Pat. 460,556 of 1913 ; this J., 1914, 69.—T. F. B.

Slag ; Utilisation of the heat of ——. C. Semmler, Wiesbaden, Germany. Eng. Pat. 22,874, Oct. 10, 1913.

See Fr. Pat. 463,298 of 1913 ; this J., 1914, 426.—T. F. B.

Copper ; Process for welding ——. H. Suzuki, Shiba-Ku, Tokyo. Eng. Pat. 23,026, Oct. 11, 1913.

See Fr. Pat. 461,688 of 1913 ; this J., 1914, 205.—T. F. B.

Furnaces : Electric —— [for melting ferro-alloys, etc.]. Soc Electro-Métallurgique de St. Béron, Lyons, France. Eng. Pat. 3835, Feb. 13, 1914. Under Int. Conv., Feb. 20, 1913.

See Fr. Pat. 466,116 of 1913 ; this J., 1914, 599.—T. F. B.

Metal ; Extraction of a —— by electrolytic exhaustion of a solution of a salt of this metal. N. H. M. Dekker, Paris. U.S. Pat. 1,101,620, June 30, 1914. Date of appl., May 14, 1913.

See Eng. Pat. 17,836 of 1912 ; this J., 1913, 662.—T. F. B.

Apparatus for clarifying liquids and thickening pulps. U.S. Pat. 1,098,812. *See* I.

Apparatus for thickening pulps. U.S. Pat. 1,099,396. *See* I.

Process of and apparatus for filtering slimes. U.S. Pats. 1,100,217 to 1,100,223. *See* I.

Apparatus for filtering slimes U.S. Pat. 1,100,267. *See* I.

Construction or lining of apparatus, etc., resistant to ozone. Ger. Pat. 274,872. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Patents.

Specific gravity of acid in cells with sealed covers ; Apparatus for testing the ——. The D.P. Battery Co., Ltd. and T. C Elliott, Bakewell, Derbyshire. Eng. Pat. 13,480, June 11, 1913.

A glass tube, containing a hydrometer, is connected below by a rubber tube to the cell. and fitting telescopically and tightly around the tube is a sliding concentric ebonite tube provided above with a vent hole. By closing the latter and withdrawing the ebonite tube, a partial vacuum is formed within which causes the acid to flow into the glass tube, so that the specific gravity of the liquid may be read off.—B. N

Electrode mass for alkaline accumulators; Restoring the activity of a positive ——. Svenska Ackumulator Aktiebolaget Jungner, Stockholm, Sweden. Eng. Pat. 72, Jan. 1, 1914. Under Int. Conv., Jan. 16, 1913.

The activity of nickel oxides may be restored by withdrawing the electrolyte, and adding a heated solution of a reducing agent, such as sugar, or a mixture of glycerin and alcohol. After some hours, the liquid is withdrawn, and the cell is charged after replacing the electrolyte. —B. N.

Electrodes; Treating ——. C. P. Landreth, Philadelphia, Pa. U.S. Pat. 1,099,654, June 9, 1914; date of appl., Feb. 21, 1913.

A mass of material, immersed in the electrolyte, is electropositive with respect to a number of metallic positive and negative electrodes, but is normally out of the electric circuit. Switching mechanism is provided for breaking the connection of the source of energy with the electrodes, and for connecting the latter with the mass of material outside of the electrolyte.—B. N.

Electrolysing liquids [brine]; Method of and apparatus for ——. H. H. Dow, Assignor to The Dow Chemical Co., Midland, Mich. U.S. Pat. 1,100,290, June 16, 1914; date of appl., Dec. 30, 1912.

Natural brine, containing alkaline-earth and iron chlorides, is electrolysed for the production of chlorine and alkali, the latter precipitating the hydroxides of the bases named to form a diaphragm between the electrodes. A partition, between the electrodes, depends below the normal level of the electrolyte, and the diaphragm collects below the cathode, extending from the partition to the adjacent wall of the cell. Suitable connections supply electrolyte above the level of the diaphragm, but the cathode is maintained in a solution substantially free from alkaline-earth and iron chlorides.—B. N.

Electrolytic process of and apparatus for producing compounds. E. A. Byrnes, Washington, D.C. U.S. Pat. 1,102,209, June 30, 1914; date of appl., July 25, 1903. Renewed March 9, 1910.

Ions of adjacent electrolytes are discharged upon intermediate electrodes, in the presence of a substance capable of oxidation by the anion and reduction by the cathion. The electrolytic products are combined, the resulting compound being separated from both electrolytes and washed out from the cell.—B. N.

Electrode material for vapour electric apparatus. R. P. Jackson, Edgewood Park, Pa., Assignor to Westinghouse Electric and Manufacturing Co., Pa. U.S. Pat. 1,099,375, June 9, 1914; date of appl., July 17, 1912.

The volatile electrode is composed of mercury, with not more than 0·2% Pb.—B. N.

Furnace; Electrical induction ——. K. A. F. Hiorth, Christiania, Norway. U.S. Pat. 1,099,440, June 9, 1914; date of appl., Oct. 8, 1913.

The channel, forming the melting bath, has a central portion extending through the magnetic core of the furnace, and branches extending outside the core. Two conductor coils, embracing individual sides of the core, lie in a plane near the top of the channel between the central portion and the branches, each coil having a flattened portion on the inside to prevent overlapping, and the remaining part forming approximately three-quarters of a circle. Two other conductor coils, each embracing one side of the core, lie wholly below the plane of the bottom of the channel, and are greater in diameter than the upper coils, so that the lower part of the outer branches of the channel lies on the surface of an imaginary cone passing through the conductor parts of the upper and lower coils.—B. N.

Electrode. Electric furnace. F. J. Machalske, Assignor to American Ferroelectride Corporation, Plattsburg, N.Y. U.S. Pats. 1,099,558 and 1,099,559, June 9, 1914; date of appl., June 27, 1913.

(1) The electrode, for smelting purposes, consists principally of a refractory magnesium compound of relatively high conductivity when heated, and several graphite rods embedded in it lengthwise to form conducting paths. (2) The bottom and lower portions of the side walls of the furnace are lined with artificial graphitic carbon, and the adjacent parts of the walls with a magnesite lining, taps being placed at the top of the graphitic lining.—B. N.

Furnace; Electric ——. W. F. McNabb, Pittsburgh, Pa. U.S. Pat. 1,100,191, June 16, 1914; date of appl., Sept. 15, 1913.

The furnace comprises a crucible chamber having a bottom in the form of an arched wall, forming an arc chamber below with a concave roof, in which an arc is produced between a pair of electrodes.—B. N.

Furnace; Electric ——. J. W. Brown, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,100,709, June 23, 1914; date of appl., Jan. 8, 1912.

The furnace, of the continuous operating type, is provided with horizontal heating electrodes, spaced apart so that the charge may be fed between them for treatment. The treated charge is removed below the electrodes, by an arrangement spaced at such a distance from them that the whole of the descending charge is inclined within lines of movement having a slope greater than 70°.—B. N.

Furnaces; Contact for electric ——. *Door for electri furnaces. Electric furnace.* F. T. Snyder, Oak Park Ill. U.S. Pats. 1,100,993 to 1,100,995, June 23, 1914 date of appl., Oct. 28, 1912.

(1) The contact holder comprises a metallic block with a enlarged lower end, through which a circular hole, provide with a continuous spiral groove, extends, forming a wate chamber in which a whirling motion is given to the liquid The ends of the hole are threaded to receive inlet an outlet pipes. (2) The furnace has an opening taperin inwards, which is closed by a tapering refractory plu secured to an outer frame. The hinge for the door con prises a pivoted post attached to two arms, betwee which the frame is pivoted, so that the door may rotated upon a vertical axis independent of the ax of the hinge. (3) The domed roof of the furnace is con posed of truncated pyramids of silica bricks keyed togeth in more than one direction, and is supported by a ske back of concrete resting upon a metallic ring, the upp end of the circular wall of the smelting chamber constituti an abutment. The crown portion of the roof is square cross-section, and is formed of several tapering bric having their converging corners grooved to provide electrode opening.—B. N.

Insulating coating and method of forming and applyi the same. H. B. Holmes, Park Ridge, and J. W. Harr Wilmette, Ill., Assignors to Western Electric Co. U. Pat. 1,101,281, June 23, 1914; date of appl., Nov. 1905.

The coating comprises a solid hydrocarbon, such ozokerite and asphaltum, and a non-drying vegetable such as castor oil, subjected to destructive distillati —B. N.

Furnaces; Electric ——. I. Rennerfelt, Stockholm. E Pat. 24,850, Oct. 31, 1913. Under Int. Conv., Dec. 1912.

See Fr. Pat. 466,291 of 1913; this J., 1914, 599.—T F.

Diaphragm for electro-chemical or electro-osmotic purpo Ges. f. Elektro-Osmose m. b. H., Frankfort on Ma Germany. Eng. Pat. 9265, April 14, 1914. U Int. Conv., April 14, 1913.

See Ger. Pat. 271,001 of 1913; this J., 1914, 427.—T. F.

zone; Apparatus for the production of ——. J. Steynis, Assignor to Steynis Ozone Co., New York. U.S. Pat. 1,100,997, June 23, 1914. Date of appl., Oct. 27, 1913.

EE Fr. Pat. 466,029 of 1913; this J., 1914, 651.—T. F. B.

eparation of liquid suspensions. Eng. Pat. 13,465. *See* I.

pparatus for the electrical purification of water. U.S. Pat. 1,101,278. *See* XIXb.

XII.—FATS; OILS; WAXES.

il and manure; Utilisation of fish and marine animals as sources of ——. Part I. Oils. Bull. Imp. Inst., 1914, **12**, 251—273.

DESCRIPTION of the sources and manufacture of whale ils, cod-liver oil, menhaden oil and of other fish oils f lesser importance, such as shark and dog-fish oils. he characters and uses of the various oils are also dealt ith, and some information is given about whale-bone and mbergris.—R. G. P.

conut oil; Refining —— with concentrated sulphuric acid. J. Pavlicek. Seifensieder-Zeit., 1914, **41**, 566—568. Chem. Zentr., 1914, **2**, 175.

XPERIMENTS were made with quantities of acid ranging om 0·5—2% of the crude oil, but satisfactory results were tained only when not more than 1% was used. The l was partially bleached, and gelatinous and albuminous bstances, and the alkaloid causing the unpleasant taste of e oil, were removed by the treatment. The treated l was more readily deodorised and then showed little ndency to become rancid. As the quantity of sulphuric d used was increased, the acid value of the oil rose d the content of volatile acids fell. No sulphuric acid uld be detected in the ash of the refined oil, and it is ggested that the reactions which take place are :—

$$C_{17}H_{33}.COOH+H_2SO_4=C_{17}H_{34}(OSO_2OH)COOH;$$
$$C_{17}H_{34}(OSO_2OH)COOH+H_2O=C_{17}H_{34}(OH)COOH+H_2SO_4.$$

—A. S.

ls; Hydrogenation of —— by the aid of nickel oxides and reduced nickel. W. Ipatiew. J. Russ. Phys.-Chem. Ges., 1914, **46**, 302—311. Chem. Zentr., 1914, **2**, 92—93.

REPLY to certain statements of Bedford and Erdmann s J., 1913, 611). By working under pressure hydro- ation can be effected at a lower temperature than when erating at atmospheric pressure. If the catalyst be imately mixed with the material under treatment, purified fats can be hydrogenated under pressure; the l pressure in the apparatus may be 7—8 atmospheres. ery high reaction velocity can be attained with specially uced nickel or by the combined action of different alysts, and the catalyst may be used several times in cession.—A. S.

ymes [lipase] of Chelidonium seeds. II. K. Bournot. Biochem. Zeits., 1914, **65**, 140—157. (See this J., 1913, 58.)

E whole seeds exhibit no lipolytic activity; the activity the powdered seeds increases with the fineness of the der. The expressed and filtered oil from the seeds is ctive, though the oil obtained by digestion of the ground ds with petroleum ether at the ordinary temperature, omewhat active. An active preparation of the lipase st obtained by extracting the ground seeds for 2—3 rs in a Soxhlet apparatus with ether or petroleum er, and sifting the residue through a fine hair sieve; urther ground, the sifted product becomes less active. lipase has considerable synthetic power. Mixtures leic acid and most of the monohydric primary alcohols esterified to the extent of about 90%; the secondary hols are esterified less readily, and the tertiary still less or not at all. Di- and trihydric alcohols are less readily esterified than monohydric alcohols. If a mixture of equal parts of oleic acid and glycerin with 5% of water is subjected to the action of the enzyme for 24 hours at 35° C., about 75% of the acid is combined. Most of the acids of the type, $R.CH_2.COOH$, are readily esterified but those of the types, $R_2.CH.COOH$, and $R_3.C.COOH$ (excepting isobutyric and benzoic acids), are not esterified; the rate of esterification increases with the number of carbon atoms in the acid.—L. E.

Fatty acids; Melting and solidifying points of mixtures of —— and the use of these points to determine the composition of such mixtures. E. Twitchell. J. Ind. Eng. Chem., 1914, **6**, 564—569.

THE molecular weights of the fatty acids present in most fats do not differ very widely and hence, in accordance with the law of equal depression of freezing point for equal molecular proportions, when a fatty acid is added in a definite proportion (up to 20%) to another fatty acid, the melting point of the solvent acid is depressed by an amount depending on the quantity of added acid but practically independent of its kind. A method of determining the composition of mixtures of fatty acids may be based on this fact, a definite proportion of the unknown mixture being added to a pure fatty acid and the depression of melting point observed. Pure stearic, palmitic, and behenic acids were prepared from hydrogenated maize oil, myrtle wax, and hydrogenated menhaden oil respectively by fractionally distilling the mixed fatty acids with steam and then recrystallising from petroleum ether and alcohol. Oleic acid free from solid fatty acids was prepared by the lead soap method. The characters of the acids were as follows :—stearic acid: solidif. pt. 69·04°, m. pt. 69·30° C., combining weight 284; palmitic acid: solidif. pt. 62·14°, m. pt. 62·44° C., combining weight 255·3; behenic acid: solidif. pt. 79·59°, m. pt. 79·99° C., combining weight 340·9; oleic acid: iodine value 92·96. The depression of the melting point of either stearic, palmitic, or behenic acid by the addition of 10% of one of the other acids or of a mixture of the same varied from 1·91 to 2·17; and by 20%, from 3·93 to 4·54. In applying the method outlined above to the examination of the fatty acids of cottonseed and menhaden oils, definite quantities of the mixed fatty acids, the solid fatty acids (separated by the lead-soap ether method) and the fatty acids from the hydrogenated oil were added to stearic acid, palmitic acid, and behenic acid respectively and from the observed depressions of the melting points, taking into consideration also the iodine value of the acids from the hydrogenated oil, the composition of the mixed fatty acids was calculated. According to this method the fatty acids of cottonseed oil contain 25·9% palmitic acid and 72·8% unsaturated C_{18} acids; and those of menhaden oil contain: palmitic acid, 22·7; other solid saturated acids, 11·8; unsaturated C_{16} acids, 0·0; unsaturated C_{18} acids, 26·7; unsaturated C_{22} acids, 20·2; other unsaturated acids, 18·6%.—A. S.

PATENTS.

(1) *Catalysts; Preparation of ——.* (2) *Hydrogenation of fats and oils.* J. Dewar, London, and A. Liebmann, Weybridge. Eng. Pats. 12,981 and 12,982, June 4, 1913.

(1) MIXTURES of oxides, hydroxides or carbonates of two or more of the metals—nickel, cobalt, copper or iron, or of one or more of these with finely divided platinum, palladium or silver, or with silver oxide are reduced by hydrogen at a low temperature. (2) Catalytic mixtures as claimed in (1) are incorporated with the oil, and reduction and hydrogenation effected concurrently at lower temperatures than hitherto possible.—C. A. M.

Oils, fats and fatty acids; Hydrogenating ——. J. N. Humphreys, Dallas, Tex. U.S. Pat. 1,100,735, June 23, 1914; date of appl., Feb. 28, 1913.

A MIXTURE of unsaturated fatty material and subdivided catalytic agent is made to flow slowly and repeatedly, by gravitation or otherwise, in a circuitous path over a baffle or other retarding device of inert material in an atmosphere containing hydrogen.—C. A. M.

Oil-presses. M. B. Green, Memphis, Tenn., U.S.A. Eng. Pat. 29,651, Dec. 23, 1913.

A mat for oil-presses comprises a base provided with channels in which rest bars, having transverse corrugations on their upper sides and slotted to allow the oil to escape. —C. A. M.

Oil; Method of and apparatus for expressing ——. H. Zander, Stettin, Germany. Eng. Pat. 5706, Mar. 6, 1914. Under Int. Conv., Mar. 8, 1913.

The platen of the cylindrical press is kept stationary until a compressed cake is obtained, and is then made to recede and to break up the cake (prior to its expulsion) by knives or the like contained within the platen.—C. A. M.

Oils and melted fats, especially vegetable oils and animal fats; Process for treating —— with nascent ozone. Soc. Anon. Electricité et Ozone. Ger. Pat. 273,935, April 16, 1913.

An ozoniser is immersed directly in the material to be treated, air being passed through one electrode, which is hollow and provided with small perforations. The air is converted into ozone at the surface of the electrodes and also serves to agitate and mix the material. An auxiliary supply of air may be used to produce more thorough aeration and mixing.—A. S.

Glycerin; Apparatus for distilling ——. F. J. Wood, Assignor to Marx and Rawolle, New York. U.S. Pat. 1,098,543, June 2, 1914; date of appl., Aug. 13, 1907.

Glycerin is distilled by a current of steam passing under uniform pressure through a series of stills and vertical condensers.—C. A. M.

Fatty saponaceous product [from vaseline oil] and method of manufacturing same. B. Benedix, Hamburg, Germany. U.S. Pat. 1,102,129, June 30, 1914. Date of appl., July 23, 1912.

See Fr. Pat. 446,009 of 1912; this J., 1913, 150.—T. F. B.

Rosin-soap sizing composition. U.S. Pat. 1,099,168. *See* V.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Turpentine; Study of authentic samples of gum ——. A. W. Schorger. J. Ind. Eng. Chem., 1914, 6, 541—548.

From the examination of 67 samples collected at different times and under different conditions, the following values for the physical characters of normal, freshly distilled gum turpentine are given:—sp. gr. at 15° C., 0·8659—0·8722 (average 0·8685); refractive index at 15° C., 1·4714—1·4746 (1·4730); initial boiling point, 154°—157·6° (156° C.). The first distillation fraction, amounting to 2·5%, has a sp. gr. not lower than 0·8630 (average about 0·8640) and an index of refraction not lower than 1·4675 (average 1·4690). A first fraction of 5% should have sp. gr. not lower than 0·8640 (average 0·8650) and index of refraction not lower than 1·4690 (average 1·4700). At least 86%, usually 91—93%, should distil up to 165° C., and at least 93%, usually 97%, up to 170° C. The residue (5%) should have sp. gr. not lower than 0·8875 (average 0·9140). Figures are also given showing the influence of variations in the time and method of collection on the characters of the turpentine and the effect of exposure. Storage with reasonable care for 1 year has little or no effect on the physical properties of turpentine. —A. S.

Varnishes; Examination of [detection of cobalt and manganese in] ——. G. Malatesta and E. di Nola. Boll. Chim. Farm., 1914, **53**, 6—7. Chem. Zentr., 1914, **2**, 173.

Cobalt salts are now used as siccatives, and their presence in varnishes may be detected by testing a solution of the varnish in an organic solvent with the 1.2-diaminoanthraquinone-3-sulphonic acid reagent (see this J., 1914, 335), which gives an immediate deep green coloration, soon separating into a deep blue lower and a yellow upper layer, if cobalt be present. If the varnish, or a solution of it in an organic solvent, be shaken with an acetic acid solution of nitroso-β-naphthol, a red coloration is produced if cobalt be present, and a red precipitate of the cobalt salt separates. Cobalt may also be detected by the characteristic blue coloration produced with concentrated ammonium thiocyanate solution. Manganese may be detected by adding hydrogen peroxide to a solution of the varnish in ether, a brown precipitate of manganese oxide being produced.—A. S.

Patents.

Paint; Process for the production of ——. M. Wasse mann, Kalk, Germany. Eng. Pat. 14,220, June 1 1913. Under Int. Conv., Dec. 21, 1912.

Train or fish oil is sulphonated with strong sulphuric aci below 40° C., and the product "salted out," washe heated with copper suboxide, and treated with litharg to obtain a paint for metal, wood, and building surface —C. A. M.

Ink; [Luminous] ——. E. F. Krapp, Assignor to J. Flannery, Pittsburgh, Pa. U.S. Pat. 1,097,981, May 2 1914; date of appl., Aug. 15, 1912.

Colloidal radioactive material and metallic sulphide a incorporated with the ink, which, for printing, may al contain burnt oil, rosin and soap.—C. A. M.

[Printing] Ink; Manufacture of ——. H. Sureti London. Eng. Pat. 14,245, June 19, 1913.

Peat is heated with an alkali silicate or equivalent alk solution, and the residue incorporated with pigment, c varnish, etc., to obtain a printing ink.—C. A. M.

Pigment colours; Process for preparing ——. Farbwer vorm. Meister, Lucius, und Brüning. Ger. Pat. 273,3 Oct. 23, 1912.

The diazo derivative of an aromatic nitroamine or substitution product thereof is combined with a sulphazo and the product is converted into a lake by aid of bari sulphate, alumina, kaolin, etc. The resulting pigments fast to water and light and insoluble in oil.—T. F. B.

Kiln for removing the chemically-combined water in pigme especially zinc sulphide pigments, and similar materia Tubular rotary ——. J. Küppers. Ger. Pat. 274,4 March 27, 1913.

The kiln consists of a cylindrical firebrick muffle provi inside with longitudinal ribs and mounted within spaced apart from an outer firebrick casing, the wh being mounted so that it can be rotated and inclined any desired angle. At one end of the kiln are a fe hopper for the material and outlets for the water-vap and heating gases, and at the other end are a discharg device and a firing device for gaseous, liquid, or powde fuel provided with burner nozzles projecting into annular space between the muffle and the outer cas —A.

[Rosin] Extractor. J. H. Castona, Gulfport, Miss. Pat. 1,098,312, May 26, 1914; date of appl., Oct. 9, 1

An outer casing encloses a perforated extraction chan above a rosin-collecting chamber. An axial perfora steam pipe rises from a steam space enclosing a hea coil for solvent, which is delivered to a perforated above the extraction chamber.—O. E. M.

Turpentine and resinous substances from wood ; Apparatus for extracting ——. F. W. Waterman, Baltimore, Md. U.S. Pat. 1,099,779, June 9, 1914 ; date of appl., Oct. 6, 1910.

THE wood is distilled under pressure in a retort connected at the bottom with the top of a digester, where the residue from the distillation of the turpentine is heated under pressure with a circulating liquid, to extract the resinous substances.—C. A. M.

Condensation products from phenols and formaldehyde ; Process for the manufacture of —— and of new materials formed therewith. H. Stockhausen, Crefeld, and R. Gruhl, Charlottenburg, Germany. Eng. Pat. 14,481, June 23, 1913.

A FLUID condensation product of formaldehyde and a phenol is kneaded at 30° to 50° C. with salts of trivalent netals (*e.g.*, 50% $FeCl_3$ calculated on the phenol), and vith or without sulphur, rubber, filling materials, etc., and, fter separation of water, the mass is heated to obtain an afusible insoluble product. In preparing an initial ondensation product the reaction may be interrupted by udden cooling, at the point of incipient turbidity. laterials, such as wood, paper, cork or fabrics may be npregnated with the condensation product prior to its ransformation into an insoluble form and then compressed nd heated.—C. A. M.

esinous condensation product and process of making the same. K. B. Howell, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,098,728, June 2, 1914 ; date of appl., July 25, 1913.

MIXTURE of castor oil (320 parts) and an ester of a olyhydric alcohol and a polybasic acid containing free ydroxy groups (*e.g.* that obtained by the interaction of bout 184 parts of glycerin and 296 parts of phthalic nhydride) is heated to obtain a flexible resin soluble a mixture of alcohol and benzene and fusible without ecomposition.—C. A. M.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

ttapercha resin ; Vulcanisation of ——. R. Ditmar. Gummi-Zeit., 1914, 28, 1626.

IXINGS of gutta-percha, resin, and sulphur, containing spectively 20·83, 25·74, 28·50, and 31·90% of the tter, were vulcanised for 4 hours at 7 atmospheres eam pressure, and filings of the ebonites obtained re extracted for 8 hours with acetone. A determina- n of free sulphur in the acetone extract was made each case, and the soluble resins estimated by fference. The results showed that a portion of the ins had on vulcanisation been rendered insoluble in etone. The figures obtained for this vulcanised resin re respectively 1·81, 4·39, 3·97, and 2·27%, calculated on gutta-percha, in the four samples. The explanation ered of the occurrence of a maximum value is that the lcanised resin dissolves in excess of sulphur, and that solution formed is soluble in acetone. It is suggested t the behaviour of the resins on vulcanisation may nstitute a means of differentiating between different ts of gutta-percha, and it is pointed out that the resin- ntent of the gutta-percha employed cannot be deduced m the values for acetone-extract of a vulcanised nple.—E. W. L.

PATENT.

nufacture of butadiene and homologues thereof. Eng. Pat. 15,049. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

PATENT.

Keratin-like substances ; Separation of particles of flesh and skin from —— in animal products. R. Berth, offene Handelsges. Ger. Pat. 273,769, Nov. 21, 1913.

PARTICLES of flesh and skin are removed from keratin-like substances, *e.g.* animal bristles, by treatment with dilute acids, especially hydrochloric acid, or digestive enzymes, or mixtures of the same.—A. S.

XVI.—SOILS ; FERTILISERS.

Nitrates ; Excessive quantities of —— in certain Colorado soils. W. P. Headden. J. Ind. Eng. Chem., 1914, 6, 586—590.

A BRIEF account of the investigations on the occurrence and origin of excessive quantities of nitrates in certain Colorado soils (Colorado Expt. Stat., Bulls. 155, 160, 178, 179, 183, 184, 186, and 193). The quantities of nitrates vary from a few tenths to over 6% of the air-dried soil, and the affected areas, distributed throughout the cultivated sections of the State, vary from a few square feet to many acres, and in many cases show a tendency to spread very rapidly. The affected areas have a characteristic brown colour ; and the effects produced on vegetation can be reproduced by excessive manuring with sodium nitrate (see this J., 1913, 1122) but not with sodium chloride. Azotobacter, which produces a pigment of colour similar to that of the affected areas, occurs very abundantly and the soils exhibit high nitrogen-fixing, ammonifying, and nitrifying powers. The algal flora of the soils is abundant and sufficient to furnish the energy necessary for the growth of azotobacter. The position and character of the affected areas and the composition of the natural water of the regions appear to exclude the possibility of the accumulation of nitrates being due to concentration of pre-existing ready-formed nitrates by the agency of water, and the view is put forward that the phenomena are due primarily to fixation of atmospheric nitrogen by azotobacter. (Compare Stewart and Greaves, Agric. Expt. Stat., Utah, Bull. 114.)—A. S.

Soils ; Distribution of certain constituents in the separates of loam ——. L. A. Steinkoenig. J. Ind. Eng. Chem., 1914, 6, 576—577.

TEN different soils (3 from N. Carolina, 2 from Pennsylvania, and 1 each from New York State, S. Carolina, Virginia, New Hampshire, and Wisconsin) were each separated by sedimentation and centrifuging into fine sand (particles 0·1—0·05 mm. diam.), coarse silt (0·05—0·025 mm.), and fine silt and clay (up to 0·025 mm.), and the different fractions analysed. The distribution of the various constituents in the fractions is shown in the following table, the figures being percentages on the material dried at 110° C.

	Fine sand.	Coarse silt.	Fine silt and clay.		Fine sand.	Coarse silt.	Fine silt aad clay.
SiO_2				MgO			
Av. ..	88·50	83·05	45·52	Av.	0·40	0·33	0·54
Max.	98·99	95·37	58·71	Max.	2·06	1·05	1·56
Min.	76·23	64·13	22·55	Min.	trace	trace	trace
Fe_2O_3				ZrO_2			
Av. ..	1·66	1·96	8·73	Av.	0·09	0·11	0·02
Max.	2·95	4·80	17·02	Max.	0·14	0·20	0·07
Min.	0·35	0·52	3·97	Min.	0·02	0·03	0·01
Al_2O_3				Na_2O			
Av. ..	5·48	8·44	22·57	Av.	0·73	0·86	0·35
Max.	12·56	18·28	31·33	Max.	2·18	1·78	0·61
Min.	0·40	1·48	16·76	Min.	trace	0·06	0·14
TiO_2				K_2O			
Av. ..	0·72	1·11	1·34	Av.	1·58	2·04	2·15
Max.	1·20	2·44	3·38	Max.	5·56	4·35	5·40
Min.	0·41	0·33	0·45	Min.	trace	0·76	0·63
CaO				P_2O_5			
Av. ..	0·59	0·48	0·64	Av.	0·11	0·08	0·29
Max.	1·72	0·97	1·27	Max.	0·20	0·14	0·46
Min.	0·05	0·13	0·22	Min.	0·04	0·01	0·08

—A. S.

Carbon in soils and soil extracts; Determination of ——. J. W. Ames and E. W. Gaither. J. Ind. Eng. Chem. 1914, **6**, 561—564.

Using 1—3 grms. of soil ground to pass a 60-mesh sieve, the whole of the organic carbon present therein can be oxidised, and all carbon dioxide chemically or mechanically combined can be liberated, by boiling for 30 mins. with a mixture of 3·3 grms. of chromic acid dissolved in 10 c.c. of water and 50 c.c. of sulphuric acid of sp. gr. 1·84. If the mixture be diluted with 50 c.c. of water the results obtained are too low, as also are those obtained by the alkaline permanganate method. It is recommended that the evolved carbon dioxide be absorbed in 4% sodium hydroxide solution and the sodium carbonate determined by double titration, with phenolphthalein and methyl orange as indicators. An apparatus for carrying out the process, including a modified form of the Ames absorption tower (J. Agric. Sci., 1908, **1**, [3], 322), is described. The method can also be used for determining carbon in 1% hydrochloric acid extracts and 4% ammonia humus solutions obtained from soils, without first concentrating these below 50 c.c.—A. S.

Guano; Penguin —— from the Falkland Islands. Bull. Imp. Inst., 1914, **12**, 208—210.

Five samples of guano contained from 64 to 80% of moisture; one sample lost 70% on exposure to air for 6 days. The composition of the samples calculated to a normal moisture content of 20% was: N 2·71—5·05; K_2O 0·46—0·98; P_2O_5 3·41—12·45%. Compared with good Peruvian guano the samples were deficient in fertilising constituents.—R. G. P.

Nitrogen in kelp; Availability of ——. J. A. Cullen. J. Ind. Eng. Chem., 1914, **6**, 581—582.

Dry kelp contains, on the average, 2% N. As determined by the official (U.S.A.) alkaline permanganate method, the available nitrogen amounted to from 13·4 to 44·8% of the total. Under these conditions, however, the whole of the organic matter was not oxidised, and by increasing the quantity of permanganate, practically the whole of the nitrogen could be converted into an available form.—A. S.

"Neutral" ammonium citrate; Preparation of ——. E. D. Eastman and J. H. Hildebrand. J. Ind. Eng. Chem., 1914, **6**, 577—580.

Determinations with the aid of the hydrogen electrode (compare Hildebrand, J. Amer. Chem. Soc., 1913, **35**, 848, 1538) showed that normal ammonium citrate solution is slightly alkaline, the hydrogen ion concentration being $10^{-7\cdot4}$. It can be prepared by dissolving 370 grms. of citric acid in 1500 c.c. of water, nearly neutralising with concentrated ammonia, cooling to 20° C., and then adding ammonia gradually until a 10 c.c. portion with 2 drops of rosolic acid solution (0·25 grm. in 50 c.c. of alcohol and 50 c.c. of water) gives the same colour as 10 c.c. of a standardised phosphate solution gives with the same quantity of indicator. To prepare the phosphate solution, 25 c.c. of 0·1 molar solution of disodium phosphate (made neutral to phenolphthalein by hydrochloric acid or sodium hydroxide) is titrated with $N/10$ hydrochloric acid in presence of methyl orange. To a fresh 25 c.c. portion of the phosphate solution one-sixth of the volume of acid used in the previous titration is added, and 10 c.c. of the resulting solution are used to prepare the colour standard. The neutralised citrate solution is diluted till it has the sp. gr 1·09 at 20° C. It is suggested that in the determination of available phosphate in a fertiliser, it might be preferable to use a citrate solution containing an excess of acid or of ammonia rather than the neutral solution, since then the hydrogen ion concentration would be far less affected by slight variations in the relative quantities of citric acid and ammonia present It might also be desirable to maintain a constant hydrogen ion concentration during the determination by adding either ammonia or citric acid so as to produce a definite colour in presence of a suitable indicator.—A. S.

Patents.

Calcium cyanamide; Process of rendering —— non-dusting. F. S. Washburn, Nashville, Tenn. U.S. Pat 1,098,651, June 2, 1914; date of appl., Oct. 3, 1912.

Commercial calcium cyanamide is mixed with wate and a binding medium, formed into briquettes unde pressure, the briquettes crushed, and sifted so as to yiel granules passing a screen of 8 meshes and retained by one of 15 meshes per sq. in. The coarser granules ar further crushed and the finer particles are again briquetted —A. S.

Fertiliser and process of making the same. F. S. Washburn Nashville, Tenn. U.S. Pat. 1,100,638, June 16, 1914 date of appl., Nov. 5, 1913.

A crystalline, non-deliquescent fertiliser, stable und normal conditions, and composed of a double sulphat and phosphate of ammonium, is obtained by treatin phosphate rock with excess of sulphuric acid, extractin the soluble constituents from the mass, and treatin the solution with excess of ammonia.—A. S.

Treatment of sewage and like organic refuse. Eng. Pa 5921. *See* XIXb.

XVII.—SUGARS; STARCHES; GUMS.

After products [Sugar]; Working up ——. O. Moien and F. Petters. Z. Zuckerind. Böhm., 1914, 3 503—517.

In dealing with low product massecuites the m important requirement is to maintain a correct co centration with falling temperature so that, on centrifugi at 40°—50° C., the molasses is only just saturated or ve slightly supersaturated. When the mother-liquor in t molasses is strongly oversaturated, crystallisation impeded and hence the molasses shows too high a quotic of purity. It thus becomes necessary to determine wh concentration the molasses must have in order to poss the slight requisite supersaturation. Samples of molas obtained from five different massecuites by centrifugi two at 45°, two at 44° and one at 43° C., were mi with pure sugar crystals free from dust and kept at t temperatures mentioned for 240 hours, the vessels be turned over at intervals, and the resulting mass cen fuged. In the analysis of the original and the trea molasses, the apparent solids determined by the pycnome on the undiluted sample and the sugar determined the Clerget method were used to calculate the pu of the molasses. The maximum reduction in the pu after treatment was 1·47 and the minimum 0·73, but connection was found between the crystallisation ef and the supersaturation coefficients. The treated mola in one case contained 14·47% of water and 49·75 of su one part of water thus holding 3·44 parts of sugar solution. Since the corresponding figure for a solutio pure sugar at 45° C. is 2·48, the coefficient of supersatu tion is 3·44 ÷ 2·48 = 1·39. The other results obtained w for 45° C., 1·32, for 44° C., 1·37 and 1·39 and for 43° 1·28.—L. J. de W.

Sucrose; Melting point of ——. B. Burne. Chem. N 1914, **110**, 47.

The melting point of sucrose is stated to be 185°—186° not 160° C. as given in the text-books.—A. S.

Starch and its transformations; Some notes on the chem of ——. W. A. Davis. J. Soc. Dyers and Col., 1 **30**, 249—255.

O'Sullivan's method of starch determination gave re 10—15% too low in cases where proteins, tannins, etc., to be removed, owing to dextrin being precipitated by basic lead acetate. Other methods also proved unsati tory, so a method was devised using taka-diastase this J., 1914, 657). The reaction depends on the maltase in the ferment, which causes the decomposition of the maltose first formed into dextrose. The first part of the reaction is rapid, dextrin being usually absent after 6 hours. This is due to the removal of the maltose as it is formed, and contrasts with the action of ordinary diastase which slows down when 80% of the starch has been converted. No such halt takes place in the case of taka-diastase, but there is a halt in the final reaction—the conversion of maltose into dextrose. The author explains the conversion of maltose by maltase by the following reactions, assuming maltose to be glucose-α-glucoside: (1) β-glucose-α-glucoside→α-glucose-α-glucoside, (2) α-glucose-α-glucoside→2 mols. α-glucose, (3) α-glucose→equilibrium mixture of α- and β-glucose showing $[\alpha]_D = 52\cdot70$. The disturbing influence of stages (1) and (3) explain why the reaction is not logarithmic. When these influences are not present the time law is that of a unimolecular reaction, as is the case in the conversion by acid.—J. B.

Determination of mannitol. Smit. *See* XXIII.

PATENTS.

Evaporators ; Multiple ——. G. Fletcher and Co., Ltd., Derby, and F. I. Scard, London. Eng. Pat. 13,855, June 16, 1913.

In the evaporation of certain classes of sugar juices, when he vapours passing from the vapour space of one vessel o the calandria or tubular heating chamber of the next are cid, they are neutralised by injecting into them an tomised alkaline liquid.—W. H. C.

ugar ; Process of making ——. A. L. Mathews, Toledo, Ohio. U.S. Pat. 1,097,724, May 26, 1914 ; date of appl., June 14, 1913.

UGAR juice containing much glucose is made alkaline with me at or below 50° C., carbonatated nearly to neutrality, reed from precipitate, carbonatated to neutrality, heated o a higher temperature, freed from precipitate, and slightly cidified with sulphur dioxide.—L. E.

ugar ; Manufacture of cane ——. J. S. de Haan, Klaten, Java. U.S. Pat. 1,101,071, June 23, 1914 ; date of appl., April 7, 1913.

HE raw juice is heated and then gradually treated with ilk of lime and simultaneously carbonatated, the alkanity being kept nearly constant and preferably between ·025 and 0·03% CaO.—L. E.

tarch drying apparatus. L. P. Bauer, Pekin, Ill., Assignor to Corn Products Refining Co. U.S. Pat. 1,099,276, June 9, 1914 ; date of appl., Sept. 30, 1910.

HE starch is conveyed through a drying tunnel in a rrier divided into compartments, the sides of which are erforated and form spaces extending lengthwise of the rrier. Separate movable closures for the compartments rmit discharge of the dried starch by gravity. Means are ovided for circulating hot air through the tunnel and r feeding the wet starch into the compartments.—L. E.

ugars from cellulose ; Process of producing ——. F. E. Gallagher, Troy, N.Y., and H. S. Mork, Allston, Mass., U.S.A. Eng. Pat. 14,939, June 28, 1913. Under Int. Conv., July 15, 1912.

E U.S. Pat. 1,056,162 of 1913 ; this J., 1913, 441.—T.F.B.

issolving sugar or other substances ; Apparatus for ——. Maschinenfabrik Grevenbroich (vorm. Langen und Hundhausen), Grevenbroich, Germany. Eng. Pat. 26,357, Nov. 17, 1913. Under Int. Conv., Dec. 27, 1912.

E Ger. Pat. 266,335 of 1912 ; this J., 1914, 14.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Malt analysis ; New [German] standards for ——. G. Bode and A. Wlokka. Allgem. Zeits. Bierbrau. u. Malzfab., 1914, **42**, 291—295.

THESE standards have been adopted by the Verein Deutscher Chemiker, to take effect from Sept. 1, 1914. Sampling to be done either by a borer (Barth-Eckhardt's recommended) or by an automatic sampler (Grafe's or Wlokka's). Malt in bulk to be shovelled over and samples taken at different depths ; in the case of sacks, 10% of the sacks to be sampled. Samples to be protected against changes in moisture-content ; the portion sent for analysis to be at least 400 grms. Large foreign bodies may be rejected ; small foreign corns and dust to be retained in the sample. The standard sifting apparatus for grist and meal, made by Seck to the specification of the Pfungstadt brewery, is adopted and details for its operation are prescribed. The mills are standardised with the help of this apparatus and a normal malt containing 4% of moisture and showing between 0·6 and 1% difference between the extracts from grist and meal. The grist mill is to be set so that the three finest fractions on the standard screens with this malt amount to 40 ± 1%. The fine mill must yield 90 ± 1% in the three finest fractions. For the determination of moisture in grist, these fractions must amount to 60%. For trade analyses the moisture is to be determined in fine meal :—10 grms. of malt are ground and duplicate portions of 5 grms. dried for 3 hours in a standard oven above 100° C. For controlling the standard oven, samples of grist or meal from four malts of very different constitution, contained in drying bottles 40 mm. in diam. and 25—30 mm. in height, are heated in the oven for 3 hours. The duplicate results must agree within 0·1%. Further heating for one hour must not cause a loss exceeding 0·1% ; if the difference is greater, the tests must be repeated with the oven temperature 1° higher, but in no case exceeding 108° C. Drying ovens by Scholvien, Ulsch and V.L.B. have been approved ; other systems are not permitted until approved. For trade analyses the extract is only determined in the fine meal, samples to be ground separately from those for moisture determination. Mashing beakers and stirrers to be of the same metal, not nickel-plated. Propeller to revolve at an uniform speed of 80—100 revs. per min., with a clearance at sides and bottom of the beaker, the latter being 1—2 mm. :—50 grms. of the entire-ground meal are mixed with 200 c.c. of water at 45° C., placed in the bath at 45° C., stirred for 30 mins., then heated to 70° C. at the rate of 1° C. per min. ; on reaching 70° C., 100 c.c. of water at 70° C. are added and the mash is stirred for one hour, cooled to the ordinary temperature in 10—15 mins. and made up to 450 grms. The whole mash is poured on to a C. S. and S. No. 560 folded filter, 32 cm. diam., the first 100 c.c. of wort being returned. The dimensions of the standard pyknometer of 50 c.c. capacity are specified. The density of the wort is determined at 17·5° C. ; the results of duplicate mashings must not differ by more than 2 in the fourth decimal place ; values are calculated by Balling's tables. The time of saccharification is determined in a separate mash, starting 10 mins. after reaching 70° C., by spotting on a plaster of Paris plate with $N/50$ iodine solution, the test being repeated every 5 mins. If saccharification is not complete after 1 hour, the mash is to be repeated at 75° C. The colour of the wort is to be estimated by Brand's colour solution, based on $N/10$ iodine, which must be obtained fresh every year from the Münich station. Mechanical analysis and the determination of extract from grist are only to be performed by special request.—J. F. B.

Yeast ; Oxidation and reduction processes effected by dead —— *at the expense of water.* W. Palladin and E. Lowtschinowskaja. Biochem. Zeits., 1914, **65**, 129—139.

IT has been suggested that the first stages of anaerobic respiration and alcoholic fermentation consist of a series of oxidation and reduction reactions at the expense of water. During the respiration, the hydrogen set free from the water is taken up by hydrogen-acceptors (this

J., 1914, 328) and finally converted into water again, whilst in alcoholic fermentation (and in absence of oxygen during anaerobic respiration), the hydrogen ultimately converts the primary decomposition products of the sugar into alcohol. Gluconic acid appears to be one of the primary products of fermentation of glucose and it is found that the decomposition of potassium gluconate by dead yeast ("Hefanol" or dried yeast) is greatly accelerated by addition of methylene blue (a hydrogen-acceptor), a much larger quantity of carbon dioxide being liberated. Potassium lactate is similarly affected. The decomposition of these compounds in presence of a hydrogen-acceptor appears to be the first successful attempt to transform fermentation into respiration artificially.—L. E.

Invertase ; Inversion of sucrose by ——. VIII. Improved method for preparing strong invertase solutions from top or bottom yeast. C. S. Hudson. J. Amer. Chem. Soc., 1914, **36**, 1566—1571. (See this J., 1910, 443.)

A MUCH more active preparation of yeast invertase is obtained if the yeast is autolysed in presence of toluene than if chloroform is used. Twelve kilos. of pressed bottom-fermentation beer yeast are kneaded with 12 litres of tap water and 750 c.c. of toluene, left for 4—5 days and filtered. The filtrate is clarified with normal lead acetate, freed from excess of lead with hydrogen sulphide, and dialysed in a collodion sac. The dialysed solution may be preserved with toluene at the ordinary temperature for a month without any loss of activity ; and it hydrolyses sucrose in the course of a night under usual analytical conditions. The invertase obtained from top yeast is less active.—L. E.

Invertase ; Inversion of sucrose by ——. IX. Is the reaction reversible? C. S. Hudson and H. S. Paine. J. Amer. Chem. Soc., 1914, **36**, 1571—1580.

CONTRARY to the statements of other workers (cp. Kohl, this J., 1908, 824), yeast invertase hydrolyses sucrose completely, the reaction being non-reversible. Further, Osaka's view that the hydrolysis of sucrose by hydrochloric acid may be reversible (this J., 1908, 1125) is not confirmed.—L. E.

Beer turbidity due to calcium fluoride. H. Will. Z. ges. Brauw., 1914, **37**, 357—358.

THE turbidity was traced to the use of fluoride as antiseptic (in quantity equivalent to 0·001% HF) ; the beer sediment consisted chiefly of calcium fluoride.—L. E.

Determination of malt extract. Dreaper. *See* VI.

Determination of mannitol. Smit. *See* XXIII.

PATENTS.

Brewing ; Process of ——. H. Heuser, Chattanooga, Tenn. U.S. Pat. 1,099,746, June 9, 1914 ; date of appl., May 23, 1912.

THE wort is fermented and transferred to the chip cask, being heated, during the transfer to about 40° F. (4·4° C.). It is treated with "kraeusen" in the chip cask and left to undergo secondary fermentation.—L. E.

Mashes or worts ; Process for transferring atmospheric oxygen, bacteria, aromatic substances, etc., to ——. O. Schulze. Ger. Pat. 274,777, Aug. 28, 1912.

A MIXTURE of hot water spray and air is led over the wort or mash in a closed vessel provided with an outlet pipe and condenser, whereby the steam is condensed on the surface of the wort or mash, and the air thus brought into intimate contact with the latter. Bacteria, aromatic substances, etc., may be mixed with the air.
—A. S.

Yeast and the like ; Dryers for ——. J. H. A. Wiesener, Hamburg, Germany. Eng. Pat. 25,392, Nov. 6, 1913.

A ROTATING horizontal drum is mounted over a trough, the interior of the drum and trough being heated by steam-pipes. Yeast is supplied from a hopper to the trough and, as it liquefies in the latter, a layer of definite thickness is carried round on the surface of the drum ; the dry film is removed by means of a scraper before the drum has made a complete revolution.—W. P. S.

Method of and apparatus for neutralising acid [sulphite lyes. U.S. Pats. 1,098,561 and 1,098,562. *See* V.

XIXa.—FOODS.

Caffeine in coffee ; Determination of ——. G. Fendler an W. Stüber. Z. Unters. Nahr. Genussm., 1914, 28 9—20.

THE methods of Lendrich and Nottbohm (this J., 190 379) and Katz (this J., 1902, 1300) though reliable an accurate, are tedious, and that of Keller (this J., 1897, 56 is untrustworthy. The following modified method i proposed, and results of determinations are given to sho that accurate results may be obtained. Ten grms. the finely powdered coffee (passed through a sieve of 1 mn mesh) are shaken for 30 mins. with 10 grms. of 10° ammonia and 200 grms. of chloroform ; the whole of th mixture is then poured on a large filter and 150 grms. the filtrate are transferred to a wide-necked flask an evaporated to dryness on a water-bath. The residue heated for 10 mins. with 80 c.c. of water, cooled, an 20 c.c. of 1% potassium permanganate are added ; aft 30 mins. the mixture is treated with a slight excess hydrogen peroxide solution (100 c.c. of 3% hydrog peroxide *plus* 1 c.c. of glacial acetic acid), and then heat on a water-bath, further quantities of hydrogen peroxi being added if the pink coloration has not disappeare After cooling, the mixture is filtered, the insoluble porti and the filter washed with cold water, and the filtrat measuring about 200 c.c., extracted four times wi chloroform, using 50, 25, 25, and 25 c.c. of the latt The chloroform extracts are evaporated in a weigh flask, the residue is dried for 30 mins. at 100° C., a weighed.—W. P. S.

Cocoa ; Examination of stabilised ——. L. Reutt Schweiz. Apoth.-Zeit., 1914, **52**, 308—312, 322—3 335—339. Chem. Zentr., 1914, **2**, 169—170.

THE fermentation process to which cacao beans subjected for the purpose of facilitating the separati of the nibs from the pulp produces considerable chan in the composition of the nibs, and recently it has be replaced by treatment with a 1% solution of sodi carbonate for 10 mins. at 45° C., whereby the beans "stabilised" and sterilised. Cocoa prepared in t way is perfectly stable, and contains no pre-formed sug Theobromine is not present in the free state, but is form together with sugar and tannin by hydrolysis. (See a this J., 1913, 709.)—A. S.

PATENTS.

Inorganic enzymes and their application for baking purpo L. Weil, Strassburg, Germany. Eng. Pat. 12,6 May 30, 1913. Under Int. Conv., June 3, 1912.

A PREPARATION consisting of colloidal manganese, calcium glycerophosphate, 5, magnesium lactophosph 0·8, colloidal silicic acid, 0·03, and potassium hydrox 0·02 grm., in 1 litre of 65% sugar solution is obtained dissolving these constituents separately in a small quan of water, adding sugar syrup, mixing the solutions, diluting the mixture with the concentrated sugar solut One kilo. of this preparation is added to the water in making dough from 100 kilos. of flour, in order to incr the enzymic activity of the latter.—W. P. S.

Extracts rich in enzymes and nitrogenous matters for use in baking, for medicinal and other purposes; Process of manufacturing highly active ——. M. Hamburg, Bishop's Stortford, Herts. Eng. Pat. 13,928, June 16, 1913.

Extracts rich in enzymes and nitrogenous substances are obtained by subjecting malted cereals mixed with wheat germ, wheat bran, and malt culms to successive mashing processes at temperatures ranging from 130° F. (55° C.) to 150° F. (65° C.), mixing the liquors and concentrating the same under reduced pressure. Modifications of the process are described.—W. P. S.

Flour and the like; Treatment of ——. B. I. Levin, Manchester. Eng. Pat. 12,917, June 4, 1913.

Flour admixed with solid "improvers" is treated with a quantity of water, in the form of a fine spray, sufficient to enable the full effects of the "improvers" to be obtained.—W. P. S.

Flour treatment. B. I. Levin, Manchester. Eng. Pat. 13,696, June 13, 1913.

Flour is sprayed with liquids obtained by the electrolysis f solutions of such substances as phosphoric acid, acid hosphates, chlorates, or ammonium salts, etc.—W. P. S.

Flour; Apparatus for treating ——. J. A. Wesener, Chicago, Ill. U.S. Pat. 1,099,225, June 9, 1914; date of appl., March 6, 1913.

s an apparatus for ageing and bleaching flour, means are rovided for subjecting the latter to a current of air harged with a suitable gas, the latter being stored in a iquid form in containers.—W. P. S.

hortening-composition [for flour]; Dry ——. A. W. Estabrook and H. E. Weaver, Kansas City, Assignors to The Larabee Flour Mills Co., Hutchinson, Kans. U.S. Pat. 1,101,015, June 23, 1914; date of appl. June 14, 1913.

lour containing an added powdered stearate is mixed ith an acid salt; the latter decomposes the stearate nd the liberated fatty acid acts as a "shortening" agent. —W. P. S.

ood for cattle and other animals; Manufacture of ——. J. J. Eastick and J. J. A. de Whalley, London. Eng. Pat. 14,607, June 24, 1913.

eat moss, containing about 30% of moisture, is treated an autoclave with 3·5% of its weight of gaseous sulphur ioxide, and then heated for about 30 mins. by the introuction of steam under a pressure of 100 lb. per sq. in. —W. P. S.

ood from whole grain; Process for the manufacture of an ensily digestible ——. C. Mauterer, Karlsruhe i.B., Germany. Eng. Pat. 18,837, Aug. 19, 1913.

ereal grains from which the husk has been removed are eeped in water, then heated to about 100° C., dried, and ated with a glazing composition such as sugar or chocote, etc.; sufficient of the latter may be employed to form e grains into a mass. The glazing composition may also ntain ground nuts, fruits, diastase, iron saccharate, emoglobin, etc.—W. P. S.

verages and the like; Manufacturing a powdered extract for use in the preparation of ——. J. L. Kellogg, Battle Creek, Mich. U.S. Pat. 1,097,720, May 26, 1914; date of appl., Jan. 28, 1914.

arley malt, 1, and a suitable starchy material, 2 parts, e mixed with water to form a paste which is heated to 170° F. (77° C.) until the starch is converted; the mixture is then further heated for 5 hours under a pressure of about 40 lb. per sq. in., and mixed with bran, malt germs, and roasted ground rye. This mixture is dried, roasted, extracted with water, and the extract is evaporated under reduced pressure and ground to a powder.—W. P. S.

Beverage extract. W. H. Post, Assignor to Postum Cereal Co., Battle Creek, Mich. U.S. Pat. 1,098,683, June 2, 1914; date of appl., Feb. 7, 1913.

The extractive matters of sweet potatoes are mixed with molasses and the mixture is roasted to caramelise the sugar.—W. P. S.

Fermented-milk product and process of making the same. A. H. Thoumaian, Baltimore, Md. U.S. Pat. 1,101,044, June 23, 1914; date of appl., May 17, 1913.

A mixture of egg albumin, milk, and cream is submitted to the action of a culture of lactic acid bacillus and *Bulgaricus bacillus*.—W. P. S.

Food substances; Process of preserving ——. W. H. Allen, Detroit, Mich. U.S. Pat. 1,098,006, May 26, 1914; date of appl., Aug. 11, 1913.

A sufficient quantity of hydrochloric acid is added to a vegetable pulp (tomato pulp) to render the latter sterile and the acid is then neutralised by the addition of sodium carbonate.—W. P. S.

Eggs; Method of desiccating ——. T. Hara, San Francisco, Cal. U.S. Pat. 1,100,973, June 23, 1914; date of appl., June 23, 1913.

Yolks and whites of eggs are beaten up separately, then mixed and dried in thin layers on metallic plates heated to about 110° F. (43° C.), the drying operation being carried out in a dark room the air in which is dried and heated to about 105° F. (40° C.).—W. P. S.

XIXb.—WATER PURIFICATION; SANITATION.

Hardness of waters; Determination of —— *by the methods of Wartha-Pfeifer and Blacher. II. Blacher's method.* J. Zink and F. Hollandt. Z. angew. Chem., 1914, **27**, 437—440. (See this J., 1914, 564.)

In Blacher's method the water is neutralised, the carbonic acid blown off with air, and the water then titrated with potassium palmitate solution, in presence of dimethylaminoazobenzene, with shaking, until a distinct red colour is produced. The authors find that it is better to use methylorange as indicator and to boil off the carbonic acid, but that for the total hardness, both these precautions are unnecessary and the water may be titrated directly in presence of phenolphthalein. They recommend that the process be carried out on 100 c.c. of the water, which, after addition of a drop of dimethylaminoazobenzene, is titrated with $N/10$ hydrochloric acid until a reddish violet colour is formed; the liquid is then boiled for 10 mins., cooled, and after addition of phenolphthalein, is titrated with $N/10$ caustic soda until faintly red, and then with $N/10$ acid until pure yellow again. The titration with potassium palmitate is next carried out, with shaking, until a permanent red colour is produced. The palmitate is standardised against lime water or a salt of any of the alkaline-earth metals. The method gave in a series of tests 87·5% of results with a less difference than 0·6 degrees German from a quantitative analysis. Humus does not affect the results, but iron and manganese raise them owing to formation of metallic soaps; on the other hand, iron salts, being precipitated at the neutral point,

may carry down calcium and magnesium salts and in this way lower the results. Instead of the palmitate a myristin soap solution is suitable. The method may be used for the determination of the sulphates in waters by precipitating with barium chloride after boiling and before titrating with the palmitate solution, the removal of the barium sulphate being unnecessary. It is concluded that Blacher's method is superior to the usual titration method in simplicity of execution and accuracy of results.
—J. H. J.

Protein-ammonia [e.g., in drinking water]; Determination of ——. L. W. Winkler. Z. angew. Chem., 1914, 27, 440.

The method, which is specially designed for drinking waters, consists in adding potassium persulphate to the acid mixture, heating, and estimating the ammonia without distillation. 100 c.c. of the water are acidified with one drop of concentrated sulphuric acid and 0·05 grm. of pure powdered potassium persulphate added. The flask is heated in the steam bath for ½ hour, then cooled, and 5 c.c. of a mixture of equal vols. of Nessler's reagent and a solution of Rochelle salt added. A second test is prepared in the same manner, without heating, with the final addition of standard ammonium chloride solution to equal the colour of the first test. It was found that all pure natural waters contain no protein-ammonia, the limit which a drinking water should not exceed being 0·1 mgrm. per litre.—J. H. J.

Hypochlorite of lime treatment of a municipal water supply and a study of certain resistant bacteria. S. J. Thomas. J. Ind. Eng. Chem., 1914, 6, 548—552.

Experiments carried out in connection with the treatment of the water supply of Bethlehem, Pa., U.S.A., by means of bleaching powder showed that the non-pathogenic organisms, *Bac. subtilis, Micrococci agilis, Bact. aerophilum,* and *Bac. subcuticularis* are capable of resisting the action of bleaching powder at a concentration of 2 parts per million.—A. S.

Chlorine [in water]; Effect of ferric salts and nitrites on the ortho-tolidine and starch-iodide tests for free ——. J. W. Ellms and S. J. Hauser. J. Ind. Eng. Chem., 1914, 6, 553—554.

Under suitable conditions colour changes are produced in solutions of *o*-tolidine not only by chlorine (this J., 1913, 1125) but by all oxidising agents. Ferric salts and nitrites are the only oxidising agents likely to be met with in natural waters and these must be present in quantity equivalent to 0·9—1 part Fe or nitrite-N per million in order to produce a colour. Moreover they can readily be detected by qualitative tests. The starch-iodide method is affected by ferric salts and nitrites in a similar manner.—A. S.

Patents.

Water; Apparatus for the electrical purification of ——. H. B. Hartmann, Assignor to G. A. Dunning, Philadelphia, Pa. U.S. Pat. 1,101,278, June 23, 1914; date of appl., Aug. 11, 1911.

The discharge pipe from an electrode chamber is provided with a gas pocket and the flow of water from this pocket controls the supply of current to the electrodes; an electro-magnetic valve regulates the flow of water through the electrode chamber towards the gas pocket, the valve being held open while the current is supplied to the electrodes.—W. P. S.

Sewage and like organic refuse; Process for the treatment of ——. J. C. Butterfield, London. Eng. Pat. 5921, Mar. 10, 1913.

Sewage, etc., is heated with petroleum (0·5 to 4·0%) in a closed retort at a low temperature (500°—800° F., 260°—427° C.), the fats, etc., are separated from the distillate, and the residue redistilled at 1000° to 1200° F. (538°—649° C.). The final residue, containing lime, animal charcoal and phosphoric acid, is used for precipitating more sewage, until eventually a residue rich in phosphoric acid and suitable for use as a fertiliser is obtained.—C. A. M.

Town refuse; Apparatus for burning ——. I. R. Glaskin, London. Eng. Pat. 17,420, July 29, 1913.

A preliminary combustion of the refuse is effected in a cylindrical chamber forming a continuation of the inlet shoot at the top of a vertical cupola furnace, and the combustion is completed in the chamber below by the aid of tangential blasts of hot air under pressure. The slag is cooled by water-jackets, and the heat from the products of combustion is utilised.—C. A. M.

Garbage; Method for disposing of ——. A. H. Woollacott and L. H. Saxton, Los Angeles, Cal. U.S. Pat. 1,099,330, June 9, 1914; date of appl., Feb. 10, 1913.

The garbage is ground to form a slurry which is stored and stirred in closed tanks and subsequently lifted and dropped through an incinerating flame.—W. P. S.

Garbage; Art of utilising ——. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,101,129, June 23, 1914. date of appl., Oct. 11, 1912.

The garbage is finely divided, deprived of excess o moisture, and then spread in a thin layer on a travellin conveyor where it is subjected to the action of a curren of hot air of progressively increasing temperature, th vapours given off by the garbage being conducted to th furnace supplying the heated air.—W. P. S.

Water; Apparatus for producing distilled ——. Bleicken, Gross-Borstel, Germany. U.S. Pat. 1,102,131 June 30, 1914. Date of appl., Jan. 19, 1914.

See Fr. Pat. 466,162 of 1913; this J., 1914, 663.—T. F.

Posser machines for disinfecting, washing, starching, dyeing etc. Eng. Pat. 21,979. *See* VI.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona trees grown in Madagascar; Value of the —— E. Perrot and C. A. Huber. Bull. Sci. Pharmacol., 191 21, 257—263. Chem. Zentr., 1914, 2, 149.

The results of the examination of barks from cinchona tre cultivated since 1900 from seeds and plants obtained fr Java, are shown in the following table :—

	Bark from stem.	Bark from roots.		
		1	2	3
	%	%	%	%
Total alkaloid..............	3·64	10·18	10·25	9·
Anhydrous quinine	1·63	0·113	2·67	1·
Cinchonidine	0·58	4·57	4·79	1·
Cinchonine	0·25	3·05	1·41	4·
Amorphous alkaloids	0·96	3·15	1·48	2·
Tannins	23·34	36·68	36·76	19·
Water	8·1	7·5	6·9	8·
Yield of basic quinine sulphate	2·33	0·152	3·59	1
Leeuwenhoek's reaction	Very weak.	Strongly positive		

A sample of bark from branches and two samples of mixed bark from stems and branches contained respectively: total alkaloids, 1·77, 2·64, 1·65; tannins, 14·74, 16·78, 13·9; and water, 9·7, 9·15, 8·35%.—A. S.

Organic bases; Displacement-curves of some ——. Application to the determination of some alkaloids. R. Goubau. Bull. Acad. roy. Belg., Classe des sci., 1914, 63—90. Chem. Zentr., 1914, 2, 172.

THE displacement curve of a base is defined as the curve representing the change of electrical conductivity of a solution of a salt of the base on addition of increasing quantities of a second base capable of completely displacing the first base from its salt. In applying the method a known excess of hydrochloric acid is added to a known quantity of the base, the solution is diluted with water or alcohol, if necessary, its electrical conductivity determined at a definite temperature, then $N/1$ or $N/10$ sodium hydroxide added in 0·1 c.c. portions and the alteration of conductivity observed. The curve obtained consists of three portions, the first representing the neutralisation of the excess of acid, the second being the displacement-curve proper and the third representing the increase of conductivity due to excess of sodium hydroxide. The form of the displacement-curve varies according to the character of the base, and the method may be applied to the determination of small quantities of alkaloids. Experiments in this direction were made with cocaine, homatropine, atropine, coniine, nicotine, aconitine, pilocarpine, morphine, codeine, quinine, quinidine, cinchonidine, cinchonine, strychnine, and brucine.—A. S.

entiopicrin and gentianose in the fresh roots of purple gentian. M. Bridel. J. Pharm. Chim., 1914, 10, 62—66.

ABOUT 1·3% of gentiopicrin and 0·4% of gentianose were btained in crystalline form from the fresh roots of *entiana purpurea*, L.—F. SHDN.

emon-grass oil from India. Bull. Imp. Inst., 1914, 12, 222—225.

OCHIN lemon-grass oil sold in the United Kingdom has ecently begun to show signs of insolubility in 70 and 0% alcohol (see this J., 1913, 306, 623). Of 5 samples f commercial Cochin oil three (Nos. 3, 4 and 5) were nsoluble in 5 vols. of 70% alcohol, the other two (Nos. 1 nd 2) dissolved to a clear solution in 2 vols. and 1 75 vols. espectively. Three of the oils gave the following figures :—

	No. 1.	No. 2.	No. 3.
p. gr. at 15° C.	0·901	0·917	0·908
otation a_D	—5° 35′ (at 21°)	—	about —2° (at 19°)
ldehydes (by bisulphite) %	68·5	77	73

wo varieties of grass—the "red-" and "white-" temmed—are distilled in North and Central Travancore. il from the white-stemmed variety more closely resembled citronella than lemon-grass oil. The oil from red-emmed grass had the sp. gr. at 15° C., 0·925, and contained aldehydes, 71·5%. It was not soluble in 5 vols. f 70% alcohol to a clear solution, but was soluble in ·8 vol. or more of 80% alcohol, and gave a somewhat urbid solution with 5 vols. The oil was separated by eam distillation into a readily volatile portion, 65%, nd a residual viscous oil, 35%; the readily volatile oil as soluble in 2·4 vols. of 70% alcohol, the residual oil as insoluble in 12 vols. The insolubility of some Cochin ls may therefore be due to distillation being carried too r.—R. G. P.

etiver oil from Fiji. Bull Imp. Inst., 1914, 12, 225—227.

HE oil was viscous and yellowish-brown and had the . gr. at 15° C., 1·018; and saponif. value, 47. It was luble in 1½ vols. of 80% alcohol, becoming turbid with 3 vols. or more. It resembled "heavy" vetiver oil as distilled in Europe rather than "light" Réunion oil. Its value is uncertain, and the demand is fully met by existing supplies.—R. G. P.

Ylang-ylang oils from the Seychelles and Mauritius. Bull. Imp. Inst., 1914, 12, 228—232.

Two samples from the Seychelles and one from Mauritius gave the following results :—

	Seychelles.			Mauritius.
	1.	2.	2. after keeping for 3 yrs.	
Sp. gr. at 15° C.	0·9567	0·9200	0·9250	0·9883
Rotation, a_D ..	—28° 5′ at 20°	—30° at 21°	—28° 36′ at 24°	—30° at 20°
Acid value	3·3	4·2	2·6	7
Ester value ..	126·0	42·2	53·5	173
Saponif. value	129·3	46·4	56·1	180
Saponif. value after acetylation	181	—	—	211
Solubility in 90% alcohol	Clear with less than 0·8 vol., turbid with 0·8 or more	Soluble in 1 vol., turbid with more	Soluble in ½ vol., turbid with 1 vol. or more	Clear with 0·1 to 2·5 vols., turbid with more

Sample 1 from the Seychelles closely resembled first-grade Manila oil in chemical character although the odour was somewhat pungent. The Mauritius sample would probably only fetch 3s.—4s. per oz., over-production having rendered the sale of all but high-grade oil unremunerative. —R. G. P.

Clove oil from Mauritius. Bull. Imp. Inst., 1914, 12, 232—233.

TRIAL distillations in Mauritius gave yields of only 11·5 and 10·2% of oil respectively against the 15 to 18% usually obtained in Europe; the low yield may be due to high moisture content. Two samples of oil had sp. gr. at 15° C., 1·061 and 1·067; and rotation, a_D at 22° = —10′ and —5′. They contained eugenol 89 and 95% and were soluble in 1·5 vols. or more and in 1·25 vols. or more respectively of 70% alcohol. Though inferior in colour and aroma to oil distilled in United Kingdom, the oils were of good quality and would meet with ready sale.—R. G. P.

Clove leaf oils from Mauritius. Bull. Imp. Inst., 1914, 12, 233—235.

THREE samples had sp. gr. from 1·059 to 1·062 and contained 90 to 91% of eugenol. The oils were of dark colour but would be saleable at about 3s. 9d. per lb. as a source of eugenol for the manufacture of vanillin. In Mauritius only 1·62% yield of oil was obtained from clove leaves; leaves from the Seychelles distilled at the Imperial Institute yielded 4·5%.—R. G. P.

Sandal wood oil from Mauritius. Bull. Imp. Inst., 1914, 12, 235—237.

THREE samples of oil distilled from the heartwood (1 and 2) and sapwood (3) of *Santalum album* gave the following results :—

	1.	2.	3.
Sp. gr. at 15° C.	0·9788	0·9804	0·9814
Rotation, a_D at 20° C. ..	—21° 19′	—20° 19′	—20° 36
Acid value	1·4	1·7	2·2
Saponif. value	4·7	3·9	2·8
Saponif. value after acetylation	199·7	203·3	203·0
Santalol % calcd. from saponif. value after acetylation	93·1	95·0	94·9

All three oils were soluble in 5½ vols. or more of 70% alcohol at 15° C. They contained a satisfactory amount of santalol but were somewhat dark-coloured. They would probably sell readily at about 20s. to 21s. per lb. in London.—R. G. P.

Essential oils; Constituents of ——. *Action of high temperatures on the sesquiterpenes; formation of terpinene; artificial preparotion of the blue compound found in many essential oils.* F. W. Semmler and W. Jakubowicz. Ber., 1914, **47**, 2252—2259.

The condensation of such substances as isoprene, terpenes, and sesquiterpenes can be effected by heating in sealed tubes to about 275° C. (this J., 1914, 765), whilst at 330° C. the converse reaction takes place. Heating to the latter temperature resolves β-gurjunene into a terpinene, $C_{10}H_{16}$, and diterpenes. α-Gurjunene similarly yields a hydrocarbon, $C_{10}H_{16}$, a diterpene, and a blue compound which boils between 140° and 180° C. at 11 mm. and is decolorised by distillation over sodium. Cedrene and caryophyllene yield hydrocarbons, $C_{10}H_{16}$. Cadinene on the other hand yields a small proportion of a monocyclic sesquiterpene, whilst the greater portion remains unchanged.—F. Shdn.

Borneol in the presence of metals and metallic oxides; Catalysis of ——. J. Aloy and V. Brustier. J. Pharm. Chim., 1914, **10**, 49—51.

Borneol was heated in a tube partly filled with finely divided copper in such a manner that the vapours passed over the metal. At about 300° C., dehydrogenation took place with the formation of camphor, the transformation being complete when the vapour was passed slowly. Higher or lower temperatures led to diminished yields. With nickel at 350° C., also, camphor was formed, whilst a small yield was obtained with iron. Using thorium oxide as catalyst at 350° C. a mixture of terpene hydrocarbons containing pinene was obtained.—F. Shdn.

Patents.

Dihalogen paraffins; Manufacture of ——. F. E. Matthews and H. J. W. Bliss, London. Eng. Pat. 15,048, June 30, 1913.

A mixture containing olefine hydrocarbons and saturated hydrocarbons is fractionated so that the olefine hydrocarbons in each fraction are chiefly such as have the same number of carbon atoms in the molecule, and the fractions are treated with only sufficient halogen to effect the saturation of the unsaturated hydrocarbons, when the dihalides can be separated by fractional distillation.—F. Shdn.

Butadiene and homologues thereof; Manufacture of ——. W. H. Perkin, Manchester, and F. E. Matthews, London. Eng. Pat. 15,049, June 30, 1913.

Butadiene or its homologues are obtained by subjecting olefines to the action of oxidising substances or substances which combine with hydrogen at elevated temperatures, with or without the use of catalysts.—F. Shdn.

Mononitro- and dinitroaminobenzene-arsinic acids or substitution derivatives thereof substituted in the amino-group; Manufacture of ——. C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. Eng. Pat. 29,546, Dec. 22, 1913. Under Int. Conv., Dec. 24, 1912.

Compounds are formed by the interaction of ammonia or ammonia derivatives and 4-chloro-3-nitrobenzene-1-arsinic acid or 4-chloro-3.5-dinitrobenzene-1-arsinic acid. The compounds obtained from 4-chloro-3-nitrobenzene-1-arsinic acid can be further nitrated.—F. Shdn.

Therapeutic agents [derivatives of aurothiosulphuric acid] in the treatment of tuberculosis and syphilis; Process of manufacturing new compounds suitable as ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 1869, Jan. 23, 1914. Under Int. Conv., Jan. 31, 1913.

Aurothiosulphates of organic bases are obtained by allowing the latter or their salts to interact with aurothiosulphuric acid or its salts. The ethylenediamine compound is a white crystalline powder, easily soluble in wate but soluble with difficulty in alcohol.—F. Shdn.

Esters of the terpene series; Process for preparing therapeutically-active ——. Kalle und Co. A.-G. Ger. Pat 273,850, Oct. 8, 1912.

Bromo-derivatives of alkyl- or aryl-acetic acids of th general formula, RR′CBr.COOH, where R and R represent an alkyl or aryl residue, are condensed in th usual manner with terpene alcohols. The resulting ester possess soporific properties resembling those of the bromo dialkylacetamides.—T. F. B.

Acetylsalicylic acid; Process for preparing a compoun [urea salt] of ——. Dr. Schütz und Co. Ger. Pa 274,046, April 10, 1913.

Equimolecular quantities of acetylsalicylic acid and ure are dissolved in high per cent. alcohol or other suitabl solvent at 60° C., and the combined solutions are evaporate at as low a temperature as possible, preferably in vacuum. The product consists of pure urea acety salicylate, uncontaminated with the salicylate; it may l used in medicine on account of its antirheumatic, analgesi and antiuratic properties.—T. F. B.

α-Bromo-isovalerylurea; Process for preparing a compou [acetylsalicylate] of ——. Knoll und Co. Ger. Pa 274,349, Aug. 2, 1912.

Molecular proportions of acetylsalicylic acid and bromo-isovalerylurea are made to react by melting the together, with or without addition of a solvent. T product exhibits the sedative properties of the ur compound together with all the characteristics of salicy acid compounds, but without the sudorific effects as ciated with acetylsalicylic acid.—T. F. B.

α-Bromoisovalerylurea: Process for preparing ——. Kr und Co. Ger. Pat. 275,200, July 27, 1912.

An α-bromo-isovaleryl halide is converted into the cyaa by treatment with a metallic cyanate in presence of indifferent diluent, and the cyanate is treated w ammonia to produce α-bromo-isovalerylurea. A gene process has been worked out for the preparation of a cyanates by treating acyl halides with metallic cyana in presence of a diluent; when silver or mercury cyan (the latter prepared from mercurous nitrate and potassi cyanate) are used, the acyl cyanates are nearly alw obtained in quantitative yield.—T. F. B.

C-Allyl-o-hydroxybenzoic acids; Process for prepa derivatives of ——. Farbenfabr. vorm. F. Bayer Co. Ger. Pat. 274,047, May 23, 1913.

C-Allyl-o-hydroxybenzoic acids are treated acylating agents, and the acyl derivatives are conve into salts. The products possess antipyretic, antineura and antirheumatic properties; in this respect they more active than the corresponding acylsalicylic a —T. F.

Alkyloxyaryl-, dialkyloxyaryl-, and alkylenedioxyaryl-aminopropanes or their N-monoalkyl derivatives; Process for preparing ——. E. Merck. Ger. Pat. 274,350, Dec. 24, 1912.

Unsaturated propylene compounds of the general formula, $R.CH_2.CH:CH_2$ or $R.CH:CH.CH_2$ (where R is alkoxyaryl, dialkoxyaryl, or alkylenedioxyaryl) are treated with hydrogen halides, and the products are treated with ammonia or a primary aromatic amine. In the treatment with hydrogen halide, the halogen atom attaches itself to the unsaturated carbon which is nearest to the benzene nucleus.—T. F. B.

Trichloroethylene from acetylene tetrachloride; Process for preparing ——. Chem. Fabr. Buckau. Ger. Pat. 274,782, Dec. 25, 1912.

Acetylene tetrachloride can be converted into trichloroethylene without the formation of hexachlorobenzene, by passing its vapour over a catalyst in presence of thorium oxide at a temperature not exceeding 390° C.—T. F. B.

Cyclohexane and its homologues; Process for purifying ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 274,920, May 18, 1913.

The impurities are removed from crude cyclohexane and its homologues by treatment with liquid sulphur dioxide or with solutions of sulphurous acid. Pure cyclohexane constitutes the upper layer, whilst the impurities (unsaturated hydrocarbons, etc.) pass into the sulphur dioxide layer and can easily be separated from it.—T. F. B.

Saponin; Process for preparing primary decomposition products of ——. F. Hoffmann-La Roche und Co. Ger. Pat. 275,048, Oct. 19, 1913. Addition to Ger. Pat. 267,815 (see this J., 1914, 220).

Saponin is treated with hydrogen peroxide solutions at temperatures below 100° C. This process has the advantage that the liquid remains colourless, and the products, which required ten to fifteen days to prepare according to the principal patent, can by this means be obtained in a single day.—T. F. B.

Acetic acid and alcohol from coal, lignite, etc.; Process for producing ——. J. Behrens. Ger. Pat. 275,049, Feb. 21, 1913.

The ethylenic compounds isolated from distillation-gases are mixed with carbon dioxide and heated to about 400° C., and the aldehyde thus produced is oxidised or reduced. Yields of about 20 grms. of alcohol or 26 grms. of acetic acid were obtained from the ethylenic compounds extracted from 1000 litres of illuminating gas by means of sulphuric acid. About 75% of the ethylenes is converted into aldehyde by this process.—T. F. B.

Hexamethylenetetramine-methyl borate; Process for preparing ——. K. H. Schmitz. Ger. Pat. 275,092, Aug. 23, 1913. Addition to Ger. Pat. 266,788 (see this J., 1914, 43).

Hexamethylenetetramine is heated with boric acid or methyl borate with or without addition of formaldehyde or a mixture of ammonia solution with formaldehyde or ts polymerides; the same product is obtained by boiling an aqueous solution of hexamethylenetetramine borate for a long time. The resulting methyl borate has the composition, $C_6H_{12}N_4.CH_3OH.5HBO_2$, and is much more stable than hexamethylenetetramine borate. It is applicable to medicine. (See also Ger. Pats. 269,746 and 270,486; this J., 1914, 375, 439.)—T. F. B.

6-Chloro-1-methyl-3-hydroxybenzene-4-carboxylic acid; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 275,093, March 20, 1913.

p-Chloro-*m*-cresol-sodium ($ONa : CH_3 : Cl = 3 : 1 : 6$) is heated to a high temperature under pressure, in presence of carbon dioxide, preferably at 160°—180° C. An almost quantitative yield of 6-chloro-1-methyl-3-hydroxybenzene-4-carboxylic acid is obtained. In contrast with *p*-chlorophenol-*o*-carboxylic acid, which has not been found to possess therapeutic value, the new compound has powerful antiseptic properties.—T. F. B.

Anhydrides of monobasic carboxylic acids; Process for the manufacture of ——. E. C. R. Marks, London. From Naamlooze Vennootschap Fabriek van Chemische Produkten, Schiedam, Holland. Eng. Pat. 12,042, May 23, 1913.

See Fr. Pat. 461,540 of 1913; this J., 1914, 219.—T. F. B.

Para-nitrophenylureas; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 17,123, July 25, 1913. Under Int. Conv., July 25, 1912.

See Addition of July 11, 1913, to Fr. Pat. 459,885 of 1913; this J., 1914, 219.—T. F. B.

Salts of acetylsalicylic acid; Process for preparing ——. O. Gerngross, Grünewald, and H. Kast, Charlottenburg, Germany. Eng. Pat. 24,849, Oct. 31, 1913. Under Int. Conv., Oct. 31, 1912.

See Fr. Pat. 464,081 of 1913; this J., 1914, 439.—T. F. B.

Chlorine derivatives of the amyl series; Producing ——. F. Webel, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,098,858, June 2, 1914. Date of appl., Feb. 27, 1913.

See Eng. Pat. 19,764 of 1912; this J., 1913, 550.—T. F. B.

Isoprene; Producing ——. F. Webel, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,098,859, June 2, 1914. Date of appl., Feb. 27, 1913.

See Eng. Pat. 13,327 of 1913; this J., 1913, 924.—T. F. B.

Morphine; Process of manufacturing alkyl-ethers of ——. M. C. Traub, Basle, Switzerland, Assignor to J. and D. McKesson, Chappaqua, and W. H. Wickham, G. C. and I. McKesson, and H. D. Robbins, New York. U.S. Pat. 1,100,998, June 23, 1914. Date of appl., May 6, 1912.

See Eng. Pat. 22,611 of 1911; this J., 1912, 557.—T. F. B.

Salts of high molecular fatty acids containing arsenic and a halogen. E. Fischer, Berlin, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,101,733, June 30, 1914. Date of appl., Aug. 12, 1913.

See Eng. Pat. 10,379 of 1913; this J., 1914, 438.—T. F. B.

Iron salts of high molecular fatty acids containing arsenic and a halogen. E. Fischer, Berlin, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,101,734, June 30 1914. Date of appl., Aug. 12, 1913.

See Ger. Pat. 271,158 of 1913; this J., 1914, 503.—T. F. B.

Manufacturing highly active extracts rich in enzymes and nitrogenous matters for use in baking, for medicinal and other purposes. Eng. Pat. 13,928. *See* XIXa.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Photographs; Process of making coloured ——. R. Fischer, Steglitz, Germany. U.S. Pat. 1,102,028, June 30, 1914. Date of appl., Jan. 27, 1913.

See Ger. Pat. 253,335 of 1912; this J., 1913, 47.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosions: Report of Board of Trade enquiry into electric main ——. [Cd. 7481.]

Serious explosions on ignition of vapour generated by short circuits in underground cables have not occurred with alternating current, or with concentric, lead-covered paper insulated, or three-core cables, or with cables laid solid in pitch compound, but have occurred in the case of cables insulated with vulcanised bitumen, and drawn into bitumen casings or laid solid in bitumen. As bitumen has been much more extensively used than pitch compound, however, a direct comparison is not possible. Bitumen and pitch mixed with whinstone dust were distilled: the limits of inflammability of the gases were narrower for bitumen than for pitch compound, but the difference disappeared if the gases were cracked at 1000° C.; no pyrophorous carbon was formed. It is recommended that where the solid system is employed, wood troughing should be used only in suitable soil, with mains in separate troughs two inches apart and packed between with earth or sand, and not below impervious pavements or close to houses, that existing, or new bends should be eased off and straights filled and cooled first and that services should be taken into houses, preferably by armoured cables, in such a manner that gas cannot enter.—O. E. M.

Patents.

Match-splints; Process of treating ——. W. G. Wey, Barberton, Ohio, Assignor to The Diamond Match Co., Chicago, Ill. U.S. Pat. 1,098,700, June 2, 1914; date of appl., May 29, 1913.

Match sticks are dipped at 121° C., in paraffin wax, in which phosphorus has been dissolved.—G. W. McD.

Process for removing bromate from chlorate. Ger. Pat. 274,471. *See* VII.

XXIII.—ANALYTICAL PROCESSES.

Lacmosol, the sensitive component of the indicator lacmoid. R. Hottinger. Biochem. Zeits., 1914, **65**, 177—188.

Commercially pure lacmoid is a mixture essentially of three constituents, all of which respond as indicators: these are (*a*) "lacmosol" (about 20%), (*b*) "lacmoid" (80%), and (*c*) a yellowish-red substance. The first, which is the most sensitive, is distinguished (from *b* and *c*) by its solubility in ether and (from *c*) by its insolubility in acidified strong brine; it is best prepared by heating 10 grms. of resorcinol with 2 c.c. of concentrated sodium nitrite solution at 105° C. until the depth of tint imparted by the product to water becomes constant (about 40 mins.), dissolving the mixture in 50 c.c. of water, pouring into 1 litre of strong brine (acidified with hydrochloric acid), and, after a time, filtering off the precipitate formed, washing with brine, dissolving in ammonia, and again precipitating with acid brine. The well-washed precipitate is dissolved in a little acetone, the solution poured into 30 vols. of ether, allowed to stand, any precipitate filtered off and rejected, the ether distilled off from the filtrate, the residue dissolved in acetone, and the process repeated until no further precipitate forms with ether. The yellowish-red constituent is removed by repeated precipitation from alkaline solution, and the powdered indicator finally extracted with ether in a Soxhlet apparatus. Lacmosol is superior to commercial lacmoid in sensitiveness and sharpness of colour change; it may be used in aqueous solution or dissolved in ether, alcohol, or acetone, and has been found specially suitable in the determination of nitrogen by Kjeldahl's method.
—F. Sodn.

Manganese sulphide and the determination of manganese. A. Villiers. Comptes rend., 1914, **159**, 67—69.

In analytical work manganese sulphide may be produced as an unstable rose-coloured, a stable rose-coloured, and a green modification respectively. The last is the densest form and is most suitable for separations; it is produced by the dehydration, with liberation of heat, of the first form. To obtain the green variety foreign salts should be absent and the solution should be rendered ammoniacal before the addition of ammonium sulphide.—T. St.

Titanium and chromium; Volumetric determination of —— *by means of a modified reductor.* C. Van Brunt. J. Amer. Chem. Soc., 1914, **36**, 1426—1429.

The reductor used by Shimer and Shimer (this J., 1912, 955) for the determination of titanium has the disadvantage that the solution passes very slowly through the long thin tube. The author uses a reductor of the usual form (containing a column of well amalgamated, coarse granulated zinc, 2·5 cm. in diameter by 20 cm. in height) wound with a few feet of resistance ribbon in series with a lamp or other resistance, so that the solution may be boiled. In using the reductor, the stopcock at the bottom is closed, and the tube is partly filled with hot 5% sulphuric acid, the solution to be reduced then being added. A rubber stopper carrying a funnel tube with a stopcock, and a small vent tube is placed in the top of the reductor, and the contents of the latter are heated and kept nearly boiling for 10—20 mins. The solution is then expelled, by the internal pressure, through a tube to the bottom of the vessel beneath, which contains excess of acidified ferric ammonium sulphate. More acid is admitted to the reductor and forced out as before, the operations being carried out without access of air to the space above the zinc. The washing is completed with 1% sulphuric acid with the top of the reductor open, and the reduced iron is titrated with permanganate, the amount of titanium (or chromium) being calculated therefrom.—L. E.

Gas analyses by fractional distillation at low temperatures. G. A. Burrell and F. M. Seibert. J. Amer. Chem. Soc., 1914, **36**, 1537—1548 (cp. Lebeau and Damiens, this J., 1913, 126, 186, 352).

This method serves for separating the individual paraffin hydrocarbons of natural gas. Methane (together with any nitrogen) is quantitatively removed by cooling the sample to —185° to —190° C., removing the gas that distils at this temperature, volatilising the liquid residue and twice repeating the liquefaction, etc. Ethane is similarly removed from the methane-free residue at —145° to—125° C., but since the distillate contains some propane, it is finally treated at —155° to —140° C. Propane is removed at —125° to —110° C. and finally freed from some accompanying butane by distillation at —135° to —120° C.—L. E.

Mannitol; The methods for the quantitative determinatio of ——. J. Smit. Z. anal. Chem., 1914, **53**, 473—490

In using the method described in this J., 1914, 769 compounds and derivatives of ammonia are eliminate by boiling with alkali, and the solution is then neutralised Amino-acids, when containing several free amino-group must either be precipitated with phosphotungstic acid or else converted by the action of nitrous acid into hydroxy-acids; the latter are extracted by shaking the solution with ether in presence of a little sulphuric acid. Tartaric acid is removed by precipitation as calcium or lead tartrate. As glycerol exerts a solvent action on copper it has to be determined: the method depending upon the solubility of glycerol in a mixture of absolute alcohol (1 vol.) and dry ether (1½ vols.) can be applied, since mannitol is insoluble in this mixture. The method is not readily applicable to mixtures containing such nearly related substances as sorbitol, dulcitol, etc.—J. R.

Determination of malt extract. Dreaper. *See* VI.

An improvement of the barium sulphate determination of sulphur in soluble sulphates when sodium salts are present. Turner. *See* VII.

Examination of [*detection of cobalt in*] *varnishes.* Malatesta and di Nola. *See* XIII.

Determination of carbon in soils and soil extracts. Ames and Gaither. *See* XVI.

Preparation of "neutral" ammonium citrate. Eastman and Hildebrand. *See* XVI.

New [*German*] *standards for malt analysis.* Bode and Wlokka. *See* XVIII.

etermination of caffeine in caffee. Fendler and Stüber. *See* XIXa.

etermination of hardness of waters by the methods of Wartha-Pfeifer and Blacher. II. Blacher's method. Zink and Hollandt. *See* XIXb.

etermination of protein-ammonia [*e.g., in drinking water*]. Winkler. *See* XIXb.

ffect of ferric salts and nitrites on the o-tolidine and starch-iodide tests for free chlorine [*in water*]. Ellms and Hauser. *See* XIXb.

isplacement curves of some organic bases. Application to the determination of some alkaloids. Goubau. *See.* XX.

PATENTS.

recipitates; Machine for washing ——. H. E. Elson, Masontown, Pa. U.S. Pat. 1,097,708, May 26, 1914; date of appl., Nov. 18, 1913.

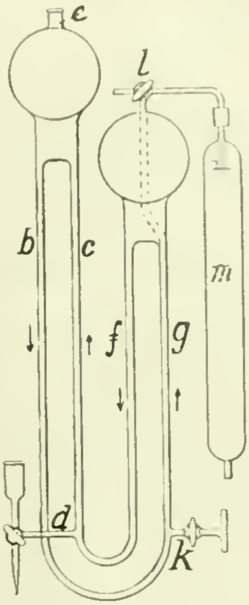
UNNELS are mounted in a rotating stand so that they can ccessively be brought into position below a tube which elivers the liquid used to wash the precipitate.
—G. W. McD.

ases; Method of, and apparatus for sampling ——. E. W. Brown, Elyria, Ohio. U.S. Pat. 1,100,171. June 16, 1914; date of appl., Oct. 7, 1912.

MEASURED sample removed from the main at the same locity as the gas passing through the main is led through weighed filter to determine the amount of solid matter esent.—G. W. McD.

s-analysis apparatus for the treatment of gases with measured quantities of a liquid reagent. K. Heinemann. Ger. Pat. 273,726, June 6, 1913.

HE apparatus is shown in the figure and is especially itable for the determination of sulphur dioxide in burner gases or of ammonia in gaseous mixtures. The reagent is introduced through *d*, the gas to be tested through *k* or *l*, and an inert gas, such as air, through *e* or *d*, whereby a vigorous circulation of gas and liquid through the tubes, *g*, *f*, *c*, *b*, is produced, similar to that in apparatus of the "emulseur" type. The residual unabsorbed gas may be transferred through *l* to the measuring vessel, *m*.
—A. S.



Inflammable (reactive) substances in gaseous mixtures; Determination of ——. W. H. Eyermann. Ger. Pat. 273,980, March 23, 1913.

THE quantity of the inflammable constituent is determined by measuring the difference in temperature of the gaseous mixture before and after a reaction (*e.g.*, combustion) has taken place. The apparatus is so constructed that the hot gases leaving the reaction chamber serve to preheat the incoming gases, and both the reaction chamber and preheater are provided with heat-insulating jackets. The reaction-chamber is fitted with baffles to effect thorough mixing of the gases and equalisation of the temperature therein.—A. S.

Samples of powdered substances or liquids; Means for taking ——. T. Roberts, Bolton. U.S. Pat. 1,101,568, June 30, 1914. Date of appl., Oct. 19, 1912.

SEE Ger. Pat. 262,896 of 1913; this J., 1913, 928.—T. F. B.

Trade Report.

Measures affecting the exportation of goods in various countries. Board of Trade, August, 1914.

THE exportation of the following articles is prohibited:—

Belgium.—Arms and munitions of war, substances used for the manufacture of explosives, copper, brass, sulphur, nitric acid, lead, German silver, zinc, and pewter, also lubricating oils, burning oils, and "essences" for motive power.

France.—Benzol, meat preserves, cotton waste, dynamite and similar explosives, mineral oils of all kinds, nitrate of soda, raw and dressed hides and skins, lead, gunpowder, guncotton, nitroglycerin and the like, saltpetre, and sulphur.

Austria-Hungary.—Leather, sulphur and sulphuric acid, saltpetre and nitric acid, calcium carbide, nitrotoluol, glycerin, acetone, sulphuric anhydride, picric acid, ammunition and explosives.

Germany.—1. Ammunition and explosives, iron and steel, tin, aluminium, nitrate of potash, ammonia, soda, nitric acid, camphor, acetate of lime, acetone, acetic ether, ethyl ether, carbolic acid, benzol, nitrated cotton and cellulose, picric acid, nitrate of barium, phosphorus, toluol, cresol and metacresol, turpentine oil, di- and tri-nitrotoluol, diphenylamine, sodium oxalate, antimony, mercury, wolfram, and colophony.

2. Raw materials for war materials as follows: Iron ore, pyrites, copper, coal, coke, mineral oils, tar oils, textiles, hides and skins, wood pulp, caoutchouc, gutta percha, and balata.

3. Surgical dressings and medicinal products as follows: Pure carbolic acid, mercury, corrosive sublimate, iodine, iodides, iodoform and chloroform, pyrazolone, phenyl-dimethyl and derivatives, such as pyramidon, powdered opium, morphia and its salts, phosphoric codein, para-formaldehyde, quinine sulphate and hydrochloride, "arekoline," salvarsan, bacteriological apparatus, material for bacteriological cultures, vaccines and serums.

Also animal products, food supplies, automobiles, mineral oils, tar oils and all oils produced therefrom.

Great Britain.—Acetone, benzol, carbons, copper, copper ore, cotton suitable for manufacture of explosives, cotton waste, creosote, dimethylaniline, fulminate of mercury, gunpowder, nickel and ferro-nickel, oil (blast furnace), tar oil, oil fuel, shale oil, petroleum oil and spirit (including Shell spirit), silk, surgical bandages and dressings, toluol, zinc.

The exportation of the following articles is prohibited to all foreign ports in Europe and on the Mediterranean and Black Sea, except those of France, Russia (except the Baltic ports), Spain and Portugal:—Aluminium and its alloys; armour plates; asbestos; coal (steam and large); engine and boiler packings; explosives of all kinds; fuel (manufactured); indiarubber sheet (vulcanised); manganese; mica; mineral jellies; molybdenum; nitrates of potassium and ammonium; nitrotoluol; nitric acid; picric acid and its components; saltpetre; sulphur; sulphuric acid; tin; tin plates; tungsten; vanadium; alcohol (as covering rectified spirits); glycerine, crude and refined; lead in all forms; saltpetre; nitrate of sodium; guncotton; carbolic acid; alcohols, ethylic; alcohols, methylic; alkaline iodides; belladonna and its preparations and alkaloids; bismuth and its salts; boric acid; bromine and alkali bromides; castor oil; chloroform; cinchona bark, quinine and its salts; coca and its preparations and alkaloids; collodion; corrosive sublimate; cresol and all preparations thereof (including cresylic acid) and nitro-cresol; digitalis and its preparations; ether; ethyl chloride; formic aldehyde; henbane and its preparations; iodine and its preparations; lysol; mercury and its salts and preparations; morphia and other alkaloids of opium; nux vomica and its alkaloids and preparations; opium and its preparations; paraffin, soft; protagol; salicylic acid and salicylates; salvarsan; all fine chemicals; sugar, all kinds; glucose; molasses and invert sugar.

Books Received.

Industrial Resources of the Philippine Islands. Bureau of Science, Manila. Gratis.

A pamphlet, 9 ins. by 4 ins., issued by authority of the Philippine Government to show the result of the work of the Bureau of Science. Detailed accounts of the work are to be found in the Philippine Journal of Science, reference to which is made throughout the pamphlet. The work is divided as follows: Chemical technology limestone and silicate industries, mineral resources bacteriology, botany, entomology, fisheries, etc. Unde the heading "chemical technology" are discussed:—Sugar, nipa palm (this J., 1914, 656); palm brandy (ib 1911, 1133); starch; coconut; vegetable oils; perfume and essential oils (*ib.* 1904, 918; 1909, 906; 1911, 1406 1912, 90); papaya gum; tanning materials (*ib.* 1909 1051; 1911, 437, 969); dyes (*ib.* 1911, 737); paper pul (*ib.* 1906, 863; 1907, 274, 941; 1910, 1450). Alum i the form of alunite is found in considerable quantity, coa is abundant (this J., 1907, 1040; 1909, 15), guano occur in limestone caves in nearly every province (this J., 1913 100); medicinal plants grow luxuriantly, but only one *Strychnos Ignatii*, is exported (*ib.* 1907, 274); the rest such as the castor oil and croton oil plants, kamala, an datura are not utilised. Guttapercha is exported (thi J., 1912, 1138).

Mines and Quarries: General Report, with Statistic 1913. Part I. Divisional Statistics. [Cd. 7,452 Wyman and Sons, Fetter Lane, E.C. Price 7d.

This return contains statistics of the number of perso employed, the output of minerals, and the accidents mines and quarries in the United Kingdom, arrange according to the inspection districts. The total outp of the undermentioned minerals in the United Kingdo in 1913, as compared with 1912, was as follows:—

—	1912.	1913.
	Tons.	Tons.
Coal	260,416,338	287,430,473
Iron ore	13,790,391	15,997,328
Clays and shale	12,808,950	13,859,821
Limestone (other than chalk)	11,500,660	12,740,664
Igneous rock	6,638,215	7,098,493
Chalk	4,285,412	4,858,126
Sandstone	3,839,567	3,977,303

Die Nitrocellulosen. Ihre Bildungsweisen, Eig schaften und Zusammensetzung. Von Dr. Haeussermann. Em. Professor der Technisch Hochschule, Stuttgart. Friedr. Vieweg und So Verlagsbuchhandlung. Braunschweig. 1914. Pr M. 1.60.

This volume ($9\frac{1}{4}$ by $6\frac{1}{4}$ ins.) contains 34 pages of subje matter classified as follows:—I. Behaviour of cott cellulose with nitric acid and nitro-sulphuric ac II. Guncotton and collodion cotton. III. Nitrohyd and nitro-oxy-celluloses. IV. Nitrostarch and nitro-deri tives of dextrins from cellulose. V. Nitrous esters cellulose.

Filters and Filter Presses for the Separation Liquids and Solids. From the German of F. Bühler. With additional matter relating to Theory of Filtration and Filtration in Su Factories and Refineries, by J. J. Easti F.I.C., A.R.S.M. Norman Rodger, St. Dunst Hill, London, E.C. 1914. Price 12s. net.

Volume ($9\frac{3}{4}$ by $6\frac{7}{8}$ ins.) containing 167 pages of subj matter with 327 illustrations, an appendix with classi references to patents taken out from 1901 to date (pa 168 to 179), and alphabetical indexes (pages 180 to 1 of subjects and names. The text is classified as follows Part I. (i), Filters with loose filtering layer. (ii), Fil with woven or felted filtering mediums. (iii), Fil with rigid filtering layer. (iv), Separating appar without filtering layer. Part II. (i), Presses with pr cloths. (ii), Presses with press-baskets. (iii), Pre with heating or cooling. Part III. (i), Filtration aids to filtration as applied to the sugar industry. Theory of filtration. (iii), Sugar filtration. (iv), Speci tions of sundry filter press patents.

ubject List of Works on the fine and graphic Arts in the Library of the Patent Office. New Series BM—BZ. The Patent Office, 25, Southampton Buildings, London, W.C. Price 6d. each.

feature of the New Series of Subject Lists, issued uides to the contents of the Library, is that the headings ontain certain marks indicating the location of classes f books in the Library. This work contains 224 small vo pages.

ubject List of Works on Photomechanical printing and photography in the Library of the Patent Office. New Series CA—CC. The Patent Office, 25, Southampton Buildings, London, W.C. Price 6d.

ontains 121 small 8vo pages.

ubject List of the Works on the Silicate Industries (Ceramics and Glass) in the Library of the Patent Office. New Series CD—CK. The Patent Office, 25, Southampton Buildings, London, W.C. Price 6d.

ontains 84 small 8vo pages.

New Books.

he Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."

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Metzger: Technik des Filterns, Filter im Klein- u. rossbetrieb m. besond. Berücksicht. ihrer Bedeutg. f. d. fentl. Gesundheitspflege. VII. 162 S. m. 124 Abbldg. ien. A. Hartleben. 1914. Cloth M. 4.80.

Ombeck, Dr. H.: Druckverlust strömender Luft in eraden zylindrischen Rohrleitungen. (64 S. m. 38 bbildgn.) Lex 8°. Berlin. J. Springer. 1914. M. 1.

IA. *Braunkohlenindustrie*, Die deut. I. Bd. 15. Lfg. Halle, Knapp. 1914. M. 2.

Butler, E.: Oil Fuel: Its Supply, Composition, and pplication. 3rd ed., greatly enlarged. Cr. 8vo, pp. 342. . Griffin. London. 1914. Net 7s. 6d.

Arends, H., and C. *Morsner*: Handbuch f. die internationale Petroleum-Industrie. Jahrg. 1914. (XXV, 614 .) gr. 8°. Berlin, Finanzverlag, G. m. b. H. Cloth . 12.

Cooper-Key, A.: A Primer on the Storage of Petroleum pirit and Carbide of Calcium. Cr. 8vo, pp. 136. C. riffin. London. 1914. Net 2s. 6d.

Strohm, R. T.: Oil fuel for steam boilers. N.Y., cGraw-Hill. 145 p. il. pocket size. 1914. $1.

Coste, J. H., and E. R. *Andrews*: The Examination nd Thermal Value of Fuel, Gaseous, Liquid and Solid. r. 8vo, pp. 294. C. Griffin. London. 1914. Net 6s.

IB. *Blok*, A.: The Elementary Principles of Illumination and Artificial Lighting. 12mo, pp. 235. cott, Greenwood. London. 1914. Net 3s. 6d.

I. *Shaw*, N.: Manchurian Tussore Silk. Demy 8vo, pp. 43. Luzac. London. 1914. Net 1s.

II. *Ganswindt*, F.: Das Färben der Seide, Wollseide, Halbseide, und Kunstseide. VII, 240 S. Wien. . Hartleben. 1914. Cloth M. 4.80.

Holmes, R. W. M.: The "Texas" garment cleaners, otters, pressers, bleachers, laundrymen and dyers guide manual of scientific and artistic methods, processes, rmulas, trade secrets, valuable business pointers, ggestions and instructions, etc., used by experts the renovating trade. Temple, Tex.. R. Holmes & Co. 121 p. 8°. 1914. $5.

Michaelis, E.: Die Kleiderfärberei, Wäscherei u. Detachur. Ein Handbuch aus der Praxis f. die Praxis. (VII, 84 S. m. 48 Abbildgn.) gr. 8. Wittenberg, A. Ziemsen. 1914. M. 2.50.

Valenta, Prof. E.: Die Rohstoffe der graphischen Druckgewerbe. 3. Bd.: Die bunten Druckfarben. (XII, 310 S. m. 48 Abbildgn.) gr. 8°. Halle, W. Knapp. 1914. M. 11.

VIII. *Berge*, Dr. A.: Keramisches Praktikum. Anleitung zu keram. Laboratoriumsarbeiten auf chem. Grundlage f. Studierende u. Techniker der keram. Industrie. (X, 90 S. m. 10 Abbildgn.) gr. 8°. Halle, W. Knapp. 1914. Cloth M. 4.80.

Rieke, Dr. R.: Bestimmung der Wärmeausdehnung einiger keramischer Massen. (14 S. m. 6 Fig.) gr. 8°. Berlin, Keram. Rundschau. 1914. 75 Pf.

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Hodgson, F. T.: Mortars, plasters, stuccos, artificial marbles, concretes, Portland cements and compositions, including reinforced concrete. Chic., Drake. c. 5—522 p. pls. 12°. 1914. $1.50.

X. *Calvert*, A. F.: Nigerian Tin Fields. 12mo, pp. 45. Wilson. London. 1914. 6d.

Demuth, T.: Technologie der Metalle f. die Fortbildungsschulen der Schlosser u. Schmiede. (IV, 125 S. m. 244 Fig.) 8°. Wien, F. Deuticke. 1914. Cloth M. 2.

Gowland, W.: The Metallurgy of the Non-Ferrous Metals. Illustrated. 8vo, pp. 534. C. Griffin. London. 1914. Net 18s.

Hobart, J. F.: Soft Soldering, Hard Soldering, and Brazing. Cr. 8vo, pp. 204. Constable. London. 1914. Net 4s.

Hofmann, H. O.: Metallurgy of copper. N.Y., McGraw-Hill. 556 p. il. 8°. 1914. $5.

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Linck, Prof. G.: Fortschritte der Mineralogie, Kristallographie u. Petrographie. Hrsg. v. der deutschen mineralog. Gesellschaft. 4. Bd. (III, 384 S. m. 23 Abbildgn.) gr. 8°. Jena, G. Fischer. 1914. M. 12.50.

Smith, H. G.: Minerals and the Microscope. Cr. 8vo, pp. 128. T. Murby. London. 1914. Net 3s. 6d.

XII. *Klimanek*, P. H.: Chinesisches weisses Insektenwachs (Pei-La). (18 S.) gr. 8°. Wien, Export Akademie des k. k. österr. Handelsmuseums. 1913. 20 Pf.

XVI. *Seemann*, Dr. F.: Leitfaden der mineralogischen Bodenanalyse. Nebst Beschreibg. der wichtigsten physikal. Untersuchungsmethoden am gewachsenen Boden. Mit 39 Textabbildgn., 3 Taf. u. 7 Mineralbestimmungstabellen. (IX, 110 S. m. 3 Bl. Erklärgn.) gr. 8°. Wien, W. Braumüller. 1914. Cloth M. 5.

XVIII. *Dräsel*, W. : Elektrizität in Brauereien. (VIII, 134 S. m. 109 Abbildgn.) gr. 8°. Leipzig, O. Leiner. 1914. Cloth M. 6.

Kusserow, Dr. R. : Mitteilungen f. Brennerei u. Presshefe-Fabrikation Nebst Anh. : Adressbuch der Lieferanten f. das Brennereigewerbe. Nr. 52. Juni 1914. (16 u. IV S.) 8°. Sachsenhausen (Mark, Chausseestr. 8), Selbstverlag. 50 Pf.

XIXA. *Besselich*, N. : Die Teigwaren-Fabrikation im Kleinbetrieb. Aus der Praxis f. die Praxis dargestellt u. hrsg. (59 S. m. Abbildgn. u. 2 Taf.) 8°. Trier, N. Besselich. 1914. Cloth M. 1.50.

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Lebbin, Dr. G. : Allgemeine Nahrungsmittelkunde. Volks [Titel-]ausg. Mit zahlreichen Abbildgn. im Text. (XI, 543 S.) gr. 8°. Berlin, L. Simion Nf. ['11]. 1914. Cloth M. 5.60.

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XXI. *Adressbuch* der photographischen Ateliers, der photochemigraphischen Kunstanstalten u. Lichtdruckereien, sowie sämtl. Handlgn. u. Fabriken photograph. Apparate, Utensilien u. Bedarfsartikel Deutschlands. 9. Jahrg. 1914/15. (XVIII, 452 S.) gr. 8°. Leipzig, Eisenschmidt & Schulze. Cloth M. 10.

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XXII. *Escales*, Dr. R. : Die Explosivstoffe m. besond. Berücksicht. der neueren Patente. 1. Heft. Schwarzpulver u. Sprengsalpeter. 2., völlig umgearb. u. erweit. Aufl. (VIII, 475 S. m. Abbildgn. u. 1 Taf.) gr. 8°. Leipzig, Veit & Co. 1914. M. 15.

XXIII. *Becker*, A., u. C. *Ramsauer* : Ueber radioaktive Messmethoden u. Einheiten. Aus dem radiolog. Institut der Universität Heidelberg. Mit e. Vorwort v. P. Lenard. (39 S. m. Fig.) gr. 8°. Heidelberg, Carl Winter. 1914. 80 Pf.

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XXIV. *Bassett*, H. Ll. : The Elements of Chemistry. Cr. 8vo, pp. 380. C. Lockwood. London. 1914. 4s. 6d.

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II. Bd. 17—19. Lfg. Aluminium bis Xenon, Nr. 56-81. Bibliographien. Abteilung Platin bis Xenon, N 71—81. (S. 1073—1291.) 1914. M. 12. Vol. II. complet Half morocco £3 19s.

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* Compiled by H. Grevel and Co., 33, King Street, C Garden, London. W.C., from whom all the works in the prec list can be obtained.

Journal of the Society of Chemical Industry.

No. 16, Vol. XXXIII. AUGUST 31, 1914. No. 16, Vol. XXXIII.

Official Notices.

BOARD OF TRADE ANNOUNCEMENT.

The Board of Trade has issued the following announcement :—

"In view of the cessation of imports from Germany and Austria and the fact that there are many articles hitherto imported from these countries of importance, if not of necessity to British manufacturers, information is invited by the Commercial Intelligence Branch of the Board of Trade from importers of such articles, as to their precise nature and quality, in order that steps may be taken to ascertain whether similar goods might be produced in this country, and, if so, where ; or, if not, from what neutral sources they could be obtained."

A Committee has been appointed by the Society of Chemical Industry to report to the Board of Trade on this subject. Communications should be addressed to the Secretary of the Society.

WITHDRAWAL OF PROHIBITION OF CERTAIN EXPORTS.

Attention is called to the notice on page 846, relative to the removal of the prohibition to export certain articles mentioned in the notice in the Aug. 15th issue of the Journal, page 810.

All such Proclamations will be found in the "London Gazette."

PATENTS AND DESIGNS ACT, 1914.

4 and 5 Geo. V. Chap. 18.

An Act to amend section ninety-one of the Patents and Designs Act, 1907.

7th August, 1914.

Whereas by a Convention made at Washington in nineteen hundred and eleven, to which His Majesty was a party, an amendment was made in Article IV. (*a*) of the International Convention for the Protection of Industrial Property made at Paris in eighteen hundred and eighty-three, whereby the rights of priority conferred by that Article on persons who have applied for protection for an invention, design or trade-mark in foreign States were extended to the legal representatives and assignees of such applicants, and it is expedient for the purpose of enabling effect to be given to the first-mentioned Convention that such amendment as hereinafter mentioned should be made in subsection (1) of section ninety-one of the Patents and Designs Act, 1907

Be it therefore enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

1. The rights conferred by section ninety-one of the Patents and Designs Act, 1907, on a person who has applied for protection for any invention, design or trade mark in a foreign State shall extend to his legal representatives and assignees, and accordingly subsection (1) of that section shall have effect as if after the words "any person who has applied for protection for any invention, design, or trade mark in that State" there were inserted the words "or his legal representative or assignee."

2. This Act may be cited as the Patents and Designs Act, 1914 ; and the Patents and Designs Act, 1907, the Patents and Designs Act, 1908, and this Act may be cited together as the Patents and Designs Acts, 1907 to 1914.

PATENTS, DESIGNS, AND TRADE MARKS (TEMPORARY RULES) ACT, 1914.

4 and 5 Geo. V. Chap. 27.

An Act to extend the powers of the Board of Trade during the continuance of the present hostilities to make Rules under the Patents and Designs Act, 1907, and the Trade Marks Act, 1905.

7th August, 1914.

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

1. (1) The power of the Board of Trade under section eighty-six of the Patents and Designs Act, 1907, and section sixty of the Trade Marks Act, 1905, to make rules and to do such things as they think expedient for the purposes therein mentioned shall include power to make rules and to do such things as they think expedient for avoiding or suspending in whole or in part any patent or licence granted to, and the registration of any trade mark the proprietor whereof is, a subject of any State at war with His Majesty, and any proceedings on any application made by any such person under either of the said Acts and for extending the time within which any act or thing may or is required to be done under those Acts.

(2) In relation to rules made under this Act the provisions of subsection (3) of section sixty of the Trade Marks Act, 1905, shall not apply.

(3) If the rules made under this Act so provide the rules or any of them shall have effect as from the passing of this Act.

2. This Act may be cited as the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914.

3. This Act and the rules made thereunder shall continue in force during the continuance of the present state of war in Europe, and for a period of six months thereafter and no longer.

PATENTS, DESIGNS, AND TRADE MARKS (TEMPORARY) RULES, 1914.

Dated 21st August, 1914.

Statutory Rules and Orders, 1914. *No.* 1255.

By virtue of the provisions of the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914, the Board of Trade hereby make the following Rules :—

1. The Board of Trade may, on the application of any person, and subject to such terms and conditions, if any, as they may think fit, order the avoidance or suspension, in whole or in part, of any patent or licence granted to a subject of any State at war with His Majesty, and the Board, before granting any such application, may require to be satisfied on the following heads :—

(*a*) That the patentee or licensee is the subject of a State at war with His Majesty ;

(*b*) That the person applying intends to manufacture, or cause to be manufactured, the patented article, or to carry on, or cause to be carried on, the patented process ;

(*c*) That it is in the general interests of the country or of a section of the community, or of a trade, that such article should be manufactured or such process carried on as aforesaid.

The fee to be paid on any such application shall be that specified in the First Schedule to these Rules, and the fee payable on depositing foreign documents or other papers for the purpose of a record not already provided for under the Patents and Designs Act, 1907, and the Trade Marks Act, 1905, shall be that specified in the First Schedule to these Rules.

An application under this section must be made on Patents Form No. 36 contained in the Second Schedule to these Rules, and shall be filed at the Patent Office.

The Board of Trade may at any time, in their absolute discretion, revoke any avoidance or suspension of any patent or licence ordered by them.

For the purpose of exercising in any case the powers of avoiding or suspending a patent or licence, the Board of Trade may appoint such person or persons as they shall think fit to hold an inquiry.

Any application to the Board for the avoidance or suspension of any patent or licence may be referred for hearing and inquiry to such person or persons who shall report thereon to the Board.

Provided always that the Board of Trade may at any time if in their absolute discretion they deem it expedient in the public interest, order the avoidance or suspension in whole or in part of any such patent or licence upon such terms and conditions, if any, as they may think fit.

2. The Comptroller may, at any time during the continuance of these Rules, avoid or suspend any proceedings on any application made under the Patents and Designs Act, 1907, and the Trade Marks Act, 1905, by a subject of any State at war with His Majesty.

3. The Comptroller may also at any time during the continuance of these Rules extend the time prescribed by the Patents and Designs Act, 1907, or the Trade Marks Act, 1905, or any Rules made thereunder, for doing any act or filing any document, upon such terms and subject to such conditions as he may think fit in the following cases, namely :—

(*a*) Where it is shown to his satisfaction that the applicant, patentee, or proprietor, as the case may be, was prevented from doing the said act, or filing the said document, by reason of active service or enforced absence from this country, or any other circumstances arising from the present state of war, which, in the opinion of the Comptroller, would justify such extension ;

(*b*) Where the doing of any act would, by reason of the circumstances arising from the present state of war be prejudicial or injurious to the rights or interests of any applicant, patentee or proprietor as aforesaid.

4. The term "person" used in these Rules shall, in addition to the meaning given thereto by Section 19 of the Interpretation Act, 1889, include any Government Department.

5. All things required or authorised to be done by to or before the Board of Trade may be done by to or before the President or a Secretary or an Assistant Secretary of the Board, or any person authorized in that behalf by the President of the Board.

All documents purporting to be orders made by the Board of Trade and to be sealed with the seal of the Board or to be signed by a Secretary or an Assistant Secretary of the Board or by any person authorised in that behalf by the President of the Board shall be received in evidence and shall be deemed to be such orders without further proof unless the contrary is shown.

A certificate signed by the President of the Board of Trade that any order made or act done is the order or act of the Board shall be conclusive evidence of the fact so certified.

6. These Rules shall come into operation as and from the Seventh day of August, 1914.

First Schedule.

	£	s.	d.
Fee payable on application under Rule 1 to Board of Trade to avoid or suspend patent rights or licence..	2	0	0
Fee payable on depositing Foreign Documents or other papers for the purpose of a record not already provided for under the Patents and Designs Act, 1907, and the Trade Marks Act, 1905......................	0	2	6

Dated the 21st day of August, 1914.

Second Schedule.

PATENT
£2

Patents Form No. 36.

PATENTS, DESIGNS AND TRADE MARKS (TEMPORARY RULES) ACT, 1914.

(*a*) Here insert (in full) name, address, and description or calling of person or persons applying.

(*a*) I (or We)__________________________
____
____
____

(*b*) Here insert number and year of Patent or particulars of Licence as the case may be.

hereby request the Board of Trade to order th avoidance or suspension of the Letters Paten No. (*b*)__________ of_________________
or the Licence granted to (*b*)________________
under Letters Patent No. (*b*)________________
of__________________

Dated this________day of____________

(Signed)__________________

Dated the 21st day of August, 1914.

TRADE MARKS (TEMPORARY) RULES, 1914.

Dated 21st August, 1914.

Statutory Rules and Orders, 1914. *No.* 1256.

By virtue of the provisions of the Patents, Designs, an Trade Marks (Temporary Rules) Act, 1914, the Board c Trade hereby make the following Rules :—

1. The Board of Trade may, on the application of an person, and subject to such terms and conditions, if an as they may think fit, order the avoidance or suspensio in whole or in part, of the registration of any Trade Mar the proprietor whereof is a subject of any State at war wit His Majesty, and the Board before granting any suc application, may require to be satisfied on the followi heads :—

(*a*) That the proprietor is the subject of a State at w with His Majesty ;

(*b*) That the person applying intends to manufacture, cause to be manufactured, the goods or any of the in respect of which the Trade Mark is registered ;

(*c*) That it is in the general interests of the country of a section of the community, or of a trade, that t registration of the Trade Mark should be so avoid or suspended.

The fee to be paid on any such application shall be th specified in the First Schedule to these Rules.

An application under this section must be made on Fo T.M. No. 36 contained in the Second Schedule to th Rules, and shall be filed at the Patent Office.

The Board of Trade may at any time, in their absol discretion, revoke any avoidance or suspension of a registration of a Trade Mark ordered by them.

For the purpose of exercising in any case the powers i avoiding or suspending the registration of a Trade Mark Board of Trade may appoint such person or persons as th shall think fit to hold an inquiry.

Any application to the Board for the avoidance r suspension of any registration of a Trade Mark may e referred for hearing and inquiry to such person or pers s who shall report thereon to the Board.

Provided always that the Board of Trade may at time, if in their absolute discretion they deem it exped t in the public interest, order the avoidance or suspen n in whole or in part of any such registration of a Tr Mark upon such terms and conditions, if any, as they y think fit.

2. The term "person" used in these Rules shall r addition to the meaning given thereto by Section 1 of the Interpretation Act, 1889, include any Governm nt Department.

3. All things required or authorised to be done by t before the Board of Trado may be done by to or befor n President or a Secretary or an Assistant Secretary of h Board, or any person authorised in that behalf by h President of the Board.

All documents purporting to be Orders made by the Board of Trade and to be sealed with the seal of the Board or to be signed by a Secretary or an Assistant Secretary of the Board or by any person authorised in that behalf by the President of the Board shall be received in evidence and shall be deemed to be such orders without further proof unless the contrary is shown.

A certificate signed by the President of the Board of Trade that any order made or act done is the order or act of the Board shall be conclusive evidence of the fact so certified.

4. These Rules shall be called the Trade Marks (Temporary) Rules, 1914, and shall come into operation as and from the Seventh day of August, 1914.

First Schedule.

	£	s.	d.
Fee payable on application under Rule 1 to Board of Trade to avoid or suspend the registration of a Trade Mark	2	0	0

Dated the 21st day of August, 1914.

Second Schedule

TRADE
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Form T.M. No. 36.

PATENTS, DESIGNS AND TRADE MARKS (TEMPORARY RULES) ACT, 1914.

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hereby request the Board of Trade to order the avoidance or suspension of the registration of Trade Mark No. (b) __________ registered in Class ________ for ______________________.

Dated this ________ day of ________________

(Signed) ____________________

Dated the 21st day of August, 1914.

London Section.

REDUCTION OF CHLORATES TO CHLORIDES BY HYDRAZINE SALTS WITH THE AID OF A CATALYTIC SUBSTANCE.

BY W. R. HODGKINSON.

Solutions of alkali, or other chlorates (bromates or odates) and hydrazine salts (nitrate, chloride, sulphate, xalate) may be mixed together in any proportion and oiled without sign of any reaction. No chloride is detectable in the chlorate solution even after 10 hours' oiling. But if a piece of tarnished copper wire or a ragment of CuO be introduced into a cold solution of otassium chlorate and hydrazine nitrate an action mmences at the surface of the solid, nitrogen being volved. If the solution be warmed the action may me violent. When visible action—effervescence—eases either all the chlorate or all the hydrazine salt is nd to have been decomposed.

Quantitative experiments, using equimolecular solutions, how perfect reduction of $KClO_3$ and that the reaction is:

$$2KClO_3+3N_2H_4HNO_3=6H_2O+3N_2+3HNO_3+2KCl.$$

The amount of copper dissolved is very small. Various opper salts produce a like result.

The action may be employed as a method of analysis of hlorates for chlorine (similarly with iodates or bromates), he slight excess of hydrazine salt necessary being afterwards destroyed by permanganate acidified with nitric acid.

Hydrazine sulphate and oxalate do not act nearly so apidly or so well with copper and its salts, probably wing to the formation of relatively insoluble double opper-hydrazine salts.

The action of hydrazine sulphate on alkali chlorate in presence of metallic iron—clean or rusty—or an iron salt, quickly becomes violent, especially with slightly rusty iron. With hydrazine nitrate and oxalate the action of iron is very slow even with warm solutions.

The catalytic action of copper and iron appears to be due to the easy change with these metals from an "ic" to "ous" state. Metals not forming two classes of oxides or salts are found to be inert.

Bichromates, arsenates, persulphates, and osmates are reduced by hydrazine salts, but not to a stage where action on a chlorate is possible. Molybdates and vanadates are particularly active in transferring oxygen from a chlorate to a hydrazine salt.

The changes of colour of the solutions during the action serve as an indication of the completion of oxidation or reduction.

Tungstates and tantalates are not active, although tungstic acid is partly reduced by heating with a hydrazine salt.

The molybdate action is quantitatively perfect, excess of the hydrazine salt being indicated by the blue molybdenum sub-oxide colour. The action in these cases (Mo. V.) depends on the reducibility of these elements to oxides of the types MO or MO_2 which re-oxidise to MO_3 on contact with chlorates, etc. Molybdic acid is reduced by any hydrazine compound to the blue sub-oxide.

A 20 vol. solution of hydrogen peroxide is apparently unaffected by hydrazine nitrate. Copper and iron immediately on contact set up an action whilst alkali molybdate and vanadate are without visible effect.

Perchlorates in solution have so far resisted reduction under any of these circumstances: NH_4ClO_4 and $N_2H_4HNO_3$ may be melted together without decomposition.

Manchester Section.

NOTES ON THE COMPOSITION OF SUNDRY RESIDUAL PRODUCTS FROM SEWAGE.

BY GILBERT J. FOWLER, D.SC., F.I.C., AND JOSEPH CLIFFORD, A.R.C.S. (DUBLIN).

The analyses discussed in the following pages have accumulated over a period of several years, and although there are still sundry lacunæ in the available data, it appears desirable to publish the results so far obtained, as a guide, at any rate, to future work. The aim of the investigation has been to discover whether, by careful analysis of the residual products obtained at various stages of the sewage purification process, any light could be thrown on the nature of the fermentative changes taking place in the solid suspended or colloidal matter of sewage, as distinct from the processes occurring in solution. For this purpose sludges have been examined from various methods of tank treatment at different places and under different conditions, and also so called "slurry" from contact beds at different depths and after differing periods of exposure to air.

For the sake of comparison a number of tables are given from the Reports of the Massachusetts State Board of Health, as summarised in a review of 21 years work given in the Report for 1908.

The samples were in all cases, unless specially stated, washed through a fine meshed sieve (¼ mm.), dried at 100° C., and finely ground before analysis. The carbon and hydrogen determinations were all made by direct combustion with copper oxide, and the nitrogen was determined in some cases by combustion, in others by the Kjeldahl method. In most cases the figures are the mean of two well agreeing analyses. All ratios and percentages of carbon, hydrogen, and nitrogen are calculated on the volatile matter as determined by loss on ignition. In a few cases determination of ether extract and oxygen absorption from permanganate (mgm. per gram) have been made.

The results may be classified under the following heads:—

1. Products obtained under *anaerobic* conditions, *i.e.*, from sedimentation and septic tanks.

2. Products obtained under *aerobic* conditions, viz., from slate-beds and primary and secondary contact beds.

3. Products obtained by "weathering" sundry of the above.

1. *Anaerobic conditions.*

Tables IA, IB and IC, give the analysis of material taken from the inlet and outlet of various septic tanks.

Tables IA and IB show that the finer particles of organic matter are deposited at the outlet end of a septic tank, as evidenced by the higher proportion of organic matter. They also indicate that the digestion of organic matter has proceeded further at the outlet than at the inlet, as is shown by the carbon to hydrogen, and carbon to nitrogen ratios respectively.

In the case of Table IC, containing results from the Hampton Hydrolytic Tank, it is seen that decomposition of the sludge has proceeded further than in the cases of Tables IA and IB, probably owing to more equable conditions.

Table II gives the composition of deposits from various experimental tanks in Calcutta, through which the sewage was allowed to pass 1, 1½, 2 and 3 days, respectively.

From these figures it would appear that the sludge from the hydrolysing chamber of the Hampton Tank has also been fairly completely digested. Inasmuch as the Calcutta sludge was practically free from grease, it may be inferred that the loss of carbon is mainly due in these cases, and in the case of the hydrolytic tank, to cellulose fermentation. This agrees with Dr. Travis's early observations.

TABLE IA.

Little Hulton Septic Tank.

Where taken.	% Organic matter.	% C. Sample dried 100° C.	% H. Sample dried 100° C.	% N. Sample dried 100° C.	% C. Organic matter.	% H. Organic matter.	% N. Organic matter.	Ratio C : H	Ratio C : N	No. of sample.
Inlet	34·4	21·50	2·05	1·38	62·5	5·95	4·01	10 : 1	15·5 : 1	1
Outlet	45·6	25·58	3·07	2·53	56·1	6·73	5·54	8 : 1	10 : 1	2

TABLE IB.

Shotley Septic Tank

Inlet	61·0	36·23	5·73	3·12	59·4	9·0	5·11	6·5 : 1	12 : 1	3
Outlet	85·0	44·46	6·85	4·10	52·3	8·0	5·0	6·5 : 1	10 : 1	4

TABLE IC.

Hampton Hydrolytic Tank. (Sampled July 23, 1907.)

Sludge chamber	64·7	34·16	5·17	2·64	52·79	8·00	4·08	6·5 : 1	13 : 1	
Hydrolysing chamber	56·6	20·16	3·93	3·64	35·61	6·94	6·41	5 : 1	6 : 1	

TABLE II.

Calcutta Model Septic Tanks.

Where taken.	% Organic matter.	% C. Sample dried 100° C.	% H. Sample dried 100° C.	% N. Sample dried 100° C.	% C. Organic matter	% H. Organic matter.	% N. Organic matter.	Ratio C : H	Rat C :
T1, 3 days	84·8	38·5	6·88	5·51	45·42	8·11	6·49	5·5 : 1	7·
T3, 2 days	80·9	40·7	6·46	5·83	50·29	7·98	7·20	6·2 : 1	7·
T2, 1½ days	82·1	43·55	7·00	5·63	52·91	8·50	6·85	6 : 1	7·5
T4, 1 day	84·99	46·2	7·8	5·96	54·59	9·17	7.01	6 : 1	8 :

TABLES III AND IV.

Comparison of Settled and Septic Sludge, Manchester.

TABLE III.

Settled Sludge. All samples taken at exit.

Where taken. Date.	% Organic matter.	% C. Sample dried at 100° C.	% H. Sample dried at 100° C.	% N. Sample dried at 100° C.	% C. Organic matter.	% H. Organic matter.	% N. Organic matter.	Ratio C : H	Ratio C : N	No sa
21/11/05. No. 7 Tank	47·45	27·83	3·37	2·55	58·65	7·10	5·37	8 : 1	11 : 1	
22/12/05. No. 6 Tank	56·35	33·93	4·61	3·40	60·22	8·20	6·03	7·5 : 1	10 : 1	1
No. 5 Tank	54·97	31·78	4·45	3·40	54·10	8·10	6·19	6·7 : 1	9 · 1	1
3/1/06. No. 7 Tank	59·18	34·68	4·26	3·94	58·60	7·20	6·66	8·3 : 1	9 · 1	1
Average	51·5	32·05	4·17	3·32	57·89	7·65	6·06	7·6 : 1	9·5 : 1	

TABLE IV.

Septic Sludge.

Where taken. Date.	% Organic matter.	% C. Sample dried at 100° C.	% H. Sample dried at 100 C.	% N. Sample dried at 100° C.	% C. Organic matter.	% H. Organic matter.	% N. Organic matter.	Ratio C : H	Ratio C : N	No. of sample.
ank 9	46·26	26·7	3·59	2·45	57·72	7·76	5·30	7·5 : 1	11 : 1	13
0 2 06. Tank 1	46·77	25·42	3·80	2·57	54·35	8·12	5·50	7 : 1	10 : 1	14
1 06. Tank 4	48·46	23·42	3·22	2·65	48·33	6·64	5·47	7 . 5:1	9 : 1	15
4 12 05. Tank 11	47·10	25·32	3·55	2·20	53·76	7·54	4·06	7 : 1	13 : 1	16
11 05. Tank 12	43·27	25·46	3·41	1·87	58·84	7·88	4·32	7 : 1	14 : 1	17
8 06. Tank 4	55·1	23·23	3·18	2·52	42·16	5·77	4·57	7 : 1	10 : 1	18
7 4 06. Tank 12	45·4	26·22	3·26	2·11	57·75	7·18	4·64	8 : 1	12 : 1	19
verage	47·48	25·11	3·43	2·34	53·42	7·41	4·84	7·29 : 1	11 : 1	

Tables III. and IV. show interesting comparative nalyses of sludge from sedimentation and septic tanks at e Davyhulme Works of the Manchester Corporation. he carbon to hydrogen and carbon to nitrogen ratios ring out clearly that under the conditions which prevailed uring the time the tanks were under observation, the ptic tanks were doing little or no work in the digestion organic matter, but were acting as sedimentation tanks.

Aerobic Conditions.—It is interesting to compare with the foregoing results the analyses of products obtained by sedimentation under aerobic conditions. Such a product, *e.g.*, is the deposit accumulating in the Dibdin slate bed, and in Table V. are given sundry analyses of the sludge from the Devizes slate beds, in the conditions occurring on the slate, and after a period of "weathering" out of contact with sewage.

TABLE V.

Aerobic conditions, Devizes, July 8th, 1905.

Where taken.	% Organic matter.	% C. Sample dried at 100° C.	% H. Sample dried at 100° C.	% N. Sample dried at 100° C.	% C. Organic matter.	% H. Organic matter.	% N. Organic matter.	Ratio C : H	Ratio C : N	No. of sample.
nweathered, 1 mm.	56·5	29·21	4·08	3·80	51·7	7·2	6·7	7 : 1	7·7 : 1	5
eathered. 1 mm.	45·0	17·0	2·50	1·99	37·7	5·5	4·4	7 : 1	8·5 : 1	7
nweathered ½ mm.	57·0	30·07	4·24	3·31	52·7	7·4	5·8	7 : 1	9 : 1	6
eathered. ½ mm.	40·1	24·07	2·44	1·83	60·2	6·1	4·5	10 : 1	13 : 1	8

An examination of samples 3 and 4 representing sludge om the inlet and outlet ends respectively of the Septic nk at Shotley by ether extraction and oxidation by acid rmanganate gives the following results, calculated on e loss on ignition :—

	Ether extract.	Oxygen absorption.
	%	mgrms. per grm.
mple 3	9·0	11·5
mple 4	21·9	14·8

This leads to the rather surprising conclusion that com- to destruction of fat does not take place under anaerobic nditions, though hydrolysis and some breaking down to er fatty acids doubtless does occur. The common perience of the extremely offensive character of old posits of sewage grease buried out of contact with air nfirm this conclusion.

The following tables from page 492 of the Massachusetts port above referred to shows that an appreciable per- ntage of fat is still present in the samples analysed :—

Percentage composition of dry septic tank sludge.

nk.	Date.	Mineral matter	Total organic.	Organic N.	Fats.	Carbon.	Hydrogen.
	Mar., 1906	54·6	45·4	2·7	11·9	25·1	3·0
	Dec., 1901	45·6	54·4	2·6	—	—	—
	Oct., 1903	70·9	29·1	1·1	8·8	—	—
	Nov. 1907	60·1	39·9	2·1	—	—	—
	Dec., 1906	50·7	49·3	2·9	11·8	29·8	4·0
	Dec., 1906	51·0	49·0	2·8	10·8	27·7	3·8

The results in Table V. show that the organic content and ratios of C to H and C to N in the corresponding columns in Tables I., II., IV. and V. are of the same order, and taken in conjunction with the analyses in Table III., point to the conclusion that sludges obtained under aerobic and anaerobic conditions, after incipient decomposition, are similar in empirical chemical composition, though they may differ widely in their physical and biological characters. The "weathered" portions of the samples, bring out the further chemical change under aerobic conditions.

The higher carbon to nitrogen ratios indicate the nitrification of a portion of the nitrogen by bacterial agency, and the subsequent removal of the nitrate, so leaving a residue richer in carbon.

Examination of samples 5 and 7 by ether extraction and oxygen absorption shows disappearance of fatty matter on "weathering," and a simultaneous reduction in oxygen absorption.

	Ether Extract. %	Oxygen Absorption. Mgms. per grm.
Sample No. 5	19·4	15·5
Sample No. 7	13·9	9·6

Analyses of various "slurries" from primary and secondary contact beds, following (except for Nos. 30 and 33) open septic tanks, are given in Table VI.

A study of these figures shows that the ratio of carbon to nitrogen is highest where oxidation is most active, *i.e.*, that the nitrogen is eliminated as nitrate faster than the cellulose, etc., is destroyed under aerobic conditions.

Analyses of slurries from secondary contact beds bring out certain interesting results. It will be noted that

TABLE VI.

Samples from various filter beds, collected under different conditions.

Where taken.	% Organic matter.	% C. Sample dried at 100° C.	% H. Sample dried at 100° C.	% N. Sample dried at 100° C.	% C. Organic matter.	% H. Organic matter.	% N. Organic matter.	Ratio C : H	Ratio C : N	No. of sample.
Davyhulme.										
Slurry from No. 30 Bed, waterlogged portion, 20/10 05	43·86	24·02	2·37	2·27	54·5	5·4	5·2	10 : 1	10 : 1	23
Slurry from No. 30 Bed, good portion, 22 11 05	44·7	20·54	3·03	2·50	55·0	7·0	5·6	8 : 1	10 : 1	24
Slurry from No. 2 Bed, depth 6″ (after 4 months test) 4/1 06	42·87	20·06	2·33	1·58	46·8	5·43	3·7	8·5 : 1	12 : 1	25
Slurry from No. 1a Bed (near septic tank) after 5 years work	38·11	19·7	2·13	1·60	52·1	5·6	4·2	9 : 1	12 : 1	26
Primary Bed Slurries.										
1st Catchpit of Washing Plant	38·0	18·47	2·17	1·67	47·72	5·60	4·31	8·5 : 1	10 : 1	31
2nd Catchpit of Washing Plant	43·6	21·85	2·44	2·15	50·11	5·57	4·9	10·1	10 : 1	32
Secondary beds.										
Surface near Inlet, 23/11/05	50·74	27·44	3·75	3·49	42·49	6·05	6·87	7 : 1	6·2 : 1	34
Ditto 4″ deep, 30/5/06	32·04	9·57	1·64	1·38	29·87	5·12	4·31	6 : 1	7 : 1	35
Ditto 3″—6″ deep........	42·2	25·21	2·00	1·86	59·71	4·75	4·40	12 : 1	15 : 1	37
Ditto 6″—9″ deep	41·2	18·4	2·10	—	44·66	5·09	—	9 : 1	—	38
Slurry washed from surface, after standing about a week in a heap	46·6	22·93	3·18	2·65	49·20	6·82	5·68	7 : 1	9 : 1	36
Withington										
No. 1 Bed	32·7	18·5	2·10	1·88	56·57	6·42	5·51	9 : 1	10 : 1	30
No. 6 Bed	21·4	14·27	0·8	0·54	66·66	3·74	2·54	17·5	26 : 1	33

TABLE VII.

Weathering experiments.

Description of Sample and Experiment.	% Organic matter.	% C. Sample dried 100° C.	% H. Sample dried 100° C.	% N. Sample dried 100° C.	% C. Organic matter.	% H. Organic matter.	% N. Organic matter.	Ratio C : H	Ratio C : N	No. of sample.
Sludge from primary effluent carrier	48·9	22·83	3·78	3·83	44·64	7·73	7·83	6 : 1	6·1	21
Ditto after several weeks weathering	49·9	19·07	3·82	2·05	38·21	7·65	4·10	5 : 1	9·1	22
Slurry from No. 1 Bed, near carrier, 4 1/06	35·89	18·60	2·20	2·13	57·8	6·13	6·0	8·6 : 1	8·6 : 1	27
After 15 days weathering ..	36·27	19·53	2·07	1·92	53·84	5·71	5·3	10·1	10 : 1	28
After 28 days weathering ..	31·91	17·91	1·77	·95	56·12	5·54	2·97	10·1	19 : 1	29
Septic sludge, No. 11 Tank	47·10	25·32	3·55	2·20	53·76	7·53	4·06	7 : 1	13 : 1	16
Septic sludge after oxidation in experimental filter ..	49·1	22·31	3·22	2·49	45·43	6·56	5·07	7 : 1	9 : 1*	40
Ditto, No. 1 Tank........	46·77	25·42	3·80	2·57	54·35	8·12	5·50	6·8 : 1	10 : 1	14
Ditto, 2 months oxidation	47·6	23·12	3·48	2·17	48·57	7·31	4·56	6·8 : 1	10 : 1	41

* The lower C : N ratio may in this case be due to elimination of fat on oxidation.

samples from the surface show C : H and C : N ratios lower than those characteristic of primary bed slurry. This would seem to be due to the great amount of bacterial and other life present in the upper portion of the secondary bed. Lower down in the bed or after weathering the carbon increases in proportion to the hydrogen and nitrogen owing to processes of oxidation.

The same result is shown in the analyses of various samples before and after weathering, given in Table VII.

The disappearance of oxidisable matter is further shown by the following results of special examination of a slu before and after 15 days weathering :—

No.	Ether extract (% organic matter)	Oxygen absorption fr permanganate in gru per grm.
27	6·3	69·4
28	7·4	49·7

The following tables quoted from page 331 of the ab mentioned Massachusetts Report indicates the disappe-ance of fat from the deposits from sewage filters :—

Table showing relation between fats and organic matter in sewage sludge, sediment from contact and trickling filters, and sands from experimental sewage filters at Lawrence.

Sample of	Per cent. of Carbon.	Per cent. of Hydrogen.	Per cent. of Fats.	Loss on ignition.	% which fats are of loss on ignition.	% which fats are of carbon.	% carbon in fats.	% carb in fa is of t carb
Andover sludge	27·00	4·0	19·70	49·60	39·3	73·0	12·2	45·
Regular Lawrence Sewage Sludge	38·90	5·3	22·20	69·50	32·2	57·1	13·8	35·5
Sediment from Filter 136T	13·70	2·3	0·12	32·90	0·36	0·88	0·07	0·5
Sediment from Filter 137C	18·60	2·9	0·41	38·70	1·06	2·21	0·25	1·3
Sediment from Filter 135-6T	22·20	3·3	2·37	43·80	5·40	10·70	1·51	6·
Sediment from Filter 221C	16·60	2·7	3·36	34·90	9·62	20·20	2·10	12·6
Sand of Filter No. 1, Average	0·256		0·017	0·534	3·07	6·64		
Sand of Filter No. 6, Average	0·428		0·024	0·838	2·86	5·61		
Sand of Filter No. 9A, Average	0·300		0·017	0·604	2·81	5·67		
Fats in Sewage Sludge	62·0	11·7						

In the following table, from page 376 of the same Report, wo lines have been added giving the percentages of itrogen on the loss of ignition. It is then seen that there s little difference in ratio, confirming the fact stated on age 817 of the present paper, that the empirical chemical omposition of the organic portion of sludges from various ources differs but little.

It is only when these are completely fermented under naerobic conditions or allowed thoroughly to oxidise, are "weathered" so to speak, that a marked change in the hemical ratios becomes apparent. In the first case then hange is mainly due to cellulose fermentation, in the econd case it is the nitrogen which disappears most apidly, though fat destruction takes place. These facts re important from the point of view of agriculture.

nalyses of Sediments from Sewage and Effluents of Filters Nos. 135 *and* 136.

	Sewage sediment.	Sediment of filter.	
		No. 135	No. 136
er cent. of total Nitrogen (Kjeldahl)	2·37	1·37	1·41
er cent. of N detd as Alb. NH_3 ..	1·30	0·70	0·78
er cent. that Albd. NH_3 is of total N (Kjeldahl)	55·00	51·00	55·30
lbuminoid NH_3 (pts. per 100,000)	1575·00	851·00	952·00
oss on ignition (per cent.)	58·50	27·60	31·50
otal Nitrogen (per cent. of loss on ignition)	4·0	4·9	4·4
lbuminoid Nitrogen (per cent. of loss on ignition)	2·2	2·5	2·4

The following general conclusions from the above data pear therefore to be justified :—

1. That there is no great difference in empirical chemical mposition between sludges obtained by ordinary dimentation, incipient septic action, and aerobic sedientation as in slate beds.

2. That under conditions of vigorous anaerobic fermentaon the main change is a destruction of cellulose matter ith a corresponding decrease in the amount of carbon esent compared to the nitrogen and hydrogen.

3. That for the final elimination of fat and of nitrogen, nditions of active oxidation are necessary.

4. Future research may more profitably be directed to e physical and biological differences between sludges of rious origin and the action of special solvents and agents upon them, rather than to their empirical chemical mposition.

The authors' thanks are due to Mr. E. M. Mumford, Sc., and to Mr. J. M. Drummond, M.Sc., for assistance completing the above analyses.

Communication.

ALCOHOL ESTIMATION IN THE TROPICS.

BY E. C. BROWNING, M.A., AND C. T. SYMONS, B.A.

For the last nine years one of the authors has noticed at the usual hydrometer method (*i.e.*, by brass Sikes's drometer) of ascertaining the strength of aqueous oholic solutions at high temperatures (80°—90° F.) gave ults not in agreement with those obtained by pyknoeter readings at 60° F. and Hehner's tables (Analyst., lume 5, 1880, pp. 42—63).

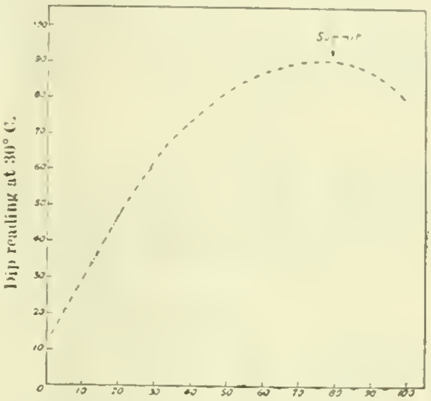
Sir Charles Bedford found that in India, Sikes's tables ve incorrect spirit strengths, especially at high air mperatures and with weak spirits. He has published set of tables for use with Sikes's glass hydrometers, which have been adopted in India. (Corrected Sikes's tables published by the Superintendent, Government Printing, Calcutta, 1910.)

The authors, for the past two years, have been engaged in comparing the readings of glass and brass hydrometers using alcohols whose strength was determined by pyknometer readings at 60° F. and Hehner's tables.

They have also included a set of readings on alcohols whose strength was determined by pyknometer readings at 35° C.* using the standard tables published in 1913 by the United States Bureau of Standards.

At the same time the refractive indices of these alcohols were determined at 30° C. (using the Zeiss immersion refractometer).

This is a very convenient method of rapidly estimating alcohol strengths from 0—35% by weight of alcohol: above this strength the accuracy is not satisfactory, as will be seen from the curve annexed.



% alcohol by wt. (U.S. tables).

Methods.

Various forms of pyknometer were tried, Sprengel's, Perkin's, Bousfield's (Chem. Soc. Trans., 1908, 679—681) using inside and outside cap stoppers, Warren's pattern (100 c.c. capacity with perforated stopper and ground on external cap), and Wade and Merriman's (Chem. Soc. Trans., 1912, 2429—2443). Wade and Merriman's form was found to be by far the most satisfactory. The pyknometers were made either of "R" or quartz glass. The thermostat used for 60° F. consisted of a teak tank holding about 62 litres. It was efficiently lagged and strongly stirred by a series of paddles mounted on a shaft running along the lower portion. A small electric motor with a worm reduction gear supplied the power. Two pieces of plate glass were inserted on the upper portion of two opposite sides so that observations could be made on the level of liquid in the pyknometers while they were immersed in the water. The tank was cooled by circulating ice water through copper coils, the flow of water being controlled by an electrically worked relay.

Temperatures were taken on thermometers recently standardised at the National Physical Laboratory and the Reichsanstalt, a large Beckmann thermometer being used to show variations in temperature. It was not found possible to keep the temperature constant to more than 1/100° C. The thermostat for measurements at 35° C. consisted of a copper tank holding about 89 litres of water. It was mounted in a table and stirred by paddles on a horizontal shaft, driven by a brass chain from a small electric motor with worm reduction gear.

At the top of the two opposite sides, plate glass windows were inserted, like those on the low temperature thermostat. The heating was done by a gas jet controlled by a Lowry spiral regulator.

---

* The temperature of 35° C. was adopted, as the laboratory temperature in the tropics frequently exceeds 30° C., and experiments showed that at 35° C. a very constant temperature could be maintained.

A very sensitive gas pressure regulator controlled the gas supply, and, as the room in which the thermostat was placed had a very steady temperature, it was found possible to keep the thermostat temperature steady within ± 1/1000° C. Wade and Merriman (Chem. Soc. Trans., 1912, 2432) have pointed out that it is necessary to keep the temperature constant within 1/1000° C. to give results accurate to one in the 6th place of decimals and within 1/100° C. to the 5th decimal place, cf. also "Density and thermal expansion of ethyl alcohol and of its mixtures with water," by Osborne, McKelvy, and Bearce (Bull. Bureau of Standards, **9**, **415**).

The hydrometers used were restandardised at the National Physical Laboratory at the conclusion of the series of measurements and the corrections (where necessary) are included in the tables.* All weights used were standardised at the National Physical Laboratory.

The following table gives results obtained with aqueous alcoholic solutions, the strength of which were determined at 60° F. in 100 c.c. pyknometers using Hehner's tables for the calculations.

The hydrometer readings were taken at temperatures about 84°—88° F. (the usual laboratory temperature in the Tropics).

TABLE A.

Strength by pyknometer at 60° F. in % by weight alcohol.	Strength by pyknometer at 60° F. in % Proof Spirit.	Glass Hydrometer * Usual Tables. % Proof Spirit.	Glass Hydrometer Bedford's Tables. % Proof Spirit.	Brass Hydrometer * Usual Tables. % Proof Spirit.	Brass Hydrometer Bedford's Tables. % Proof Spirit.
1·06	2·34	3·4	3·9	1·8	2·1
1·96	4·29	5·0	5·6	3·3	3·7
2·97	6·52	6·95	7·6	4·95	5·5
3·95	8·65	8·75	9·5	7·3	7·9
4·87	10·67	10·75	11·65	8·0	8·7
5·55	12·14	12·3	13·3	10·5	11·45
5·84	12·77	12·9	13·75	11·25	12·15
6·90	15·07	15·1	15·9	12·6	13·5
11·38	24·69	24·5	25·3	21·6	22·55
12·16	26·35	26·4	27·2	24·95	25·7
19·17	41·15	40·6	41·8	39·05	40·15
19·67	42·20	41·37	42·9	40·52	41·77
23·54	50·25	48·05	50·35	46·92	49·05
29·53	62·49	61·1	62·85	59·7	61·45
35·15	73·62	72·6	74·1	73·3	74·80
38·67	80·43	79·00	80·2	78·5	79·65
39·17	81·40	80·1	81·4	79·4	80·6
51·00	103·12	102·7	103·05	102·38	102·63
59·86	118·39	118·1	118·8	117·5	118·1
62·95	123·52	123·15	123·5	122·9	123·25
68·58	132·56	132·15	132·5	131·8	132·15
80·92	151·15	150·6	151·1	150·4	150·9
88·96	162·12	161·8	162·7	161·5	162·3

* *i.e.* Tables supplied with the instruments (*e.g.*, Oertling's). These are identical with those supplied by Dring and Fage for use with Sikes' brass hydrometer.

It will be seen that the brass hydrometer with the usual tables (those supplied by the makers of the instrument) gives quite inaccurate results, especially at low strengths and that at no strength are they even approximately satisfactory.

It will also be seen that Bedford's tables used with glass hydrometers give the more satisfactory readings, except at low strengths.

The following table gives results obtained with aqueous alcoholic solutions, the strengths of which were ascertained by pyknometer readings at 35° C. using the United States tables. The hydrometer readings were taken at temperatures from 84°—88° F.

The table requires little comment; the brass hydrometer with the ordinary tables is almost useless, but with Bedford's tables gives very fair results indeed.

There seems no doubt that the new United States tables are among the most accurate that have been published and the authors consider that it would be advisable to base all alcoholic work on these.

The authors also consider that, in view of the confusion caused by the use of the term "proof spirit" it is time that this was dropped, and alcohol strengths given in % of alcohol by weight or by volume.

TABLE B.

Alcohol % by weight U.S. Tables.	% Proof Spirit calc. from sp. gr.	Glass Hydrometer Usual Tables. % Proof Spirit.	Glass Hydrometer Bedford's Tables. % Proof Spirit.	Brass Hydrometer Usual Tables. % Proof Spirit.	Brass Hydrometer Bedford's Tables. % Proof Spirit.
1·02	2·25	3·4	3·9	2·15	2·4
1·81	3·99	4·9	5·5	2·85	3·25
2·82	6·20	7·20	8·0	4·70	5·25
3·78	8·30	8·95	9·85	6·95	7·6
4·71	10·30	10·55	11·4	8·65	9·4
5·67	12·39	12·55	13·55	11·75	12·6
6·65	14·52	15·1	15·9	13·4	14·2
8·92	19·40	20·4	21·15	17·9	18·65
11·02	23·90	24·8	25·55	22·7	23·3
11·86	25·69	26·3	27·05	24·3	25·0
13·73	29·68	30·45	31·2	28·6	29·3
14·84	32·03	32·45	33·5	30·5	31·3
16·79	36·16	36·17	37·3	34·45	35·65
18·92	40·64	40·65	42·0	38·4	39·7
19·38	41·60	41·37	42·9	39·7	41·2
22·03	47·13	45·6	48·35	44·1	46·7
25·09	53·46	52·2	54·9	50·1	53·2
29·15	61·73	60·95	62·95	58·8	61·1
32·67	68·75	67·7	69·6	66·5	68·4
34·95	73·24	72·7	74·1	71·4	72·9
38·80	80·68	79·95	81·15	79·3	80·6
39·08	81·22	80·77	82·0	79·8	81·1
43·08	88·76	88·2	89·3	87·4	88·55
50·86	102·87	102·8	103·2	101·7	102·4
51·18	103·43	103·2	103·6	102·5	103·1
59·75	118·22	118·1	118·6	117·6	118·2
62·84	123·33	123·4	123·85	122·85	123·05
65·28	127·30	127·0	127·5	126·85	127·3
68·45	132·34	132·1	132·45	131·8	132·2
71·832	137·59	137·6	137·8	137·0	137·1
75·885	143·81	143·65	144·3	143·3	143·8
79·25	148·75	148·75	149·2	148·2	148·7
80·60	150·70	150·8	151·4	150·2	150·8
88·74	161·83	Off scale at 83° F.	—	—	—

Hydrometers should be graduated to give % of alcoh by weight or % of alcohol by volume and not % of pro spirit, and for tropical use should be standardised at sa 30° C. and not 51° F.

The following table gives the refractive index of aqueo alcoholic solutions at 30° C. the strength of the alcoh being ascertained from the United States tables.

TABLE C.

Refractive Indices by Zeiss Immersion Refractometer 30° C. Strength of alcohols determined by United St tables (at 35° C.).

Alcohol, % by weight, (United States Tables).	Dip reading at 30° C.	Alcohol. % by weight (United States Tables).	Dip readin at 30° C.
0·	11·8	32·67	65·45
1·02	13·4	34·95	68·30
1·81	14·8	38·37	71·82
2·82	16·4	38·80	72·15
3·78	17·95	39·08	72·5
4·71	19·4	43·08	76·1
5·42	20·5	50·86	81·9
5·67	21·1	51·18	82·2
6·65	22·8	59·75	86·5
8·92	26·5	62·84	87·45
11·02	30·4	65·28	88·05
11·86	31·9	68·45	89·0
13·73	35·3	71·83	89·55
14·84	37·3	75·89	90·0
16·79	40·87	79·25	90·1
18·92	44·4	80·60	90·0
19·38	45·4	88·74	87·9
22·03	50·0	89·28	87·65
25·09	54·85	99·46	80·0
29·15	60·8		

From this table it will be seen that the refractive in x reaches a maximum at about 79·25% by weight of alc ol (cf. Holmes, Chem. Soc. Trans., 1913, 2165). A c e constructed from these figures with refractometer read gs as ordinates and % of alcohol by weight as absc e shows certain irregularities, one being marked at a 5% by weight of alcohol. The measurements have repeatedly and independently checked without producing any change in the curve and it is proposed to investigate these slight irregularities.

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* The standardisation was done by comparing the hydrometers against the standards at the N. P. L. at 51° F.

The following table is constructed from Table C :—

Table D.

% by weight, Alcohol (U.S.A. Tables).	Dip reading at 30° C.	% by weight Alcohol.	Dip reading at 30° C.
1	13·4	27	57·7
2	15·1	28	59·1
3	16·7	29	60 6
4	18·3	30	61·9
5	19·9	31	63·2
6	21·7	32	64·6
7	23·4	33	65·9
8	25·0	34	67·1
9	26·6	35	68·4
10	28·5	36	69·4
11	30·4	37	70·4
12	32·1	38	71·4
13	34·0	39	72·4
14	35·8	40	73·3
15	37·6	41	74·2
16	39 4	42	75·1
17	41·2	43	76·0
18	42·9	44	76·8
19	44·6	45	77·5
20	46·5	46	78·3
21	48·0	47	79·0
22	50·0	48	79·8
23	51·5	49	80·5
24	53·1	50	81·3
25	54·7	51	82·0
26	56·2		

In conclusion the authors propose to continue the investigations of the refractive index of aqueous alcoholic solutions at varying temperatures, as several points of interest have arisen in the present work which appear to merit close study.

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Colombo, Ceylon.

Note.—It is worth noting that the glass hydrometers alter as they age, in a somewhat large and irregular manner. For example: A 5-stem set standardised at the N.P.L. against their standards at 60° F. had in 1911 the following corrections :—

Hydrometer No.	0	10	20	30	40	50	60	70	80	90	100
11728	0·0	0·0	0·0								
11729			0·0	0·0	0·0						
11730					−0·1	−0·1	−0·1				
11731							−0·1	0·0	−0·1		
11732									−0·2	−0·2	0·0
In 1914 the same set at 60° F. gave											
11728	−0·3	−0·2	−0·2								
11729			−0·2	−0·3	−0·3						
11730					−0·2	−0·2	−0·2				
11731							−0·1	−0·1	−0·2		
11732									−0·3	−0·4	−0·1

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
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French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, German.

I.—GENERAL PLANT; MACHINERY.

Patents.

Furnaces. W. Cross, London. From La Soc. des Perfectionnements à la Vaporisation, Paris. Eng. Pat. 14,432, June 21, 1913.

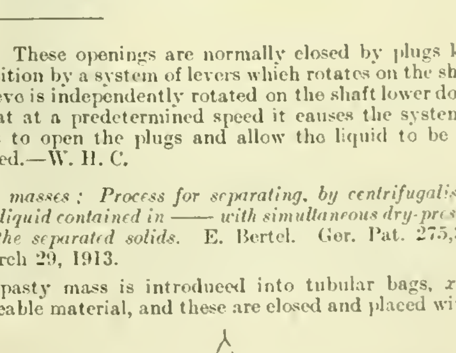
Three inclined reciprocating grates are arranged with the two uppermost inclined from front to rear step fashion, and the third inclined in the opposite direction below the second. The fuel is fed on to the top of the upper grate from a rotating drum hopper and the ashes are similarly discharged from the bottom of the lowest grate. All the grates have closed ash-pits into which air is delivered under pressure; the front of the furnace is also closed.—W. H. C.

Separating machines; Centrifugal ——. B. Hoffman. Topeka, Kans. U.S. Pats. 1,101,548 and 1,101,549, June 30, 1914; dates of appl., Oct. 21 and 24, 1911.

(1). A closed drum is mounted on a hollow horizontal shaft and rotated in a vertical plane. The liquid is fed into one end of the shaft and is delivered to the inner periphery of the drum through radial branch pipes which project from the hollow shaft and have their ends turned in a direction opposite to that in which the drum rotates. The heavier liquid collects at the inner periphery of the drum, is collected by radial pipes extending from the hollow shaft and is discharged from the opposite end to that by which the liquid enters, the shaft having a partition in the centre. The lighter liquid passes directly into another passage in the hollow shaft from the axis of the drum. (2). The drum of the machine has the form of a frustum of a cone and is rotated on a vertical shaft. The liquids to be separated are fed into the drum near the axis and the separated liquids are discharged the one over the upper edge of the drum and the other through one or more openings formed in the periphery of the drum at its widest part. These openings are normally closed by plugs kept in position by a system of levers which rotates on the shaft. A sleeve is independently rotated on the shaft lower down, so that at a predetermined speed it causes the system of levers to open the plugs and allow the liquid to be discharged.—W. H. C.

Pasty masses; Process for separating, by centrifugalising, the liquid contained in —— *with simultaneous dry-pressing of the separated solids.* E. Bertel. Ger. Pat. 275,387, March 29, 1913.

The pasty mass is introduced into tubular bags, *x*, of permeable material, and these are closed and placed within the basket of a centrifugal machine as shown in the figure. The liquid separated from the mass passes out through the



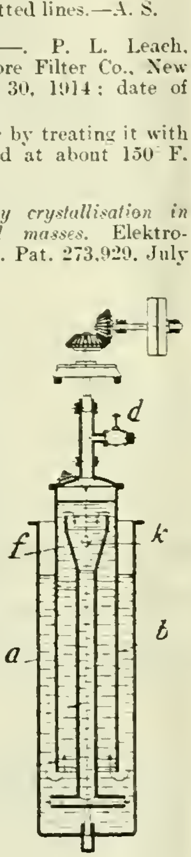
basket and the residue is compressed by the action of centrifugal force aided by the movable members. 14, which may be hollow metal boxes weighted by filling with water. Around the pressing members, 14, is a casing, 17, which is kept in place after the fashion of a spring, and serves to shut off the space containing the bags, *x*, from the interior of the centrifuge. Channels, 9 and 10, are provided so that the bags, *x*, may be compressed into the form of flat plates as shown by the dotted lines.—A. S.

Filter-leaves; Method of cleaning ——. P. L. Leach, Wollaston, Mass., Assignor to Moore Filter Co., New York. U.S. Pat. 1,101,639, June 30, 1914; date of appl., Oct. 25, 1911.

LIME is removed from the filter fabric by treating it with a 4% aqueous solution of lactic acid at about 150° F. (66° C.).—W. H. C.

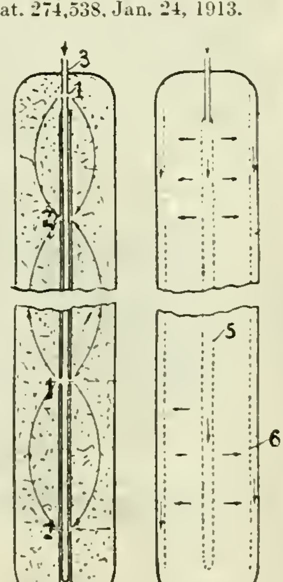
Crystals; Production of large —— *by crystallisation in motion from solutions and fused masses.* Elektrochemische Werke G. m. b. H. Ger. Pat. 273,929, July 17, 1913.

IN the apparatus shown in the figure, *a* is the dissolving vessel, or receptacle for the fused mass, and *f* is the crystallising vessel, which is fixed to, and rotates with, the tube, *b*. Suction is applied at *d* to draw the liquid up to the level of the upper edge of *f*, then the cock, *d*, is closed and the tube, *b*, is rotated, whereby circulation of the liquid is set up as shown by the arrows. A crystal to act as a nucleus is suspended at *k*. By raising or lowering *b*, the difference of level between the liquid in *a*, which may be heated, and in *f*, and hence also the difference in temperature, can be regulated as desired.—A. S.



Gas reactions; Process for carrying out high-pressure ——. K. H. Vallalat. Ger. Pat. 274,538, Jan. 24, 1913.

THE gaseous mixture instead of passing through the entire length of the reaction chamber, is divided into a number of separate currents, each of which travels only a fraction of the total length. In the form of apparatus shown in Fig. 1, the gas is forced into the reaction chamber through openings, 1, in the inner tube, 3, and is drawn into the outer outlet tube, 4, through openings, 2. In the modification shown in Fig. 2, the gas is forced through the permeable tube, 5, into the reaction chamber, and is withdrawn from the annular space formed between the outer wall and the permeable partition, 6.—A. S.



Reaction-vessel for carrying out chemical processes of all kinds between two or more liquids, solutions, solids in paste form, and also gases. Westfälisch-Anhaltische Sprengstoff-A.-G. Ger. Pat. 274,854, Sept. 27, 1912.

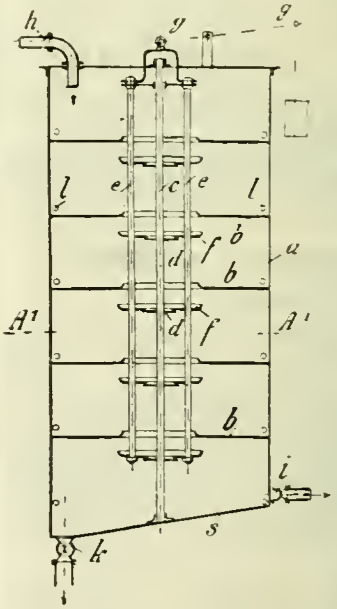
THE apparatus consists essentially of two vessels, one within the other, and either or both of which may be rotated. The outer vessel has blades, projecting from its inner surface and the inner vessel has, on its outer surface, similar blades projecting into the spaces between the blades on the outer vessel. The materials pass continuously through the space between the two vessels. The apparatus is specially suitable for the manufacture of explosive substances, *e.g.*, for the nitration of toluene. —A. S.

Oxidation-reactions; Process for carrying out ——. Badische Anilin und Soda Fabrik. Ger. Pat. 275,518, March 30, 1913.

RUTHENIUM or one of its compounds is used as an oxidation catalyst. The application of these catalysts to the oxidation of gaseous hydrocarbons by means of air is disclaimed.—T. F. B.

Clarifying apparatus for intermittent or continuous working. H. Pappé. Ger. Pat. 274,869, June 22, 1913.

THE apparatus consists of an upright vessel, *a*, preferably with a sloping bottom, *s*, and divided into compartments by partitions, *b*, *b*, the centres of which have circular openings with raised edges. Below these openings a number of circular trays, *f*, *f*, with central openings, are supported on discs, *d*, *d*, fixed to a vertical shaft: these trays are slightly larger than the openings in the plates, *b*, *b*. The liquid to be clarified is run in through *h*, and, passing down the apparatus, deposits the solid particles on the trays and plates, finally running off through *i*. To clean the apparatus, the trays, *f*, *f*, together with the framework, *e*, *e*, are lifted by means of the counterpoise, *g*, so that they close the openings in the plates, *b*, *b*; water or other washing liquid is then pumped in through openings as shown at *l*, *l*, washing the solid from the trays and plates, through the central openings in the trays, *f*, *f*, into the bottom o the vessel, whence it is run off through *k*.—T. F. B.



Dialyser-membranes. R. Hömberg, C. Brahm, and H Mühsam. Ger. Pat. 274,963, Sept. 19, 1913.

THE membranes are prepared from solutions of "konny aku" (a product obtained from *Conophallus*, *Colocasia* and similar kinds of plants). The membranes may be mad more elastic by adding softening agents, such as oils, t the solutions, and they are rendered insoluble in water b treatment with alkalis or other alkaline substance alkaline-earth carbonates, or basic salts. To increase th strength of the membrane, inert substances such as bariu sulphate, talc, kieselguhr and the like may be incorporate with the solution or may be precipitated in the membrar during its fixing or after-treatment.—A. S.

Drying aqueous animal or vegetable liquids, etc., by admixture of anhydrous sodium sulphate. V. Niegovan. Ger. Pat. 275,127, June 7, 1913. Under Int. Conv., June 7, 1912.

After mixing with anhydrous sodium sulphate, the mass is dried by exposure to a temperature below the melting point of Glauber's salt, *e.g.*, in a vacuum over sulphuric acid. When the sodium sulphate is again completely dehydrated, the mass falls to a fine powder from which the anhydrous sodium sulphate can be separated by means of its insolubility in anhydrous organic solvents.—A. S.

Drying apparatus. J. E. Hobbs, Coulsden, Assignor to Ransome-ver Mehr Machinery Co., Ltd., London. U.S. Pat. 1,102,662, July 7, 1914. Date of appl., Oct. 21, 1912.

See Eng. Pat. 29,313 of 1911; this J., 1913, 221.—T. F. B.

Drying or cooling granular materials; Process of ——. E. Bornmann, Assignor to J. A. Topf und Söhne, Erfurt, Germany. U.S. Pat. 1,102,714, July 7, 1914. Date of appl., Oct. 29, 1913.

See Eng. Pat. 29,835 of 1912; this J., 1913. 1147.—T. F. B.

Liquids; Apparatus for aerating and gasifying ——. T. K. Irwin. Fr. Pat. 467,288, June 14, 1914. Under Int. Conv., Jan. 23, 1913.

See Eng. Pat. 1925 of 1913; this J., 1914, 274.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Hydrogen and methane; Modification of the Jaeger method for determining ——. Wibaut. J. Gas Lighting, 1914, 127, 174.

The Jaeger method consists in the fractional combustion of the gaseous mixture by passing it over copper oxide, first at 250°—270° C., to burn the hydrogen, and then at red heat to burn the methane. Both steps in the process are very slow. To accelerate the combustion, the author adds sufficient cerium dioxide to give a grayish white mixture with the copper oxide. A silica combustion tube is used, filled with nitrogen before the experiment, and the gas is passed through the tube 4 to 6 times, each passage taking 1 to 2 mins. The copper oxide is regenerated by means of oxygen after each experiment. A sample of coal gas containing H 49·9% as determined by absorption with palladium black, and CH_4 20·9% as determined by explosion, gave by the new method, H 49·5 and CH_4, 21·2%.—A. T. L.

Mineral oil exports from the United States. Oil, Paint, and Drug Rep., Aug. 3, 1914. [T.R.]

Exports of mineral oils from the principal customs districts of the United States (representing about 98% of the shipments from all parts), during the twelve months, July 1, 1913, to June 30, 1914, were as follows:—

	Gallons.	Value Dollars.
Crude oil	146,056,086	6,808,513
Illuminating oil	1,155,809,430	74,374,091
Lubricating and paraffin oils	195,472,181	27,566,378
Naphthas, gasoline, etc.	185,578,776	26,568,682
Residuum, gas oil, fuel oil, etc.	586,301,600	15,562,192
Total, 1913-14	2,269,218,073	150,879,856
Total, 1912-13	1,947,746,303	134,514,109

Patents.

Peat sods, which may be immediately stacked, made from partly drained peat. J. W. R. von Traubenberg, Reval, Russia. Eng. Pat. 15,715, July 8, 1913.

A mixture of young or fibrous peat cut from the upper layers of the bog, with an equal or greater quantity of amorphous peat from the lower layers, is pressed and cut into sods, which may be stacked for air-drying. These may contain up to 91% moisture, although amorphous peat alone, containing 88% moisture, cannot be stacked —A. T. L.

Coke ovens, etc.; Apparatus for charging ——. J. J. Allen, Crook, Durham. Eng. Pat. 1121, Jan. 15, 1914.

The charging device, which is brought opposite the mouthpiece of a horizontal retort, has a stiff centre bar carrying pivoted push-plates which are held against stops in an operative position during the forward movement of the bar, and are free to move about their pivots so as to be drawn over the coal on the return stroke. The stops are arranged so that the push-plates are slightly inclined to the vertical on the charging stroke, and to the horizontal on the return stroke, whereby the coal is pressed downwards on both strokes of the bar.—A. T. L.

Coke; Process for cooling hot —— by means of inert waste gases. W. Walch. Ger. Pat. 275,436, Nov. 4, 1913.

Waste gases from the heating of the coke ovens are passed through a heat-interchanger (*e.g.*, a steam boiler or the like) and are then used to cool the hot coke, after which they are again passed through the heat-interchanger. —A. S.

Coal; Continuous carbonisation of —— in vertical retorts. H. J. Toogood and R. Dempster and Sons, Ltd., Elland, Yorks. Eng. Pat. 9400, April 22, 1913.

The cooling chambers, or coke receptacles, at or near the bottom of each retort are connected by valve-controlled by-pass pipes, so that any temporary excessive gas pressure in one retort may be relieved by opening the valve. Automatic dip seals may be used instead of the valves. In a retort of elongated cross-section, the coal-feeding shoot is situated centrally of the major cross-sectional axis in such a manner that the outer edges of the top of the charge are within the heated portion of the retort.—W. F. F.

Distillation of coal; Treatment of hot gases produced by ——. W. J. B. Leech and A. Edwards, Leeds. Eng. Pat. 20,964, Sept. 17, 1913.

The gas from the retort is cooled, and deposits of pitch and ammonium chloride prevented, by the introduction of regulated sprays of circulating water and coal tar, applied respectively between the hydraulic main and the retort mouthpiece, and against the gas stream at a point behind the hydraulic main. The ammonium chloride solution and the tar flow together into a circulating well, the circulation continuing until the solution is strong enough to allow of crystallisation of ammonium chloride. —W. F. F.

Gas producers; Suction ——. H. Dormand, Hartlepool. Eng. Pat. 27,201, Nov. 26, 1913.

To avoid the pulsation of the fuel in the feed-pipe at every suction stroke of the engine, a vacuum is maintained in an annular enlargement in the feed-pipe. Side feed apertures are formed at the delivery end of the pipe. The zone of combustion in the producer is regulated by the provision of a circular vaporiser around the combustion chamber, the water supply being adjustable, and the mixed air and water vapour being delivered into the sealed ash-pit. —W. F. F.

Gas producers. J. A. Herrick, New York. U.S. Pats. 1,100,074 and 1,100,075, June 16, 1914; date of appl., Feb. 27, 1911. Renewed, Nov. 12, 1913.

(1) A gas producer is formed with fixed upper and lower sections carrying a number of stirrers projecting into the middle section, which is rotatable. (2) The producer is entirely stationary, but the stirrers projecting from the upper and lower ends are caused to rotate. The air is introduced through a number of radial tuyère boxes, upon which the lower stirrers are mounted.—H. H.

Illuminating gas; Device for indicating naphthalene in ——. E. St. Claire Deville, Assignor to Soc. du Gaz de Paris, Paris. U.S. Pat. 1,100,231, June 16, 1914; date of appl., Apr. 24, 1913.

The gas is cooled and passed through a restricted orifice, the fall in temperature and the pressure difference on each side of the orifice being noted. The saturation temperature of the gas with naphthalene vapour may also be determined by the apparatus if the gas be first passed through a receptacle containing naphthalene.—H. H.

Gas generator. D. D. Barnum. Worcester, Mass. U.S. Pat. 1,100,941, June 23, 1914; date of appl., Mar. 1, 1912.

A steam injector is fitted near the centre of the grate of a gas producer to force an upward jet of steam through the central mass of fuel, while radial jets arranged just above the grate introduce steam under pressure at the sides of the producer.—H. H.

Combustible elastic fluid mixtures; Means for regulating ——. A. C. Ionides, London. Eng. Pat. 15,758, July 8, 1913.

A sensitive bell or diaphragm, subjected on its two sides to the static pressures of the two constituents of the mixture (*e.g.*, gas and air) is connected by lever arms to two regulating valves, each of double-beat type, in such a way that the weight of the bell or diaphragm is counterbalanced. The constituents are admitted to the mixing chamber through flap valves, the loads on which are independently adjustable. A slide-valve allows the strength of the mixture to be varied without altering the ratio of the pressures at the double beat valves. —W. F. F.

Gas producers; Apparatus for regulating the air supply for ——. H. L. Doherty, New York. U.S. Pat. 1,101,787, June 30, 1914; date of appl., Feb. 15, 1910.

A valve in the air-supply conduit is moved in one direction by hand and is returned slowly by a weight, the return movement being controlled by a liquid dash-pot having an adjustable by-pass valve.—A. T. L.

Gas; Apparatus for purifying ——. H. F. Smith, Lexington, Ohio. U.S. Pat. 1,099,773, June 9, 1914; date of appl., Oct. 12, 1912.

The gas is passed through a rotatable cage containing a pervious diaphragm to separate tar particles. Upon rotation of the cage, the gas passes through the diaphragm in the reverse direction.—H. H.

Fuels for internal-combustion engines, and means for preparing them for use. L. N. Reddie, London. From Explosions-Turbine-Studienges. m. b. H., Berlin-Wilmersdorf, Germany. Eng. Pat. 14,520, June 23, 1913.

Fuel which can be used in a carburettor without heating, consists of an emulsion made by stirring together crude oil or tar, a light oil such as crude naphtha or benzene, and a liquid which does not mix with the oils, such as water or alcohol. To render the emulsion permanent, soap, caustic soda, ammonia, sodium carbonate, lime water, milk, or rubber solution may be added. Examples given are: (1) crude naphtha, 500; water, 50; soft soap, 10; and petroleum, 100 parts; (2) gas tar, 100; benzene, 100; soap and water, 10; alcohol, 10; and petroleum, 10 parts; (3) crude naphtha, 500; crude petroleum, 200—300; water, 50—100; and soap, 5—10 parts. —A. T. L.

[Mineral] Oils; Treating [diminishing the viscosity of] ——. A. Philip, Portsmouth. Eng. Pat. 14,778, June 26, 1913.

Petroleum oils, which are too viscous to be readily pumped or otherwise handled, may be rendered less viscous by addition of naphthalene up to about 8% by weight of the mixture. Oils of which the high viscosity is due to the presence of the heavier paraffins may be treated in this way.—W. F. F.

Hydrocarbons [pentanes]; Process of obtaining liquid ——. E. Schill, Assignor to Continental Gas Compressing Corporation, New York. U.S. Pat. 1,100,260, June 16, 1914; date of appl., Oct. 10, 1912.

A gaseous mixture of hydrocarbons of low, medium and high boiling points is compressed in the presence of a finely divided heat-absorbing agent and cooled sufficiently to liquefy the portions, normally volatilised above 25° C., having the medium and high boiling points. The liquefied mixture is led whilst still under pressure, to a still where the ingredients of medium boiling point, viz. the pentanes, are distilled off.—H. H.

Oil; Treating [dehydrogenating] ——. J. A. Dubbs, Pittsburgh, Pa., Assignor to R. J. Dunham, Chicago, Ill. U.S. Pat. 1,100,717, June 23, 1914; date of appl., Nov. 9, 1905.

Hydrocarbons are dehydrogenated by heating to a temperature at which they are broken up when mingled with air, and forcing air through at a rate sufficient to maintain continuous distillation without further application of heat. —H. H.

Oils; Apparatus for fractionating mineral ——. C. B. Forward, Urbana, Ohio. U.S. Pat. 1,100,966, June 23, 1914; date of appl., Mar. 4, 1914.

A retort for heating oils under pressure at about 650° F. (343° C.) is provided with a series of condenser columns, the first of which has pipe connections so that the liquid condensed therein can be returned direct to the retort in order to control the quality of the asphaltum base left in the retort.—H. H.

Petroleum hydrocarbons; Treatment of ——. R. F. Bacon and C. W. Clark, Pittsburgh, Pa. U.S. Pat. 1,101,482, June 23, 1914; date of appl., May 6, 1912.

Petroleum hydrocarbons having a boiling point of about 250° C. and upwards are decomposed and distilled under a pressure of 100 to 300 lb. per sq. in., the heat being applied at such a rate as to give a minimum yield of 18% of gasoline hydrocarbons boiling at 30° to 150° C.—H. H.

Combustion; Method of conducting ——. *Methods of burning liquid fuels.* H. L. Doherty, New York. U.S. Pats. 1,101,788, 1,101,789, and 1,101,790, June 30, 1914. Dates of appl., Jan. 10, Jan. 10, and April 13, 1911.

(1). In a kiln for calcining carbonate minerals by direc contact with the flame, liquid fuel is sprayed by a stean jet and admitted to the combustion chamber with limited quantity of air so as to effect a partial combustio of the fuel in contact with refractory material and t convert the unburnt fuel into fixed gases; and the resultin gaseous products are mixed with air containing at leas 30% of combustion products and brought into contac with the hot materials in the kiln, whereby complet combustion is effected, and a large flame of moderat temperature is formed. (2). For decomposing material by direct contact with flame, the process described abov is modified by using compressed air in place of stean (3). Liquid fuel is atomised, mixed with carbon dioxid and air, and partially burnt, and the resulting gas is burn with a further supply of air. The quantity of carbo dioxide is such as to prevent the production of soot durin the initial combustion, and the quantity of primary air sufficient to give a temperature between 1300° and 2000° (704°—1093° C.).—A. T. L.

Burning finely-divided fuel; Apparatus for ——. D. Irish, New York, Assignor to The Babcock and Wilc Co., Bayonne, N.J. U.S. Pat. 1,102,510, July 7, 191 Date of appl., April 1. 1913.

See Eng. Pat. 18,712 of 1911; this J., 1912, 864.—T. F.

Fuels; Method and device for measuring the heating val of ——. H. Junkers, Aix-la-Chapelle, Germany. U Pat. 1,103,915, July 14, 1914. Date of appl., Oct. 1913.

See Eng. Pat. 22,514 of 1913; this J., 1914, 105.—T. F.

Heating peat and other peaty substances; Process and apparatus for ——, to prepare them for mechanical dehydration. G. Wolters. Fr. Pat. 467,344, March 27, 1913.

See Eng. Pat. 2766 of 1913; this J., 1913, 1000.—T. F. B.

Briquettes of coal and carbonaceous waste; Process for making ——. Naamlooze Vennootschap Briquet Co. (Briket Maatsch.). Fr. Pat. 467,572, Jan. 22, 1914. Under Int. Conv., Feb. 1, 1913.

See Eng. Pat. 5416 of 1913; this J., 1913, 860.—T. F. B.

Coke ovens; Regenerative ——. E. Lecocq, Brussels. Eng. Pat. 16,599, July 19, 1913. Under Int. Conv., Sept. 4, 1912.

See Fr. Pat. 460,399 of 1913; this J., 1914, 67.—T. F. B.

Coal, shale or the like; Process and apparatus for the treatment of —— in vertical retorts. A. Waddell, Dunfermline. U.S. Pat. 1,103,112, July 14, 1914. Date of appl., Sept. 11, 1913.

See Eng. Pat. 21,991 of 1912; this J., 1913, 690.—T. F. B.

Water-gas; Process for the production of ——. Dellwik-Fleischer Wassergas-Ges. m. b. H., Frankfort, Germany. Eng. Pat. 304, Jan. 5, 1914. Under Int. Conv., Aug. 6, 1913.

See Fr. Pat. 466,421 of 1913; this J., 1914, 585.—T. F. B.

Gas producers; Rotary grate for ——. K. Koller. Fr. Pat. 467,540, Jan. 21, 1914. Under Int. Conv., Jan. 22, 1913.

See Eng. Pat. 1692 of 1914; this J., 1914, 740.—T. F. B.

Gas producer. C. Whitfield. Fr. Pat. 467,676, Jan. 24, 1914.

See Eng. Pat. 1117 of 1913; this J., 1914, 190.—T. F. B.

Gas washer. W. J. Fiddes. Fr. Pat. 466,456, Dec. 22, 1913. Under Int. Conv., June 14, 1913.

See U.S. Pat. 1,095,835 of 1914; this J., 1914, 585.—T. F. B.

Gas liquor; Method of treating —— in small gas works. Berlin-Anhaltische Maschinenbau-Act.-Ges., Berlin. Eng. Pat. 4242, Feb. 18, 1914. Under Int. Conv., May 9, 1913.

See Ger. Pat. 269,658 of 1913; this J., 1914, 685.—T. F. B.

Benzol from petroleum or its distillates; Process for obtaining ——. J. Holegreber, Lodz, Russian Poland. Eng. Pat. 17,272, July 28, 1913.

See Fr. Pat. 460,827 of 1913; this J., 1914, 17.—T. F. B.

Petroleum distillation; Process of treating residue of ——. H. Wade, London. From Standard Oil Co., Whiting, Ind., U.S.A. Eng. Pat. 6593, March 16, 1914.

See U.S. Pat. 1,049,667 of 1913; this J., 1913, 414.—T. F. B.

Manufacture of wagon- and machine-grease. Ger. Pat. 274,209. *See* XII.

Manufacture of lubricants and substances for adding thereto, capable of indicating "hot running." Ger. Pat. 275,055. *See* XII.

Apparatus for testing lubricants. Ger. Pat. 275,225. *See* XXIII.

Device for detecting combustible or explosive gases, especially firedamp. Eng. Pat. 15,064. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Lighting and heating flames; Investigations on the quantity of carbon monoxide and nitric oxide in ——. E. Terres. J. Gasbeleucht., 1914, **57**, 605—613, 700—706.

The quantities of carbon monoxide and of nitric oxide were determined in the combustion products from inverted and upright incandescence burners, from a petroleum lamp and from candles, from a heating burner placed beneath a vessel of water, and from the burner of a Junkers' calorimeter. The amount of carbon monoxide was from 0·2 to 0·4, of nitric oxide 0·06 to 0·17 and of sulphur dioxide 0·025 to 0·12% of the amount of carbon dioxide formed. With insufficient primary air, the amount of carbon monoxide was 1·7 to 2% of the amount of carbon dioxide. In an atmosphere contaminated with combustion products that it contains 1% of carbon dioxide, these quantities are well below the danger point. In a room of 48 cb. m. capacity, without special means for ventilation, and lighted by gas, the quantity of carbon dioxide could rarely reach 0·5 or 0·75%.—A. T. L.

Patents.

Wood; Plant for carbonising ——. R. Dittmer. Ger. Pat. 275,516, Feb. 8, 1913.

In a carbonising plant comprising vertical retorts with outlets at their bases, the charge is heated first at the top, so that carbonisation proceeds downwards: in this way the contact of tar and other products with the highly heated retort walls, is avoided.—T. F. B.

Electrodes for arc lamps; Manufacture of ——. F. M. Lewis, Brighton. Eng. Pat. 22,222, Oct. 2, 1913. Under Int. Conv., July 2, 1913.

See Ger. Pat. 271,993 of 1913; this J., 1914, 543.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Dimethylaminodihydroxybenzophenone. M. Wenzing. Ber., 1914, **47**, 2152—2156.

When Michler's ketone is heated with resorcinol and zinc chloride an addition product is first formed (Ger. Pat. 31,321). The author carried this reaction further and obtained dimethylaminodihydroxybenzophenone:

$$[(CH_3)_2N.C_6H_4]_2C(OH).C_6H_3(OH)_2 \rightarrow (CH_3)_2N.C_6H_4.CO.C_6H_3(OH)_2 + C_6H_5.N(CH_3)_2.$$

The new product was isolated as its zinc chloride double salt. The free base exists in two crystalline modifications, needles melting at 165°—167° C., and leaflets melting at 171°—172° C. It is insoluble in water but forms soluble salts. The base is soluble in caustic alkali with an intense yellow colour.—J. B.

Use of refined coal tar in the creosoting industry. Von Schrenk and Kammerer. *See* IX.

Report on wood preservatives [*creosote oil*]. *See* IX.

Quantity and character of creosote in well-preserved timbers. Alleman. *See* IX.

Patents.

Diarylurea chlorides; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 20,107, Sept. 5, 1913.

Diarylamines can be converted completely into the corresponding diarylurea chlorides, free or practically free from the diarylamine hydrochloride, by carrying out the last part of the treatment with phosgene at a higher temperature (*e.g.*, 100° C.), and continuing the reaction until all the diarylamine hydrochloride has been converted into the urea chloride. The process may be carried out either in absence or in presence of a diluent or solvent.—T. F. B.

Ureas of the naphthalene series; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Eng. Pat. 9472, April 16, 1914. Under Int. Conv., June 21, 1913.

New ureas of the naphthalene series, suitable for medicinal purposes and for the production of substantive cotton dyestuffs, are obtained by treating with phosgene derivatives of 1.8-aminonaphtholsulphonic acids which are substituted in the amino group by the aminobenzoyl or aminobenzoylaminobenzoyl residues or their derivatives, or by a number of similarly grouped aminobenzoyl residues or their derivatives. The compound produced by the action of phosgene on *p*-aminobenzoyl-1-amino-8-naphthol-4 6-disulphonic acid has a strong curative effect on animals affected with trypanosomes, and when combined with diazobenzene yields a pure bluish-red dyestuff.—T. F. B.

Aminoanthraquinones or their derivatives; Manufacture of ——. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 8917, April 8, 1914. Under Int. Conv., June 30, 1913.

The ureas produced by the action of phosgene on 3-aminobenzoyl-o-benzoic acid or its derivatives, can be condensed to anthraquinone derivatives by heating with concentrated or fuming sulphuric acid. The condensation takes place at 80°—90° C., without saponification occurring; by heating for a longer period or to a higher temperature, the ureas are saponified and the corresponding aminoanthraquinones produced. When ureas of 3-aminobenzoyl-o-benzoic acid having a free 6-position are used, the process yields mainly 2-aminoanthraquinones, with small proportions of 1-aminoanthraquinone derivatives. On the other hand, when compounds substituted in the 6-position, such as 3-amino-6-halogenbenzoyl-*o*-benzoic acids, are used, the products consist exclusively of 1-aminoanthraquinone derivatives.
—T. F. B.

Anthraquinone; Process of making ——. F. Singer and E. Milarch, Offenbach, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 1,103,383, July 14, 1914. Date of appl., Jan. 8, 1914.

Anthracene is treated with nitric acid in presence of an indifferent liquid, at a temperature below 60° C., and the intermediate product is converted into anthraquinone by treatment with nitric acid above 60° C.—T. F. B.

Anthraquinone nitriles; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 275,517, March 23, 1913. Addition to Ger. Pat. 271,790 (see this J., 1914, 637).

β-Halogen-anthraquinones are converted into anthraquinone-β-nitriles by heating them with copper cyanide in presence of an indifferent solvent. The products may be used for preparing dyestuffs.—T. F. B.

Anthracene derivatives; Process for preparing ——. M. Kardos. Ger. Pat. 275,248, May 4, 1913.

Anthracene or one of its derivatives is treated with malonyl chloride in presence of a substance which assists condensation. Coloured compounds are obtained, which are probably 1.9-malonylanthracene derivatives. Mild oxidation (*e.g.*, with permanganate) in alkaline solution converts them into anthraquinone-1-carboxylic acid or its derivatives.—T. F. B.

Dihalogen-carbazoles; Process for preparing nitration products of ——. G. List. Ger. Pat. 275,833, Aug. 14, 1912.

Carbazole is treated with a halogen or its equivalent in glacial acetic acid solution, and when the reaction is complete the product is treated with concentrated nitric acid. The dihalogen-nitrocarbazoles thus produced differ from the known compounds in having at least one labile halogen atom: the reactivity of the halogens can be increased by introducing a sulphonic or other acidic group into the molecule.—T. F. B.

Hydrocarbons; Process for the systematic oxidation of —— *by air at the ordinary temperature.* Soc. Anon. des Combustibles Industriels. Fr. Pat. 467,715, April 3, 1914.

See Eng. Pat. 10,208 of 1913; this J., 1914, 586.—T. F. B.

Sulphonic acids; [Electrolytic] process of producing ——. A. Vagt, Leverküsen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,102,827, July 7, 1914. Date of Appl., Dec. 6, 1911.

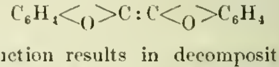
See Fr. Pat. 439,012 of 1912; this J., 1912, 579.—T. F. B.

Obtaining benzol from petroleum or its distillates. Eng. Pat. 17,272. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

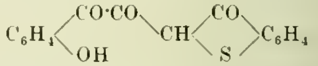
Oxindigo. I. K. Fries, A. Hasselbach, and L. Schröder. Annalen, 1914, **405**, 346—372.

By the method previously described for oxindigo (this J., 1911, 124) 6.6′-dimethyl-2.2′-biscumaronindigo and 5.5′-dichloro-2.2′-biscumaronindigo have been prepared and found to differ little from the parent substance. Reduction of oxindigo by zinc dust and acetic anhydride gives the diacetate of oxindigo white; in glacial acetic acid however reduction goes further and four atoms of hydrogen are taken up, probably with formation of

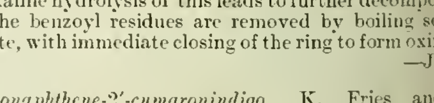


$$C_6H_4<\overset{CH\cdot OH}{\underset{O}{}}>C:C<\overset{CH\cdot OH}{\underset{O}{}}>C_6H_4$$

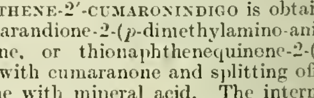
Alkaline reduction results in decomposition. By th action of alkali on the mixed thio-oxindigo only th cumarone ring is affected and the compound,



is formed. It is therefore probable that in the case of oxindig the compound, $HO.C_6H_4.CO.CH(OH).CO.CO.C_6H_4.OH$, first formed, and this is further broken down by the actio of the alkali. Oxindigo is also decomposed by miner acids, o-hydroxybenzoylformic acid and a compoun $C_{16}H_{10}O_4$, resulting. This compound is soluble in alkal and forms an acetyl derivative. By heating it is converte into an isomeride of similar properties. The decompositi by alkalis has been investigated by means of the additi products of primary amines with oxindigo, which a relatively stable against alkalis. The addition product fro *p*-aminodimethylaniline is attacked by alkali on one si of the ring only. The product can be isolated as the benzo compound, which has the formula:



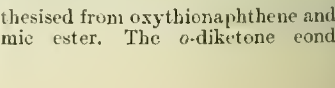
and when treated with mineral acid yields aminodimeth aniline and the compound,



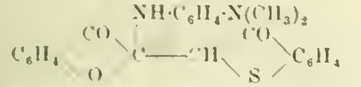
Alkaline hydrolysis of this leads to further decomposit but the benzoyl residues are removed by boiling sodi acetate, with immediate closing of the ring to form oxindi
—J. B

2-*Thionaphthene-2′-cumaronindigo.* K. Fries and Bartholomäus. Annalen, 1914, **405**, 373—394.

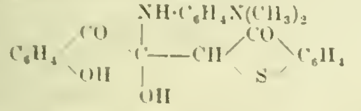
2-Thionaphthene-2′-cumaronindigo is obtained by c densing cumarandione-2-(*p*-dimethylamino-anil) with thionaphthene, or thionaphthenequinone-2-(*p*-dimet amino-anil) with cumaranone and splitting off *p*-amin methylaniline with mineral acid. The intermediate duct is the same, whichever method of formation is u so that direct formation of thio-oxindigo must oc combination with the free amine then taking place. oxindigo the new mixed indigo has no vat-dyeing prope as it is decomposed by alkalis. The decomposition proc



can be synthesised from oxythionaphthene and *o*-hydr benzoylformic ester. The *o*-diketone condenses th o-phenylenediamine to give a quinoxaline derivative and it forms a dibenzoyl derivative with benzoyl chloride. By heating to 180° C. thio-oxindigo is re-formed. The aminodimethylaniline condensation product of thio-oxindigo must have the constitution



since it is decomposed by alkalis to form the product



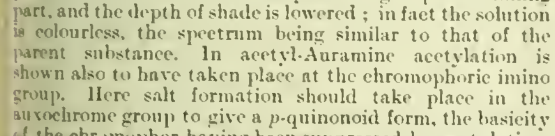
characterised by its dibenzoyl derivative (see preceding abstract).—J. B.

Auramine ; The constitution of ——. E. Grandmougin and S. Favre-Ambrumyan. Ber., 1914, 47, 2127—2132.

To decide between the rival formulæ for Auramine (Graebe's and Stock's) it is necessary to know at which part of the molecule salt formation takes place—in the chromophoric imino group or in the auxochrome dimethylamine group. According to the authors' views a deepening of the shade should take place in the first case, whilst in the second the shade would be raised in the direction of the light end of the spectrum (see this J., 1913, 973 ; 1914, 687). Spectroscopic examination shows that salt formation is, in fact, accompanied by a deepening and a doubling of the chief band to 375 and 435 $\mu\mu$. The case is parallel with that of phenazine (this J., 1914, 687). On the other hand if concentrated acid is used, double salt formation takes place, the auxochrome dimethylamino group also taking part, and the depth of shade is lowered ; in fact the solution is colourless, the spectrum being similar to that of the parent substance. In acetyl-Auramine acetylation is shown also to have taken place at the chromophoric imino group. Here salt formation should take place in the auxochrome group to give a *p*-quinonoid form, the basicity of the chromophor having been suppressed by acetylation. The spectrum of the blue solution thus obtained shows, however, no relationship with the other observations and some further change must be assumed to have taken place. The quinonoid possibilities can thus be varied at will, but no definite distinction can be drawn between them, the conversion of a salt-forming group into the quinonoid form depending simply on its relative basicity.—J. B.

Flavonols ; The conversion of benzalcumaranones into ——. K. v. Auwers and P. Pohl. Annalen, 1914, **405**, 243—294.

An investigation of the general applicability of the syntheses of 2-methylflavonol from the dibromide of benzal-4-methylcumaranon-2) by the action of alkali described by Auwers and Müller (Ber., 1908, **41**, 4233). The conclusion is that a flavonol can only result when the necessary opening of the cumaranone ring takes place more easily than the splitting-off of hydrogen halide. The reaction takes place thus :



It is facilitated by the presence of a methyl, methoxy, or chlorine group *para* to the oxygen of the cumaranone ring, whilst methyl or methoxy groups in the *meta* position hinder the reaction, as does also the presence of two methoxy groups in the aldehyde residue. The method has the advantage that the cumaranones are easily accessible whereas the flavonones necessary in carrying out Kostanecki's process (this J., 1904, 367, 543) are not. Several syntheses of flavones are described.—J. B.

Phenyloxindole. R. Stollé. Ber., 1914, **47**, 2120—2122.

Phenyloxindole is readily obtained by heating chloroacetyldiphenylamine with aluminium chloride to 160—180° C. : $(C_6H_5)_2N{\cdot}CO{\cdot}CH_2{\cdot}Cl \rightarrow C_6H_4{<}\genfrac{}{}{0pt}{}{CH_2-}{N(C_6H_5)}{>}CO$. It condenses with phenylisatin to give diphenylisoindigotin (this J., 1909, 420, 831). The known ethyloxindole can also be prepared by this method from chloroacetylethylaniline. The condensation product of chloroacetylchloride and thiocresol is shown to be $CH_3.C_6H_4.S.CH_2.CO.Cl$ and not $CH_3.C_6H_4.S.CO.CH_2.Cl$, as stated by Auwers and Arndt (Ber., 1909, **42**, 544).—J. B.

o-Hydroxyazo-compounds derived from α-naphthol. G. Charrier and L. Casale. Gaz. chim. ital., 1914, **44**, I., 607—624.

By the action of diazonium salts on α-naphthol, there are formed, in addition to *p*-hydroxyazo-compounds, small quantities of *o*-hydroxyazo-derivatives, identical with the β-naphthoquinonearylhydrazones obtained by the action of the corresponding arylhydrazines on β-naphthoquinone. These *o*-derivatives are red crystalline substances, sparingly soluble in organic solvents, mostly insoluble in cold and slightly soluble in hot alkali solution, and soluble in concentrated sulphuric acid with a red colour, changing in a few cases to reddish-violet. 2-*p*-Anisylazo-1-naphthol is soluble in boiling dilute sodium hydroxide solution and forms a crystalline sodium salt.—A. S.

Patents.

Dyestuffs ; Process for preventing organic —— from forming dust. L. Cassella und Co. Ger. Pat. 274,642, Feb. 2, 1914.

The dyestuffs are ground with non-volatile, liquid or semi-liquid hydrocarbons, such as mineral oils. The incorporation of a small quantity of oil is sufficient for the purpose ; the dyestuffs can be worked up into powders, which are easily moistened by water and dissolve without difficulty.
—T. F. B.

Dyestuffs insoluble in water ; Process for converting —— into a finely divided condition. Badische Anilin und Soda Fabrik. Ger. Pat. 274,970, March 29, 1913. Addition to Ger. Pat. 222,191 (see this J., 1910, 1003).

The process described in Ger. Pat. 265,536 (first additional patent ; see this J., 1913, 1101) is modified by replacing the sulphite-cellulose lye by aromatic sulphonic or carboxylic acids, such as benzylated aminosulphonic acids, or amorphous, soluble aromatic sulphonic acids containing no hydroxyl groups, or phenolsulphonic acids or their condensation products with formaldehyde.—T. F. B.

Vat dyestuffs of the anthracene series ; Process for preparing ——. M. Kardos. Ger. Pat. 275,220, Jan. 30, 1913.

Anthracene-1.9-dicarboxylic acid imine or one of its halogen substitution products is fused with alkali, the melt is diluted with water, and the dyestuff is precipitated from the solution by treatment with air or other oxidising agent.—T. F. B.

Blue dyestuff from 1-aminonaphthalene-4.6.8-trisulphonic acid ; Process for preparing a —— by melting with alkaline sulphur compounds. Kalle und Co. A.-G. Ger. Pat. 275,449, June 8, 1913.

1-Aminonaphthalene-4.6.8-trisulphonic acid is melted with an alkaline sulphur compound, the melt is diluted with water, and the gases with reducing properties, or their compounds, are removed from the solution before separating the dyestuff ; this may be done by adding a suitable precipitant to the neutral or alkaline solution or by passing a current of air through the acidified solution. This results in a considerably increased yield of the dyestuff.—T. F. B.

Vat [anthracene] dyestuffs ; Red —— and process of making same. R. Herz. Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 1,103,004, July 7, 1914. Date of appl., July 23, 1913.

See Fr. Pat. 459,256 of 1912 ; this J., 1913, 1101.—T. F. B.

Vat dyestuffs of the anthracene series ; Production of ——. Badische Anilin und Soda Fabrik. Second Addition, dated Dec. 15, 1913, to Fr. Pat. 370,070, Sept. 27, 1906. Under Int. Conv., April 5, 1913.

SEE Eng. Pat. 10,291 of 1913 ; this J., 1914, 544.—T. F. B.

Dibenzanthrone ; Derivatives of —— *and vat dyestuffs derived therefrom.* Badische Anilin und Soda Fabrik. First Addition, dated Dec. 20, 1913, to Fr. Pat. 451,798, Dec. 11, 1912. Under Int. Conv., May 9, 1913.

SEE Eng. Pat. 12,818 of 1913 ; this J., 1914, 71.—T. F. B.

Vat [*anthracene*] *dyestuffs.* Badische Anilin und Soda Fabrik. Fr. Pat. 467,115, Jan. 8, 1914. Under Int. Conv., May 9 and Aug. 28, 1913.

SEE Eng. Pat. 12,817 of 1913 ; this J., 1914, 638.—T. F. B.

1.2.4-*Purpurin-3-carboxylic acid ; Process for producing* ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Dec. 12, 1913, to Fr. Pat. 451,927, Dec. 14, 1912. Under Int. Conv., March 10, 1913.

SEE Ger. Pat. 272,301 of 1913 ; this J., 1914, 545.—T. F. B.

Colours or dyestuffs fast to water and to light ; Process for making ——. N. W. Turkin. Fr. Pat. 467,041, Jan. 6, 1914.

SEE Eng. Pat. 5737 of 1913 ; this J., 1914, 742.—T. F. B.

Preparing an agent for decolorising and clarifying tannin and dyestuff extracts from soya beans. Ger. Pat. 274,974. *See* XV.

Manufacture of ureas of the naphthalene series. Eng. Pat. 9472. *See* XX.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Paper standards and paper testing. C. F. Cross. Papierfab., 1914, **12**, 831—832.

THE primary physical properties involved in paper testing are : in breaking strain, the sectional area ; in specific volume-weight, the density or concentration of fibre-substance. In testing for strength, the breaking strain should be referred not only to the unit of sectional area of the strip but the results should also be calculated on the assumption that the area broken consists entirely of fibre-substance without air-space. The ratio of thickness of paper to absolute fibre-density should always be kept in view. The suggestion by Briggs (this J., 1914, 745) that breaking strain and volume, both referred to unit weight of paper-substance, should be combined additively to give an expression for "handle," is criticised, the author's view being that any combination of the two factors mentioned above should be expressed as a product. —J. F. B.

PATENTS.

Paper pulp ; Machines for preparing ——. W. W. Beaumont, London. Eng. Pats. 16,768, July 22, 1913, and 2287, Jan. 28, 1914.

To a machine consisting of pulping-barrel, feed-hopper and shaft with disintegrating and propelling arms is attached, in line, a preliminary treating hopper or vat, in which are similar arms mounted on a hollow shaft enclosing the main shaft and driven at a lower speed. Rubber-bars are attached to the body of the pulping barrel and some of the arms of the shaft in that portion are provided with similar bars. In the lower part of the machine, near the feed end, transverse shafts are mounted to collect stringy impurities. Adjustable baffle-plates are provided to control the passage of the material through the various portions of the machine.—J. F. B.

Flax and jute ; Process for utilising the waste of ——. J. Geisberger. Fr. Pat. 466,847, Dec. 19, 1913. Under Int. Conv., Dec. 19, 1912.

SEE Ger. Pat. 273,881 of 1912 ; this J., 1914, 746.—T. F. B.

Silk, silk waste, and cocoons ; Treatment of raw —— *with solutions of tryptic ferments, to separate rapidly the sericin and to disintegrate them.* E. Graeger and A. Kemmler. Fr. Pat. 467,776, Jan. 27, 1914. Under Int. Conv., Jan. 28, 1913.

SEE Eng. Pat. 2213 of 1914 ; this J., 1914, 746.—T. F. B

Celluloid ; Process for the manufacture of a substitut fo ——. A. von S. Szolayski, Vienna. Eng. Pat. 1223 Jan. 16, 1914.

SEE Fr. Pat. 463,906 of 1913 ; this J., 1914, 417.—T. F.

Threads, films, or plates [*from viscose*] *; Process for the pr duction of* ——. E. Bronnert, Niedermorschweile Assignor to Verein. Glanzstoff-Fabriken A.-G., Elberfel Germany. U.S. Pat. 1,102,237, July 7, 1914. Date appl., April 9, 1913.

SEE Fr. Pat. 454,011 of 1913 ; this J., 1913, 865.—T. F.

Sulphite-cellulose ; Process for making ——. E. Öma Fr. Pat. 467,466, Jan. 19, 1914. Under Int. Conv Feb. 6, 1913.

SEE Eng. Pat. 1145 of 1914 ; this J., 1914, 348.—T. F.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Chinese block gambier. Sommerhoff and Aposto *See* XV.

PATENTS.

Dyeings on cotton fast to washing and to light ; Process producing ——. Kalle und Co. A.-G. Ger. P 275,660, Dec. 1, 1912.

COTTON is dyed with the dyestuff, 1-aminonaphthalen sulphonic acid→α-naphthylamine→2-amino-5-naphtho sulphonic acid, and this is diazotised and combined w a naphthol.—T. F. B.

Black dyeings on cotton ; Process for producing fast — Farbwerke vorm. Meister, Lucius, und Brüning. Pat. 275,698, Dec. 17, 1912.

pp'-DIAMINODIPHENYLAMINE or a homologue or deriva thereof is diazotised and combined with one mol. of aminonaphthol-3·6-disulphonic acid, and the intermed product is tetrazotised and combined with two mol resorcinol ; when cotton dyed with this dyestuff is tre with formaldehyde, black dyeings very fast to water to light are produced.—T. F. B.

Bleaching, dyeing, washing, or otherwise treating with liq hanks of textile yarn, silk, or other fibrous mate Apparatus for ——. Courtaulds, Ltd., and J. Clay Fr. Pat. 467,222, Jan. 12, 1914. Under Int. C April 17, 1913.

SEE Eng. Pat. 9067 of 1913 ; this J., 1914, 197.—T.

Dyeing with Aniline Black ; Process for ——. H. Flet Thaon-les-Vosges, Assignor to A. E. Vergé, Vince France. U.S. Pat. 1,102,898, July 7, 1914. Da appl., July 21, 1913.

SEE Eng. Pat. 15,668 of 1913 ; this J., 1914, 418.—T.

Dyeing vegetable fibres intense orange, red, or brown sh Processes for —— *and dyestuffs for that purpose* Levinstein, J. Baddiley, and Levinstein, Ltd. Addition, dated Dec. 6, 1913, to Fr. Pat. 46 Nov. 29, 1913. Under Int. Conv., Dec. 7, 1912.

SEE Eng. Pat. 28,296 of 1912 ; this J., 1914, 73.—T.

Dyeing textiles ; Apparatus for ——. W. R. Smith. Fr. Pat. 466,681, Dec. 27, 1913. Under Int. Conv., Jan. 4, 1913.

See Eng. Pat. 294 of 1913 ; this J., 1913, 866.—T. F. B.

Vat dyeing baths ; Process for preparing ——. M. Maxim. Fr. Pat. 467,631, Jan. 21, 1914.

See Ger. Pat. 260,058 of 1912 ; this J., 1913, 697.—T. F. B.

Printing on fabrics ; Process of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 5011, Feb. 26, 1914. Under Int. Conv., Feb. 27, 1913.

See Ger. Pat. 272,526 of 1913 ; this J., 1914, 547.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Ammonia ; Synthesis of —— by means of aluminium nitride. C. Matignon. Chem.-Zeit., 1914, **38**, 894—895, 909—910.

ERPEK has shown that when a current of nitrogen is passed hrough a mixture of alumina and carbon at 1800° C., the lumina is rapidly converted into aluminium nitride :— $Al_2O_3+3C+N_2=Al_2N_2+3CO-187{\cdot}6$ cal. The heats of ormation of the nitrides of the following metals, calculated n N_2, are :—Mg, 119·7 ; Ca, 111·2 ; Si, 90 ; Al, 110 cals. luminium combines directly with atmospheric nitrogen hen introduced at a high temperature into a flask conaining nitrogen, or if a mixture of aluminium powder and arbon is strongly heated and a current of nitrogen introuced through a carbon tube within the mass. A temperaure of 2000° C. is easily obtained in this way. Serpek's rocess can be accelerated, and effected at 1500° C., by he aid of the catalytic action of hydrogen and iron. n experiments at 1500° C. lasting an hour, in the presence f hydrogen, the product contained 12·85% N ; in the resence of iron, 7·7% and in the presence of both hydrogen nd iron 27·07%. Bauxite, containing iron oxide can herefore be used for the process, and subsequent decompoition of the nitride yields ammonia and pure alumina. he nitride is heated under pressure with a solution of dium aluminate of 20°—21° B. (sp. gr. 1·162—1·171), and he alumina is then thrown down by adding some preipitated alumina, the solution being used again without rther concentration. The cost of preparing alumina om the nitride in this way is about half that of reparing it from bauxite by heating under pressure with ustic soda and sodium aluminate of 40° B. (sp. gr. 1·383). hen the process is worked solely for the production of mmonia, the alumina is not purified, and the decomposion of the nitride is simpler. A furnace for the manufacre of aluminium nitride by Serpek's process comprises a xed chamber arranged between two inclined rotating ylindrical chambers which open into it. The lower of these tating chambers contains a resistance and forms an ectric furnace ; the lining is of aluminium nitride. auxite is fed into the upper end of the upper rotating hamber and passes downwards through the chambers, uxing with carbon which is fed into the fixed chamber, nd meeting a current of nitrogen which is admitted at the wer end of the electric furnace. The carbon monoxide rmed in the reaction is burnt at the lower end of the upper hamber, and serves to preheat the bauxite. Each of the tating chambers is 25 m. long, and a current of 10,000 mperes at 230 volts is used.—A. T. L.

otassium carbonate ; An impurity of ——. W. Kohen. Chem.-Zeit., 1914, **38**, 898.

OTASSIUM carbonate, purified so as to yield no precipitate ith silver nitrate, often gives one after ignition. The thor has found this to be due to the presence of tassium chlorate, which is formed during the electrolytic duction of caustic potash and remains in the carbonate anufactured therefrom.—A. T. L.

Magnesium sulphate, sodium sulphate and sodium phosphate ; Commercial standards for dried ——. J. C. Umney and C. T. Bennett. Proc. Brit. Pharm. Conf., 1914, 23—24.

DRIED magnesium sulphate should be prepared by drying the crystalline salt at 100° C. till it has lost about a third of its weight and contains 23 to 31% H_2O. The product should be readily and completely soluble in water. Sodium sulphate can be readily dehydrated by heating for two hours at 100° C., and the dried salt should not contain more than 5% H_2O. The same limit should be adopted for sodium phosphate which can be prepared by drying the crystalline salt at 100° C.—F. SHDN.

Aluminium hydroxide ; Some reversible hydrosols derived from ——. R. P. Rose. Kolloid-Zeits., 1914, **15**, 1—7.

PRECIPITATED aluminium hydroxide if washed rapidly and dried slowly, *e.g.*, at 40°—80° C., becomes, during the drying, soluble in dilute acetic acid. Products of the composition, $Al_2O_3,7-6H_2O$, give very viscous solutions ; from $Al_2O_3,4{\cdot}5H_2O$ to $Al_2O_3,2{\cdot}75H_2O$, mobile, faintly opalescent solutions are obtained, and from $Al_2O_3,1{\cdot}9H_2O$ downwards solution no longer takes place. The most suitable concentration of acetic acid is 6—8% ; above 40% of acid, normal aluminium acetate is formed. The solutions produced are colloidal in character. Propionic, butyric, nitric (N/20—N/35), hydrochloric (N/20—N/35), hydrobromic (N/10—N/20), and hydriodic acid (N/5—N/12) also form hydrosols with the aluminium hydroxide under similar conditions. Sodium and potassium sulphates produce irreversible coagulation of the hydrosols, but the coagulation produced by boiling, by hydrochloric acid, or by the aluminium salt of the acid used in preparing the hydrosol, is reversible, the coagulum being redissolved on replacing the supernatant liquid by water. The disperse phase in the hydrosol is evidently a basic aluminium salt, and the view is expressed that the molecule of this basic salt is ionised to a certain degree, and that the reversible coagulation represents a phase of the law of mass-action as applied to the solubility product.—A. S.

Silicic acid gel ; Structure of ——. J. S. Anderson. Z. physik. Chem., 1914, **88**, 191—228.

EXPERIMENTS on the repeated dehydration and re-hydration of silicic acid gel are described, together with similar experiments using benzene and alcohol in place of water. The results are interpreted in accordance with Zsigmondy's view (this J., 1911, 1056) that the gel is permeated by extremely fine capillaries ; the average diameter of the largest capillaries is calculated to be 5·55 $\mu\mu$ and that of the smallest 2·63 $\mu\mu$. The specific gravities of the gel substance, of the dried gel, and of the gel saturated with water were found to be 2·048, 0·980 and 1·500 respectively. No evidence of the formation of hydrates was observed. —A. S.

Nickel oxide and protoxide ; Tariff treatment of —— in Sweden. Board of Trade J., July 30, 1914. [T.R.]

A SWEDISH Royal Decree, dated the 13th May, 1914, provides that *nickel oxide* and *nickel protoxide* shall be added to the list of duty-free chemicals included under No. 1163 of the Swedish Customs Tariff. This Decree is to take effect from the 1st January, 1915.

Acetic acid for industrial purposes in Belgium. Board of Trade J., July 30, 1914. [T.R.]

A DECREE of the Belgian Minister of Finance, dated the 17th July, provides that foreign acetic acid imported into Belgium by manufacturers who are known to require acetic acid in their manufacturing processes, may, under a permit issued by the Administration, be admitted at the following reduced rates of duty :—

Acetic acid containing in pure acetic acid—

40% or less, 3 frs. per hectolitre (1·3d. per gall.).
More than 40% up to 60%. 4½ frs. per hectolitre (2d.).
More than 60% up to 80%, 6 frs. per hectolitre (2·6d.).
More than 80%, 7½ frs. per hectolitre (3¼d.).

Acetic acid imported at these reduced rates must, before delivery to the importer, be denatured in the presence of the Customs officers, so as to render it unfit for comestible purposes.

[*Note.*—Hitherto foreign acetic acid for industrial purposes has been allowed to be imported *free* of Customs duty by virtue of Article 3 of the Law of the 11th June, 1887, and the Decree of the 13th June, 1887.]

Patents.

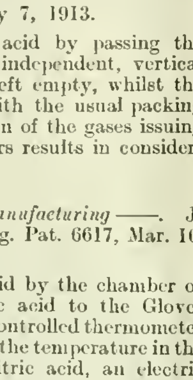
Sulphuric acid ; Process and apparatus for the manufacture of ——. J. F. Carmichael, Liverpool, and F. Guillaume, Brussels. Eng. Pat. 15,679, July 7, 1913.

In the manufacture of sulphuric acid by passing the reacting gases through a series of independent, vertical chambers, alternate chambers are left empty, whilst the intermediate chambers are filled with the usual packing materials ; the consequent expansion of the gases issuing from the packed chambers or towers results in considerably increased yields.—O. R.

Sulphuric acid ; Process of manufacturing ——. J. Lutjens, Hanover, Germany. Eng. Pat. 6617, Mar. 16, 1914.

In the manufacture of sulphuric acid by the chamber or tower process, the supply of nitric acid to the Glover tower is regulated by an electrically-controlled thermometer situated in the lead chamber. When the temperature in the chamber falls, owing to lack of nitric acid, an electric circuit is closed, operating a valve which admits nitric acid to the Glover tower, and *vice versa*.—O. R.

Sulphuric acid ; Water-spraying device, especially for the manufacture of —— *in lead chambers.* Harkortsche Bergwerke und Chem. Fabriken zu Schwelm und Harkorten A.-G. Ger. Pat., 275,388, Nov. 16, 1913.



The spraying device (see fig.) consists of a casing of hard lead in two parts, *a* and *b*, screwed together, with a packing ring in between. In the lower part fits a glass vessel, *k*, having a central opening and provided with grooves which extend from the top to the bottom in a curved path and diminish in cross-section as they approach the central opening. A ball, *i*, of glass or the like rests in the vessel, *k*, and partly closes the grooves. The upper part, *c*, of the device is connected with the water supply and then flows out through the grooves mentioned, issuing from the opening, *g*, in the form of fine spray.—A. S.

Acetic acid from acetylene ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 467,515, Jan. 20, 1914. Under Int. Conv., Feb. 21, 1913.

Acetylene is converted into acetic acid by passing it through a solution of hydrogen peroxide, persulphuric acid, monopersulphuric acid, or a salt of one of these acids, in presence of mercury or a mercury compound. *Example:* A current of acetylene (10·8 parts by weight) is passed into a mixture of 250 parts of 20 to 30% sulphuric acid, 100 parts of 95% ammonium persulphate, and 5 to 10 parts of mercuric oxide, the temperature being kept between 30° and 40° C. The resulting liquid contains 24 to 25 parts of acetic acid.—T. F. B.

Acetic acid from acetylene ; Electrolytic process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 467,778, Jan. 27, 1914. Under Int. Conv., March 27, 1913.

The anodic oxidation of acetylene to acetic acid can be effected in a satisfactory manner by using a solution of sulphuric acid or other acid solution as electrolyte, in presence of a mercury compound. *Example.* The anode compartment of an electrolytic cell, with clay diaphragm and lead anode, is filled with 30% sulphuric acid containing 1 to 2% of mercuric oxide : the cathode, which may be of lead or copper, is also in 30% sulphuric acid. Acetylene is introduced into the anode compartment at the rate of 48·5 grms. per hour for every 100 amps. The current used may be 5 to 15 amps. per sq. decimetre of anode surface at 3 to 4·5 volts, and the electrolyte is kept at 30° to 40° C. The yield of acetic acid amounts to 0·5 kilo. or more per litre of anolyte in 24 hours.—T. F. B.

Salt for culinary purposes. G. W. Malcolm, Northwich, and The Salt Union Ltd., Liverpool. Eng. Pat. 29,053, Dec. 16, 1913.

Common salt is moulded in the form of cubes, blocks, or the like, each of which contains a predetermined quantity of salt (where the amounts of salt used are in tablespoonfuls, cupfuls, etc., etc.), suitable for culinary purposes.—O. R.

Rare earth metals ; Process for the manufacture of compounds of the ——. Gebr. Siemens und Co., Berlin-Lichtenberg, Germany. Eng. Pat. 8015, March 30, 1914. Under Int. Conv., April 1, 1913.

Rare metals are rapidly precipitated from their solutions as fluorides, by the addition of ground fluorspar and a little hydrochloric acid, the mixture being preferably heated and stirred. Ground apatite may be used instead of fluorspar, phosphates of the earths being precipitated. —O. R.

Magnesium carbonate from magnesian limestone ; Process of manufacturing ——. F. S. Young, Newark, N.J. U.S. Pat. 1,101,772, June 30, 1914 ; date of appl., Oct. 6, 1909.

Magnesian limestone is calcined, hydrated, suspended in water, and carbonated at atmospheric pressure, with the formation of magnesium bicarbonate solution and the precipitation of calcium carbonate.—O. R.

Amalgams of alkali and alkaline-earth metals ; Process for the decomposition of ——. M. Helbig. Ger. Pat. 275,047, Aug. 17, 1913.

In the electrolytic production of alkali and alkaline-earth hydroxides with the aid of mercury cathodes, the decomposition of the amalgam is accelerated by the additio thereto, or to the reaction liquid, of small quantities o vanadium, molybdenum, or tungsten, alone or distribute on a suitable support, or in the form of an alloy or chemica compound. Under these conditions, the amalgam is decomposed as rapidly as it is formed, and a nearly theoretica current yield can be obtained with a relatively smal quantity of mercury and in a simple form of apparatus —A. S.

Barium aluminate ; Process for obtaining ——. C. A Beringer. Ger. Pat. 275,287, March 5, 1913.

A mixture of barium sulphate, a substance containin aluminium silicate, and a reducing agent is heated for long time to bright redness with burnt lime or limeston or substances, *e.g.* calcareous marl, containing the sam in order to convert the silica into calcium silicate. F example a finely powdered mixture of : clay 100, heav spar 84, carbon 35, and slaked lime 120 parts is heated f 8 hours at 1200° C., and barium aluminate is extract from the product by lixiviation with water. The residu calcium silicate is suitable for use in the manufacture cement.—A. S.

Thionyl chloride ; Manufacture of ——. P. A. Newto London. From Farbenfabr. vorm. F. Bayer und C Elberfeld, Germany. Eng. Pat. 27,830, Dec. 3, 1913.

Thionyl chloride is obtained by the interaction of sulph or sulphur monochloride with chlorine and chlorosulpho acid or of sulphur dichloride with chlorosulphonic aci with or without addition of a catalyst, such as antimo trichloride or mercuric chloride.—A. S.

Thionyl chloride ; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 275,378, April 16, 1913.

THIONYL chloride is produced by the interaction of sulphur trioxide and sulphur dichloride at the ordinary temperature and pressure, in presence of suitable catalysts, *e.g.*, antimony trichloride, mercuric chloride, or other chlorides of heavy metals.—A. S.

Hydrogen peroxide solutions ; Process for preventing the decomposition of ——. A. Farago and H. Gonda. Ger. Pat. 275,440, Oct. 29, 1913. Under Int. Conv., April 30, 1913.

THE solutions are saturated with oxygen and kept in closed vessels in which a high pressure is maintained by means of a gas, preferably oxygen.—A. S.

Hydrogen peroxide ; Process for increasing the stability of —— in neutral liquid or solid media. E. Merck. Ger. Pat. 275,499, June 1, 1912.

THE stability of aqueous solutions of hydrogen peroxide or f solid compounds containing loosely-combined hydrogen eroxide is increased by addition of small quantities of eutral acyl esters of aminohydroxycarboxylic acids. -Benzoylhydroxy-β-dimethylamino*iso*butyric acid, benzoylecgonine, and α-benzoyl-β-piperidopropionic acid are pecially suitable.—A. S.

ir : Separation of oxygen from ——. L. Bergfeld, Durlach, Germany. Eng. Pat. 21,211, Sept. 19, 1913.

HE object of the invention is to obtain oxygen from the ir. Nitric acid vapours are passed over heated sulphuric cid to form oxygen, water, and nitrosyl sulphuric acid ; he last-named is treated with water to form sulphuric acid nd nitrous anhydride, nitric acid being re-formed from he nitrous anhydride by means of water and atmospheric xygen. The equations are : $2HNO_3=2NO_2+H_2O+O$;

$$2H_2SO_4+2NO_2=2HO.SO_2.O(NO)+H_2O+O\ ;$$

$$2HO.SO_2.O(NO)+H_2O=2H_2SO_4+N_2O_3\ ;\ \text{and}$$

$_2O_3+O_2+H_2O=2HNO_3$. The cycle of reactions is arried out continuously in a system of refractory and cid-proof tubes, acting as heat interchangers on the ounter-current principle, the tubes being preferably acked with quartz grains or the like, which offer resistance the flow of fluids, and facilitate the interchange of eat.—O. R.

ulphuric acid anhydride ; Process for producing —— according to the contact process. H. von Kéler and A. Weindel, Leverkusen, Germany, Assignors to General Chemical Co., New York. U.S. Pat. 1,102,670, July 7, 1914. Date of appl., June 23, 1913.

EE Fr. Pat. 460,074 of 1913 ; this J., 1914, 22.—T. F. B.

inc sulphate solution : Preparing pure ——. S. Araki, Osaka, Japan. Eng. Pat. 15,546, July 5, 1913. Under Int. Conv., Sept. 8, 1912.

E Fr. Pat. 464,038 of 1913 ; this J., 1914, 484.—T. F. B.

itrides ; Purification of mixtures containing ——. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,102,715, July 7, 1914. Date of appl., June 20, 1910.

E Fr. Pat. 418,059 of 1910 ; this J., 1911, 26.—T. F. B.

yanamide : Production of ——. M. Engelmann and B. Merkel. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,102,892, July 7, 1914. Date of appl., Feb. 27, 1912.

E Eng. Pat. 2311 of 1912 ; this J., 1912, 900.—T. F. B.

lphur and sulphates ; Process of producing ——. C. Hansen, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,102,911, July 7, 1914. Date of appl., June 30, 1913.

E Ger. Pat. 264,920 of 1912 ; this J., 1913, 1068.—T. F. B.

Cream of tartar ; Manufacture of ——. H. Cantoni, Voghera, Italy, and J. Chautems and E. Degrange, Assignors to Cantoni, Chautems et Cie., and E. Degrange, Geneva. U.S. Pat. 1,103,658, July 14, 1914. Date of appl., Feb. 8, 1912.

SEE Fr. Pat. 426,714 of 1911 ; this J., 1911, 956.—T. F. B.

Reducing agents ; Process for making stable —— from rapidly oxidisable substances which are difficult to use, such as sodium, potassium, calcium, phosphorus, and similar substances. P. Goldstein. Fr. Pat. 466,853, Dec. 23, 1913. Under Int. Conv., Dec. 23, 1912.

SEE Ger. Pat. 268,657 of 1912 ; this J., 1914, 201.—T. F. B.

Base-exchanging substances containing silicic acid, alumina, and bases ; Process for making ——. Permutit-Akt.-Ges. Fr. Pat. 467,300, Jan. 14, 1914. Under Int. Conv., April 30, 1913.

SEE Eng. Pat. 1039 of 1914 ; this J., 1914, 549.—T. F. B.

Hydrogen peroxide solutions ; Process for preventing the decomposition of ——. A. Farago and H. Gonda. Fr. Pat. 467,103, Jan. 8, 1914. Under Int. Conv., April 30, 1913.

SEE Ger. Pat. 275,440 ; preceding.—T. F. B.

Hydrogen peroxide ; Cathodic manufacture of —— in an electrolyte containing oxygen or gases containing oxygen. Henkel und Co. Fr. Pat. 467,223, Jan. 12, 1914.

SEE Eng, Pat. 754 of 1914 and Ger. Pat. 273,269 ; this J. 1914, 644, 693.—T. F. B.

Hydrogen ; Producing —— and apparatus therefor. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,102,716, July 7, 1914. Date of appl., July 7, 1913.

SEE Eng. Pat. 2096 of 1913 ; this J., 1913, 1156.—T. F. B.

Hydrogen ; Process for producing pure ——. Badische Anilin und Soda Fabrik. First Addition, dated Dec. 26, 1913, to Fr. Pat. 439,262, Jan. 22, 1912. Under Int. Conv., May 16, 1913.

SEE Eng. Pat. 14,509 of 1913 ; this J., 1914, 256.—T. F. B.

Nitrogen and oxides of nitrogen ; Process for the simultaneous production of ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Dec. 8, 1913, to Fr. Pat. 453,845, Jan. 31, 1913. Under Int. Conv., Dec. 12, 1912.

SEE Eng. Pat. 28,737 of 1913 ; this J., 1914, 483.—T. F. B.

Nitrogen compounds ; Process and apparatus for making ——. A. H. Lymn. Fr. Pat. 467,592, Jan. 22, 1914. Under Int. Conv., Jan. 22, 1913.

SEE Eng. Pat. 1851 of 1913 ; this J., 1914, 244.—T. F B.

VIII.—GLASS ; CERAMICS.

PATENTS.

Glass [rod] manufacture ; Apparatus for ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 17,602, July 31, 1913.

A NUMBER of gripping devices travelling continuously up and down above a bath of molten glass, seize an initial length of solidified glass rod, which has been started by means of a bait, and draw it upwards. Towards the end of the upward travel of each of the carriages, on which the gripping devices are mounted, means are actuated for severing the rod below the point where it is gripped, and the detached length of glass rod is swung over the top of the machine and deposited in a receiver. The gripping devices then descend and remain open until they come into position again on the upward path, and seize a fresh rod of glass, which is already held and being drawn upwards by a gripping device higher up.—O. R.

Furnaces for melting glass or metals. J. Lambot, Marcinelle-Charleroi, Belgium. Eng. Pat. 29,813, Dec. 27, 1913.

In a tilting furnace for melting glass or metals, a detachable head is arranged at each end of the hearth, and is water-jacketed around the port, which communicates with the gas-supply flue, fixed in the axis of rotation of the furnace. A circular connection is fixed to the water-jacket to secure a tight joint, and another port is provided in the head, communicating with a movable and detachable hot air flue; the latter is secured to the head, and communicates in turn with the conduit of one of the regenerators, through a connection ensuring a tight joint, whatever be the position of the furnace. To form such a connection, the lateral faces of the water-jacket are enclosed in a frame of asbestos sheets secured to the upper portion of a metal frame, the lower edge of which rests in a groove filled with sand, two of the faces of the jacket being flat, and two being so curved as to remain in contact with the edges of the asbestos frame, whatever be the position of the movable flue. By this means communication between the hearth and the regenerators is ensured during tilting as well as during melting.—O. R.

Thin-walled articles from substances other than clay, but which can be moulded and burnt in a similar manner to ceramic materials; Manufacture of very ——. E. Podszus. Ger. Pat. 274,847, April 19, 1912.

The process is for the preparation of thin-walled articles from such substances as thoria, zirconia, rare earths, alumina, silica, boron nitride, and carbon. A permanent mould made of material having a low coefficient of expansion is used. It is coated first with a thin layer of paraffin, ceresin, wax, or ozokerite, and then with a layer of the refractory substance previously made into a thin paste. After the paste has set or dried, the layer of paraffin or the like is removed by warming or by means of a solvent, whereupon the shaped article of refractory material can be withdrawn from the mould. The surface of the intermediate layer of paraffin or the like may be roughened or rubbed over with graphite to make it adhere well to the layer of refractory material, or a layer of gelatin, collodion or the like may be applied before the refractory material. If the layer of gelatin or collodion be made sufficiently thick it may be withdrawn, after removing the intermediate layer, and will then itself serve as a mould.—A. S

Illuminating-glass; Method and batch or mixture for making ——. G. A. Macbeth, Assignor to Macbeth-Evans Glass Co., Pittsburg. Reissue No. 13,766, July 7, 1914, of U.S. Pat. 1,097,600, May 19, 1914. Date of appl., June 9, 1914.

See this J., 1914, 693.—T. F. B.

Furnace for melting glass or metals; Tilting ——. J. Lambot. Fr. Pat. 466,664, Dec. 26, 1913. Under Int Conv., Jan. 30, 1913.

See Eng. Pat. 29,813 of 1913; preceding.—T. F. B.

Porcelain and similar substances; Apparatus for baking —— *in continuous furnaces with movable hearths.* E. G. Faugeron, Assignor to Soc. Anon. des Faienceries de Creil et Montereau, Montereau, France. U.S. Pat. 1,103,184, July 14, 1914. Date of appl., Oct. 11, 1911.

See Fr. Pat. 421,765 of 1910; this J., 1911, 424.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement raw materials; Burning tests of Philippine ——. A. P. West and A. J. Cox. Philippine J. Sci., 1914, 9, 79—102.

Cement made in an experimental gas-fired stationary kiln, from local materials (chiefly limestone and volcanic tuff), mixed so that the ratios, $SiO_2 : R_2O_3$ and $CaO : (SiO_2 + R_2O_3)$, and the cementation index, are within the usual technical limits, was found to be sound and of high specific gravity and tensile strength.—F. Sodn.

Wood; Preliminary work in fire-proofing ——. R. E. Prince. Proc. Amer. Wood Preservers' Assoc., 1914, 158—172.

The apparatus for testing inflammability consisted of a quartz cylinder, 3 ins. in diam. and 10 ins. long wound with nichrome ribbon of high electrical resistance and insulated with asbestos. The apparatus was heated electrically, natural draught was used, and the temperature of the air inside the cylinder indicated by a thermocouple pyrometer. Test pieces, 1¼ ins. square, by 4 ins. long, were impregnated with concentrated solutions under 100 lb. pressure per sq. in. The pieces, containing 6% of moisture, were placed in the cylinder previously heated to 200° C. and allowed to remain until the gases ignited at a small pilot-light 1 inch above the test-piece and set fire to the wood or, in default, for 40 mins. The tests were repeated at temperature-increments of 50° C. If the wood ignited the time was noted and the piece dropped into a chamber below the cylinder; it was allowed to burn for 3 mins. and the loss of weight recorded. Of untreated woods tamarack was the most resistant and redwood next. Of the chemical impregnating agents, oxalic acid, sodium carbonate and bicarbonate were inefficient in retarding combustion and weakened the wood. Ammonium salts were most effective, while borax was also of considerable value.—J. F. B.

Wood preservatives [creosote oil]; Report of the Committee on ——. Proc. Amer. Wood Preservers' Assoc., 1914, 58—76.

The definition of creosote oil is revised, and comprises all distillate oils boiling between 200° and 400° C., obtained by direct distillation from tars consisting principally of compounds of the aromatic series and containing well-defined amounts of phenoloids. The most important tests are: those for moisture, specific gravity and distillation. Additional tests are: for free carbon, tar acids, sulphonation; the Hempel distillation test, refractive indices and specific gravities of the fractions. These tests are described in detail with the apparatus employed. All temperature observations must be made with a standard thermometer of specified dimensions, length of stem from 0° to 400° C., 295 mm., bulb 14 mm. long and 6 mm. in diam. Readings to be uncorrected. No recommendations have yet been formulated as to standard specifications for creosote oils but the specifications enforced by several consumers associations are reprinted collectively for comparison.
—J. F. B.

Creosote in well preserved timbers; Quantity and character o ——. G. Alleman. Proc. Amer. Wood Preservers Assoc., 1914, 88—96.

The creosote oils extracted from timber which had been i use many years showed an average of 32·9% of distillat below 270° C. and 66·8 of oils of high boiling point. Th defects of most modern creosote preservatives are deficienc in basic oils of high boiling point and the substitution f these of tar or other viscous substances. Under prop conditions of distillation a stable, heavy creosote oil (sp. g 1·10) could be manufactured from coal tar, containin nothing which boils below 210° C.; for general purpos not more than 50% of the total should distil below 315° and for wood-paving blocks not more than 35%. Th qualities demanded are penetrating power, stability, ar preservative and water-proofing value. All these a possessed in a high degree by pure heavy creosote o Tar has a very low penetrating power, even when injecte at a high temperature, and wood treated with a mixtu shows a separation of the components: oil, tar and carbo at the margins of the close-grain rings. As regards stabilit losses occur owing to volatilisation, extraction by wat and crystallisation in wood impregnated with light creos oils. Preservative value may depend on direct antisep action or permanent adhesion of a stable oil-coating to t walls of the minutest cells; external filming without pe tration is of little account. In the light oils the antisep constituents predominate but are volatile and larg soluble in water. The heavy oils are sufficiently rich in t higher homologues of cresols, both these and the protect oils being far more stable. Waterproofing also depe on the complete coating of the cell walls with an oily dep which excludes moisture.—J. F. B.

Creosoting industry ; Use of refined coal tar in the ——. H. von Schrenk and A. L. Kammerer. Proc. Amer. Wood Preservers' Assoc., 1914, 99—148.

The efficiency and permanence of the preservative effect of creosote oils depend on the proportion of oils boiling above 235° C., and this corresponds inversely with the rate of evaporation in open dishes or in timber test-blocks. The best results are always obtained with a heavy oil equivalent to the No. 1 specification of the Amer. Railway Eng. Assoc., but the supply of such oils is limited and far short of the demand. The blending of a small proportion of refined coal-tar enables inferior oils to be used with more satisfactory results, as regards permanence, than are obtained with such oils in the pure state. Eighty parts of the inferior creosote oil should be thoroughly mixed with 20 parts of coke-oven coal-tar, containing not more than 5—6% of carbon, at 180° F. (83° C.) and the temperature of the mixture during impregnation should not be below this. The penetrating power of the mixture is not less than that of creosote oil if the time under pressure be slightly increased. The separation of the tarry components from the oil in the pores of the wood is denied and the superior retention of the oil is proved experimentally.—J. F. B.

Wood-preserving industry in the United States, 1913. Board of Trade J., July 23, 1914. [T.R.]

Returns from 93 wood-preserving plants, of which 58 are commercial plants and 35 private plants (of these 20 are operated by railway companies), show that in 1913 these plants treated 153,613,888 cubic ft. of material, or 21·9% more than in 1912. The total consumption of creosote oil by these plants in 1913 was 108,373,359 (American) galls., an increase of 29·5% over the previous year; the consumption of zinc chloride amounted to 26,466,803 lb., an increase of 27·5%, and of miscellaneous liquid preservatives 3,885,738 galls., an increase of 26·4%. The quantity of creosote imported in 1913 was 62% of the total amount used. New plants for the manufacture of creosote oil are, however, being erected in the middle west and, if present plans materialise, should add about 10,000,000 gallons annually to the available supply of creosote.

Patents.

Kilns or ovens for calcining lime, cement, and other material. F. Crosland, Liscard, Cheshire, and R. Booth, London. Eng. Pat. 22,173, Oct. 2, 1913.

To prolong the life of the lining of vertical shaft kilns, and o preheat the material before calcination, the kiln lining s oval or elliptical in shape from the gas ports upwards to desired point, the wall itself being vertical: from the upper end of the vertical wall to a desired point higher up, he lining is twisted in the shape of a spiral, and from the upper end of the spiral, the section of the kiln becomes ircular, finally widening into hopper form at the summit. —O. R.

Food ; Process for preserving ——. W. Lichty. Ger. Pat. 274,662, July 23, 1913.

Food is impregnated with solutions of lead chloride and ercuric chloride, which may be applied consecutively or imultaneously.—T. F. B.

ement : Process of and furnace for manufacturing ——. L. P. Basset, Montmorency, France. Eng. Pat. 15,612, July 7, 1913.

ee Fr. Pat. 457,511 of 1912 ; this J., 1913, 1012. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the atents and Designs Act, 1907, to Eng. Pats. 9545 of 94 and 24,620 of 1909.—T. F. B.

rocess for obtaining barium aluminate. Ger. Pat. 275,287. *See* VII.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cyaniding ; Calcium hydroxide for ——. R. K. Meade. Eng. and Min. J., 1914, 98, 52—53.

Slaked lime prepared by rotating quicklime crushed to pea-size in a steel drum with slight excess of water, and sifted from the coarse particles, is preferable to quicklime. —W. R. S.

Copper and zinc ; New researches on the alloys of ——. L. Guillet. Bull. Soc. d'Encour., 1914, 121, 14—56.

A series of pure Cu-Zn alloys with Cu from 56 to 100% was subjected to mechanical tests after rolling, in some cases after rolling and drawing, and also after working and annealing. The annealed samples showed a simple relation between the tensile strength and the Brinell hardness. Rolling (hot and cold) had a considerable influence on the properties of the alloys, but the effects were eliminated by annealing. Quenching increased the hardness. For industrial use, alloys with not less than 72% Cu are recommended.—T. St.

Bronzes ; Three-metal ——. A. M. Blow. Met. and Chem. Eng., 1914, 12, 461—467.

A description of the ternary systems: copper-tin with lead, zinc, phosphorus, manganese and aluminium. *Lead* imparts plasticity to bronze, and diminishes hardness and temperature changes ("imparts a lower mutual freezing point"). Microscopic examination shows that the lead is distributed throughout the mass. Segregation, to which bronzes rich in lead are liable, is prevented by the addition of 1% Ni, sulphur added in the form of galena, phosphorus, or arsenic. A small addition of *zinc* does not materially alter the structure of bronzes, whilst ductility and tensile strength are slightly increased. Bronzes containing zinc are more easily forged and cold-rolled and less readily corroded by sea-water. *Phosphorus* may exist entirely as solid solution (up to 1%) or as Cu_3P ; it greatly increases the hardness and resistance to wear, whilst impairing the tensile strength, elasticity and elongation. The maximum in commercial bronzes is about 0·8% P, with about 8% Sn. The valuable properties of *manganese* bronze are its strength and non-corrodibility; commercial products often contain more aluminium than manganese. True *aluminium* bronze seldom contains more than 11% Al; it is useful in casting, though it shrinks considerably. The addition of tin increases its ductility.—W. R. S.

Lead, copper, zinc, tin, aluminium, nickel, mercury, and silver ; World's production of ——. Board of Trade J., Aug. 6, 1914. [T.R.]

According to a statistical summary and report compiled by the "Metallbank und Metallurgische Gesellschaft," Frankfort-on-Maine, the total production of these metals during the last three years has been :—

	1911.	1912.	1913.
	Metric tons.	Metric tons.	Metric tons.
Lead	1,136,000	1,181,800	1,186,700
Copper	893,800	1,018,600	1,005,900
Zinc	902,100	977,900	997,900
Tin	117,600	124,700	128,900
Aluminium	45,000	62,600	68,200
Nickel	24,500	28,500	30,000*
Mercury	4,100	4,300	4,200
Silver, fine	7,685	7,745	..

*Estimated.

Steel production in the United States. Eng. and Min. J., Aug. 1, 1914. [T.R.]

The Statistical Bureau of the American Iron and Steel Association states that the production of steel in the United States in 1913 was the largest ever reported. A further decrease in the make of Bessemer or converter steel, and a large increase in open-hearth steel, chiefly basic metal, are noteworthy.

The production in 1912 and 1913 was :—

	1912.	1913.
	Tons.	Tons.
Bessemer	10,327,901	9,545,706
Open-hearth	20,780,723	21,599,931
Crucible	121,517	121,226
Electric	18,309	30,180
Miscellaneous	2,853	3,831
Total	31,251,303	31,300,874

Included in the open-hearth steel are 1,255,305 tons made by the acid process and 2,210,718 tons produced by the duplex process, made from metal partly treated in Bessemer converters and finally purified in open-hearth furnaces. This is an increase of 772,064 tons over the previous year.

In 1913 the production of steel treated with ferro-vanadium, ferrotitanium, nickel and other alloys was 714.357 tons, a decrease of 78,144 tons from 1912. The total included 74,924 tons Bessemer steel, 213,404 acid open-hearth, 386,486 basic open-hearth, 28,279 crucible and 11.264 tons electric and miscellaneous steel.

At the close of 1913 there were 30 plants equipped to make steel by the standard Bessemer process and 80 by the Tropenas or other modifications of that process. There were 119 basic and 93 acid open-hearth plants, 29 of them being equipped to make both acid and open-hearth steel. There were 110 crucible steel plants and 19 electric plants.

Mineral output of the Philippine Islands in 1913. Board of Trade J., July 30, 1914. [T.R.]

The following statistics have been obtained from the Mines Department of the Bureau of Science of the Philippine Islands showing the mineral output of the islands in 1913, as compared with 1912 :—

	1912.		1913.	
	Quantity	Value.	Quantity.	Value.
		Dollars.		Dollars.
Iron .. metric tons	141	24,636*	227	32.235*
Silver .. fine ounces	7,121	4.332	Not stated	Not stated
Gold .. „	27,582	570.212	42,011	868,362
Coal .. metric tons	2.720	10.100	Not stated	Not stated
Clay products	—	226.500	—	230,000
Lime .. metric tons	—	46,013	11,050	51,350
Sand and gravel cubic metres	—	234,375	689.011	297,823
Stone „	—	325.525	197.039	175.020
Salt .. metric tons	19,147	287,255	19,500	287,500

* The statistics for iron represent the quantity and value of iron castings, mostly ploughshares.

Mineral products mined or manufactured but not sold at the end of each year are not included in the foregoing figures.

Mineral production of Canada in 1913. J. McLeish. Min. and Eng. World, July 18, 1914. [T.R.]

The preliminary report on mineral production in Canada in 1913 shows a total value of $144,031,047, made up as shown in the following table :—

Metallic.

Product.	Quantity.	Value.
Copper, at 15.269 cts., lb.	76,975,832	$11,753,440
Gold, oz.	784.525	16.216,131
Pig iron, tons	73.508	996.429
Iron ore sold, tons	216.614	430,561
Lead, at 4.659 cts., lb.	37,662,703	1,754,705
Nickel, at 30 cts., lb.	49.676.772	14,903,032
Silver, at 59.791 cts., oz.	31,750,618	18,984.012
Cobalt and nickel oxides	—	689.511
Zinc ore, tons	7,535	400,000
Total		$66,127,821

Non-metallic.

Actinolite, tons	66	$720
Arsenic, white, tons	1,692	101,463
Asbestos, tons	136,951	3,830,909
Asbestic, tons	24,135	19,016
Coal, tons	15,115,089	36,250,311
Corundum, tons	1,177	137,036
Feldspar, tons	15,935	56,841
Graphite, tons	2.162	90.282
Grindstones, tons	4,284	43,900
Gypsum, tons	639,698	1,477,589
Magnesite, tons	770	4,620
Mica, tons	—	170,112
Mineral pigments—		
Barytes, tons	641	6,410
Ochres, tons	5,987	41,774
Mineral water	—	173,677
Natural gas, per M	20,345,763	3.338,314
Peat, tons	2,600	10,100
Petroleum, at $1.782 brls.	228,080	406,439
Phosphate, tons	25	217
Pyrites, tons	228,811	638,185
Quartz, tons	78,261	169,842
Salt, tons	100,791	491,280
Talc, tons	12,250	45,980
Tripolite, tons	620	12,138
Total	—	$47,517,155

Structural materials and clay products.

Cement, Portland, brls.	8,658,922	$11,227,284
Clay products—		
Brick, common, pressed, paving	—	7,709,224
Sewer pipe	—	920,973
Fire clay, drain tile, pottery, etc.	—	1,037,870
Kaolin, tons	500	5,000
Lime, bus.	7,671,381	1,605,812
Sand and gravel	—	1,712,256
Sand-lime brick	—	962,004
Slate, sq.	1,432	6.444
Stone—		
Granite	—	1,644,183
Limestone	—	3,087,991
Marble	—	250,373
Sandstone	—	216,657
Total structural materials and clay products	—	$30,386,071
All other non-metallic	—	47,517,155
Total value, metallic	—	66,127,821
Grand total, 1913	—	$144,031,047

Smelter production.—The total quantity of ore, concentrates, etc., treated in 1913, was 3,027,085 tons as compared with 3,005,410 tons in 1912. The ores treated may be classified as follows :—

	1912.	1913.
	Tons.	Tons.
Nickel-copper ores	725,065	823.403
Silver-cobalt-nickel-arsenic ores	8,097	5,818
Lead and other ores treated in lead furnaces	59.932	78,110
Copper-gold-silver ores	2,212,316	2,119,754
Total	3,005,410	3,027,085

The products obtained in Canada from the treatment of these ores include refined lead produced at Trail, B.C., and fine gold, fine silver, copper sulphate, and antimony produced from the residues of the lead refinery there silver bullion, white arsenic, nickel oxide and cobalt oxid produced in Ontario from the Cobalt district ores. I addition to these refined products, blister copper, coppe matte, nickel-copper matte, cobalt material or mixe cobalt and nickel oxides are produced and exported fo refining outside of Canada.

Refined products produced and metals contained in refined smelter products exported.	1913	
	Refined products.	Metals contained in matte, bliste base bulli and speiss
Gold, oz.	11,977	213,279
Silver, oz.	13,789,709	934,601
Lead (including secondary lead), lb.	39,468,729	—
Copper, lb.	—	59,245 722
Copper sulphate, lb.	130,533	—
Nickel, lb.	—	49,676,772
Nickel and cobalt oxides, etc., lb.	1,644,185	
White arsenic, lb.	3,384,249	—

The aggregate results of smelting and refining operations may be summarized as in the above table. The figures do not represent the total production from smelting ores mined in Canada since considerable quantities of copper and silver ores are still shipped to other smelters outside Canada for smelting.

Smelter products shipped out of Canada for refining were blister copper carrying gold and silver values 15,270 tons in 1913, as compared with 17,063 tons in 1912, copper matte carrying gold and silver values 5159 tons in 1913 as against 6727 tons in 1912 and Bessemer nickel-copper matte carrying small gold and silver values as well as metals of the platinum group 47,150 tons in 1913 as compared with 41,925 tons in 1912.

PATENTS.

Metal; Means for stirring or agitating molten —— in melting pots. I. Hall, Birmingham. Eng. Pats. 15,323, 23,493, and 24,081, July 3, Oct. 7 and Oct. 24, 1913.

THE dish-shaped stirrer fits fairly closely into the bottom of the melting pot, and its outer edge is turned upwards and is provided with annular corrugations. Perforations are arranged at or near the angle where the turned-up portion commences. A central sleeve, attached to the solid central part of the dish, surrounds the stem of a valve which controls a central tapping hole. The dish is worked upwards and downwards by a lever attached to the sleeve and pivoted on the furnace edge. Modified forms have perforated radial blades attached to the sleeve, and means for imparting a rotary motion to the dished member. —T. St.

Metals; Composite ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 19,021, Aug. 21, 1913.

METAL of the general character of Monel metal (Ni 2, Cu 1) is united to steel by means of an intermediate film of copper. Plates of the two metals, with a sheet of copper between, are heated in hydrogen or in a vacuum to somewhat above the melting point of copper, but below the melting-point of the other metals. The composite sheet may be rolled or otherwise worked without danger of the components separating.—T. St.

Waste heat of slags; Method and apparatus for utilising the ——. C. Semmler. First Addition, dated Dec. 4, 1913, to Fr. Pat. 463,298, Oct. 6, 1913 (this J., 1914, 426).

THE receptacles into which molten slag is run, are surrounded by closed-in vessels full of water. A reservoir situated at a higher level communicates with the water vessels by pipes through which a natural circulation of the water takes place. The steam produced, assists the circulation. Various forms embodying this principle are described.—T. St.

Furnaces; Calcining and roasting ——. E. Cornet. First Addition, dated Jan. 8, 1914, to Fr. Pat. 465,302, Nov. 25, 1913 (this J., 1914, 540).

THE lower portion of the furnace containing the calcined product is surrounded by an annular chamber, or independent segmental chambers, containing refractory chequer-work in which the incoming air is strongly heated. The central conduit which admits air into the centre of the charge, to complete the oxidation of carbon monoxide, is also provided with chequer-work. The iron bars of the framework of the annular preheaters may be hollow so as to allow of water cooling.—T. St.

Furnace for roasting ores. P. Piketty. Fr. Pat. 466,991, Jan. 5, 1914.

A SHAFT furnace is built up on a framework of reinforced concrete. The walls are formed of independent slabs of concrete with asbestos in the joints. The lining is composed of refractory bricks, vertical grooves being left for air cooling.—T. St.

Alloys of high melting point; Manufacture of ——. Wolfram Lampen Akt.-Ges. Fr. Pat. 466,737, Dec. 30, 1913. Under Int. Conv., Aug. 19, 1913.

IN making ductile alloys of high melting point from one of the metals Cr, V, Nb, Ta, Os, Ru, Th, Zr, and W, with a small amount of another of the same metals, a very small amount (1/2000 of the total mass) of a metal of the platinum group is added to the mixture before compression, to act as a catalytic agent in facilitating the formation of an alloy, or solid solution.—T. St.

Ores; Method of agglomerating and simultaneously transforming —— before smelting. R. E. Trottier. Fr. Pat. 467,301, March 26, 1913.

THE ore is agglomerated with the coal necessary for reduction and the necessary flux so that the briquettes can be treated in a blast-furnace direct without other additions. The briquettes may be heated to dull redness out of contact with air, or in a reducing atmosphere, before charging into the blast-furnace, whereby volatile constituents of the ore are driven off, the distillation products of the coal are recovered, and the metal is partly reduced. —T. St.

Agglomeration of iron ores; Process for increasing the output of rotary kilns especially as used for the ——. G. Polysius, Eisengiesserei und Maschinenfabrik. Ger. Pat. 275,582, Feb. 8, 1913.

BESIDES the main burner a second burner is provided, the flame from which is directed to that part of the kiln where the finer material, which is not or only partly agglomerated, accumulates. The two burners may form branches from a common fuel- and air-supply pipe.—A. S.

Plated metals; Process for removing the coating from —— by means of mercury, with recovery of the latter by distillation. K. Albert, E. Ellenberger, and C. von der Linde. Ger. Pat. 275,105, Sept. 13, 1912.

THE plated metal is treated with mercury vapour, which condenses and forms with the coating metal a liquid amalgam. The residual mercury adhering to the metal, and unused mercury vapour, are distilled from the reaction vessel and recovered. The process, which is applicable to the treatment of iron coated with zinc, copper, lead, tin, brass, or nickel-copper alloys, may be carried out wholly or partly in a vacuum.—A. S.

Briquettes from iron ore and flue dust; Manufacture of ——. M. Freiberger, Charlottenburg, Germany. Eng. Pat. 15,919, July 10, 1913. Under Int. Conv., July 10, 1912.

SEE Fr. Pat. 460,954 of 1913; this J., 1914, 85.—T. F. B.

Iron or manganese metal; Process of manufacturing —— from pure or impure iron or manganese-metal oxides. C. A. Brackelsberg, Stockum, Germany. U.S. Pat. 1,103,258, July 14, 1914. Date of appl., Dec. 11, 1911.

SEE Ger. Pat. 241,321 of 1910; this J., 1912, 136.—T. F. B.

Iron; Process for treating pure ——. The International Metal Products Co. Fr. Pat. 467,332, Jan. 15, 1914. Under Int. Conv., Jan. 16, 1913.

SEE U.S. Pat. 1,090,115 of 1914; this J., 1914, 424.—T. F. B.

Blast furnaces for smelting iron and other ores. T. B. Rogerson. Fr. Pat. 467,357, Jan. 15, 1914.

SEE Eng. Pat. 10,399 of 1912; this J., 1913, 607.—T. F. B.

Steel; Production of —— and the subsequent treatment thereof. J. Churchward, Mount Vernon, N.Y., U.S.A. Eng. Pat. 15,924, July 10, 1913.

SEE U.S. Pat. 1,069,387 of 1913; this J., 1913, 870.—T. F. B.

Steel; Manufacture of ——. G. J. Boyle, Viscount Chetwynd. Fr. Pat. 466,649, Dec. 26, 1913. Under Int. Conv., Jan. 16, May 20, June 4 and 21, and July 22, 1913.

See Eng. Pats. 1306, 11,778, 12,961, 14,431, and 16,821 of 1913; this J., 1914, 597.—T. F. B.

Iron alloy. Pittsburg Iron and Steel Foundries Co. Fr. Pat. 466,663, Dec. 26, 1913. Under Int. Conv., March 18, 1913.

See U.S. Pat. 1,071,364 of 1913; this J., 1913, 947.—T. F. B.

Steel alloys containing chromium and nickel, Use of —— in making articles such as vessels, tubes, parts of machines, etc., required to withstand the action of acids and mechanical stresses. C. Pasel. Fr. Pat. 466,910, Nov. 8, 1913. Under Int. Conv., Dec. 20, 1912.

See Eng. Pat. 13,415 of 1913; this J., 1914, 697.—T. F. B.

Melting furnaces, ladles, and like containers for molten material. J. Churchward, Mount Vernon, N.Y., U.S.A. Eng. Pat. 15,923, July 10, 1913.

See U.S. Pat. 1,069,601 of 1913; this J., 1913, 900.—T. F. B.

Open-hearth furnace. K. Albert, Wiesbaden, Germany. Reissue No. 13,763, July 7, 1914, of U.S. Pat. 1,073,653, Sept. 23, 1913. Date of appl., Jan. 29, 1914.

See Fr. Pat. 451,797 of 1912; this J., 1913, 662.—T. F. B.

Reheating furnaces. F. K. Siemens. Fr. Pat. 467,149, Jan. 9, 1914. Under Int. Conv., Dec. 5, 1913.

See Ger. Pat. 268,379 of 1913; this J., 1914, 144.—T. F. B.

Zinc or copper ores, ashes, waste, and chippings; Treatment of ——. F. Bourgeot, Lastours, France. Eng. Pat. 15,943, July 10, 1913. Under Int. Conv., Aug. 3, 1912.

See Fr. Pat. 458,336 of 1912; this J., 1913, 1073.—T. F. B.

Metallurgical furnaces for use chiefly in the metallurgy of copper. L. Addicks, Perth Amboy, and C. L. Brower, Chrome, N.J., U.S.A. Eng. Pat. 16,307, July 15, 1913.

See U.S. Pat. 1,083,719 of 1914; this J., 1914, 144. Some constructional details are also claimed.—T. F. B.

Metallic alloy; Non-corrodible ——. J. Coup and E. Allbaugh, Clyde, Ohio, U.S.A. Eng. Pat. 18,161, Aug. 9, 1913.

See U.S. Pat. 1,069,113 of 1913; this J., 1913, 870.—T. F. B.

Alloys stable against strong acids; Process of producing ——. W. and R. Borchers, Aachen, Germany. Eng. Pat. 18,212, Aug. 11, 1913.

See Ger. Pats. 256,361, 265,076, and 265,328; this J., 1913, 431, 1160.—T. F. B.

Pyrophoric alloy. P. Faehr, Bitterfeld, Assignor to Elektrochemische Werke G.m.b. H., Berlin. U.S. Pat. 1,102,575, July 7, 1914. Date of appl., March 27, 1912.

See Fr. Pat. 439,058 of 1912; this J., 1912, 648.—T. F. B.

Alloy for welding copper and nickel. C. Canzler and R. Samesreuther, Düren, Assignors to Autogenwerk Sirius Ges. m. b. H., Dusseldorf, Germany. U.S. Pat. 1,103,482, July 14, 1914. Date of appl., Sept. 24, 1913.

See Fr. Pat. 461,942 of 1913; this J., 1914, 205.—T. F. B.

Alloy; Metallic ——. C. E. Monkhouse. Fr. Pat. 467,487, Jan. 20, 1914. Under Int. Conv., Jan. 22, 1913.

See Eng. Pat. 1819 of 1913; this J., 1914, 87.—T. F. B.

Minerals; Process for treatment of —— and extracting metal. B. Junquera, Oviedo, Spain. U.S. Pat. 1,102,339, July 7, 1914. Date of appl., Dec. 18, 1908.

See Fr. Pat. 394,719 of 1908; this J., 1909, 370.—T. F. B.

Ore concentration. H. H. Greenway, Clare, South Australia, and A. H. P. Lowry, Prahran, Victoria. U.S. Pat. 1,102,738, July 7, 1914. Date of appl., May 17, 1913.

See Fr. Pat. 458,051 of 1913; this J., 1913, 1078.—T. F. B.

Ore concentration. (1) G. A. Chapman and S. Tucker, (2) G. A. Chapman. Assignors to Minerals Separation, Ltd., London. U.S. Pats. 1,102,873 and 1,102,874, July 7, 1914. Dates of appl., Dec. 26, 1912, and May 8, 1913.

See Eng. Pats. 28,929 of 1911 and 12,171 of 1912; this J., 1913, 146.—T. F. B.

Ores and similar substances; Process and apparatus for preparing [concentrating] ——. G. S. A. Appelqvist and E. O. E. Tydén. Fr. Pat. 467,018, Jan. 5, 1914. Under Int. Conv., Jan. 6, 1913.

See Eng. Pat. 402 of 1913; this J., 1913, 430.—T. F. B.

Filter for slimes pulp and the like. G. Ridgway, Kalgoorlie, Western Australia. U.S. Pat. 1,103,080, July 14, 1914. Date of appl., Feb. 3, 1912.

See Eng. Pat. 10,731 of 1912; this J., 1913, 608.—T. F. B.

Gold and silver from refractory ores; Recovery of ——. C. Butters, London. U.S. Pat. 1,103,346, July 14, 1914. Date of appl., Aug. 28, 1912.

See Eng. Pat. 18,660 of 1912; this J., 1913, 915.—T. F. B.

Nickel; Extraction of —— from mixtures of nickel and other metals. H. E. Fierz, Basle, Switzerland. U.S. Pat. 1,103,747, July 14, 1914. Date of appl., March 26, 1914.

See Eng. Pat. 4249 of 1913; this J., 1913, 870.—T. F. B.

Nickel; Recovery of —— from its ores. The Madagascar Minerals Synd., Ltd. First Addition, dated Feb. 15, 1913, to Fr. Pat. 463,615, Dec. 21, 1912.

See Eng. Pats. 27,626 of 1912 and 3814 and 6703 of 1913; this J., 1914, 30.—T. F. B.

Nickel; Recovery of —— from its ores. The Madagascar Minerals Synd., Ltd. Second Addition, dated March 22, 1913, to Fr. Pat. 463,615, Dec. 21, 1912.

See Eng. Pats. 6703, 17,131, and 18,769 of 1913; this J., 1914, 30, 489.—T. F. B.

Metals; Process for extracting ——. MacKay Copper Process Co. Fr. Pat. 465,614, Dec. 3, 1913.

See U.S. Pat. 1,094,371 of 1914; this J., 1914, 598.—T. F. B.

Copper; Process for hardening ——. W. H. White. Fr. Pat. 467,583, Jan. 22, 1914.

See U.S. Pat. 1,062,067 of 1913; this J., 1913, 662.—T. F. B.

Furnaces for melting glass or metals. Eng. Pat. 29,313. *See* VIII.

XI.—ELECTRO-CHEMISTRY.

Patents.

Accumulators; Alkaline electric ——. E. Foss, F. Harris and B. W. Parker, London. Eng. Pat. 16,027, July 11 1913.

Positive electrodes of nickel or cobalt hydroxide, an negative ones of iron monoxide or sesquioxide, are contained in a box partly filled with granulated pumice ston saturated with caustic potash solution.—B. N.

Wood for storage-battery separators; Process of treating ——. J. M. Skinner, Assignor to Philadelphia Storage Battery Co., Philadelphia. U.S. Pat. 1,098,357, May 26, 1914. Date of appl., Dec. 26, 1912.

Wood separators for storage batteries are immersed in an aqueous solution of sodium sulphide or other sulphide at 15° to 100° C.; they are removed before the fibres and cells are disintegrated, and are then washed and dried under pressure. The object of this treatment is to remove some of the constituents objectionable for battery purposes, and to make the wood more porous.—T. F. B.

Furnaces; Electric ——. I. Rennerfelt, Stockholm, Sweden. Eng. Pat. 226, Jan. 5, 1914. Under Int. Conv., Jan. 4, 1913.

Electrodes, for the production of arcs, are supported in stationary brickwork portion of the furnace, and within this portion the bottom, supporting a number of crucibles arranged in a circle underneath the electrodes, is rotated round a vertical axis. The arcs play directly on to arbon, or other conducting material, supported on a rojection fixed to the movable bottom, and the roof of the urnace radiates the heat rays on to the crucibles. Burners, or oil or gas, may be located in the stationary portion as supplementary source of heat.—B. N.

using refractory materials; Process for ——. E. Podszus, Berlin-Treptow, Germany. Eng. Pat. 27,744, Dec. 2, 1913. Under Int. Conv., Dec. 2, 1912.

ee Fr. Pat. 465,604 of 1913; this J., 1914, 700.—T. F. B.

lectrolytic apparatus. W. Thum, Hammond, Ind., U.S.A. Eng. Pat. 9232, April 14, 1914.

ee U.S. Pat. 1,095,748 of 1914; this J., 1914, 601.—T. F. B.

urnace; Electric ——. A. Minet and H. L. L. Lucas, Paris. U.S. Pat. 1,103,309, July 14, 1914. Date of appl., Dec. 30, 1913.

ee Eng. Pat. 12,444 of 1913; this J., 1913, 1159.—T. F. B.

lectric arcs; Method of generating heat by means of ——. I. Rennerfelt, Stockholm. U.S. Pat. 1,103,379, July 14, 1914. Date of appl., March 18, 1913.

ee Fr. Pat. 466,291 of 1913; this J., 1914, 599.—T. F. B.

l used for electrical purposes; Process of regenerating ——. R. Friese, Charlottenburg. Assignor to Siemens-Schuckertwerke G. m. b. H., Berlin. U.S. Pat. 1,103,499, July 14, 1914. Date of appl., April 1. 1913.

ee Eng. Pat. 8130 of 1913; this J., 1913, 950.—T. F. B.

lectrolytic process for producing acetic acid from acetylene. Fr. Pat. 467,778. *See* VII.

mposition of amalgams of alkali and alkaline-earth metals. Ger. Pat. 275,047. *See* VII.

XII.—FATS; OILS; WAXES.

an oil extracting mill at Dairen. Board of Trade J., Aug. 6. 1914. [T.R.]

he new experimental bean-mill belonging to the South anchuria Railway Company (see this J., 1914, 756) arted operations in the middle of April last. The mill situated at Ji-ji-ko, about two miles from the Dairen harves, and cost about £30,000, of which the plant cost out £20,000. It is equipped for the manufacture crude oil and bean meal from soya beans, and for fining the crude oil obtained. The maximum capacity the mill is 80 tons of beans per day of 24 hours. At esent only 50 tons are used daily, producing 7 tons of oil and 40 tons of meal. The crude oil is not at present refined at the mill as there are no operatives sufficiently trained to work the refining plant.

Owing to the low percentage of moisture and oil in the residue obtained by this process, it will be possible to export this residue to Europe for use as a cattle food, and trial shipments for this purpose are to be made. At present the residue is sold in Japan as a fertiliser. It fetches a higher price by 20% than bean cake; but from equal quantities of beans the residue obtained is 20% less than the amount of bean cake obtained by the crushing method, whilst there is the additional expense of providing bags for packing.

It is too early to say whether the experiment will give satisfactory results from a commercial point of view. The capital cost is much greater than for a mill of the ordinary type and more skilful operatives are necessary. The crude oil contains benzine and is therefore unsuitable for edible purposes—its chief use in China; for this reason it has fetched lower prices than the oil from the crushing mills The oil must therefore be refined before being put on the market, and it will probably be necessary to find a market in Europe or America.

Kukui and lumbang oils. Oil, Paint, and Drug Rep., July 27, 1914. [T.R.]

There is very little if any difference between the kukui nut of Hawaii and the lumbang nuts, *Aleurites moluccana* and *Aleurites triloba*, found in the Philippines. Kukui-nut oil is a valuable Hawaiian product and is in demand in the paint and varnish trade. It has been shipped to the United States from various Pacific islands for the last 75 years. The kukui-nut oil of Hawaii, like the lumbang oil of the Philippines, has very pronounced drying properties and is said to be suitable for all purposes for which linseed oil is used. The kukui-nut press cake is rich in nitrogen, phosphoric acid, and potash, and is highly prized as a fertiliser. This is also true of the lumbang cake of the Philippines. There seems to be some difference of opinion as to the value of these cakes as a fodder, but most feeders consider them poisonous. The oils are generally considered as unfit for human consumption on account of their pronounced purgative properties.

An oil is made in the Philippines from the nuts of *Aleurites tri-sperma*, locally called "lumbang banucalad," which is asserted to be practically identical with Chinese tung oil.

Soya bean oil for paint making in Australia; Denaturation of ——. Board of Trade J., July 30, 1914. [T.R.]

The following formula has been approved, under the provisions of By-Law No. 231, for the denaturation of soya bean oil for paint making:—

Soya bean oil	85	gallons
Linseed oil, double boiled	15	„

Oil so denatured may be delivered free of duty under Tariff heading No. 234 (H).

Hardened oils in Europe. Oil, Paint and Drug Rep., July 20, 1914. [T.R.]

Artificially hardened liquid oils are now being supplied in large quantities, both in Europe and in the United States. On account of the relatively lower price of linseed oil during the past year, this has been more generally hardened for the soap makers than the other oils. Whale oil is also coming into use for this purpose. Cottonseed oil, being relatively high in price, is not being hardened in important quantities except for edible uses. In the United States most of the large makers of compound lard, who formerly used 80% of liquid cottonseed oil and 20% oleo-stearin, now use cottonseed oil exclusively, after hardening it to the desired consistency. In Europe small quantities of cottonseed oil are being hardened for margarine, and this will probably be an important business, but for the present most of the hardened oils are being used for soap. The total capacity of European hardening plants for 1914 is put at 1,375,000 barrels (400 lb. each), but not more than half this amount was made in 1913. In the United States the output for 1913 is put at 500,000 barrels, and the plants are said to be rapidly increasing.

The amounts of various oils used in the principal European countries in 1913 for making margarine are estimated at:—Copra oil, 169,000 metric tons; palm kernel oil, 35,000; animal hard fats, 143,500; liquid oils, 150,000 tons. The production of margarine is increasing year by year, and copra oil as an ingredient is becoming increasingly popular. The demand for this purpose alone will probably be 250,000 tons in 1914, and this is two-thirds of the world's crop. The soap trade will always require important quantities. The copra crop of 1913 is estimated at 630,000 metric tons. At the highest probable yield of 60%, this would make 378,000 metric tons of oil.

PATENTS.

Wagon- and machine-grease; Manufacture of ——. A. Schmitt, geb. Zannowsky. Ger. Pat. 274,209, Aug. 29, 1911.

In the preparation of lubricating greases, a solution of sodium aluminate is used instead of calcium oxide or hydroxide to effect saponification of saponifiable oils or fats dissolved in mineral oils. Aluminium hydroxide in a very fine state of division, and possessing considerable lubricating value, is precipitated in the mass.—A. S.

Lubricants and substances for adding thereto; Manufacture of —— *capable of indicating "hot running."* W. Esch. Ger. Pat. 275,055, April 22, 1913.

Naphthalene-sulphur (prepared by melting together equal weights of naphthalene and sulphur) is incorporated with the lubricant by heating, and after cooling, burnt magnesia or equivalent oxides, hydroxides, peroxides or the like, may also be incorporated with the mass. If a bearing lubricated with this preparation becomes heated, hydrogen sulphide is evolved.—A. S.

Trimethylamine derivatives for use in preparing soaps, candles, ointments, finishing materials, or for other purposes for which stearine is used; Process for making ——. M. Herzmann. Ger. Pat. 275,344, June 15, 1911.

Trimethylamine is treated, first at the ordinary temperature and then at about 120° C. under pressure, with the chlorohydroxy-fatty acids or sulphuric esters of hydroxy fatty acids, such as Turkey-red oil, obtainable from higher unsaturated fatty acids; a small quantity of a catalyst, such as finely divided copper or pyridine, facilitates the reaction. The products thus obtained contain the carboxyl group intact, and can therefore be saponified with alkalis; on the other hand, owing to their basic properties, they can combine with oxalic and other acids to form salts.—T. F. B.

Wood-oil; Process of preserving —— *from congealing on being subjected to heat.* E. Beringer and W. Zimmer, Charlottenburg, Assignors to Reichhold, Flügger und Böcking, Hamburg, Germany. U.S. Pat. 1,103,473, July 14, 1914. Date of appl., Sept. 23, 1913.

See Ger. Pat. 261,403 of 1912; this J., 1913, 834.—T. F. B.

Apparatus for testing lubricants. Ger. Pat. 275,225. *See* XXIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

PATENTS.

Plastic masses; Process for preparing solid ——. K. Hagendorf. Ger. Pat. 274,179, July 29, 1913.

Serum from the blood of cattle is treated with formic acid and trioxymethylene or formaldehyde, and then heated with phenol and sodium peroxide until a solid product is obtained.—T. F. B.

Paints and printing colours; Manufacture of ——. N. W. Turkin. Fr. Pat. 467,039, Jan. 6, 1914.

See Eng. Pat. 23,128 of 1913; this J., 1914, 757.—T. F. B.

Paints, enamels, etc.; Process for making ——. International Color and Chemical Co., Inc. Fr. Pat. 467,464, Jan. 19, 1914. Under Int. Conv., Feb. 1, 1913.

See U.S. Pat. 1,084,361 of 1914; this J., 1914, 208.—T. F. B.

Cellulose nitrates; Solutions of —— *more especially applicable for lacquers.* A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 17,953, Aug. 6, 1913.

See Fr. Pat. 461,034 of 1913; this J., 1914, 93.—T. F. B.

Resin-soap and resin; Method for manufacturing ——. J. Aktschourin, Aktschourin-Tupik, Russia. U.S. Pat. 1,103,336, July 14, 1914. Date of appl., Jan. 8, 1913.

See Ger. Pat. 257,015 of 1912; this J., 1913, 499.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber solutions; Influence of the solvent on the viscosity of ——. F. Kirchhof. Kolloid-Zeits., 1914, **15**, 30—36.

The experiments were made with an Ostwald capillary viscometer as modified by Ubbelohde. Preliminary tests showed that with a working pressure corresponding tc 60 cm. of water the viscosity-coefficients of not too concentrated solutions were practically independent of the efflux-velocity. The viscosity-coefficients of 0·5, 1, 2, and 3% solutions of plantation rubber in carbon tetrachloride tetrachloroethane, and pentachloroethane respectivel were about double those of solutions of equal concentratio in benzene or petroleum benzine. According to Hatschek (Kolloid-Zeits., 1913, **12**, 238, **13**, 88), the viscosity of a emulsoid sol. depends upon the ratio of the total volum to the volume of the disperse phase, in that this rati $A=\left(\frac{\eta}{\eta-1}\right)^3$, where η is the viscosity coefficient; and th values for the volume of the disperse phase calculated b the aid of this formula showed that the rubber in th disperse phase was combined with many times its ow volume of solvent; the quantity of solvent thus combine was different for different solvents and varied with tl concentration of the solution. When the concentratio of the solutions were calculated on the basis of the volun of the disperse phase, values were obtained which we in agreement with the enormous increase of viscosi observed with solutions containing more than 1% dissolved rubber.—A. S.

PATENTS.

Rubber compounds. J. F. Monnot, Paris. Eng. P 16,033, July 11, 1913.

Durability of rubber tyres is increased and tendency skid lessened by making them with a mixture of Pa rubber, 15; sulphur, 1·8; litharge, 1·5: magnesi carbonate, 1·8; whitening, 1·7; zinc oxide, 5·0, a finely ground "ruby arpax or telium," 3·2 kilos.—D. J.

Rubber; Apparatus for evaporating the moisture out coagulated ——. Bertrams Ltd., R. F. Gillespie a P. M. Matthew, Edinburgh. Eng. Pat. 16,372, July 1913.

Rubber is carried on a continuous band or the like fr the coagulating machine through rollers into a dry chamber, from which the moist air may be forced out drawn off. Partitions in the drying chamber cause air to follow a tortuous path, and the band passing c rollers is caused to travel up and down the chamber d present an extended drying surface.—D. J. L.

Rubber; Process for regenerating old ——. L. Sachs. Ger. Pat. 275,061, Feb. 11, 1913.

Finely subdivided rubber waste is treated with a mixture of a metallic sulphite and an oil capable of combining with sulphur, at a high temperature and preferably under increased pressure.—T. F. B.

Caoutchouc, guttapercha, and like substances; Treatment of ——. L. Feval and J. de la Fresnaye, Paris. U.S. Pat. 1,102,487, July 7, 1914. Date of appl., Aug. 11, 1913.

See Eng. Pat. 17,582 of 1913: this J., 1913, 1078.—T. F. B.

Rubber: Process for accelerating the vulcanisation of natural or artificial ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Dec. 29, 1913, to Fr. Pat. 464,533, Nov. 7, 1913. Under Int. Conv., Feb. 25, 1913.

See Ger. Pat. 269,512 of 1913; this J., 1914, 365.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Salt stains: The salting of hides and the avoidance of so-called ——. E. Romana and G. Baldracco. Collegium, 1914. 517—519.

Fresh hides were carefully washed in running water and tumbled in running water for half an hour. They were then laid on the horse, hair side out, allowed to drain for 12 hours, and afterwards salted with 15% of denatured salt with an addition of 1% (on the weight of salt) of various other salts (sodium fluoride and sulphate, potassium carbonate, chloride and borax). After salting the hides were left in pile for 24 hours, then bundled in the usual way and left for 15 days. They were found to be perfectly preserved, the hair being firm and the flesh quite clear. After soaking back, and washing out the salt, the hides were limed in a lime liquor to which sodium sulphide had been added, fleshed and delimed. In every case the grain was white and without stains. It is concluded that salt stains are caused by impurities contained in the hide, and that to obtain good results it is indispensable to wash the hides well before salting.—D. J. L.

Tanning effects of various quinones; The comparative ——. L. Meunier and A. Seyewetz. Collegium, 1914, 523—527.

The authors have shown previously (this J., 1908, 580, 909) that a product of great stability, having all the physical and chemical characters of true leather, is produced by the action of benzoquinone on the amidogen groups of the albumin molecule. The reaction is accompanied by an oxidation of the fibre, resulting in the transformation of part of the quinone into quinol (hydroquinone) thus:—

$$R.NH_2+2C_6H_4O_2=R.N:C_6H_1O_2+C_6H_4(OH)_2.$$
$$2R.NH_2+3C_6H_4O_2=(R.N)_2:C_6H_4O_2+2C_6H_4(OH)_2.$$

The tanning properties of various substituted quinones have been compared with those of ordinary benzoquinone with regard to their power of rendering gelatin insoluble and their rapidity of penetration. 5 grms. of gelatin in thin sheets was soaked in distilled water for 2 hours, then placed in flasks with 200 c.c. of recently boiled distilled water containing respectively 0·2, 0 15, 0·10 and 0·05 grm. of each of the various substituted quinones. The flasks were kept in the dark and the resistance of the gelatin to boiling water was measured after 18, 68, 96 and 120 hours. Benzoquinone in very dilute solutions did not render gelatin insoluble instantaneously, but only after an appreciable lapse of time. In 120 hours, 5 grms. of gelatin were rendered insoluble by 0·05 grm. of quinone in 200 c.c. of water. Higher homologues of quinone, at concentrations lower than 0·1%. did not render gelatin insoluble in 120 hours. The chlorine, sulphonated, chloro-sulphonated and bromo-sulphonated derivatives of quinone had a more rapid tanning action than quinone itself. At very great dilutions their action seemed to be a surface effect. All the sulphonated derivatives were used in the form of their sodium salts; their tanning action would be modified by the presence of an acid. In determining penetrating power tubes were used containing 5 c.c. of 4% gelatin solution and 15 c.c. of 0·2% solutions of the quinones. The degree of penetration was followed by observing the reddish brown colour of the gelatin when tanned by the quinones. All the sulphonated, chloro-sulphonated and bromo-sulphonated quinones which had a rapid tanning action coloured and tanned the outer surface of the gelatin rapidly but the penetrating action was very weak and the lower part of the gelatin remained untanned. The slower acting quinones such as toluquinone penetrated slowly but regularly. The action of ordinary benzoquinone was intermediate between that of the two types. Quinones thus resemble natural tannins in the fact that the more rapid their tanning action the feebler is their penetrating power.—D. J. L.

Gambier; Chinese block ——. E. O. Sommerhoff and C. Apostolo. Collegium, 1914, 7, 504—509.

The mineral matter, *e.g.*, magnesium salts, in tanning extracts exists as a kind of complex salt with the tannin, analogous to the combination of magnesium in chlorophyll. A kind of dongola tannage takes place when these extracts are used, even when no extra mineral substance is added. In the yellow powder deposited from Indragiri gambier in hot water, 1·5% of ash was found; the dissolved matter yielded 4·9% ash. Comparative analyses of the ash of Chinese and Indragiri gambier are given; the Chinese gambier contains more alkali salts while the Indragiri contains more magnesium salts. The difference in the method of extraction is held responsible for the different composition of the ash. The Chinese gambier was extracted in an open vessel in the light and air, while the Indragiri was extracted in a closed battery. By dissolving in boiling water and stirring in the light the red Indragiri gambier becomes yellow and similar to the Chinese. By stirring, relatively dilute gambier solution can be caused to coagulate. In both kinds of gambier 0·52% of nitrogen was found, corresponding to 3·5% dry vegetable albumin. This nitrogen has been disregarded in the determination of the amount of loading silk fibre has undergone when gambier has been used for the purpose. Gambier consists of sparingly soluble catechin and more easily soluble catechintannic acid. The substance which is generally regarded as being fixed by the hide cells is the catechin which is sparingly soluble in water but soluble in ether, while the catechintannic acid, insoluble in ether, is easily soluble in water, and washed out from the leather to a great extent.—D. J. L.

Mangrove in quebracho extracts: van Gijn and van der Waerden's method for the detection of ——. W. Moeller. Collegium, 1914, 485—487. (See this J., 1914, 151.)

The presence of methylpentosans in a tanning extract is not always due to mangrove, and their absence is no proof that mangrove is not present. Furfural is volatilised in the process of manufacture and by drastic treatment all furfural and methylfurfural may be removed from mangrove or quebracho or any other extract. Quebracho wood contains 14% and oak bark 16% of pentosans but their extracts contain none. Mangrove wood contains both pentosans and methylpentosans but the extract only methylpentosans. As the boiling point of methylfurfural is 20° higher than that of furfural, more of the former is left in the extract after the manufacturing process. Methylfurfural is formed in mangrove extract during manufacture and may be removed almost quantitatively by distillation at 110° C. in a vacuum without adding hydrochloric acid; it is not removed by shaking out with ether, being apparently in a loosely combined form. Methylfurfural is destroyed by other chemical treatment besides sulphiting as found by van Gijn, and quebracho extract may contain 50% of mangrove without showing it by the test. A small quantity of methylfurfural found in an extract shows the probability of the presence of mangrove, but it may be derived from other materials. Many other barks beside that originally known as mangrove bark appear in trade under the same name, and all barks giving a red extract and containing much tannin are now called mangrove. Some samples of so-called mangrove bark give a value of 30—40% when shaken out with ethyl acetate (see this J., 1914, 94), while real mangrove, according to Stiasny, should yield only 0—5%.—D. J. L.

Barks; Valuation of birch —— by von Schroeder's hydrometer method. W Appelius. Collegium, 1914, 399—402.

A table is given showing the connection between the specific gravity of birch bark liquors and the percentage of total extract and tannin contained in them. The tannin content was, on the average, 10% by the official method and 9% by the Löwenthal method. An average of 3·7% of sugar was found, and, per 100 parts of tannin, 93—94 parts of non-tannins and 35 parts of saccharine substances. —D. J. L.

Tanning extracts, and in leather; Cellulose extracts and their detection in ——. W. Moeller. Collegium, 1914, 488—493. (See also this J., 1914, 365, 654.)

The substances in cellulose extract which react with aniline and hydrochloric acid are all contained in the portion of it which is absorbed by hide. That the non-tannin filtrate sometimes gives the precipitate is due to the fact that many cellulose extracts are neutral or alkaline, and the material reacts very slowly with hide powder. Cellulose extract was detected in the suspender pits of a tannery in which its use had been discontinued for 6 months. By adding absolute alcohol to a fairly strong cellulose extract solution 40—50% is precipitated, which is quite a different action to that shown by most tanning materials. The precipitate contains all the substance which gives the Procter-Hirst reaction (this J., 1909, 293), and the portion left in solution is free from lignin. By reprecipitating the lignin substance was obtained as an oily liquid which was evaporated to a solid extract consisting mainly of substances absorbed by hide. The alcoholic filtrate contained very little material capable of being absorbed by hide and did not react with aniline. Small quantities of cellulose extract mixed with other extracts can be detected by precipitating with alcohol and applying the Procter-Hirst test to the dissolved precipitate. The author found it impossible to detect cellulose extract in leather in the manufacture of which it had been used mixed with other extracts in the ordinary course of manufacture. When cellulose extract has been used as a filling and weighting material on tanned leather it can be washed out with water and the Procter-Hirst test applied.—D. J. L.

Leather and in sulphited extracts; Sulphuric acid in ——. U. J. Thuau and R. Madru. Collegium, 1914, 527—533.

A great quantity of leather, in the manufacture of which no sulphuric acid has been used, is refused for use in the French army as containing too much sulphuric acid. The quasi-official method of determination of Balland and Maljean is inaccurate, amorphous sulphur, sulphur of sulphites and bisulphites and all organic sulphur being converted by it into sulphuric acid and estimated as such. The presence of sulphur is necessary in many leathers. Dufour has investigated the behaviour of organic sulphur under the Balland method and has attempted to isolate the tanning matter from sulphited extracts and separate from it the inorganic sulphites and sulphates. 20 c.c. of $N/10$ hydrochloric acid was added to 5 grms., sulphited extract of 25° Bé. (1·21 sp. gr.) in 100 c.c. of water. The tannin was precipitated with a 5% solution of cinchonine hydrochloride and the precipitate washed, dried, and burnt in an electric muffle furnace. The solution of the ash in dilute nitric acid gave no precipitate with barium chloride. On repeating the experiment and adding 10—15 c.c. of $N/1$ sodium carbonate to the tannin precipitate before burning, much precipitate was obtained with barium chloride. An extract sulphited with 10% of bisulphite and containing 40% tannin showed 1·094% SO_3. A leather tanned with this extract and containing 40% tannin would thus show the same percentage of SO_3 by Balland's method but would appear basic by Procter's method. Chestnut and oak wood extracts contain organic acids and when sulphited or mixed with a sulphited extract, free sulphuric acid may be formed and may appear in the leather. Sulphates and sulphites may be estimated accurately to 3% by the following method. Sulphates are first estimated by precipitation with barium chloride. A known weight of the extract is evaporated with sodium carbonate and potassium nitrate and ignited, and sulphates estimated in the ash. The difference between the two is calculated as sulphurous acid. Free sulphurous acid is estimated by distilling into standard soda solution, oxidising with bromine water and precipitating as sulphate. The rate at which sulphurous acid is driven off by boiling is some guide as to the behaviour of the extract in practice. Extracts sulphited under pressure give off much less sulphurous acid than others. In the first case sulphonation probably takes place, and the Balland and Maljean method would not distinguish between free sulphuric acid and SO_3 combined in this form.—D. J. L.

Patents.

Tannin; Process for extracting —— from bark, wood or other vegetable materials and apparatus for carrying out the said process. S. B. Bilbrough and J. Frew, Johannesburg. Eng. Pat. 14,405, June 21, 1913.

The material is subjected to a preliminary mechanical crushing to render it absorbent and afterwards to a series of crushings or squeezings prior to one or more of which it is soaked with tannin liquor or water. The material is delivered direct from one set of rollers to the next by conveyors or carriers set between the rollers, and pumps deliver the tan liquors expressed from each set of rollers through pipes which spray the liquors on the material issuing from the preceding set of rollers. Means are provided for applying two or more washes prior to any or all of the stages of pressing, each wash being followed by one or more pressings. Flanges are provided to prevent the bark pulp or fibre from spreading beyond the ends of the rollers.—D. J. L.

Tannin and dyestuff extracts; Process for preparing an agent for decolorising and clarifying —— from soya beans. E. Dammer. Ger. Pat. 274,974, Feb. 2, 1913.

Soya beans are ground, freed mechanically from oil, and dried, and these processes are repeated several times, the husks and starch particles being removed. This treatment renders the protein substances insoluble, and yields a product suitable for decolorising and clarifying tannin and dyestuff extracts, by virtue of its power of precipitating colouring matters without affecting the tannin.—T. F. B.

Hides; Method of storing ——. W. H. Allen, Detroit, Mich. U.S. Pat. 1,098,005, May 26, 1914; date of appl., March 12, 1913.

Tanned hides are kept in a condition suitable for dyein by storing them whilst still wet in a chamber of which th atmosphere is kept saturated with moisture and an anti septic such as formaldehyde. The hides before storin may be treated with an antiseptic and should be raise on supports to keep them off the floor of the chamber —D. J. L.

Leather; Process for decolorising ——. R. Friedrich Ger. Pat. 275,304, July 16, 1913.

Vegetable-tanned hides are immersed in a dilute solutio of aluminium bisulphite, or of a mixture of aluminiu sulphate and sodium bisulphite; treatment with a dilut alkali carbonate solution may precede the bisulphit treatment when hides tanned with mangrove and simila extracts and then dried and finished, are to be bleache —T. F. B.

Adhesive substance; Production of an —— of a lig colour from seaweeds. A. Krefting, Assignor to Nor Tangsyndikat, Christiania, Norway. U.S. Pa 1,099,382, June 9, 1914. Date of appl., Feb. 21, 191

The outer dark-coloured skin is removed from the stal of sea-weeds by grinding, cutting or slitting. The stal re then cut into smaller pieces, leached with water and ibjected to a treatment with chemicals to effect dissotion.—D. J. L.

rotein-containing materials [*soya-beans*]; *Preparation of plastic substances* [*artificial horn, bone, etc.*] *from* ——. R. Dodd and H. B. P. Humphries, London. Eng. Pat. 15,316, July 3, 1913.

SEMI-PLASTIC material is prepared from the soya bean y removing the bulk of the oil, macerating and extracting ith water, separating the insoluble and non-emulsifiable ibstances from the liquors or paste so obtained and agulating the liquor either warm or cold with aluminium lphate or formaldehyde. Suitable glutinous, colouring, ling, hardening or other materials may afterwards be lded.—D. J. L.

anning. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 18,258, Aug. 11, 1913.

E Addition of July 31, 1913, to Fr. Pat. 443,730 of 1912; is J., 1914, 209.—T. F. B.

tins; Process for preparing —— for tanning and dyeing. E. d'Huart. Fr. Pat. 466,562, Oct. 20, 1913.

E Eng. Pat. 23,841 of 1913; this J., 1914, 326.—T. F. B.

XVI.—SOILS; FERTILISERS.

itrification and denitrification in arable soils: Influence of organic matter on ——. A. Kossowicz. Z. Gärungsphysiol., 1914, **4**, 1—48. Chem. Zentr., 1914, **2**, 260—261.

HE experiments were made on an alluvial loam soil. itrification was retarded by peptone and to a lesser extent a mixture of peptone and straw, and also by very large iantities of straw alone. Dried farm manure had a ght retarding action, and dried manure mixed with raw had a greater effect than old manure with straw. nitrification was greatly accelerated by straw and straw with peptone and in a still higher degree straw with manure; the ammonia-nitrogen formed the decomposition of peptone was rapidly nitrified. other experiments in which both ammonium lphate and potassium nitrate were added, the effect various substances on nitrification and denitrification gether was similar to that on nitrification alone. rbohydrates had no specially favourable influence on trification. The following substances had a progressively eater retarding effect on nitrification in the order given: ea, ammonium acetate, acetamide, asparagin, peptone. the case of peptone nitrification began only when all e peptone-nitrogen was converted into ammoniatrogen; formation of nitrate and nitrite began simulneously in nearly all cases. (See also Barthel, this J., 14, 759).—A. S.

Patent.

ag containing phosphoric acid; Process for increasing the solubility in citric acid of ——. Act.-Ges. Peiner Walzwerk, and H. Küppers. Fr. Pat. 467,111, Jan. 8, 1914.

E Eng. Pat. 922 of 1914; this J., 1914, 704.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

aste waters; Report upon the work of the (*German*) *State Commission for the examination of methods of purifying beet sugar factory* ——. C. Günther and A. Herzfeld. Z. Ver. deut. Zuckerind., 1914, 139—168.

IL purification processes cannot be applied generally account of the large amount of land required. It is possible to find one method that will suit every case. The ne applies to the Proskowetz process (this J., 1912, 205) and its modifications; another disadvantage of the latter process is the "sliming" of the soil. Which process should be adopted depends upon a large number of factors, amongst which may be mentioned the nature and amount of land available, the possibility of enlarging the factory, and the relative prices of sugar and of beetroot slices. —J. P. O.

Determination of rhamnose in presence of other methylpentoses. Votocek and Potmesil. *See* XXIII

Patents.

Beet slices; Apparatus for the lixiviation of subdivided material, especially ——. W. Möhring. Ger. Pat. 273,960, April 14, 1912.

The apparatus comprises two smooth pipes of the same diameter, inclined to one another at an acute angle, and connected by a curved piece, at the lowest part of which is a juice outlet provided with a grating. The material is conveyed through the apparatus, under a constant degree of compression, by a suitable conveyor, which also acts as a scraper serving to prevent stoppage of the juice outlet. The shorter pipe, immediately below the feed hopper, is surrounded by a heating device.—A. S.

Sugar cane and other materials; Apparatus for obtaining juice from ——. O. Mengelbier. Ger. Pat. 274,462, Dec. 13, 1912. Addition to Ger. Pat. 261,999.

In the process described in the principal patent (this J., 1913, 920) the bagasse, on its way from one set of press rolls to another, was passed through a chamber divided into compartments, in one of which it was treated with steam and in others with sweet water or water. According to the present patent the compartments are formed by partitions fixed to the conveyor on which the bagasse is carried through the chamber.—A. S.

Sugar solutions; Clarification of ——. E. Köpke, Honolulu, Hawaii, Assignor to Köpke Clarifier Co. U.S. Pat. 1,101,940, June 30, 1914; appl., July 20, 1911.

Expressed juice is centrifuged to remove insoluble matter, the latter being extracted with water and centrifuged again. The solutions thus obtained are clarified, heated, and centrifuged to remove coagulated impurities. The coagulum is extracted with water and centrifuged, the clear solution obtained being concentrated and centrifuged.—L. E.

Molasses; Process for desaccharifying —— and boiling centrifugal syrup. A. Gräntzdörffer and A. List, Magdeburg, Germany. Eng. Pat. 15,957, July 10, 1913.

See Fr. Pat. 460,192 of 1913; this J., 1914, 36.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Determination of glycogen in ——. E. Salkowski. Z. physiol. Chem., 1914, **92**, 75—88.

The author states that glycogen in yeast cannot be determined by the method and modifications thereof recently proposed (see Schönfeld and Künzel, this J., 1914, 155). The yeast gum which is not removed in the course of the analysis, yields reducing sugar in the final treatment with hydrochloric acid; further, part of the yeast cell membrane is converted by the hot potassium hydroxide into erythrocellulose which behaves like, and in the author's opinion is identical with, yeast glycogen.—L. E.

Ethylmercaptan; Phytochemical formation of ——. C. Neuberg and F. F. Nord. Ber., 1914, **47**, 2264—2271.

When an aqueous alcoholic solution of thialdine (the ammonia-compound of thio-acetaldehyde) was added to an aqueous solution of sucrose undergoing fermentation by means of yeast, no noteworthy slackening of fermentation was observed, and after a few minutes the odour of mercaptan was distinctly perceptible. The formation of ethylmercaptan was demonstrated by passing the fermentation gases through a solution of mercuric cyanide, when a yellow precipitate was produced. This was separated, decomposed with dilute hydrochloric acid, and the evolved gas passed into a solution of lead acetate, a yellow precipitate of the lead salt of ethylmercaptan being produced. In an analogous experiment with dead yeast no formation of mercaptan took place.—A. S.

Acetic fermentation ; Favourable influence of manganese on ——. G. Bertrand and R. Sazerac. Bull. Soc Chim., 1914, **15**, 627—630.

Mycoderma aceti was allowed to act on alcohol in a nutrient medium in presence of varying amounts of manganese sulphate for 2—10 days, and the liquid then titrated with $N/1$ alkali. The quantity of acetic acid formed increased with the proportion of manganese sulphate up to a concentration of about 1 : 10,000, beyond which it decreased. —W. P. S.

PATENTS.

Malting machine. J. Sleeman, Stonehouse, Gloucester Eng. Pat. 13,426, June 10, 1913.

An improved form of the machine described in Eng. Pat. 22,204 of 1911 (this J., 1912, 1091), the perforated hinged sections dividing the space into grain-chamber and air-chamber being dispensed with. The grain lies on a single perforated floor situated midway between the axis and the lower periphery of the drum, so that when the latter is rotated the bed of grain is thoroughly broken up. Air is introduced through a hollow trunnion and distributed by pipes on either side of the floor : gases may be exhausted in a similar manner.—J. F. B.

XIXa.—FOODS.

PATENTS.

Milk ; Apparatus for sterilising, pasteurising, and condensing ——. A. Reynierse, Middelburg, Holland. Eng. Pat. 14,616, June 24, 1913. Under Int. Conv., Jan. 6, 1913.

The milk is introduced into a water-jacketed vessel containing a cooling coil and hollow perforated stirring arms carrying brushes which rub against the wall of the vessel and prevent incrustation. For sterilisation, steam is first admitted to the water-jacket, and when the milk has been heated to about 90° C., steam is admitted through the stirring arms into the milk, the latter being stirred. When the milk has been heated to 120° C., the steam to the arms is cut off, and the water in the jacket is kept at 120° C. for 30 mins. The milk is then cooled, stirring being continued. During sterilisation, air is admitted to the space above the milk, being first sterilised by passage through a sinuous tube.—L. E.

Milk separators ; Centrifugal ——. H. Lanz, Mannheim, Germany. Eng. Pat. 4028, Feb. 16, 1914. Under Int. Conv., May 2, 1913.

Plates fitted in a centrifugal drum are provided with openings for the supply of milk and for conducting the cream to the uptake adjacent to the central inlet ; auxiliary openings in the plates permit the cream to pass radially towards the centre and reduce the surface to which it is exposed.—W. P. S.

Meat and other foodstuffs ; Process for the preservation of ——. O. Bocandé, Paris. Eng. Pat. 19,921, Sept. 3, 1913. Under Int. Conv., Nov. 18, 1912.

Joints of meat are placed in a closed chamber and the air is exhausted from the latter ; air mixed with ozone is then admitted and the chamber again exhausted, a pressure of 5—15 mm. being maintained until the meat has lost from 15 to 20% of its water-content ; the evaporated water is condensed or absorbed by hygroscopic substances. The joints are now removed from the chamber, wrapped in tinfoil, paper, or fabric, and then coated with a mixture consisting of water, 60—65 ; gelatin, 20—25 ; sea salt, 5 ; sugar, 5 ; glycerin, 5 ; and formalin, about 1%. —W. P. S.

Potatoes ; Process for the production of dried ——. C. Warth, Charlottenberg, Germany. Eng. Pat. 3531, Feb. 11, 1914. Under Int. Conv., June 5, 1913.

Potatoes are grated and the mass is washed on a sieve with water to remove the starch. The aqueous portion is centrifuged to separate the water as far as possibl from the starch, and the pulp on the sieve is pressed. The starch and the pulp are then mixed and the mixture dried by heat.—W. P. S.

Food fats ; Manufacture of —— *more particularly for th preparation of pastries and the like.* P. A. Schmitt Hamburg, Germany. U.S. Pat. 1,102,551, July 7, 1914 Date of appl., July 10, 1913.

See Fr. Pat. 460,614 of 1913 ; this J., 1914, 98.—T. F. B

Milk ; Process for preparing dried —— *or milk powde* Casein Co. of America. Fr. Pat. 466,528, Dec. 24, 191 Under Int. Conv., April 11, 1913.

See U.S. Pat. 1,074,419 of 1913 ; this J., 1913, 1027.—T.F.

Beverage from dairy residues ; Process for preparing salutary ——. A. Jolles. Fr. Pat. 467,530, March 3 1913.

See U.S. Pat. 1,073,135 of 1913 ; this J., 1913, 987.—T. F.

Fruits ; Process for preserving —— *in their natural stat in a solution of sodium bisulphite and sulphurous anh dride.* R. Oliver. Fr. Pat. 466,589, March 6, 1913.

See Eng. Pat. 5999 of 1913 ; this J., 1914, 38.—T. F.

XIXb.—WATER PURIFICATION ; SANITATIO

Report on the work of the (German) State Commission the examination of methods of purifying beet sugar fact waste waters. Günther and Herzfeld. *See* XVII.

PATENTS.

Refuse destructors. A. B. Seorer and Meldrums, Lt Manchester. Eng. Pat. 14,753, June 26, 1913.

In destructors comprising a number of sectional furna separated from one another by dwarf party walls, latter are in the form of hollow metal conduits in wh the air supplied to the ash-pits for the combustion of fuel is preheated.—W. P. S.

Destructor furnaces or stoves. J. Thomas, Kenilwor Warwick. Eng. Pats. 24,923, Nov. 1, 1913, and 74 Mar. 24, 1914.

A hollow jacket surrounds the combustion chamber within the latter is a casing composed of tubes : curre of heated air flow from the upper ends of the jacket the tubes to the upper part of the furnace above burning refuse. A gas burner is provided in the u part of the furnace in order that a gas flame may directed into the smoke at the time of lighting or charging, or when there is excess of smoke, baffle-pl being arranged so as to direct the flame into the sm —W. P.

Water, sewage, and other liquids ; Purification of — F. M. Leavitt, Smithtown, N.Y., U.S.A. Eng. 21,547, Sept. 24, 1913. Under Int. Conv., Oct. 8, 1

See U.S. Pat. 1,088,232 of 1914; this J., 1914, 372.—T.

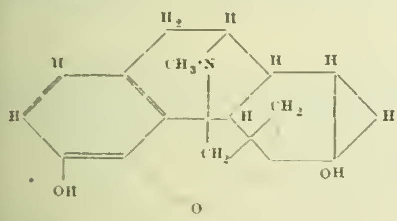
ntiseptic product derived from salicylic acid. H. Weitz. Fr. Pat. 466,791, April 22, 1913.

ee Ger. Pat. 262,328 of 1912 ; this J., 1913, 925.—T. F. B.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

pium alkaloids. J. v. Braun. Ber., 1914, **47**, 2312—2330.

s the formulæ which have been deduced for morphine, odeine, and thebaine (see Knorr and Hörlein, this J., 907, 943) there is a partially hydrogenised benzene ring ontaining a double linkage in the $\beta\gamma$-position to the itrogen atom. Previous investigations by the author ad indicated that compounds of this character behave bnormally with cyanogen bromide, the ring being ruptured t the nitrogen atom, instead of the normal replacement y a CN-group of a CH_3-group attached to the nitrogen. Then thebaine was treated with cyanogen bromide it was onverted into a compound, soluble in ether, in which the ethyl group attached to nitrogen was still intact. Iorphine and codeine, on the other hand, when treated ith cyanogen bromide, after acetylation of the free ydroxyl groups, behaved in a normal manner, the methyl roup attached to the nitrogen being replaced by a CN-roup, with the production respectively of cyanodiacetylnor-orphine and cyanodiacetylnorcodeine. The acetyl erivatives of dihydromorphine and dihydrocodeine ehaved in a similar manner. It is concluded that in the rmulæ of morphine and codeine there is no double linkage the benzene ring III. (*loc. cit.*), but probably a bridge-nkage connecting the carbon atoms at 6 and 8 :—



n hydrolysis of cyanodiacetyl-normorphine and -nor-deine, the acetyl groups are first removed, and e cyanonormorphine, $C_{16}H_{14}O(OH)_2 : N.CN$, and yanonorcodeine, $C_{16}H_{14}O(OH)(OCH_3) : N.CN$, formed, e subsequently converted respectively into ormorphine, $C_{16}H_{14}O(OH)_2 : NH$, and norcodeine, $_{16}H_{14}O(OH)(OCH_3) : NH$ (Diels and Fischer's N-de-ethylcodeine, this J., 1914, 765). These bases are milar in properties to morphine and codeine (into which ey are converted by methylation), but are more reactive certain directions owing to the presence of the imino-roup. The O-isoamyl derivative of normorphine and the -phenylethyl derivative of norcodeine were prepared. —A. S.

ocaine ; Detection of ——. G. Denigès. Bull. Soc. Pharm. Bordeaux, **52**, 385. Z. anal. Chem., 1914, **53**, 497.

a 0·5% solution of a cocaine salt be treated with an qual volume of a 5% solution of sodium perchlorate, a recipitate composed of long, very fine needles is formed ; ith very small quantities the precipitation is observed nder the microscope.—A. S.

trychnine in presence of brucine ; Determination of ——. D. B. Dott. Proc. Brit. Pharm. Conf., 1914, 8.

HEN strong nitric acid is added in the proportion of 1 vol. 10 vols. of acid solution, and 1 c.c. of nitric acid for ach 0·25 grm. of brucine, a period of 20 mins. at the dinary temperature is sufficient to destroy all the brucine. arming to 40° C. causes an appreciable loss of strychnine. —F. Shdn.

Belladonna leaves ; Adulteration of ——. G. S. Allen and H. Deane. Proc. Brit. Pharm. Conf., 1914, 9—11.

Belladonna is largely adulterated with *Phytolacca decandra*, *Scopola carniolica* and *Ailanthus glandulosa*, which are best distinguished by the microscope. Portions of the leaf are warmed with chloral hydrate solution till sufficiently transparent for microscopic examination. *Phytolacca* shows characteristic acicular raphides of calcium oxalate differing from the sandy crystals of belladonna. In *Ailanthus* and *Scopola* the stomata occur on the lower surface of the leaf whilst in belladonna they are found on both surfaces.—F. Shdn.

Benzoin ; Analytical characters of ——. T. T. Cocking and J. D. Kettle. Proc. Brit. Pharm. Conf., 1914, 13—14.

To determine the balsamic acids in benzoin 5 grms. are extracted with alcohol in a Soxhlet apparatus and the extract hydrolysed with alcoholic potash. The alcohol is evaporated, the residue dissolved in 100 c.c. of water and treated with a slight excess of hydrochloric acid, 5 grms. of light magnesium oxide and 20 c.c. of xylene. The whole is boiled under a reflux condenser for an hour, cooled, the aqueous portion filtered off and the insoluble matter boiled twice with 100 c.c. of water which is allowed to cool before filtering. The combined aqueous extracts are shaken out once with ether, when the balsamic acids are liberated by the addition of hydrochloric acid and removed by ether, the latter being distilled off and the residue dried in a vacuum over sulphuric acid before weighing. To determine the cinnamic acid the ethereal residue is left overnight in contact with excess of a 5% solution of bromine in carbon tetrachloride, and the excess of the latter is driven off by evaporation on the water bath. The residue is evaporated several times with ether, dried as before and weighed. The amount of cinnamic acid is calculated from the increase of weight, one mol. of the acid absorbing 2 atoms of bromine (see this J., 1910, 112). The "free" balsamic acids are determined by boiling the powdered drug with water, magnesium oxide and xylene and proceeding as described above. The acid and ester values are determined on the alcoholic extract of a separate portion of the drug. Analyses of a number of different specimens are given.—F. Shdn.

Pepsin ; Bacteriological purity of ——. E. Quant. Proc. Brit. Pharm. Conf., 1914, 8—9.

Out of eleven samples of pepsin in scale or powder form from various sources, several were contaminated with bacteria. The most satisfactory samples contained a small amount of free acid. The standard might be improved by the presence of free acid and the use of chloroform.—F. Shdn.

Oil rich in sulphur from Kimmeridge shale of St. Champ (France). Demesse and Réaubourg. Bull. Soc. Chim., 1914. **15**, 625—627.

Dry distillation of Kimmeridge shale found at St. Champ yielded an oil of the following composition : C 77·3, H 9·2, S 11·99, N 0·37, O (by diff.) 1·14%. The sulphonation product neutralised by ammonia was similar to ichthyol and like products used in therapeutics.—W. R. S.

Cinnamic aldehyde ; Stability of ——. H. A. Phillips. Proc. Brit. Pharm. Conf., 1914, 17—18.

Cinnamic aldehyde, whether pure or as a constituent of cinnamon oil, is not appreciably oxidised when distilled with steam under ordinary conditions.—F. Shdn.

Carbon bisulphide in official pharmacy and suggestions for its further use. F. H. Alcock. Proc. Brit. Pharm. Conf., 1914, 21—22.

Useful results can be obtained by determining the amounts extracted by carbon bisulphide from official liquid extracts and tinctures. In this way 0·3% of fat, containing very little alkaloid, can be withdrawn from the liquid extract of *Nux vomica*.—F. Shdn.

Glycerophosphates of commerce; Composition of the ——. J. C. Umney and C. T. Bennett. Proc. Brit. Pharm. Conf., 1914, 22—23.

The composition of calcium glycerophosphate varies and does not correspond with a definite molecular proportion of water. The so-called "soluble" salt, containing citric acid, is less likely to cause a deposit in the preparation of the compound syrup. There is no objection to the addition of citric acid so long as the content of calcium is not reduced below 15%. The salt should be soluble in 25 parts of water. Magnesium glycerophosphate may also contain citric acid but the magnesium content should not be less than 10%. Ferric glycerophosphate should contain about 15% Fe and be soluble in 2 parts of water. Solutions of potassium glycerophosphate, which is difficult to obtain in crystalline form, should be required to contain definite percentages of the anhydrous salt. Sodium glycerophosphate crystallises with 5 mols. H_2O.—F. Shdn.

Cadmium salicylate. W. O. de Coninck. Bull. Soc. Chim., 1914, **15**, 608—609.

Freshly precipitated cadmium carbonate is treated with warm aqueous salicylic acid solution containing a little alcohol, and the salt re-crystallised from boiling water, from which it is deposited without decomposition. The salt, dried at 95°—96° C., has the composition, $[C_6H_4(OH).CO.O]_2Cd + H_2O$; it does not decompose below 165° C., when it gives off carbon dioxide and phenol; it chars above 170° C.—W. R. S.

Determination of rhamnose in presence of other methylpentoses. Votocek and Potmesil. *See* XXIII.

Commercial standards for dried magnesium sulphate, sodium sulphate, and sodium phosphate. Umney and Bennett. *See* VII.

Patents.

Hydrogenised organic substances or compounds [of the opium group]; Manufacture of ——. Verein Chininfabriken Zimmer und Co., G. m. b. H., Frankfort, Germany. Eng. Pat. 14,247, June 19, 1913. Addition to Eng. Pat. 10,204 of 1913, dated May 9, 1912 (see this J., 1913, 989).

Morphine, codeine, and other opium compounds are hydrogenated by treating them with formic acid and a finely divided metal of the platinum group, or a colloidal solution of such metal. For example, 5 parts of codeine hydrochloride are dissolved in 70 parts of a 1% solution of formic acid and mixed with the palladium black obtained from 0·5 part of palladious chloride. The solution is allowed to stand first at the ordinary temperature for a few hours and then at 50° C. until evolution of carbon dioxide has ceased; it is then filtered, mixed with excess of soda lye, saturated with common salt, and extracted with ether The ethereal extract contains the hydrocodeine, which can be recrystallised from water.—T. F. B.

Acetylation [of halogen-hydrocarbons]; Process of ——. W. E. Masland, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,095,013, April 28, 1914. Date of appl., Oct. 16, 1912.

A mixture of halogen derivatives of aliphatic hydrocarbons (*e.g.*, amyl and hexyl chlorides) is acetylated at a temperature suitable for removing halogen acid from them, with the formation of olefines; the olefines are removed and the remaining chlorohydrocarbons are acetylated at temperatures suitable for the formation of organic acetates (compare Eng. Pat. 29,963 of 1912; this J., 1914, 502).—T. F. B.

Dichlorohydrocarbons; Acetylation of ——. W. E. Masland, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,102,347, July 7, 1914. Date of appl., Oct. 19, 1912.

Dichlorohydrocarbons, such as mixtures of dichloropentane and dichlorohexane, are acetylated by treatment with 70 to 99% acetic acid in presence of sodium acetate. —T. F. B.

Oxidising compounds and producing terpene peroxide; Process of ——. A. S. Ramage, Detroit, Assignor to E. A. Byrnes and C. P. Townsend, Washington. U.S. Pat. 1,097,939, May 26, 1914. Date of appl., March 6, 1906.

The vapours of terpenes and other oxidisable liquids are passed over a catalytic agent, such as platinised asbestos, and simultaneously treated with ozone. Terpenes are converted into peroxides by this process.—T. F. B.

Organic peroxide [from cineol] and process of producing same. A. S. Ramage, Detroit, Assignor to E. A. Byrnes and C. P. Townsend, Washington. U.S. Pat. 1,097,940, May 26, 1914. Date of appl., March 31, 1906.

Cineol is subjected to the continued action of ozone in presence of a catalytic agent (*e.g.*, platinum black) at the ordinary temperature, until a thick, viscous, non-volatile liquid is obtained. This liquid is brownish-yellow, insoluble in water, soluble in petroleum; it is an active oxidising agent and germicide, liberating iodine from potassium iodide, and containing about 18 times its volume of loosely-combined oxygen; it decomposes explosively when heated.—T. F. B.

Terpene peroxide; Process of producing ——. A. S. Ramage, Cleveland, Assignor to E. A. Byrnes and C. P. Townsend, Washington. U.S. Pat. 1,098,356, May 26, 1914. Date of appl., Feb. 7, 1903.

Terpenes capable of being oxidised to peroxide, are treated with ozone or ozonised air at a temperature above 38° C., and in absence of water, the reaction being carried out under conditions to "drive off the terpene peroxide in the form of fumes."—T. F. B.

Quinoline compounds and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis. U.S. Pat. 1,098,022, May 26, 1914. Date of appl., Jan. 31, 1913.

Equimolecular proportions of salicylic aldehyde, pyruvi acid, and a suitable aromatic amine (*e.g.*, *p*-toluidine) ar boiled together in absolute alcoholic solution, and th product is allowed to crystallise. 2-*o*-Hydroxyphenyl-6 methylquinoline-4-carboxylic acid is produced when *p* toluidine is used.—T. F. B.

Formaldehyde; Process of making ——. H. von Hoch stetter, Constance, Germany. U.S. Pat. 1,100,076, Jun 16, 1914; date of appl., Jan. 9, 1913.

Formaldehyde is produced by passing a mixture of ai and methyl alcohol vapour at a suitable temperatur over two or more catalysts, *e.g.*, through a copper tub containing metallic silver, which may be precipitated upo the copper.—H. H.

Gallic acid; Preparation of ——. M. Hamel, Assign to Nitritfabrik Akt.-Ges., Berlin. U.S. Pat. 1,100,73 June 23, 1914; date of appl., Feb. 25, 1914.

Moist fermented masses of nutgalls, sumac and the like ar dried at an elevated temperature in order to convert th impurities formed during the fermentation into a stat in which they are insoluble in the solvents used for subs quently extracting the gallic acid.—D. J. L.

Chloroform; Method of making ——. T. Griswold, jun and C. J. Strosacker, Assignors to The Midland Chemic Co., Midland, Mich. U.S. Pat. 1,101,025, June 23, 191 Date of appl., July 26, 1912.

Carbon tetrachloride is reduced in presence of water l a metal, such as iron, a portion of which, at least, introduced in the form of relatively coarse particles, whi are subjected to a grinding action to reduce them to fin particles.—T. F. B.

Alkyl sulphates; Process for the manufacture of alipha ——. E. Wolf, Assignor to Chinoin gyógyszer és ve yészeti termékek gyára r. t. Dr. Kereszty és Dr. Wo Ujpest, Austria-Hungary. U.S. Pat. 1,101,373, June 1914. Date of appl., Dec. 8, 1913.

Aliphatic simple or mixed ethers are converted into t corresponding alkyl sulphates by adding sulphuric a chlorhydrin at a low temperature and heating the mixture until the evolution of hydrogen chloride ceases.—T. F. B.

Essential oils, perfumes, and odorous substances ; Process for extracting ——. J. A. Meunier. First Addition, dated Aug. 18, 1913, to Fr. Pat. 466,273, Feb. 26, 1913 (see this J., 1914, 613).

The aqueous solutions or mixtures containing the odorous products, obtained as described in the principal patent, are concentrated by distillation. This is necessary to ensure the production of stable extracts, particularly in the case of fruits.—T. F. B.

Methyl-hexamethylenetetramine thiocyanate ; Process for making ——. K. H. Schmitz. First Addition, dated Dec. 31, 1913, to Fr. Pat. 466,619, Dec. 26, 1913.

See Ger. Pat. 270,486 of 1913 ; this J., 1914, 439. The perchlorate, chromate, and other salts can be obtained n a similar manner to the thiocyanate. The free base, $C_6H_{12}N_4(CH_3)OH$, is obtained by treating the chromate with barium oxide or the halides with moist silver oxide ; by neutralising this with the appropriate acid, pure salts are obtained.—T. F. B.

Esters of tertiary alcohols ; Process for preparing ——. Dr. Neumann und Co. Chem. Fabrik G. m. b. H., and J. Zeltner. Fr. Pat. 466,804, Nov. 8, 1913.

Tertiary alcohols are esterified by treating them with acid chlorides in presence of tertiary bases, such as pyridine r dimethylaniline. In some cases the reaction is facilitated by gentle heating.—T. F. B.

Dimethyl-p-aminophenol and p-hydroxyphenyltrimethylammonium ; Process for preparing pure, stable salts of ——. Fabrique de Produits Chimique ci-dev. Sandoz. Fr. Pat. 467,085, Jan. 7, 1914. Under Int. Conv., Nov. 18, 1913.

The product obtained by the methylation of *p*-aminohenol contains the mono- and dimethylaminophenols ogether with a salt of *p*-hydroxyphenyltrimethylammonium. To separate these, advantage is taken of the act that *p*-aminophenol and its monomethyl derivative o not form precipitates with ferrocyanides in acid soluion, whilst the other two compounds are precipitated apidly and completely as acid ferrocyanides : these two ompounds can then be separated from one another by crystallisation in presence of a normal alkali sulphite, hen dimethyl-*p*-aminophenol is separated in the form f a normal ferrocyanide and the quaternary ammonium ompound remains in solution. A separation of the bases om their mixed ferrocyanides can also be effected by aking the mixture feebly alkaline and extracting the imethyl-*p*-aminophenol by means of benzene or other olvent.—T. F. B.

3-Dihalogen-2-methylbutane and homologues thereof ; Producing ——. O. Graul, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,102,654, July 7, 1914. Date of appl., Sept. 5, 1912.

ee Eng. Pat. 3870 of 1912 ; this J., 1913, 252.—T. F. B.

o-olefines ; Producing ——. O. Graul, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,102,655, July 7, 1914. Date of appl., March 13, 1913.

ee Fr. Pat. 450,461 of 1912 ; this J., 1913, 624.—T. F. B.

ethyl-hexamethylenetetramine thiocyanate ; Process for making ——. K. H. Schmitz. Fr. Pat. 466,619, Dec. 26, 1913. Under Int. Conv., Feb. 3, 1913.

ee Ger. Pat. 266,788 of 1913 ; this J., 1914, 43.—T. F. B.

ormaldehyde : Process for making ——. Holzverkohlungs-Industrie Akt.-Ges. Fr. Pat. 467,076, Jan. 7, 1914. Under Int. Conv., Jan. 9, 1913.

e U.S. Pat. 1,100,076 of 1914 ; preceding.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Silver gelatinobromide or collodio-bromide paper with two emulsions for rapidly producing direct positives in the camera. A. Balconi. Fr. Pat. 466,996, Jan. 5, 1914.

Paper is coated with a slow (*e.g.*, gas-light) emulsion, then with a layer of arrowroot or other starch paste, and finally with a rapid emulsion. After exposure in the camera and development, the paper is exposed to light, the negative film is stripped off, and the positive developed on the slow emulsion. This produces reversed positives. If it is desired to make correct positives, the emulsions are applied to opposite sides of a thin, grainless paper.—T. F. B.

Polychrome screen plates for colour photography ; Manufacture of ——. A. and L. Lumière. Fr. Pat. 467,128, March 21, 1913.

One of the difficulties in preparing polychrome screen-plates is due to the screen presenting a certain amount of colour, which affects the general tone of the finished photographs. It has not been found possible to correct this by staining the gelatin emulsion, but satisfactory results have been obtained by the use of a layer of varnish of a colour complementary to that of the fault in the screen ; the varnish may be introduced between the screen and the emulsion or it may be applied to the glass.—T. F. B.

Colour photographs and the process for their production. A. H. Walker, London. From The Hess-Ives Co., Philadelphia. Eng. Pat. 15,823, July 9, 1913.

See Fr. Pat. 463,737 of 1913 ; this J., 1914, 441.—T. F. B.

Photographic plates, films, and papers ; Sensitive ——. R. E. Crowther. Fr. Pat. 466,530, Dec. 24, 1913. Under Int. Conv., Dec. 30, 1912.

See Eng. Pat. 29,919 of 1912 ; this J., 1914, 221.—T. F. B.

Bleaching-out layers for colour photography ; Process for producing —— *either ready sensitised or to be sensitised before use.* J. Szczepanik and F. Habrich. Fr. Pat. 466,906, Sept. 8, 1913. Under Int. Conv., Sept. 9, 1912.

See Ger. Pat. 264,207 of 1912 ; this J., 1913, 1033.—T. F. B.

Preparing pure stable salts of dimethyl-p-aminophenol and p-hydroxyphenyltrimethylammonium. Fr. Pat. 467,085. *See* XX.

XXII.—EXPLOSIVES ; MATCHES.

Patents.

Detonating explosive charges for mining and military purposes ; Method of ——. C. Claessen, Berlin. Eng. Pat. 16,456, July 17, 1913.

See Addition of July 7, 1913, to Fr. Pat. 459,979 of 1913 ; this J., 1914, 44.—T. F. B.

Explosive. O. Silberrad, Buckhurst Hill. U.S. Pat. 1,102,964, July 7, 1914. Date of appl., Nov. 23, 1912.

See Eng. Pat. 13,860 of 1911 ; this J., 1912, 1009.—T. F. B.

Reaction-vessel for carrying out chemical processes of all kinds between two or more liquids, solutions, solids in paste form, and also gases. Ger. Pat. 274,854. *See* I.

XXIII.—ANALYTICAL PROCESSES.

Iron in the presence of phosphoric acid ; Determination of ——. C. E. Corfield and W. R. Pratt. Proc. Brit. Pharm. Conf., 1914, 19—21.

Gravimetric determinations of iron are unreliable in the presence of even small quantities of phosphoric acid.

Ferrous iron can be oxidised by boiling with hydrogen peroxide and the ferric iron determined by the usual iodimetric method, care being taken that the hydrochloric acid is in excess. Satisfactory results are obtained by reduction with stannous chloride.—F. Shdn.

Rhamnose; Determination of —— in presence of other methylpentoses. E. Votoček and R. Potmesil. Bull. Soc. Chim., 1914, **15**, 634—639.

Hydrocyanic acid converts rhamnose into a cyanhydrin which, on hydrolysis, gives α-rhamnohexonic acid, nitric acid (sp. gr. 1·15—1·2) oxidising the latter to mucic acid. After oxidation is complete, the liquid is evaporated to one-third of its bulk on a water-bath and left to stand for 3 days in the cold, while occasionally rubbing the sides of the beaker with a glass rod. The crystalline precipitate of mucic acid is washed with a little cold water, dried and weighed. 100 parts of anhydrous rhamnose gave an average of 45·5 parts of mucic acid. In presence of other methylpentoses (*e.g.*, rhodeose) the yield of mucic acid was not quite so constant, but sufficiently so to determine the molecular proportion of rhamnose in the products of hydrolysis of glucosides containing it.—W. R. S.

Modification of the Jaeger method for determining hydrogen and methane. Wibaut. *See* IIa.

Effect of acidity of assay slags on silver losses. Livingstone. *See* X.

Van Gijn and van der Waerden's method for detecting mangrove in quebracho extracts. Moeller. *See* XV.

Cellulose extracts and their detection in tanning extracts and in leather. Mœller. *See* XV.

Sulphuric acid in leather and in sulphited extracts. Thuau and Madru. *See* XV.

Determination of glycogen in yeast. Salkowski. *See* XVIII.

Determination of strychnine in presence of brucine Dott. *See* XX.

Detection of cocaine. Denigès. *See* XX.

Analytical characters of benzoin. Cocking and Kettle. *See* XX.

Patents.

Detecting combustible or explosive gases, especially fire-damp; Device for ——. Accumulatoren-Fabrik A.-G. and F. Rüsse, Berlin, Germany. Eng. Pat. 15,064, June 30, 1913.

A safety-lamp and spark gap are supplied from the same source of current through separate circuits controlled by a change-over switch, the spark gap being connected with the secondary winding of an induction coil. The device may be made more sensitive by employing an electrically-heated wire below the spark gap, the latter being placed within the constricted portion of a glass tube; the gas to be tested is thus heated and its velocity increased.—B. N.

Lubricants; Apparatus for testing ——. R. Drosten. Ger. Pat. 275,225, June 7, 1913. Under Int. Conv., June 22, 1912.

The apparatus is of the type in which a mixture of steam and oil is subjected to friction between a fixed and a rotating surface in a closed casing. In the apparatus described, a vertical rotating shaft carries at different heights two conical valves which rotate on seatings; the latter are provided with openings under control. The oil is delivered on to the upper end of the shaft and the steam is delivered above the upper valve. The space between the two valves acts as a steam-expansion chamber. The oil finds its way between the valves and their seatings and passes through the openings in the latter along with the steam. The mixture of steam and oil leaving the chamber is passed to a condenser.—A. S.

Pyrometers. J. Churchward, Mount Vernon, N.Y., U.S.A. Eng. Pat. 15,922, July 10, 1913.

See U.S. Pat. 1,069,318 of 1913; this J., 1913, 928.—T. F. B.

Trade Report.

Withdrawal of prohibition of certain exports from the United Kingdom.

A supplement to the "London Gazette," dated August 20th, 1914, contains a Proclamation modifying the Proclamations of August 3rd, 5th, and 10th, relative to the prohibition of certain exports from the United Kingdom.

The list published in this Journal, August 15th, 1914, page 810, is accordingly modified as follows:—

The Ports of Belgium are added to the list of Ports excepted from the prohibition.

The following articles are deleted from the list:—Coal, steam, large; fuel, manufactured; nitrates of sodium; tin plates; creosote; glucose.

"Lead, pig, sheet or pipe" is inserted in place of "Lead in all forms."

Union of South Africa; New Customs Tariff and Regulations of the ——, 1914. Suppl. to the Board of Trade J., Aug. 13, 1914. Price 3d.

Among the changes in and additions to Class I. (special rates) of this tariff are the following:—

33. Motor spirit, namely benzine, benzoline, naphtha (not potable), gasoline, petrol, and petroleum spirit generally. 2d. per impl. gallon.

34. Lubricating oils (not elsewhere specified), 3d. pe impl. gallon.

45c. Saccharin, now includes derivatives of ortho toluenesulphamide, dulcin and derivatives of phenylcarbamide and other sweetening substances, £1 per lb.

48. Varnish. 2s. per impl. gallon.

Class III. (25% *ad valorem*) now includes glycerin distilled, not in bulk (formerly 15% *ad val.*). Class IV (3% *ad. val.*) includes glycerin other than crude, and i bulk for manufacturing purposes. Class V. (free of duty includes the items glycerin, crude, in bulk (formerly 15 *ad. val.*); dyes for manufacturing purposes, and tannin substances for leather, including alum; radium; sulphu and iron pyrites in bulk; tallow, including vegetabl tallow.

Netherlands; Prohibition of certain exports from the —— Board of Trade, Aug., 1914.

The issues of the "Nederlandsche Staatscourant" f the 1st, 3rd, and 8th August publish Decrees prohibitin the exportation of the undermentioned articles from th Netherlands:—Acetone; ammunition and gunpowder coal and coke; ether; gold coin and material for mintir gold (except in special cases in which exemption from th prohibition may be allowed); glycerin; lead; medicin bandages, and materials for making the same; molasse sodium nitrate; sugar.

Books Received.

Alkali, etc., Works Regulation Act, 1906. Fiftie Annual Report on Alkali, etc. Works, by the Chi Inspector. Proceedings during the year 1913, H.C. 3 Wyman and Sons, Fetter Lane, E.C. Price 7½d.

A full abstract of this report will appear in an early iss of the Journal.

Some Engineering Phases of Pittsburgh's Smo Problem. Bulletin No. 8 of "Smoke Investigatio Mellon Inst. of Industrial Research, Pittsburgh, P U.S.A. 193 pp. 8vo.

Journal of the Society of Chemical Industry.

No. 17, Vol. XXXIII. SEPTEMBER 15, 1914. No. 17, Vol. XXXIII.

Official Notices.

INTERNATIONAL CONGRESS OF MINING, METALLURGY, &c., LONDON, 1915.

At a meeting of the Executive Committee of the Congress, held at the Iron and Steel Institute on September lth, it was decided, owing to the War, to adjourn *sine die* he holding of the Congress, and, subject to a small levy or expenses already incurred, to release the guarantors rom any further liability.

'OMPETITION WITH GERMANY AND AUSTRIA-HUNGARY.

Further Action by the Board of Trade.

The Board of Trade have received many inquiries for ames of sellers or buyers of articles of which sources of ipply or markets have been interfered with by the war, nd special arrangements have been made for dealing with iem. Lists are being prepared and circulated of articles hich inquirers desire (a) to purchase and (b) to sell. The rst lists (see page 896) may be obtained on application to ie Commercial Intelligence Branch. Firms interested in ay of the goods mentioned, either as buyers or sellers, iould communicate with the Director. An enlarged mple room will also be established exclusively for exbiting samples of German and Austrian or Hungarian oods or materials which have competed with British oducts at home or abroad, especially those which are cessary for the continuance of British manufacture it which cannot be obtained from their previous sources. rms who may wish to exhibit goods are invited to apply the Commercial Intelligence Branch.

A catalogue library will also be opened, and firms are vited to furnish catalogues of goods formerly received by em from Germany and Austria-Hungary; these catagues will be classified by trades in order to be readily cessible to inquirers.

The address of the Commercial Intelligence Branch is , Basinghall Street, London, E.C.

'ATENTS, DESIGNS, AND TRADE MARKS TEMPORARY RULES (AMENDMENT) ACT, 1914.

4 & 5 Geo. 5. Chap. 73.

An Act to amend the Patents, Designs, and Trade arks (Temporary Rules) Act, 1914.

28th August, 1914.

Be it enacted by the King's most Excellent Majesty, and with the advice and consent of the Lords Spiritual d Temporal, and Commons, in this present Parliament sembled, and by the authority of the same, as follows :—

1. The Patents, Designs, and Trade Marks (Temporary les) Act, 1914, shall have effect, and shall be deemed ays to have had effect, subject to the following amendnts, that is to say :—

(a) In section one, for the words "any patent or licence granted to, and the registration of any trade mark the proprietor whereof is, a subject of any State at war with His Majesty, and any proceedings on any application made by any such person under either of the said Acts," there shall be substituted the following words: "any patent or licence the person ntitled to the benefit of which is the subject of any State at war with His Majesty; for avoiding r suspending the registration, and all or any rights conferred by the registration, of any design or trade mark the proprietor whereof is a subject as aforesaid: for avoiding or suspending any application made by any such person under either of the said Acts; for enabling the Board to grant, in favour of persons other than such persons as aforesaid, on such terms and conditions, and either for the whole term of the patent or registration or for such less period, as the Board may think fit, licences to make, use, exercise, or vend patented inventions and registered designs so liable to avoidance or suspension as aforesaid":

(*b*) At the end of the same section the following subsection shall be added :—

"(4) This Act shall apply to any person resident and carrying on business in the territory of a State at war with His Majesty as if he was a subject of that State; and the expression 'subject of any State at war with His Majesty' shall, with reference to a company, include any company the business whereof is managed or controlled by such subjects, or is carried on wholly or mainly for the benefit or on behalf of such subjects, notwithstanding that the company may be registered within His Majesty's dominions: and, where a patent has been granted to any person in respect of an invention declared in the application or any specification to have been communicated to him by some other person, that other person shall, for the purposes of this Act, be deemed to be the person entitled to the benefit of the patent unless the contrary is proved."

2. This Act may be cited as the Patents, Designs, and Trade Marks Temporary Rules (Amendment) Act, 1914; and the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914, and this Act may be cited as the Patents, Designs, and Trade Marks (Temporary Rules) Acts, 1914.

PATENTS AND DESIGNS (TEMPORARY) RULES, 1914.

Dated September 7, 1914.

Statutory Rules and Orders, 1914. *No.* 1328.

By virtue of the provisions of the Patents, Designs and Trade Marks (Temporary) Rules Acts, 1914, the Board of Trade do hereby make the following Rules :—

1. In any case in which the Board of Trade make an Order by virtue of the powers vested in them under the provisions of the Patents, Designs, and Trade Marks (Temporary) Rules Acts, 1914, and under any Rules made under these Acts or either of them, avoiding or suspending in whole or in part a Patent, or avoiding or suspending the registration and all or any rights conferred by the registration of any Design the Board may in their discretion grant in favour of persons other than the subject of any State at war with His Majesty, licences to make, use, exercise, or vend the patented invention or registered design so avoided or suspended upon such terms and conditions, and either for the whole term of the patent or registration of the design, or for such less period as the Board of Trade may think fit.

2. These Rules shall be read and construed as one with the Patents, Designs, and Trade Marks (Temporary) Rules, 1914, dated 21st August, 1914, and the Designs Rules, 1914, dated 5th September, 1914.

London Section.

NOTES ON THE APPLICATION OF TUNGSTEN SALTS TO THE ANALYSIS OF TANNING MATERIALS.

BY ALEXANDER T. HOUGH.

Whilst investigating the properties of colloidal tungstic acid from quite another point of view, its suitability for the differential analysis of tanning materials became apparent, inasmuch as it gives a reaction with the tannins, analogous to that discovered by Lauffmann with ammonium molybdate (Collegium, 1913, No. 513, p. 10; this J., 1913, 153).

I have been able to prepare two reagents with sodium tungstate, which apparently give different results with the same tannin. The importance of this lies in the fact that it may be possible to establish the purity of a given tanning extract by the constancy of the ratio between the two results given by the different reagents.

Unfortunately, it has only been possible to carry out experiments with mangrove extract, in the manufacture of which I am at present engaged; I am therefore unable to state whether this ratio between the two results will be the same for other tanning materials or not; in the affirmative it naturally loses its importance, as to be interesting it should furnish a characteristic number for each material.

Then, again, the acidity of an extract may have some bearing upon the results, but unless it is such as to more than neutralise the sodium ion of the tungstate—and this is barely possible—I do not anticipate any exaggerated divergence from this source. In any case, even though the ratio of the two figures should prove to be unimportant, the figures themselves will be characteristic of each tanning material in the same way as the "molybdate figure" of Lauffmann.

The following table gives the composition of the two reagents I have worked with:—

Table I.

	Reagent 1.	Reagent 2.
	c.c.	c.c.
10% sodium tungstate	5	5
25% ammonium chloride	3	3
8% by volume HCl	—	2
Water	2	—

In both cases the ammonium chloride solution should be added last and the reagents should only be mixed immediately before use, as after a short interval they rapidly deposit crystalline tungstic acid. The 8% solution of hydrochloric acid was 0·85 normal, *i.e.*, 2 c.c. hydrochloric acid neutralised 17 c.c. *N*/10 sodium carbonate or 5 c.c. of a 10% solution of sodium tungstate, freeing the tungstic acid in the colloidal state; the resulting solution did not turn methyl orange red but was slightly acid to litmus.

In using these solutions for the analysis of tanning materials, the method of Lauffmann is followed exactly, of which the following is a résumé:—

A tannin solution is prepared containing about 4 grms. tannin in 250 c.c. and 10 c.c. of the filtered solution is mixed with 10 c.c. of the reagent; the whole is filtered and 10 c.c. of the filtrate is evaporated to dryness—(A). The precipitate on the filter is now dissolved in hot water, added to the remainder of the filtrate and the washings of both pipette and beaker, then evaporated to dryness—(B). Both residues are dried until constant in weight and the weight of the precipitate is B—A. It is necessary to determine the salted-out tungsten-tannin precipitate by this indirect method as it cannot be washed.

The amount of precipitate is now calculated on the percentage of tanning matter in the extract, and to do this the total solubles in 10 c.c. of the above tannin solution are determined and the amount of tannin in this solution—(C) calculated from the non-tan figure obtained by the official method of tannin analysis using the above solution diluted four times. Then $\frac{(B-A)\,100}{C}$ gives the "Tungstate figure" of the tannin using the first reagent, and the same formula gives the "Tungstic figure" of the tannin using the second reagent, and presumably $\frac{\text{Tungstic}}{\text{Tungstate}} = K$ for any given tanning material.

The following table shows the results obtained with pure mangrove extract "Tannadine," but I cannot vouch for their absolute accuracy, as climatic and other conditions tend to make exact research a difficult matter in Borneo.

Table II.

		Reagent 1.	Reagent 2.
A.	Solids in 10 c.c. of filtrate	0·560 grm.	0·597 grm.
B.	Solids in remainder	0·755 grm.	0·802 grm.
(B−A).	Weight of precipitate	0·195 grm.	0·205 grm.
(B+A).	Total solids	1·315 grm.	1·399 grm.
	"Tungstate figure"......	149	——
	"Tungstic figure"	——	156·5
	Ratio	1·0503	
	Solubles in 10 c.c. tannin solution	0 178 grm.	
C.	Tannin „ „ „	0·131 grm.	

It will be noticed that with reagent 1 the solids a much lower than with reagent 2; this is due to the stro alkaline reaction of sodium tungstate which decompos the ammonium chloride. With reagent 2 the added ac naturally fixes the ammonia although a small amount still released during evaporation.

The filtrate from reagent 1 is pale red; this is probab due to the action of the atmospheric oxygen on the tanni like matters in the alkaline filtrate. The filtrate from agent 2 is of a pale straw colour, but upon the addition alkali gradually develops a reddish tint. The precipita from the latter is also lighter in colour and more eas soluble in water.

I regret my inability to follow up this work here, a request my interested colleagues to apply the reacti to and establish the constants of other tanning materi

Finally I have to thank the Chemische Fabrik v Heyden, Radebeul, for kindly sending me samples sodium tungstate.

Pontianak, Borneo, May, 1914

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery L London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourg Paris (3e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Filtration; Studies on ——. J. W. Bain and A. E. Wigle. J. Ind. Eng. Chem., 1914, 6, 672—675.

To determine the amount of liquid retained by a mass of finely-divided solid when filtration is carried out under atmospheric or other pressure, or by centrifuging, experiments were made with well-rounded lake sand graded into various sizes (30-, 40-, 50-, 60-, and 80-mesh) by screening: the 40-mesh size, *e.g.*, being composed of grains which passed a 30-mesh but were retained a 40-mesh screen. It was found that the pore space is practically independent of the size of grain, ranging f m 34·1 to 37·7% of the total volume, and a mass of m d small and large grains was similar in porosity to ma es of either small or large grains alone. For masse of crystals such as are commonly produced by rapid coo g, the pore space may be taken as approximately of the total volume. Experiments made by King (Nineteenth Ann. Report, U.S. Geol. Survey) showed that at atmospheric pressure, sand of 20-mesh size retained 11%, and sand of 100-mesh size 20% of water, after draining for 1 hour. In the authors' tests, using a vacuum of 2 ins. of mercury for 15 mins., the amount of water retained, ranged from 5·7 to 7·5%, average 7%, for sand of from 30- to 80-mesh size. In a layer of sand 70 cm. leep, using a vacuum of 5 ins. of mercury for 15 mins., he water retained was, on the average, 4% in the top 10 cm.) and 6·5% in the bottom layer, the size of grain eing of little importance. By the use of a centrifuge, t was possible to reduce the water-content to about 3·5%, irrespective of the size of grain. It was calculated hat in the case of sand of 30-mesh size retaining 6% of moisture, each grain would have a film 0·0116 mm. thick f all the water were distributed over the surface of the particles; or the water would occupy 30% of the pore pace. (See also Hatschek, this J., 1908, 538.)—A. S.

PATENTS.

Drying machines; Steam-heated cylinders of ——. T. Garstang and J. Kershaw, Blackburn, and J. Gent, Chorley. Eng. Pat. 14,545, June 24, 1913.

THE "dolly-head" or bearing for the journal-pin of a team-heated cylinder is provided with a ball or roller earing situated in front of the inner face of the ordinary earing and separated therefrom by an oil well or grease up to prevent any steam which may leak past the ordinary earing, from gaining access to the ball or roller bearing. —W. H. C.

ryer. W. B. Ruggles, Bayonne, N.J. U.S. Pat. 1,105,927, Aug. 4, 1914. Date of appl., June 11, 1909.

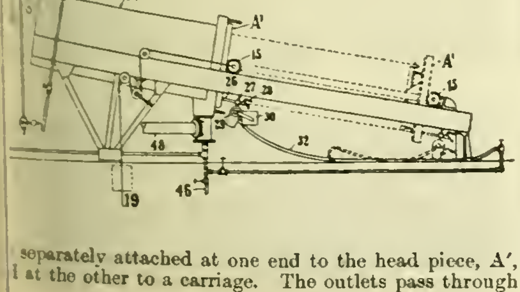
EE Eng. Pat. 10,349 of 1910; this J., 1911, 672.—T. F. B.

rying pulpy materials; Machine for ——. J. T. Knowles, London. From The Sherwin-Williams Co., Cleveland, Ohio, U.S.A. Eng. Pat. 19,409, Aug. 27, 1913.

HE pulp is fed on to an annular rotary drying table, vided into sections which are heated independently. he vapours are drawn off through hoods arranged over e sections and the dried material is stripped from the nnular table by a scraper placed behind the feed point d discharged over the inner edge of the table into a pper. Dust carried by the air current is removed by dust-filter. The whole apparatus is enclosed in a casing d a slightly reduced pressure is maintained therein. prevent the leakage or dust or poisonous gases.—W. H. C.

ltering apparatus. A. L. Genter, Charlottenburg, Germany. Eng. Pat. 14,592, June 24, 1913.

ONGITUDINAL filter-frames covered with bags of filter-th and having their upper edges protected by a metal p to prevent the formation of filter-cake on the top,



separately attached at one end to the head piece, A′, d at the other to a carriage. The outlets pass through the headpiece and can be separately controlled. The carriage is supported on wheels, 15, running on rails, and counterbalanced by weights attached to cords, 19, so that it can be easily run into or out of the inclined chamber, A. The end piece, A′, is made tight by a system of radial toggles and levers and the liquid to be filtered is pumped through the main, 46, the filtrate escaping by the pipes and taps, 26, 27, 28, either into the closed conduit, 29, or the trough, 30. When the cakes are of sufficient thickness the carriage is run out of the chamber and any pieces of cake or sand that may have collected on the bottom of the chamber are pushed out by a hemispherical scraper attached to the rear of the carriage. Compressed air or steam is admitted to the interior of the filter-frames along with an injected cleansing agent and the cakes are stripped off. The carriage is then run into the chamber again and the filter-cloths may be further cleansed by pumping water into the chamber through the pipe, 48, and injecting air at the same time to agitate the water. To prevent the premature discharge of the cakes when the excess of liquid is withdrawn, a float chamber, 41, and a reducing valve, 38, are provided, which admit low-pressure air as the liquid is discharged, so that there is always a slight pressure within the chamber.—W. H. C.

Dryer. J. Janka and O. Vyskŏcil. Fr. Pat. 466,568, Nov. 22, 1913. Under Int. Conv., Nov. 23, 1912.

THE passage of air into and out of the dryer, inside which a separate circulation of air is maintained, is regulated by dampers controlled electrically or pneumatically by a hygrometer within the dryer.—O. E. M.

Filters; Mechanical ——. The Pulsometer Engineering Co., Ltd., and J. Björnstad, Reading. Eng. Pat. 20,652, Sept. 12, 1913.

IN mechanical filters which are cleaned by reversing the flow, in order to secure the cleansing of the filter material which lies next the shell, an enlarged recessed ring is formed in the shell to support the strainer plates.—W. H. C.

Filters; Process and apparatus for the preparation of a refractory material with large pores for —— *and for other applications.* L. Kern. Fr. Pats. 466,657 and 466,659, Dec. 26, 1913. Under Int. Conv., Sept. 19 and Dec. 3, 1913.

A MIXTURE of refractory material with organic substances and a binding agent is heated in a furnace and oxygen from an independent source forced through the pores to burn out the organic matter; or, after heating, high-pressure air is forced through the material for the same purpose, after which the calcination is completed in a still atmosphere.—W. H. C.

Retort or furnace tubes or chambers for gaseous reactions at high temperatures; Manufacture of ——. R. P. Pictet, Berlin. Eng. Pat. 15,379, July 3, 1913.

To prepare tubes which will be impermeable to hydrogen and which will not suffer deformation when heated to 2000° C., a paste is made of highly refractory oxides and mixed with finely-divided carbon prepared by decomposing hydrocarbons by heat. After the tubes have been formed and dried they are heated to incipient fusion either electrically or in a reverberatory furnace heated by water gas and oxygenated air.—W. H. C.

Hollow vessel for chemical reactions. R. Glauser. Fr. Pat. 467,796, Jan. 28, 1914. Under Int. Conv., Jan. 29, 1913.

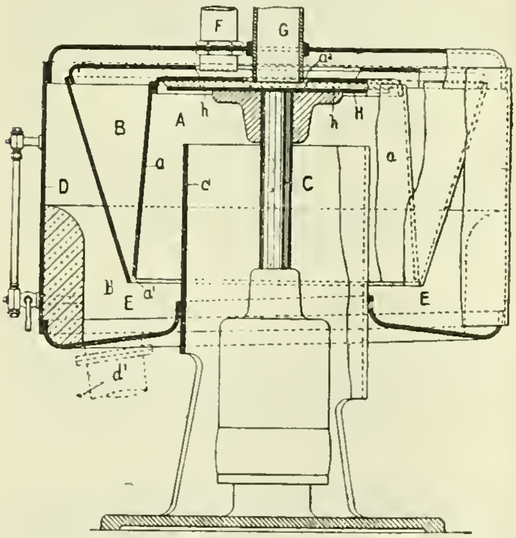
THAT part of the hollow vessel which comes into contact with the chemicals is formed of glass, porcelain or other refractory material which is a poor conductor of heat, and that portion which comes into contact with the fire is provided with a coating of a suitable metal which is a good conductor.—W. H. C.

Gas-furnaces ; Regenerative ——. F. K. Siemens. First Addition, dated Jan. 9, 1914 (under Int. Conv., Dec. 5, 1913), to Fr. Pat. 461,938, Aug. 27, 1913 (this J., 1914, 342).

The air and gas passages are so connected that the major portion of the preheated air is employed for the direct flame heating the sole or hearth of the furnace and a smaller proportion for a flame which serves to heat the regenerators.—W. H. C.

Separating [*solid*] *materials by centrifugal force ; Process and apparatus for* ——. W. W. Richardson, St. Austell, Cornwall. Eng. Pat. 26,142, Nov. 14, 1913.

Two vessels, A and B, of the shape shown (see fig.), are rotated about a common axis, C, within an outer casing, D. Water is fed through the pipe, F, on to the top of the vessel, A, and flows down over its outer surface, part being caused by the centrifugal force to stand up against the inner surface of the outer vessel, B, in a line vertically above the lip, *b′*, and part escaping between the edges, *a′*, *b′*. The latter portion fills the space, E, to a predetermined level, sealing the lower ends of the vessels, A, B. The solid material to be separated is fed through the pipe, G, on to the plate, H, is distributed by the vanes, *h*, and along with some of the water flows down the inner surface, *a*, of the vessel, A. When it reaches the lower edge, *a′*, which is slightly overlapped by the edge, *b′*, the heavier particles are projected through the water on to the edge, *b′*, and are caused by the centrifugal action to rise and collect in the upper part of B. The lighter particles pass on with the water and are eventually discharged through the gate-valve, *d′*, by which the height of the water is regulated. The scouring action of the water on the inner surface of A, helps to disintegrate and separate the material. The heavier particles which collect in the upper part of B, are discharged through the opening between A and B, by stopping the feed and reducing the speed.—W. H. C.



Solids from liquids ; Process for obtaining ——. I. S. and O. E. Merrell, Syracuse, N.Y., Assignors to Merrell-Soule Co. U.S. Pat. 1,102,601, July 7, 1914 ; date of appl., Feb. 16, 1912.

The solution is blown, in an atomised condition, into a whirling body of air within a desiccating chamber and at the same time a direct current of air surrounding the spray is blown into the chamber.—W. H. C.

Heating and evaporating liquids ; Method of ——. O. K. Zwingenberger, Perth Amboy, N.J., Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,104,285, July 21, 1914 ; date of appl., Nov. 25, 1911.

Hot gas is circulated upwards in a zig-zag path through a system of primary evaporators. The liquid is circulated from the bottom to the top in the evaporators and the hot gas is distributed over a sufficient number thereof to prevent the liquid from reaching the boiling point. From the evaporators the hot gas passes to a series of boilers, the steam generated in which is used for evaporating purposes in any convenient way.—A. S.

Evaporator. L. Hirt. Fr. Pat. 466,496, Dec. 23, 1913 Under Int. Conv., Feb. 21, 1913.

To avoid interruption of the flow of heat by the presenc of bubbles of vapour, or deposited solids, on the heatin surface, the liquid to be evaporated is pumped throug the heating tubes under a pressure, maintained by loade valves, sufficient to prevent boiling ; after passing th valves, it is sprayed into a chamber in which evaporatio takes place.—O. E. M.

Agglomeration of powdered carbon, metals or other material for the preparation of articles used for electrical and othe purposes. Comp. Fr. de Charbons pour l'Electricit Fr. Pat. 466,639, March 8, 1913.

Powdered substances to be agglomerated are mixed wit a small quantity of a binder so that after grinding an mixing, the substance is still in the form of powder. suitable solvent for the binder is then added, and the ma brought to the desired consistence and forced into moul under a pressure of at least 1000 kilos. per sq. cm.—A. T.

Method for carrying out reactions [*by the action of ultr violet rays*]. J. de Kowalski-Wierusz. Fr. Pat. 466,91 Dec. 8, 1913. Under Int. Conv., Dec. 11, 1912.

Substances, especially organic compounds, are expos to the action of ultra-violet rays by passing them vapour, alone or mixed with other vapours, through a hig frequency field, so that they become self-luminous. —O. E. M.

Particles suspended in gases ; Apparatus for the remo of ——. Soc. des Carbures Métalliques. Fr. P 467,267, March 25, 1913.

To remove suspended liquid or solid particles, the ga passed between flat electrodes, consisting of coarse sack attached with graphite and sodium silicate to glass pla and connected to an alternator. The high-tension f thus formed is modified by a glass plate, midway betw and parallel to the electrodes, which collects the suspen particles.—O. E. M.

Cleaning tubular and other vessels [*used for treating p*]. T. Rigby, Dumfries, and N. Testrup, Assignors to W carbonizing, Ltd., London. U.S. Pat. 1,106, Aug. 4, 1914. Date of appl., Dec. 6, 1911.

See Eng. Pat. 9105 of 1911 ; this J., 1912, 677.—T. F. B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Weathering of the Pittsburgh coal bed at the experim mine near Bruceton, Pa. H. C. Porter and A. C. Fiel U.S. Bureau of Mines, Technical Paper 35, pp. 35

The experimental mine comprises an outcrop of the Pittsburgh coal-bed on a hillside. Two nearly horiz galleries were driven about 620 ft. and coals take various distances from the outcrop were compared. Ch in chemical composition have occurred for a distan bout 50 ft. from the outcrop, the amount of cover at is distance being less than 25 ft. The weathered coal ntains less carbon and hydrogen and more oxygen and mbined water in the coal-substance, has a lower calorific lue, absorbs less oxygen from air and liberates less ethane. Boiler tests with clean coal taken at 620 ft., d with "rusty" coal (lumps having yellow coatings of on compounds) taken at 70 ft. from the outcrop, showed differences in evaporative power, furnace efficiency, or rning qualities.—A. T. L.

flammability of gaseous mixtures; The dilution-limits of ——. H. F. Coward and F. Brinsley. Chem. Soc. Trans., 1914, **105**, 1859—1885.

termination of dilution limits.—The results given by evious workers varied over a considerable range, owing different forms of apparatus, and different arrangements r ignition having been used and different standards opted for inflammability. The authors define a gaseous xture as inflammable at a stated temperature and essure if it will propagate flame indefinitely when the burnt portion of the mixture is kept at that temperature d pressure. Combustion in an inflammable mixture is t necessarily complete. In order to conform with this finition, the flame is started near the bottom of a tall ssel which is of sufficient cross-section to minimize the ling influence of the walls, and the bottom of the ssel is sealed in water so that the pressure cannot rise preciably. Upward flame propagation is adopted since very weak mixtures the velocity of propagation may be s than that of the upward convection currents and wnward propagation of the flame may thus be prevented. e largest vessel employed was 1·8 meters high and sq. cm. in section, two sides being made of wood and e of glass. Electric ignition was usually employed

Lowest limits for hydrogen, methane and carbon monoxide air.—Mixtures at atmospheric pressure, and saturated th water vapour at 17°—18° C., were inflammable if ey contained not less than 4·1% H_2, 5·3% CH_4, or 12·5%).—A. T. L.

tural-gas wells; The Hungarian ——. Chem.-Zeit., 1914, **38**, 469.

e occurrence of natural gas in Hungary has long been own, and for some years the gas has been used for ving gas engines. The distribution of the gas for long tances has now been undertaken. In April, 1909, a gas-ring layer was tapped at a depth of 302 meters (990 ft.); wells yield 1·7 million cub. m. (60 million cb. ft.) of (pure methane) per day. It is intended to supply gas for lighting and for power over a wide district, luding the cities of Klausenburg and Marosvásárhely, h 150,000 inhabitants, and to carry the gas eventually Budapest. It is estimated that natural gas could be l in Budapest for 2·4 heller per cub. m. (6·8d. per 1000 ft.), as compared with 7 heller (19·8d. per 1000 cb. ft.) coal gas. The gas is already being distributed over a tance of 75 km. (46½ miles). The rolling stock of the te railways in the district is lighted with the gas, which tored in 40-litre cylinders at 100 atmospheres, and the is also used in several large chemical works, including Portland cement factory. Natural gas and oil have ently been discovered in the north-west of Hungary, r Pressburg, the first boring yielding 1½ wagon-loads oil per day and about 500 cub. m. (17,650 cb. ft.) gas containing 95% CH_4 per hour.—A. T. L.

nbustion in motors. E. Terres. Chem.-Zeit., 1914, **38**, 417.

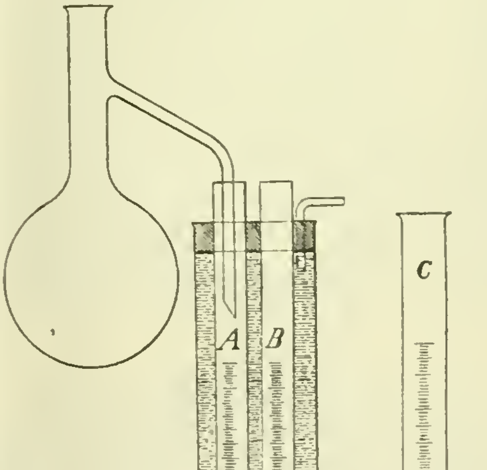
e completeness of the combustion in a four-stroke-le engine working with benzene was found to vary with load, the degree of compression, the timing of the tion, and the quantity of air in the charge. The heat due to incomplete combustion increased from 1·47 to 9% as the load decreased from 3·5 H.P. to no load. —A. T. L.

Petroleums of California; Physical and chemical properties of ——. I. C. Allon, W. A. Jacobs, A. S. Crossfield and R. R. Matthews. Techn. Paper 74, Dept. of Interior, Bureau of Mines, U.S.A. 38 pages.

Tables are given of the results of the fractional distillation of typical oils from different districts. The asphaltic petroleums, after distillation of oils up to 325° C. at 10 to 20 mm. pressure, left a residue of solid elastic asphaltum of technical value. In many cases paraffin wax could be determined by the following method:—The filtered petroleum spirit solution of the sample was treated first with strong and then with fuming sulphuric acid, the petroleum spirit distilled, and the residue dissolved in ethyl acetate. The solution was mixed with 95% alcohol, cooled to 0° C., and the precipitated paraffin wax washed with 75% alcohol, dried and weighed. Under these conditions 2·5 mgrms. of paraffin wax of m. pt. 56° to 58° C. dissolved in 100 c.c. of the solvent. Applying this correction to test mixtures of Trinidad asphaltum and paraffin wax, results were obtained within 0·1% of theory. Refinement of the oils by agitation four times with sulphuric acid, once with sodium carbonate solution, and three or four times with water, and redistillation, showed a total loss of 11% of the oil. In the case of heavier fractions dilution with 1% of pure benzene before the acid treatment obviated difficulties caused by the high viscosity.—C. A. M.

Petroleum; Fractional distillation of ——. J. M. Sanders. Chem. Soc. Trans., 1914, **105**, 1697—1703.

To enable rapid determinations to be made of the specific gravity of successive fractions, a graduated vertical condenser, A, is used, which can be connected by a three-way cock, D, with a discharge tube, E, or with the graduated tube B, and levelling tube, C. The tube, C, is adjusted at the start and at the end of each stage of the fractionation so that water stands at the zero mark on tube, A, and readings are taken of the height of the oil and water levels in A and B respectively. The successive



distillates are run off at E. The levelling tube, C, is graduated so that the quantity of water in the sample of oil can be ascertained from the increase in the amount of water in the tubes A, B, C. For distilling heavy crude oils, containing water which causes frothing, and asphaltic matter which requires heating to the coking stage to ensure complete distillation, a copper-coated distillation flask having two branch tubes at the same level in its neck is used. The flask can be heated very strongly without danger, the expansion of the copper coating separating it from the glass so that a thin film of air is left between them, and the flask is very uniformly heated. Frothing is reduced by passing a current of carbon dioxide into the flask and through the oil by means of one of the branch tubes, and an electrically heated test-tube is inserted in the still-head to prevent condensation.—A. T. L.

Petroleum distillates; Fluorescence of ——. B. T. Brooks and R. F. Bacon. J. Ind. Eng. Chem., 1914, **6**, 623—625.

Evidence is adduced showing that the fluorescence of petroleum oils is not due to resinous or asphaltic constituents in colloidal solution, or to carbon, sulphur, or other substances in colloidal suspension. The fluorescent constituents are only slightly absorbed by fullers' earth and the character of the fluorescence is affected by the addition of various common solvents in the same way as in the case of the fluorescent diamino-derivatives of terephthalic acid methyl ester (Kauffmann, Annalen, 1912, **393**, 1). The fluorescent substance was isolated in a crude state from the acid sludge tar obtained in refining petroleum with sulphuric acid, by washing with water, nearly neutralising the dilute acid solution with lime, filtering, evaporating nearly to dryness, and extracting the residue with alcohol. It probably contains one or more compounds of the benzene series resembling chrysene, fluorene, or pyrene, and is formed to a considerable extent during the distillation of the crude oil, for products obtained by distilling under diminished pressure are much less fluorescent than those distilled at atmospheric pressure. The fluorescence is destroyed by halogenation, hydrogenation, and partly or completely by oxidation. The action of nitro-compounds in neutralising the fluorescence is physical in character, for if an oil "debloomed" in this way be refined with sulphuric acid, a fluorescent product is obtained. A light-coloured oil having only a slight bluish fluorescence, similar to sun-bleached oil can be obtained by shaking lubricating oil with nitrous acid for 3 mins., washing with water, and filtering through fullers' earth, or by treating the chilled oil (not above 10° C.) with oxides of nitrogen and washing with dilute alkali.
—A. S.

Patents.

Fuel; Use of chlorophyll extracts as ——. E. Bouchaud-Praceiq. Fr. Pat. 466,985, March 19, 1913.

The chlorophyll extract may be obtained by means of alcohol or ether, alone or mixed with carbon bisulphide or tetrachloride, or other organic solvents, the plant residue forming a colourless material which can be used for the manufacture of cellulose for paper-making, etc., or as a cattle-food. The residue from evaporating the chlorophyll extract is distilled, alone or with steam, yielding a light fuel oil, suitable for use in internal combustion engines, ammonia which is recovered, and a mineral residue containing phosphates which is useful as a manure.
—A. T. L.

Coal briquettes; Manufacture of ——. Pure Coal Briquettes, Ltd. Fr. Pat. 467,688, Jan. 24, 1914.

Waste coal is ground wet, and the pulp containing 45 to 60 parts of water to 100 parts of coal, is partially dried and solidified by submitting it to a pressure of 500—800 kilos. per sq. cm. between two pistons in a mould having its sides formed by vertical bars which are practically in contact at the inner surface and are tapered towards the outer surface so as to leave spaces for the escape of the water. The briquettes are passed through a tube in which the temperature rises from 80° C. at the inlet end to 250°—500° C. at the discharge end, so that the coal is dried and begins to soften, and the briquettes are compressed while hot at a pressure of 800 to 2500 kilos. per sq. cm.—A. T. L.

Fuel; Briquetted ——. Soc. Internationale des Combustibles Artificiels. Fr. Pat. 467,757, April 4, 1913.

Powdered carbon (*e.g.* wood charcoal), 100 parts, is mixed with sodium silicate, 15—20, and calcium carbonate, 2—3 parts, and briquetted.—A. T. L.

Separating the solid residues of combustion, especially those derived from furnaces; Apparatus for ——. A. F. Müller, Berlin. Eng. Pat. 14,928, June 28, 1913.

The furnace residues are first passed over a reciprocating sieve to remove the fine ashes and then treated with a liquid having a higher specific gravity than the utilisable fuel but lower than the non-combustible residue. The liquid which may be waste dilute molasses from sugar factories or waste from cellulose factories, etc., is contained in a horizontal cylindrical vessel which is half filled. The residues are delivered on to the surface of a rotary sieve and enter the liquid with the latter, as it turns into a horizontal position. The lighter fuel floats off as the sieve sinks, the incombustible residue follows the sieve until the latter is nearly or quite vertical when it falls into the bottom of the cylinder and is removed by a scraper.
—W. H. C.

Vertical retorts for the distillation of coal; Continuous ——. Comp. Générale de Construction de Fours. Fr. Pat. 467,445, Jan. 17, 1914.

The primary and/or secondary air and/or the gases from the generators are preheated by being passed through flues adjacent to the lower part of the retorts, and the waste gases from the combustion chamber are caused to pass through flues adjacent to the preheating flues tc assist in the heating.—W. H. C.

Gas producers; Working of by-product recovery —— T. Rigby and G. W. Andrew, Dumfries, and Wet carbonizing Ltd., London. Eng. Pat. 10,981, May 9 1913.

Peat is gasified in the presence of an excess of steam as in the Mond ammonia-recovery process, and the gase are cooled in two stages so as to separate the more volatil by-products such as methyl alcohol, from the wate and tar. The cooling may be effected in surface con densers, or the gas may first be brought into direct contac with the cooling water under conditions which ensu a final temperature high enough to prevent condensatio of methyl alcohol, and afterwards cooled in a surfac condenser. The gases cooled to atmospheric temperatu may be scrubbed with water or other solvents to recov uncondensed volatile by-products.—A. T. L.

Gas producers and method af working same. J. Stewa Glasgow. Eng. Pat. 21,697, Sept. 26, 1913.

Relates to improvements in producers of the ty described in Eng. Pat. 26,858 of 1909 (this J., 1910, 119 for generating tar-free gas continuously from bitumino coal. The producer comprises a lower, an intermedia and two upper chambers. The lower chamber is provid with a grate and air inlet and is of suitable dimensio for continuous production of gas. The upper chambers a separated from one another by a hollow vertical metal w extending downwards to the top of the intermedia chamber, and serving as an air heater or as a stea generator. Each upper chamber is provided with a fe hopper, air inlet and gas outlet, and with controlli valves. The upper chambers are charged with fresh f alternately, and the newly charged chamber is work with a down-draught of air or air and steam and t other chamber with an up-draught until it needs chargi when the currents are reversed, the lower and int mediate chambers being worked continuously with up-draught. If desired, one of the upper chambers u be fed with anthracite or coke, and the other with bitum ous coal, and the chambers may then be worked c tinuously with up-draught and down-draught respective.

The grate is pivoted and is rocked to agitate the fuel or turned further about a horizontal axis to leave a space for the discharge of ashes into the ash-pit. The upper part of the producer is closed by a hollow casing serving as an air heater or as an evaporator.—A. T. L.

Producer-gas; Process for the production of —— in rotary generators. Alpine, Maschinenfabrikges. m. b. H. vorm. Holz-Häner'sche Maschinenfab. G. m. b. H. and F. Meyer. Fr. Pat. 466,860, Dec. 27, 1913. Under Int. Conv., Jan. 10, 1913.

Oxidation (combustion) of the fuel is effected in an auxiliary furnace and the gases are introduced into the rotary furnace where destructive distillation is carried out, under such conditions as to composition and temperature that no fusion of the ash takes place.—W. H. C.

Generation of mixed steam and combustion products under pressure for the purpose of power. J. B. Kinnear, Kinloch, Fife. Eng. Pat. 22,775, Oct. 9, 1913.

Solid, liquid or gaseous fuel is burnt with air under pressure in an hermetically-sealed furnace, connected with a steam-chamber, and water is injected into the hot products of combustion until the temperature of the mixed gases passing to the steam-chamber is reduced to the desired point. (Reference is directed to Eng. Pats. 3556 of 1877, 23,828 of 1893, 573 of 1894, and 4278 of 1902.)—A. T. L.

Gas-purification; Apparatus for ——. C. Heine. Fr. Pat. 466,459, Dec 22, 1913.

The gas passes upwards through a series of flat drums perforated with small holes at the bottom, and large ones, fitted with internal baffle-plates, at the top. The drums are in a gas-tight casing from which they can be removed separately.—O. E. M.

Petrol or like fuel; Method of increasing the efficiency of —— in internal-combustion engines. J. E. Birtill, Manchester. Eng. Pats. 15,524 and 17,539, July 5 and 31, 1913.

The petrol, before entering the carburettor, is mixed with about 0·05 of its quantity of a soluble lubricating oil. —A. T. L.

Fuel suitable for use in internal-combustion engines; Manufacture of ——. P. H. King, London. Eng. Pat. 15,970, July 10, 1913.

A petrol substitute consisting of heavy hydrocarbons, such as a petroleum distillate boiling from 100°—350° C., mixed with a standard saturated solution of acetylene in benzene.—A. T. L.

Light oils; Production of —— from crude, heavy, or lighting oils. J. Moeller and H. C. Woltereck, London. Eng. Pat. 16,611, July 19, 1913.

The vapours of the crude oil are mixed with steam at 700°—800° C. under atmospheric pressure and passed through tubes filled with coke and heated to 600°—700° C. A large yield of light oils free from sulphur is obtained. —A. T. L.

Combustible liquid from heavy hydrocarbons; Process for the manufacture of ——. W. A. Hall. Fr. Pat. 467,381, Jan. 16, 1914. Under Int. Conv., Oct. 28, 1913.

The gases and liquid distillates from "gas oil" distilled under pressure, after separation and purification from tarry substances, are passed together through a retort heated to about 200° C. and at a pressure of about 3½ atmospheres. The gas combines with the oil to form a liquid suitable for internal combustion engines.—W. H. C.

Coke; Process for the production of ——. L. Franck, Luxemburg. U.S. Pat. 1,098,359, May 26, 1914. Date of appl., Jan. 6, 1914.

See Ger. Pat. 274,853 of 1914; this J., 1914, 782.—T. F. B.

Heating gases; Process for obtaining ——. "Athion" Ges.m.b.H., Mannheim-Waldhof, Germany. Eng. Pat. 21,213, Sept. 19, 1913. Under Int. Conv., Sept. 21, 1912.

See Fr. Pat. 462,740 of 1913; this J., 1914, 304.—T. F. B.

Gas-producer. J. A. Weil, Stockton-on-Tees. U.S. Pat. 1,105,474, July 28, 1914. Date of appl., May 16, 1914.

See Eng. Pat. 4452 of 1914; this J., 1914, 636.—T. F. B.

Gases; Treating illuminating and heating —— for purifying them and obtaining useful products therefrom. "Athion" Ges. m. b. H., Mannheim-Waldhof, Germany. Eng. Pat. 17,877, Aug. 5, 1913. Under Int. Conv., Aug. 7, 1912.

See Fr. Pat. 461,107 of 1913; this J., 1914, 244.—T. F. B.

[Mineral] oil; Apparatus for mixing —— with chemicals. O. J. Shiner, Bayonne, N.J. (M. E. Shiner, Administratrix). U.S. Pat. 1,102,696, July 7, 1914. Date of appl., Feb. 2, 1914.

See Eng. Pat. 13,441 of 1913; this J., 1914, 740.—T. F. B.

Treatment of [mineral] oils [for medicinal purposes]. Eng. Pat. 15,551. *See* XX.

Calorimeter for gas and other fuels. Fr. Pat. 467,180. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Bunsen flame; Influence of secondary air on the inner cone of the ——. L. Ubbelohde and O. Dommer. J. Gasbeleucht., 1914, **57**, 733—740.

A mixture of gas and air containing less air than is necessary to form an explosive mixture, will burn at the orifice of a tube with a flame having an inner cone. This is due to the fact that combustion effected by secondary air (*i.e.*, air derived from the atmosphere about the flame) extends within the inner cone. Experiments made with a burner 0·7 cm. diam., with mixtures of carbon monoxide and air, showed that the velocity of the gases at the surface of the inner cone, *i.e.*, the velocity of flame propagation in the mixture of gas and air, was increased by the secondary combustion when the mixture contained 60% CO or more, and the temperature of the inner cone was similarly raised when the mixture contained 45% CO or more. By analysing gases withdrawn from various parts of the flame it was found that the inner cone contained products from the secondary combustion when the gas mixture contained 50% CO or more, and with 85% CO the gases in the inner cone contained nearly double the quantities of carbon dioxide and nitrogen that could be formed by the primary combustion alone. The maximum flame temperature of carbon monoxide was obtained with a mixture containing CO 34, air 66%. With large quantities of primary air in the gas mixture, combustion in the inner flame was very incomplete. —A. T. L.

Wood; Steaming of ——. Heuser. *See* V.

Patents.

Decolorising-carbon; Regenerating ——. A. Wijnberg, Amsterdam. Eng. Pat. 17,432, July 29, 1913. Addition to Eng. Pat. 19,357, Aug. 23, 1912 (this J., 1913, 85).

Carbon revivified as described in the principal patent loses its efficiency after about 15 to 20 repetitions of the process. It can then be regenerated by treating with a solution (1% to 25%) of alkalis, alkaline compounds, or alkaline-earths, with or without an oxidising agent, and heating to red heat or incandescence. The regenerated carbon may be revivified after use as described previously (*loc. cit.*).—A. T. L.

Filaments for incandescent electric lamps ; Manufacture of metallic ——. J. A. Scoular and Dick, Kerr and Co., Ltd., London. Eng. Pat. 14,807, June 26, 1913. Addition to Eng. Pat. 11,455, May 14, 1912 (this J., 1913, 527).

Tungsten powder is mixed with a small proportion of sodium silicate and squirted into filaments, which are straightened, dried in hot air and heated to bright redness in an atmosphere of hydrogen. They are then treated with a solution of hydrofluoric acid, washed, dried, and heated to a sintering temperature.—W. H. C.

Electric incandescent lamps ; Manufacture of ——. F. Simpson, Liverpool. Eng. Pats. 15,297, July 2, 1913, and 2612, Jan. 31, 1914.

Tungsten filaments or bars are manufactured in bulk from a paste made of tungsten or its oxygen compounds and an organic binding material. The filaments are squirted, and dried in air at 150°—200° C. Batches of 500 or more of the dry filaments are hung over T-shaped tungsten supports, and carried by power-driven mechanism into a tubular resistance furnace which is kept at about 900° C. and through which a current of dry hydrogen, free from nitrogen and oxygen, is passed. The filaments are heated in the furnace for about 30 mins. to carbonize the binder and reduce the tungsten to metal. They are then heated to 240° C. in an oven to which air has access, so as to produce more oxide than is sufficient for the decarbonisation of the filaments, this being effected by heating for ½ to 20 mins. at 1800° C. in an atmosphere of hydrogen in a furnace consisting of a resistance tube of pure iridium. Alternatively the re-oxidised filaments may be heated *in vacuo* for 6—8 mins. at 800°—950° C., so as to remove carbon, and are sintered by heating for 2—5 mins. to 1800° C. in hydrogen. (See also Eng. Pats. 11,409, 13,596, and 21,509, of 1906, 8947 of 1907, 12,720 of 1908 and 15,192 of 1909; this J., 1907, 462, 1131 ; 1908, 798 ; 1909, 788).—A. T. L.

Electrodes suitable for electric arc lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,355, Aug. 12, 1913.

The electrodes are composed of magnetite 70, rutile 30, and lithium fluoride or other lithium compound, 1 part. —W. H. C.

Arc light carbons. H. Ayrton, London. Eng. Pat. 6104, March 10, 1914. Addition to Eng. Pat. 1775, Jan. 22, 1913 (this J., 1914, 346).

The carbon is similar to that described in the principal patent but has an additional thin layer of copper or other metal between the hard core and the soft outer shell. —A. T. L.

Metallic filaments for electric incandescent lamps ; Manufacture of ——. J. A. Scoular, Hammersmith, Assignor to Dick, Kerr and Co., Ltd., London. U.S. Pat. 1,104,557, July 21, 1914. Date of appl., March 14, 1913.

See Eng. Pat. 11,455 of 1912 ; this J., 1913, 527.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Patents.

Triaminocarbazolemonosulphonic acid ; Process for preparing ——. L. Cassella und Co. Ger. Pat. 275,975, July 1, 1913.

Carbazole is highly sulphonated, preferably until a trisulphonic acid is formed, and the product is treated with powerful nitrating agents. This results in the replacement of sulphonic groups by nitro groups, and also in the introduction of a further nitro group, with the formation of a trinitrocarbazolemonosulphonic acid, convertible by reduction into triaminocarbazolemonosulphonic acid. —T. F. B.

Pitch, resin, and the like ; Granulation of ——. C. N. Stevens, Chicago, U.S.A. Eng. Pat. 25,567, Nov. 8, 1913. Under Int. Conv., April 10, 1913.

See U.S. Pat. 1,088,635 of 1914 ; this J., 1914, 413.—T.F.B.

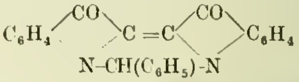
Dinitro-diaminobenzophenone. L. Blangey, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,104,611, July 21, 1914. Date of appl., Feb. 26, 1914.

See Eng. Pat. 8690 of 1914 ; this J., 1914, 743.—T. F. B.

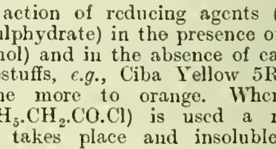
IV.—COLOURING MATTERS AND DYES.

Indigo ; Some new derivatives of —— *and other indigoid dyestuffs.* G. Engi. Chem.-Zeit., 1914, **38**, 199.

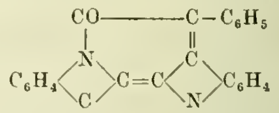
A description of the dyestuffs of the Indigo Yellow series discovered by the author and I. Fröhlich (Eng. Pats. 29,368 of 1910 ; 8900 of 1911 ; 8421 and 9940 of 1912 ; and Ger. Pat. 263,470 ; this J., 1911, 1247 ; 1912, 22,635, 766 ; 1913, 1005). Indigo Yellow 3G, made by condensing indigo with benzoyl chloride in a neutral solvent in the presence of copper powder, is regarded as having the constitution



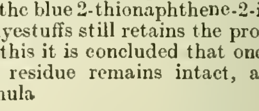
Its bromo-derivative is known as Ciba Yellow G and from this by the action of reducing agents (sodium hydrosulphite or sulphydrate) in the presence of an indifferent solvent (alcohol) and in the absence of caustic alkali are obtained dyestuffs, *e.g.*, Ciba Yellow 5R of which the shades incline more to orange. When phenylacetyl chloride ($C_6H_5.CH_2.CO.Cl$) is used a more extensive condensation takes place and insoluble products are obtained incapable of giving vats but valuable as pigments on account of their fastness to light, *e.g.*, Lake Red Ciba B. The product obtained by condensing indigo with phenylacetyl chloride probably has the constitution



The green β-naphthylindigo gives a red pigment dyestuff. The sulphonic acids of these products are wool dyestuffs. In the case of the blue 2-thionaphthene-2-indole-indigo the resulting red dyestuffs still retains the property of forming a vat. From this it is concluded that one carbonyl group of the indigo residue remains intact, as shown in the suggested formula



2-Naphthalene-2-indole-indigo condensed with phenylacetyl chloride gives a vat dyestuff dyeing bright but fugitive carmine-red shades. It probably has the constitution



—J. B.

Indigo ; Halogenated —— *and derivatives.* E. Grandmougin and P. Seyder. Ber., 1914, **47**, 2365—2373. (See also this J., 1910, 553.)

5.7.5.′7′-Tetrachloroindigo (Brilliant Indigo B ; Fr. Pa 315,180 ; this J., 1902, 401) is redder than the tetrabrom indigo (Ciba Blue 2B, Brilliant Indigo 4B; Ber., 1909, 42, 4408; this J., 1910, 14). It gives on oxidation 5.7-dichloroisatin. 4.4′-Dichloro-5.5′-dibromoindigo (Brilliant Indigo 4G; Ger. Pat. 234,961) oxidises to 4-chloro-5-bromoisatin. 4.7.4′.7′-Tetrachloroindigo (Ber., 1884, 17, 752; this J., 1884, 411) gives similarly 4.7-dichloroisatin. Octochloroindigo (Annalen, 1912, 48, 473) dyes in blue violet tones and gives on oxidation 4.5.6.7-tetrachloro-satin. 6.6′-Di-iodoindigo is obtained from 6.6′-diamino-ndigo (Monatsh. Chem., 26, 1253) by diazotising in ulphuric acid solution and decomposing with potassium odide. It dissolves in hot nitrobenzene or methyl enzoate with a violet colour, turning pure blue on cooling. 6.6′-Dibromoindigo (Ger. Pat. 195,291) has also been prepared by the Sandmeyer reaction. 6.6′-Diamino-5.7.5′.7′-tetrabromoindigo is a brown dyestuff (Ciba Brown R), although the unbrominated diaminoindigo is worthless. The absorption spectra of the different ndigo derivatives have been determined.—J. B.

m-Aminophenol and m-anisidine; Nitro-derivatives of the acidyl-derivatives of ——. F. Reverdin and K. Widmer. Chem.-Zeit., 1914, **38**, 276.

By nitrating the diacetyl-, dibenzoyl- and ditoluene-ulphonyl compounds of *m*-aminophenol, the 4- and 6-mononitro derivatives have been obtained. The four ossible mononitro-*m*-anisidines have also been obtained y nitrating and saponifying acetyl-*m*-anisidine. The -mononitro-compound melts at 169° C., the 2-mononitro-ompound at 143° C. The other two are known. Further itration yielded 4.6-, 2.4- and 2.6-dinitro-*m*-anisidine, he latter compound melting at 146° C. Trinitro-erivatives were not obtained.—J. B.

itro-m-anisidines; Comparison of the azo dyestuffs from —— with those from the corresponding nitranilines. F. Reverdin and K. Widmer. Chem.-Zeit., 1914, **38**, 276.

s the orange and red dyestuffs the introduction of the ethoxy-group caused the shade to incline towards red r violet. 4-Nitro-*m*-anisidine gave dyes of brighter shades an the 5-isomeride. The dyestuffs from the 5-isomeride nd naphthionic acid, 1.4-naphtholsulphonic acid and 3.6-naphtholdisulphonic acid are distinguished for stness to light.—J. B.

urpurogallin; The yield of —— by oxidation of pyrogallol with peroxydase and hydrogen peroxide. A. Bach. Ber., 1914, **47**, 2125—2126.

HE highest yields previously obtained by Bach and hodat (this J., 1904, 505) were 16·2 and 16·8%. öcklin's yield of 50% (Dissertation, Geneva, 1907) used the author to re-investigate the matter, using a ry active peroxydase obtained by the ultrafiltration ethod (see preceding abstract) and with various pro-rtions and concentrations of hydrogen peroxide. Never ore than half Stöcklin's yield was obtained, however, d the possibility of error due to retention of water by e voluminous purpurogallin precipitate is suggested. very sensitive test for purpurogallin is to dissolve the tter in alcohol or acetone, dilute with 3 vols. of water d add peroxydase and hydrogen peroxide. A violet loration results, gradually becoming brown. One part purpurogallin in 500,000 can be detected. Phenolase ves the same reaction. The yield of purpurogallin from rogallol is evidently dependent on the avoidance this reaction by separation of the purpurogallin from e solution as quickly as possible.—J. B.

PATENTS.

louring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 21,133, Sept. 18, 1913.

dyestuffs which produce violet shades on vegetable res are obtained by condensing halogenated fluorenene-boxylic acids with 1-aminoanthraquinone. During the ocess the carboxyl group is split off, giving products identical with those obtained by condensing halogenated fluorenones with 1-aminoanthraquinone (see Addition to Fr. Pat. 365,920; this J., 1910, 1197).—T. F. B.

Azo-dyestuffs; Production of ——. Chem. Fabr. Griesheim Elektron, Frankfurt a/M., Germany. Eng. Pat. 3313, Feb. 7, 1914. Under Int. Conv., April 19, 1913.

ARYLIDES of 2.3-hydroxynaphthoic acid are condensed with formaldehyde in alkaline solution (Eng. Pat. 3312 of 1914; this J., 1914, 742). The new products may be combined with diazo compounds just as in the case of the parent materials (see also Eng. Pats. 6379 of 1912 and 17,279 of 1913; this J., 1912, 635 and 1914, 73).—J. B.

Azo dyestuffs; Production of new ——. Chem. Fabr. Griesheim Elektron. Fr. Pat. 466,922, Dec. 26, 1913.

THE diazo-compound of an aminoarylamide of an *o*-hydroxycarboxylic acid of the benzene series is combined with a suitable end component. For example 1.4-naphtholsulphonic acid with the *p*-aminoanilide of salicylic acid gives a red which dyes wool fast to washing and milling.—J. B.

Nitrosulphochlorides of ortho-oxycarboxylic acids or of their derivatives; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 12,061, May 15, 1914. Under Int. Conv., May 29, 1913.

THE sulphochlorides of phenol-*o*-carboxylic acids or their derivatives can be converted into nitro compounds by nitration in the usual manner. The *p*-sulphochloride of salicylic acid is converted into a nitro derivative ($OH : COOH \cdot SO_2Cl : NO_2 = 1 : 2 : 4 : 6$). The products may be used as intermediate compounds in the manufacture of azo dyestuffs.—T. F. B.

Polyazo dyestuffs; Preparation of green substantive ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 276,140, May 3, 1913, and 276,141 and 276,142, Aug. 5, 1913.

(1.) AN aromatic acidyldiamine or nitroamine, or a derivative or sulphonic acid thereof, is diazotised and combined with a diazotisable amino compound; the product is diazotised and combined with a *m*-aminobenzo derivative of 2.5-aminonaphthol-7-sulphonic acid, and the disazo dyestuff thus produced is diazotised and combined with resorcinol or *m*-aminophenol, the product being finally saponified or reduced. When dyeings with such compounds are treated with formaldehyde, fast green shades are produced. The *m*-aminobenzo derivatives, mentioned above, may be the *m*-aminobenzoyl derivative, or *m*-aminobenzenyl-1.2-naphthylenediamine-7-sulphonic acid, or the benzonaphthothiazole, etc. (2.) The dyestuffs obtained according to the preceding patent are diazotised and combined with resorcinol or *m*-aminophenol, or a diazotised acidyldiamine or nitroamine is combined with an amino compound, the product is diazotised and combined with a *m*-aminobenzo derivative as above, the disazo dyestuff is saponified or reduced, and the product is tetrazotised and combined with two mols. of resorcinol or *m*-aminophenol, or with one mol. of each. (3.) The acidyldiamine or nitroamine in Ger. Pat. 276,140 is replaced by α- or β-naphthylamine or their sulphonic acids.—T. F. B.

Amino-anthraquinones; Process of producing ——. R. Uhlenhuth, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,104,943, July 28, 1914. Date of appl., June 2, 1913.

ANTHRAQUINONESULPHONIC acids are converted into the corresponding aminoanthraquinones by heating them with aqueous ammonia in such a manner that the sulphurous acid produced is converted into a practically insoluble metallic salt; for example, the reaction may be carried out in presence of barium chloride or other soluble barium salt.—T. F. B.

Dyestuffs ; Preparation of brown, chrome —— for wool. Fab. Prod. Chim. ci-dev. Sandoz. Fr. Pat. 467,114, Jan. 8, 1914. Under Int. Conv., Nov. 23, 1913.

Resorcinol is combined on the one hand with a diazobenzene sulphonic acid or the diazo-compound of a monoazo dyestuff made by combining Clève's acid with a diazobenzenesulphonic acid or an o-diazophenol, and on the other with an o-diazophenol or the diazo-compound of a monoazo dyestuff made by combining Clève's acid with an o-diazophenol. The new dyestuffs dye wool directly in brown shades sufficiently fast to milling and potting for ordinary purposes, becoming still faster on after-chroming. (Compare Ger. Pat. 251,844 ; this J., 1912, 1117.)—J. B.

[Azo] colouring matters capable of being further developed ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,714, Sept. 13, 1913.

See Ger. Pat. 273,934 of 1913 ; this J., 1914, 783.—T. F. B.

Dyes for dyeing furs, hairs, and the like. A. Erlenbach and K. Marx, Dessau, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,105,501, July 28, 1914. Date of appl., Nov. 6, 1912.

See Addition of May 7, 1912, to Fr. Pat. 413,877 of 1910 ; this J., 1912, 1121.—T. F. B.

Sulphurised dyes and process of making same. H. Heimann, Dessau, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,105,515, July 28, 1914. Date of appl., Oct. 16, 1912.

See Fr. Pat. 436,373 of 1911 ; this J., 1912, 426.—T. F. B.

Mordant dyestuffs ; Green —— and process of making. E. Bodmer, Assignor to Dye-Works, formerly L. Durand, Huguenin und Co., Basle, Switzerland. U.S. Pat. 1,106,185, Aug. 4, 1914. Date of appl., July 3, 1913.

See Fr. Pat. 459,681 of 1913 ; this J., 1913, 1101.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Wool ; The presence of an amino-group in ——. K. Gebhard. Färber-Zeit., 1914, **25**, 279—283. (See this J., 1914, 251 and 640.)

Kann's conclusion that wool contains no amino-group is disputed. Wool treated with formaldehyde under the conditions described by Kann still retains its power of reacting with nitrous acid to form a true diazo-compound. This is explained by the author's theory that wool contains two substances, an amino-acid and a colloidal substance loosely attached to the amino-groups of the acid. Kann probably effected the splitting off and coagulation of this colloid, leaving free the amino-acid with an active amino-group.—J. B.

Cellulose for making cellulose solutions ; Preparation and requirements of ——. C. Piest. Papierfab., 1914, **12**, 860—865.

For guncotton the material most largely employed is a mixture of spinning waste and American "linter-waste." The threads are first torn up and the lint passed through a cleaning machine to remove all mechanical impurities. Oil, natural wax, proteins, etc. are then removed by digesting with about 1% caustic soda solution under 3 atmos. pressure. The material must be tightly packed in the boilers and good circulation ensured ; high purity of the soda and the exclusion of air during boiling and washing are advantageous. Bleaching must be very carefully controlled to preserve the chemical integrity of the cellulose ; a little acetic acid may be added. The "copper value" (Schwalbe's test) must not exceed 1·0 ; fat and waxy matters, extracted by absolute alcohol, 0·5% ; wood-gum, 2%. Tissue paper, from sulphite wood pulp, may also be used for nitrating but is dearer than cotton-waste and yields an inferior product. For celluloid, great mechanical purity is required to avoid specks in the product ; a low "copper value," not above 1·0 is specified. For collodion cotton, long fine fibres and freedom from metallic impurities are required. For nitro-artificial silk, resin and oil are most objectionable impurities ; as highly concentrated solutions of low viscosity are employed, the degree of bleaching, as indicated by the "copper value," may be higher. Wood celluloses give a softer but weaker silk ; they should be purified by boiling under pressure with dilute sodium carbonate solution with the addition of a little caustic soda or sodium sulphide. For leather-substitutes the requirements are the same as for celluloid, but a higher degree of bleaching may be permitted. For cellulose acetate, freedom from knots is an additional requirement. For cuprammonium silk also, the cotton must be free from knots and the "copper value" must not exceed 1·0. According to one process, the cotton is bleached, then mercerised, washed, centrifuged and dissolved without drying. For viscose, only wood cellulose is employed, generally purified by steeping in 2% hydrofluoric acid and then boiling out with 1% caustic soda ; the "copper value" should not exceed 4·0.—J. F. B.

Celluloid chemistry ; Problems of ——, *and the necessity of colloid-chemical views in this industry.* H. Schwarz. Kolloidchem. Beihefte, 1914, **6**, 90—126.

Celluloid may be regarded as a solid colloidal solution of nitrocellulose and camphor and the process of manufacture consists of two stages : the conversion of a mixture of nitrocellulose and camphor into a celluloid-gel by means of alcohol, and the conversion of the gel into celluloid by hot rolling and drying, whereby the alcohol is removed ; the stability of the system is increased in both stages of the process. Two factors of great importance in regard to the suitability of nitrocellulose for celluloid manufacture are the magnitude of the latent acidity (*i.e.*, acidity developed when nitrated paper which has been washed until neutral is subsequently subjected to certain treatments such as beating, washing with hot water, etc.) and the ease with which such latent acidity becomes manifest. Celluloid also shows the phenomenon of latent acidity an part of this latent acidity may become manifest in th operation of hot pressing. The nature and causes of number of defects of celluloid are discussed and also th so-called "antazide" treatment. In the case of a colloida system such as celluloid, an antazide will be more effectiv the larger the size of its particles and the more colloida its character : in agreement with this, solids are found t be more effective than liquids and the substituted urea superior to urea itself. The efficacy of an antazide in creases, within limits, with the quantity used, but it i possible that certain colouring matters may interfere wit the action, since it is known, for example, that the additio of some Erythrosine solution prevents the precipitation silver bromide from its solution by sodium sulphate. solid antazides those which also act as colouring matte (zinc white, zinc carbonate, white lead, etc.) are mo largely employed. All pigments and mineral colou must be regarded as antazides and it is irrational attempt to increase the stability of celluloid coloured wi a pigment by addition of a special antazide. Opaque coloured celluloid is more stable than the transpare material, and treatment with special antazides, apa from the colouring matters and gelatinising agents used the ordinary course of manufacture, should never resorted to except after taking all precautions to ensu that the nitrocellulose used is of good quality a stability.—A. S.

Wood ; The steaming of ——. Heuser. Chem.-Ze 1914, **38**, 126—127.

The by-products formed in the steaming of wood brown mechanical pulp at 4 atmos. pressure for 8 ho were examined at intervals. They included organic aci sugars, resin, mineral salts, incrusting matters, tanni furfural. It may be assumed that the resins, tanni incrusting matters and salts are extracted from the w without chemical change. The acetic and formic ac are produced by the decomposition of the lignone ;

sugar and furfural are formed from the carbohydrates. The "browning" may be regarded as a first step towards carbonisation. The formation of organic acids reached a maximum after 4—6 hours' steaming. The analytical separation of acetic and formic acids was complicated by the presence of sugar; they were separated from this by distillation *in vacuo* and then determined by Lieben's method (this J., 1894, 288). The yield calculated from 100 kilos. of wood was 213 grms. of acetic acid and 32 grms. of formic acid. These numbers would vary according to the species of wood; pine wood yielded more formic acid. The sugar was estimated as dextrose; the maximum production from spruce wood was found after steaming for 2—5 hours, from pine wood after steaming for 4—6 hours. The total quantity from pine wood was greater than from spruce; the highest value found was 0·52% of the solid wood. The maximum amount of resin was separated in the early stages of the process but was too small for profitable recovery. The furfural appears to be formed either by the direct action of the steam and inorganic salts or else by the action of the steam and organic acids, the latter playing the part of hydrochloric acid. Müller stated that if the wood be immersed for a short time in caustic soda before steaming, the consumption of power in the grinding process is reduced by 25%; by blowing in the alkali with the steam the economy of power has been increased to 45%.—J. F. B.

Paper pulp; Suitability of long-leaf pine for ——. H. E. Surface and R. E. Cooper. U.S. Dept. Agric., Bull. No. 72, May 29, 1914, 1—26.

Digestions were made with Southern long-leaf pine material, logs and edgings, in a stationary vertical boiler of 62 galls. capacity. The high density of the wood, 3550 lb. oven-dry weight per solid cord of 100 cb. ft. green volume, is favourable from the point of view of yield. Mild conditions of digestion by the sulphate process gave high yields (61%) of fibre, somewhat harsh in character but suitable for papers of kraft type of moderate strength. The best results were obtained with a lye containing 15 lb. NaOH and 7·5 Na_2S per 100 lb. of chips, at the rate of 0·68 gall. per lb. of material; the maximum pressure of 100 lb. per sq. in. was maintained for 3 hours; total time, 3½ hours. Under these conditions the yield was reduced to 48·4—49·1%, but the papers produced from the pulp were as strong and as resistant to wear as the best imported "krafts," and possessed the characteristic "leathery" handle. In the digestions with caustic soda alone, the best results were obtained with a liquor containing 20 lb. NaOH per 100 lb. of wood, at an initial concentration of 79·7 grms. per litre; steam-pressure 110 lb. per sq. in. for 5 hours; total time 6 hours. The yield was 48% of pulp, which gave papers of excellent quality. The sulphate process is superior in all respects to the caustic soda process, particularly as regards time. The presence of inactive salts, such as sodium sulphate and carbonate serves no useful function; there appears to be, for each different combination of digestion conditions, some definite minimum proportion of sodium sulphide to caustic soda necessary to produce the characteristic toughness of kraft pulps, but as the sulphide is increased the odour becomes more pronounced. Plain soda pulps from long-leaf pine tend to be soft and "fluffy" if well boiled, and do not acquire the same degree of "greasiness" in beating as the sulphate pulps; they are generally less resistant to rubbing, even if the tensile strength is good. Soda pulps, if underboiled, will not give even moderately good papers, and the maximum yield at which papers can be made is only about 50%, whereas with the sulphate process, fairly strong papers can be made from underboiled pulps prepared with a yield of 60%.—J. F. B.

Sulphite pulp manufacture; Notes on ——. A. Frohberg. Chem.-Zeit., 1914, **38**, 126.

The idea that the system of digesting with indirect steam is superior to the direct steam system is not correct. When boiling with live steam the circulation is much better and the mixing of the "acid" and raising of the temperature are more rapid. Below 100° C. adsorption phenomena occur, the colloidal wood adsorbing sulphurous acid from the liquor; consequently high concentration and maximum surface development are favourable. The chief objection to the direct steam system is the necessity for blowing over large quantities of liquor owing to the dilution. The liquors thus driven over and regenerated contain organic matters which weaken the efficiency of the "acid" by promoting the decomposition of the sulphurous acid into trithionic acid. It is better to separate the gases from the liquors blown over and utilise them separately. The organic matters in the "acid" may be determined colorimetrically after driving off the sulphurous acid, or oxidising by hydrogen peroxide. Acid produced in the towers at 3—3·2% strength can be enriched up to 4·5% by a systematic regeneration process. Blowing over also causes loss of heat; the necessity for blowing over increasea with steam of low heat-capacity; the use of superheated steam up to 220° C. affords a considerable economy in this direction. Good distribution of superheated steam is essential; a maximum digestion temperature of 145° C. does not injure the quality of the cellulose. When pneumatic stamping machines are used to increase the quantity of the charge, the strength of the "acid" should be increased. Dry wood shows a higher adsorption capacity than fresh; artificial drying by waste heat or hot air is very advantageous. In producing sulphurous acid, rich and cool gases are desirable. The formation of sulphur trioxide is at a maximum at 400°—500° C.; at 900°—1000° C. the sulphur trioxide is decomposed again into sulphur dioxide and oxygen. The furnace therefore must be worked as hot as possible in order to obtain gases rich in sulphur dioxide; the gases must be immediately cooled by direct spraying with water to reduce the temperature to 90°—100° C., the formation of sulphur trioxide being thus reduced to a minimum.
—J. F. B.

Coniferous woods; The resin of —— and its removal from sulphite-cellulose. C. G. Schwalbe. Chem.-Zeit., 1914, **38**, 926.

The "resin spots" of paper are caused by a mixture of resin and fat. The resin itself is hard, but the mixture is plastic, hence the fat content is the real cause of the markings. The fat consists mainly of the glyceride of oleic acid and some linolic acid. For the removal of this impurity from sulphite-cellulose an emulsifying agent is suggested. Alkalis in the proportion of 1% NaOH or Na_2CO_3 on the weight of the material remove 70—80% of the resin and fat, but affect the cellulose. Borax or "tetrapol" soap remove 50—70%. Emulsifying agents capable of acting in acid solution would be especially valuable. Twitchell's reagent (this J., 1900, 254), for example, removed 50%.—J. B.

Fibres; Observations on bleaching soda and sulphite [wood-pulp] ——. E. Sutermeister. Papierfab., 1914, **12**, 898—900.

Investigations were made with poplar soda pulp requiring 11·5% of bleaching powder, easy bleaching sulphite requiring 5% and medium sulphite requiring 13% to produce a standard colour at 40° C., when acting for 11—13 hours. Bleaching at 68° C. instead of 40° C. gave a poorer colour than the standard. Bleaching with very much larger proportions of bleach liquor gave in all cases a higher colour than the standard, but increments of bleach did not always produce proportional increments of colour. Of the two sulphite pulps the easy bleaching sample responded more readily to an excess of bleach than the poorer grade while the soda pulp showed less improvement still. In bleaching with potassium permanganate, 1 part produced the same effect as 1·85 parts of bleaching powder. In this case the use of an excessive proportion produced a maximum effect upon the soda pulp and had least effect on the higher grade sulphite. The results obtained by bringing the pulp to the standard colour by bleach liquor and producing the higher whites by permanganate showed little advantage in cost over permanganate alone. In producing high whites with excess of hypochlorite the loss in weight increased as the action was intensified but was less with the permanganate bleach than with the hypochlorite bleach. The destructive effect of high bleaching on the fibre was studied (*a*) by the "copper value," (*b*) by the loss on boiling with 0·25% caustic soda; the two methods gave parallel results. Mechanical tests of papers prepared from the pulps showed that moderate bleaching tended to increase rather than decrease the strength as compared with the same pulps in the unbleached condition.—J. F. B.

Loading materials [*for paper*]; *The behaviour of* —— *to dyestuffs.* P. v. Ehrenthal. Chem.-Zeit., 1914, 38, 87.

The adsorption of various types of dyestuff used in paper making by the various filling materials—talc, china clay, asbestine and *blanc fixe*—was investigated with a view to devising a method of rapidly estimating the value of a given loading material. Irregularities in the adsorption curves show that the method must be used with discretion.—J. B.

Paper; Removal of ink from printed ——. H. Wangner. Chem. Zeit., 1914, 38, 927—928.

In removing the carbon of printers' ink from waste papers it is necessary first to decompose the linseed oil medium by the action of alkali and then to pulp the paper without direct pressure, in order to avoid fixing the particles of carbon on the fibres. In the author's process, the yellowing of the mechanical wood fibre by the action of the alkali is prevented by the use of a special bleaching-soda, which contains about 3% Na_2O_2. The paper is fed dry into one end of a perforated steeping drum revolving slowly in a trough containing a 1% solution of this alkali, heated to a temperature depending on the class of paper under treatment, 30°—40° C. for news paper. The interior of the drum is provided with helical passages and a special scoop removes a given quantity of the steeped material from the delivery end at each revolution. This material falls into a helical compressor which squeezes out the excess of lye to be pumped back to the steeping trough and delivers the paper as a cake to the pulping machine. The latter is arranged vertically and contains a rotating bell provided with blunt teeth. The material travels down between the bell and the outer mantle and then rises up inside the bell till it reaches the top of a stationary central cylinder. By that time it is completely pulped by the action of the teeth, and it is washed down the central tube by a large quantity of back-water from the washing process, the dilution being assisted by stirring-vanes on the shaft. The fluid stuff is collected in a chest, then passed over sand-tables and through a strainer, from which it flows on to an endless wire-sieve which receives a vertical shaking motion, imparted by ribs on the guide-rolls which are driven at high speed. The fine particles of carbon, clay and fibre-debris are washed through the sieve by means of spray pipes arranged above the travelling wire, so that the stuff is delivered at the other end perfectly washed and practically free from colour. Provision is made for the systematic re-utilisation of the cleaner back-waters. The loss of stuff amounts to 20—30%.—J. F. B.

Manufacture of ethyl alcohol from wood waste. Preliminary experiments on the hydrolysis of white spruce. Kressmann. *See* XVIII.

Report of National Physical Laboratory. [*Balloon fabrics.*] *See* XXIII.

Patents.

Artificial sponge; Process of manufacturing ——. V. Ottorepetz, Graz, Austria. Eng. Pat. 23,196, Oct. 14, 1913. Under Int. Conv., Oct. 20, 1912.

A concentrated solution of a derivative of cellulose, such as a nitrate or acetate, or viscose, is mixed with fibrous material (cotton, etc.) and a readily soluble substance such as a salt or sugar, and the paste thus obtained is immersed in water or a dilute acid or salt solution, so that pores are formed in the mass owing to the solution of the salts, etc., and the cellulose derivative remains in the form of a spongy body enclosing the fibrous substance.—T. F. B.

Textile plants; Electrolytic and electrochemical process for de-gumming ——. M. S. Peyvel. Fr. Pat. 466,555, March 5, 1913.

The plant, previously steeped in water, is subjected to the action of an electric current in presence of an electrolyte consisting of a solution of caustic soda of suitable strength. —J. F. B.

Cotton waste; Process for cleaning ——. W. Zimmermann. Fr. Pat. 466,806, Nov. 18, 1913.

A mixture of 6 kilos. of fullers' earth with 10 litres of cold water is mixed with a solution of 1 kilo. of potash soap, 1 kilo. of sodium carbonate, and 0·5 kilo. of sodium chloride in 5 litres of boiling water; the whole is boiled and about 250 grms. of "ammonium" are added. The used cotton waste is sprinkled with this solution in a drum fitted with agitators and pressing rolls. The solid impurities collect in a recess at the bottom of the drum; the cleansing liquid is gradually displaced by water and the oily matters floating on the surface of the liquid are drawn off by aspiration through an adjustable pipe passing through the lid.—J. F. B.

Cellulose xanthate; Manufacture of derivatives of ——. F. Petit. First Addition, dated Apr. 4, 1913, to Fr. Pat. 461,900, Nov. 8, 1912 (this J., 1914, 196).

Additional examples of suitable precipitating baths are (1) a 25% solution of common salt with 15% of commercial phosphoric acid, sp. gr. 1·42; (2) a 25% solution of salt with 15% of ammonium chloride and 6% of commercial hydrochloric acid.—J. F. B.

Lustrous threads from crude viscose; Manufacture of —— *by means of a hot mineral acid.* Vereinigte Glanzstoff-Fabriken Act.-Ges. Fr. Pats. 467,164 and 467,165, Jan. 9, 1913. Under Int. Conv, Jan. 10, 1913.

Threads are spun by injecting crude viscose into a coagulating bath containing warm mineral acid only: (1) For viscose which has been ripened for 8 days at 15°—20° C., a coagulating bath containing 20% of sulphuric acid at 40° C. is specified. A normal speed of 40 m. per min. and a normal length of bath of 10—15 cm. are suitable. (2) For viscose in a fresher condition, ripened for about 4 days, corresponding to the stage "C_{12}—C_{18}," a bath containing 10% of sulphuric acid at 25° C. is used; at the normal speed the length of thread immersed in the bath should be about 3 cm.—J. F. B.

Coated sheets; Process of drying ——. G. H. May, Boston, Mass., and W. M. Grosvenor, New York. Eng. Pat. 15,256, July 2, 1913.

Sheets coated with materials combined with volatile solvents, *e.g.*, sheets of waterproofed paper, are dried in a chamber in which the drying medium (*e.g.*, air) is circulated in a closed circuit, the medium being heated to a temperature slightly below the boiling point of the solvent and saturated to the extent of about 60—90% with the vapours of the solvent before coming in contact with the sheets. The evaporation of the solvent is thus controlled and surface-skinning, blistering, etc. are prevented. The closed drying chamber is provided with a condenser maintained at a moderate temperature so that only a determined proportion of the solvent evaporated is condensed, the remainder passing with the air to the re-heater to maintain the partial degree o saturation.—J. F. B.

Paper; Method and apparatus for drying webs of —— C. Bauer, Leipzig-Schleussig, Germany. Eng. Pat. 8607 April 4, 1914.

For completing the drying on both sides of a web o coated paper previously partly dried, the web is conducte by rollers supporting it alternately on opposite side through an annular drying chamber consisting of a hollow cylinder surrounded by a casing, the walls of both bein provided with slots through which heated air is blown o both sides of the paper.—J. F. B.

Paper; Process of sizing ——. Dubois und Kaufmann. Fr. Pat. 467,808, Jan. 28, 1914. Under Int. Conv., Jan. 30, 1913.

Vegetable globulins, dissolved by means of alkalis, ammonia or alkaline-earths, are employed for sizing paper and are fixed by means of aluminium salts or weak acids, or by heating the paper to 60°—120° C. with or without the addition of water.—J. F. B.

Sulphite fibre; Reclaiming waste products [sulphur dioxide] in the manufacture of ——. H. K. Moore and R. B. Wolf, Berlin, N.H. U.S. Pat. 1,103,216, July 14, 1914; date of appl., Nov. 1, 1910.

The contents of the digester are discharged into a blow-pit provided with a vent which maintains the pressure substantially at that of the atmosphere. A surface condenser communicates with the vent, so that the absorption of the sulphur dioxide is limited to that taken up by the liquid products of condensation. The condensed liquid is collected and the excess of sulphur dioxide in the gases passed on for recovery.—J. F. B.

Solutions of cellulose or materials containing cellulose; Process for the production of ——. R. Willstätter, Berlin-Dahlem, Germany. Eng. Pat. 10,605, April 29, 1914. Under Int. Conv., May 24, 1913.

See Ger. Pat. 273,800 of 1913; this J., 1914, 746. Hydrochloric acid containing more than 39% HCl is specified. —T. F. B.

Cellulose; Method of bleaching ——. F. W. Dobson, Tamworth. U.S. Pat. 1,104,109, July 21, 1914. Date of appl., Jan. 26, 1912.

See Eng. Pat. 3181 of 1911; this J., 1912, 225.—T. F. B.

Shaped articles from copper-ammonium cellulose solution; Process for the production of ——. E. Bronnert, Niedermorschweiler, Assignor to Verein. Glanzstoff-Fabriken A.-G., Elberfeld, Germany. U.S. Pat. 1,106,077, Aug. 4, 1914. Date of appl., April 9, 1913.

See Fr. Pat. 454,811 of 1913; this J., 1913, 865.—T. F. B.

Waste water from paper-mills, cellulose factories, and the like; Apparatus for purifying ——. E. Mann and J. Heess, Ebertsheim, Germany. Eng. Pat. 24,938, Nov. 1, 1913.

See Fr. Pat. 464,483 of 1913; this J., 1914, 478.—T. F. B.

Use of chlorophyll extracts as fuel. Fr. Pat. 466,985. *See* IIa.

VI.—BLEACHING; DYEING; PRINTING, FINISHING.

Fibres [bleached cotton]; Causes of discoloration of organic —— *and of articles manufactured from them.* B. Haas. Papierfab., 1914, 12, 891—894.

The tendency to discoloration of bleached cellulose was studied with samples of pure cotton cloth, (a) American, (b), Egyptian. A most useful test consisted in boiling the fabric with distilled water, draining and exposing to light; in many cases the discoloration was already apparent in the aqueous extract. Fabrics bleached with bleaching powder solution showed the greatest tendency to discoloration; those bleached by electrolytic liquor were better and those bleached with sodium peroxide were almost stable in colour. Another test consisted in damping the cellulose and subjecting it in small heaps to a retting process with a thermometer embedded in the heap; lack of purity and tendency to discoloration were then indicated by a greater or less rise of temperature. Unbleached cottons responded to this test in the highest degree but the bleached fabrics also followed in the order of the bleaching processes mentioned above. In all cases the Egyptian samples showed more distinct reactions than the corresponding American samples. The infeiror results obtained with bleaching powder liquor are attributed partly to the deleterious action of the calcium chloride and free lime and partly to the fixation of alkaline-earth compounds on the fibre in an insoluble condition; moreover the benefit to be derived from the use of soft water in the bleaching process is forfeited. In the electrolytic bleach, the sodium chloride and chlorate may have a minor deleterious action, but the fixation of insoluble calcium compounds is avoided. Discoloration is due to the presence of impurities of original or secondary nature, mechanically or chemically combined with the true cellulose, and to the auto-oxidation or alteration of these impurities. The nearec the cellulose approaches a state of complete purity the more stable is the bleached colour.—J. F. B.

Zirconium mordants. P. Wengraf. Färber-Zeit., 1914, **25**, 277—279.

Zirconium was applied to the fibre as the basic acetate and as the bisulphite and its mordanting properties compared with those of an equimolecular quantity of aluminium acetate. Some mordant-dyestuffs were fixed better on zirconium than on aluminium and others the reverse.—J. B.

Aged colours; The diazotisation and development of —— *on the fibre.* M. Freiberger. Färber-Zeit., 1914, 25, 283—284.

Various amines may be oxidised on the fibre like Aniline Black and afterwards diazotised and developed. Fast colours which can be discharged are produced. For instance, Benzidine Puce in this way with various developers gives shades ranging from red-brown to yellow-brown and grey-brown. Xylidine when oxidised on the fibre and developed with resorcinol or α-naphthol gives a bronze, with β-naphthol a dark red-brown, with "Diamine solution" (Cassella) a drab. *o*-Toluidine and dimethylaniline similarly developed give greys. —J. B.

Indigo; Discharge printing on —— *with hydrosulphite and without steaming. Coloured discharge printing with diazo-compounds and vat-dyestuffs.* A. Juteau. Chem.-Zeit., 1914, **38**, 929.

The new indigo-discharge consists in printing a hydrosulphite in an insoluble state—best as zinc salt—and passing through alkali. The paste is prepared directly from sodium hydrosulphite, zinc oxide and zinc chloride. The printed cloth is then treated for 10—15 seconds in a boiling bath containing 10 c.c. of caustic soda of 40° B. (sp. gr. 1·383) per litre, followed by a sodium silicate bath as in the usual process. The caustic soda bath tends to accumulate hydrosulphite and must therefore be frequently renewed. By this method there is no danger of overheating in the drying or re-oxidation, as in the usual method; it is also much cheaper. The paste keeps well and Indanthrene and Algol dyestuffs can be printed along with it as coloured discharges, in which case a caustic soda bath is used as in the ferrous sulphate—stannous chloride process, but weaker. This method of coloured discharge printing can also be combined with the chromate discharge for the purpose of printing diazo-colours. The diazo-colour (nitroanisidine or α-naphthylamine) is printed along with barium chloride. The latter is converted into barium carbonate by passing through boiling sodium carbonate solution, which also removes leuco-indigo. A subsequent bath of bichromate converts the barium carbonate into the chromate. Careful washing and then a bath of oxalic acid and hydrochloric acid follow. The chromic acid liberated, discharges the indigo. The chief difficulty of this method is the careful treatment required on account of the barium carbonate and chromate not being well fixed on the fibre.—J. B.

2-Hydroxy-1-naphthoic acid [*; Use of —— in printing*]. J. Heilmann et Cie. and M. Battegay. Sealed notes 2029, dated Sept. 6, 1910, 2043, dated Oct. 12, 1910, 2045 and 2046, dated Oct. 22, 1910. Report thereon by E. Noelting. Bull. Soc. Ind. Mulhouse, 1914, 84, 267—281.

When diazo-compounds react with 2-hydroxy-1-naphthoic acid combination takes place in the 1-position, the carboxyl group being replaced and products identical with those from β-naphthol produced. Its property of forming stable solutions of the salts without the use of caustic soda and the non-volatility of its salts make the use of this acid of interest in special cases. Thus vat-dyestuffs can be printed on a ground of 2-hydroxy-1-naphthoic acid and fixed by steaming under conditions which would injure a β-naphthol ground on account of dissociation, sublimation, etc. The same applies to printing tannin-colours, which require a good steaming for fixation. The copper and persulphate used in printing Dianisidine Blue easily destroy 2-hydroxy-1-naphthoic acid during steaming, especially in the presence of a little castor oil soap. The rest of the ground can be developed with *p*-nitraniline or, better, with *p*-nitro-*o*-anisidine, the diazonium salt of which is less sensitive to copper. Several recipes show the application of 2-hydroxy-1-naphthoic acid for diazo-colours in conjunction with Aniline Black or basic colours. Additions of antimony salts and (except for α-Naphthylamine Claret) of castor oil soap are generally useful. The acid can also be used in the form of its salts for the production of diazo-colours on wool.—J. B.

Patents.

Ermine; Bleaching ——. A. Gabriel-Claude and H. L. Bricard. Fr. Pat. 467,518, Jan. 21, 1914.

After cleaning (*e.g.* with ether) the skin is impregnated with paraffin, for instance by injecting a solution of paraffin in ether. It is thus protected from the bleaching agent. The hair is then treated with hydrogen peroxide solution followed by hydrosulphite, and rinsed. If a greenish tinge persists, the hair is treated with permanganate followed by hydrosulphite. After soaping and drying, the paraffin is dissolved out of the skin with ether and the latter softened in the usual way.—J. B.

Felt cloth; Process for treating [*sizing*] ——. G. R. Shevill, Brooklyn, N.Y.; M. E. Shevill, Executrix. U.S. Pat. 1,103,694, July 14, 1914; date of appl., Aug. 22, 1912.

Felt cloth and shaped articles thereof are sized with an aqueous solution of gum tragacanth and gum dammar so that the gums become incorporated in and form part of the cloth; bleaching agents, acids and mordants may be added if required.—J. F. B.

Lustre; Production of a fast, silky —— on cotton and other vegetable fabrics. H. Dutschke. Fr. Pat. 467,670, Jan. 24, 1914.

The cloth is impregnated with a salt, *e.g.*, sodium or ammonium chloride, or other crystallisable substance, and calendered at 100°—200° C. The crystallisation of the salt during the hot calendering produces the lustre. —J. B.

Mercerising cotton piece goods and recovering the soda lye used therein; Process of and apparatus for ——. W. Brächter, Lohausen, Germany. Eng. Pat. 25,691, Nov. 10, 1913. Under Int. Conv., Nov. 14, 1912.

See Fr. Pat. 464,730 of 1913; this J., 1914, 480.—T. F. B.

Dyeing furs, hairs, and the like; Process for ——. K. Marx, Dessau, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,105,447, July 28, 1914. Date of appl., Feb. 21, 1913.

See Fr. Pat. 445,880 of 1912; this J., 1912, 1176.—T. F. B.

Dyeing hairs, furs, and the like; Preparation for ——. A. Erlenbach, Dessau, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 1,105,554, July 28, 1914. Date of appl., Sept. 19, 1910.

See Eng. Pat. 5134 of 1910; this J., 1910, 1103.—T. F. B.

Dyeing vegetable fibres. J. Turner and H. Dean, Assignors to Read Holliday and Sons, Ltd., Huddersfield. U.S. Pat. 1,105,722, Aug. 4, 1914. Date of appl., March 18, 1913.

See Fr. Pat. 453,362 of 1913; this J., 1913, 749.—T. F. B.

Dyeings on the fibre; Process for producing fast ——. L. Cassella und Co. G. m. b. H. Fr. Pat. 467,610, April 1, 1913.

See Ger. Pat. 273,312 of 1913; this J., 1914, 786.—T. F. B.

Cotton and other fabrics containing vegetable fibre; Process for imparting a silk-like gloss, which is proof against the action of hot and cold water, to ——. H. Dutschke, Elberfeld, Germany. Eng. Pat. 2164, Jan. 27, 1914.

See Fr. Pat. 467,670 of 1914; preceding.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Alkali, etc., works; Fiftieth annual report on —— by the Chief Inspector. Proceedings during the year 1913, *etc.* pp. 151. Price 7½d.

The number of works registered in England, Ireland, and Wales was 1327 (including 70 "alkali" works), and in Scotland 167; this makes a net increase of 23 for the United Kingdom. The increase is again largely associated with the utilisation of by-products, especially ammonia and tar. The acidity of gases of "all chimneys" was equivalent to 1·198 grain SO_3 per cb. ft. as compared with 1·218 grain during 1912, and the further general adoption of mechanical appliances has conduced to the prevention of local intermittent escapes of acid gases and fumes. No occasion for prosecution arose during the year, but in 5 cases back fees for non-registration of processes were accepted in lieu of proceeding being taken.

Alkali and copper (wet process) works. Activity wa maintained throughout the year, the amount of sal decomposed being distinctly greater than during 1912 and a slight but continuous increase is reported in th proportion of hydrochloric acid condensed, as compare with that produced; but the boom in trade of the las two years is considered unlikely to continue in som departments owing to developments in this industr abroad and in the colonies. Means have been taken a St. Helens to neutralise all acid drainage before allowin it to mix with that from the old alkali waste heaps, an the nuisance due to such drainage at Widnes has bee overcome by constructing a special drain around the ol waste heaps. Complaints of escaping acid fumes aros in one case owing to neglect of operatives at the saltcak furnaces to spread a little cold saltcake over the h freshly-drawn charge. A further considerable extensio in the use of mechanical furnaces for calcining burn pyrites in copper works is reported.

Cement works. The emission of black smoke fro rotaries has been much reduced. A steady reduction in t number of vertical kilns, both intermittent and continuo and an increase in the number of horizontal rotary kil continues. *Smelting works.* Further advance w made during 1913 in the prevention of the escape metallic fume and in the reduction of acid escapi with chimney gases, but the acidity of gases from le and copper smelting works presents a problem whi still awaits solution, and the amount of sulphur escaping into the air from the zinc blende calciners in the immediate neighbourhood of Swansea (within an area of 4 sq. miles) is equivalent to approximately 80 tons sulphuric acid of 150 T. (sp. gr. 1·75) per 24 hours. At one large spelter works chambers are being erected for the manufacture of sulphuric acid from the gases, and it is suggested that by calcination in muffle-type furnaces, at a central works, or by arrangement with vitriol makers, the whole of these waste gases might become a source of profit instead of polluting the air.

More attention is now given to providing wider space between sulphuric acid chambers, thus affording greater cooling space and condensing power, longer life to the chambers, greater ease in effecting repairs, and opportunity for keeping the outside of the chambers clean; the practice of limewashing chambers and woodwork is commended as tending to preserve the latter and as making evident the slightest leak. Encasing flues from burners to denitrating columns in cast iron has been found successful in preventing local escapes due to weakening of the brickwork by heat. Appreciative reference is made to an apparatus called "Nitrophor," devised to control automatically the supply of "nitre" to the system by responding to alterations of temperature of the chamber gases, but it is pointed out that influence may be exerted by factors other than the chemical actions taking place in the chambers. Glass-packed absorbing towers are being used in increasing numbers, and water sprays in lieu of steam for supplying moisture to the chambers are on the increase, although in Scotland there is said to be some tendency to return to the older system. The injection of sodium nitrate solution into the first chamber instead of "potting" nitrate in the burner flue, is also becoming popular. In Scotland, fans for controlling draught and additional Gay Lussac towers are in more general use, and a strong solution of soda ash has been employed at several works to reduce obstruction of towers by chemical deposits, with good effect. The undue escapes previously reported during the concentration of acid in over-heat pans were greatly lessened. Kessler plant came into more extended use during the year; the substitution of mechanical means for obtaining the necessary draught further replaced the high-pressure steam jet aspirator originally used in all installations of this form, with advantage as regards steam consumption and strength of recovered weak acid. The cascade system was also further adopted, silica ware, "tantiron," and, to a small extent, "ironac" being in use for making the evaporating vessels.

Chemical manure works were in full activity during the year, the use of mechanical means for removing the freshly manufactured superphosphate from the dens affecting very favourably the general condition of the works. The general average escape of acid gases, equivalent to 0·105 grain SO_3 per cb. ft., is considered satisfactory, being reduced from 0·127 grain for 1912. The quantities of manure materials, expressed in tons, imported into the United Kingdom during the years 1911-13 were:—

	1913.	1912.	1911.
Guano	25,548	14,115	34,124
Mineral phosphates	539,016	520,270	493,413
Nitrate of soda	140,926	123,580	128,487

The imports of mineral phosphates exceed those given in any previous Reports. The exports of ammonium sulphate in 1913 amounted to 325,000 tons, as compared with an estimated home consumption (for all purposes, including manure manufacture) of 97,000 tons. The corresponding figures for 1912 were 287,000 and 90,000 tons. The rapid increase in the manufacture of cyanamide is illustrated by statistics which show a production of 266,000 tons for 1913, as against 152,500 tons for 1912.

Sulphate and muriate of ammonia and gas liquor works continued to increase in number owing, in great measure, to the erection of coke oven works provided with recovery plant for by-products. The amount of ammonia recovered in the United Kingdom (expressed as tons of sulphate) was:—

	1913.	1912.	1911.
Gas works	182,180	172,094	168,783
Iron works	19,956	17,026	20,121
Shale works	63,061	62,207	60,765
Coke oven works	133,816	104,932	105,343
Producer-gas and carbonising works (bone and coal)	33,605	32,019	29,964
Total	432,618	388,308	384,976

In each group of works an increased production over 1912 is recorded. The "direct" method of producing ammonium sulphate and the "semi-direct" method (in which the gases are cooled, to extract tar, and re-heated before passing into sulphuric acid) were put to further service both in coke oven and gas works, and some very high returns of ammonium sulphate per ton of coal carbonised, were claimed as compared with ordinary experience with the distillation method. The fitting of simple but effective systems for continuous liming of stills has extended during the year, with beneficial results on yields, and at two works it has been the practice to decompose cyanides present in the liquor by running down the still a little polysulphide of sodium or calcium with the liquor; this gives an exceedingly white salt. The noxious gases evolved during the distillation continued to be dealt with chiefly by oxide of iron purifiers, and the "heap" form is again reported to be steadily displacing the box or brick walled purifier. The system is useful both in large and small works and for cleaning, and working up to high sulphur content, oxide which has become inert in carburetted water gas purifiers through impregnation with oil; the heat of chemical action taking place in an exposed heap of such contaminated oxide will in time entirely remove the oil by volatilisation. The study of the behaviour of oxide of iron during fouling and revivification (see Reports for 1911 and 1912; this J., 1912, 717; 1913, 787) was continued, with special reference to (*a*) the valuation of oxide as absorbent for hydrogen sulphide, by means of the "sulphuretted hydrogen burette" (*loc. cit.*), (*b*) the part played by ammonia in the foul gases entering the purifier in preventing "souring" of oxide, and (*c*) the temperature attained by oxide purifiers in English and Scottish practice during sulphiding and revivification. Comparative results obtained with the "burette" showed that oxide prepared by drying at 100° C. and remoistening so as to contain 15—20% H_2O is in the best condition for absorbing hydrogen sulphide. In revivifying, the sulphided product was moistened with ammonia water before heating to 40°—50° C. in air, and remoistened as required with the same solution; this prevented a small but distinct loss of sulphur, presumably as sulphur dioxide, as well as formation of free sulphuric acid and soluble sulphate, the sum of the sulphur equivalents of the "free" sulphur, soluble sulphate, and disulphide and other forms found by oxidation with fuming nitric acid being found equal to the sulphur absorbed as hydrogen sulphide. When the degree of hydration was low, a marked increase was observed in the amount of disulphide formed (and subsequently of its oxidation product, ferrous sulphate); a due degree of hydration is therefore considered of the first importance if the efficiency of an oxide is to be maintained. Ignited oxide, although completely sulphided in time, gave a product which re-oxidised very slowly, and the revivified material consisted mainly of the inert disulphide; a significant and discouraging result in view of recent attempts to utilise burnt pyrites and other furnace products for purification purposes. Experiments at both English and Scottish works showed that the average amount of ammonia entering the oxide purifiers with the foul gases was in all cases very small; in the English works however the weight per cb. ft. was nearly 20 times that in the Scottish works. The results so far confirm the conclusion previously arrived at, that the amount of ammonia in the foul gases in Scottish works is insufficient to neutralise acid conditions set up as the result of defective working of the oxide, and are in accordance with Gedel's views (this J., 1905, 664). A very complete study of the working conditions of oxide purifiers has been made in all parts of the country (involving over 220 purifiers) both with respect to the condition of the oxide charged and the maximum temperature attained in the active layer during sulphiding and revivification. The results, given in the form of tables, lead to the conclusions, (1) that in English practice a box or heap purifier, roofed over, is suitable provided care be taken to ensure that the oxide does not get too dry, the heap purifier being preferred for general use, (2) that in Scottish practice the conditions of working are such as to lower the working temperature of the purifier and thereby unduly prolong the "life" of the oxide, giving opportunity for oxidation of the disulphide (a relatively slow process) to soluble sulphate and free acid. The lower working temperature is considered due, in the main, to the small proportion of ammonia and high proportion of carbon dioxide in Scottish gas liquor compared with the sulphide present, but the larger purifying area in Scottish works and, in the north, the lower average atmospheric temperature are contributory causes. It is thought better where possible to seek a remedy for the souring evil by prevention than to apply chemical treatment after the mischief is done (this J., 1913, 787). Where the working temperature is unduly low, the replacing of box by heap purifiers is suggested, or even slight preheating of the saturator gases, after condensation and before admission to the purifier; but the best procedure in cases where souring is a chronic source of trouble is considered to be the use of heap purifiers of small dimensions, with frequent transfer, where possible, of the oxide to the gas works purifiers, where conditions would be suitable for complete sulphiding of the mass, in absence of air. By this means any soluble sulphate present in the oxide would tend to be neutralised by traces of ammonia entering with the crude coal gas and disulphide effectually excluded from contact with air in the surface layers of the material during the sulphiding stage. Laboratory experiments carried out by H. J. Bailey to determine the temperature attained by oxide of iron when fouled with undiluted hydrogen sulphide, in absence of air, and revivified by exposure to air in a thin layer (the processes of sulphiding and revivification being repeated 4 times), showed that an increase in the rate of fouling is attended by a very definite rise of temperature, but that no excessive rise during sulphiding need be apprehended with hydrated oxide suitably moistened, even with the strongest gas; there was no appearance of souring, the increase of soluble sulphate being extremely small. The Claus sulphur recovery process is said to be less popular than it was, partly owing to the comparatively short life of the brick depositing chambers, but partly to the fact that the treatment of large quantities of hydrogen sulphide by oxide purification is so much better understood than formerly. Some few gas works dispose locally of their make of ammonium sulphate but the bulk is sent abroad, although so many of the works are situated in towns surrounded by agricultural districts. Statistics show that whilst in England the consumption of sulphate was only 24% of the product, the United States, France, and Belgium consumed more than they produced, and Germany, with a manufacture of about 500,000 tons, utilised 84% of her output. Five men were gassed (non-fatally) at a coke oven works while repairing a saturator which was blanked off from the foul gas main by a leaden blind slide: physical disconnection of the saturator for such a purpose is regarded as the only safe course.

Fibre separation works. Investigation of a complaint as to a works in the Dewsbury district, for the separation of wool and cotton fibres by means of hot hydrogen chloride gas showed that, although condensation of the acid gases escaping after their employment in the carbonising process was satisfactory, nuisance was liable to arise in removing the carbonised rags from the machine, or by the escape of smoke and steam from the rag-drying plant or accidental firing of dust dropping from the carbonising machines during working. *Tin plate flux works.* Operations were somewhat restricted throughout the year. The average general escape of hydrogen chloride was further reduced to 0·114 grain per cb. ft., from 0·170 in 1912, but it is again pointed out that thorough investigation is needed on the part of manufacturers as to the treatment of scruff and the escaping smoke so as to obtain the best possible yield of valuable material. A plan adopted by many small works consists in giving the whole of the scruff a prolonged washing with boiling water and furnacing the washed material at a very low temperature: short flues suffice, and no wash-tower is necessary. *Venetian red works.* The scrap-iron wash towers, erected in the first instance to prevent pollution of the air by acid gases, continue to give satisfactory results and are now regarded as the cheapest source of the raw material required in the process, at one works more than 40% of the total copperas furnaced being obtained in this manner. *Tar works.* Thirteen new works have been registered. The increase is due chiefly to the extended use of prepared tar for road purposes and to the erection of coke oven works with plant for recovery of by-products. *Zinc residue works.* During 1913 renewed attention was paid to the arresting of fume produced in the condensation of zinc extracted from "residues" containing zinc chloride or zinc and ammonium chlorides. Opportunity was afforded for studying working conditions at 3 works where zinc "ashes" (containing volatile chloride) were in use for spelter making, and tables are given showing the relative fume-arresting efficiency of various types of "prolong," (figured in the Report), both as regards the weights of fume collected and its chemical composition. The prolongs consisted of iron tubes, divided by a bridge into body and end portions; they were attached to certain selected receivers as soon as the "steaming stage" was over, so that the escaping fumes passed through them before being discharged into the air. The condensed fume collected was composed essentially of zinc chloride and metallic zinc or zinc oxide, and consisted of fine dust mixed with "granular" matter (richest in chlorides) and "massive" metal in the form of shot and irregular particles; the weights accumulating in the body and end portions of the prolongs were determined separately and the proportion of zinc and zinc chloride ascertained. Analysis of the material skimmed at the first tapping showed a composition in respect of chlorine content, very similar to that of the fume, but it was contaminated with a large amount of ash and finely divided breeze carried forward from the retorts. The return of fume and skimmings, without treatment, to the furnace with a subsequent charge, as commonly practised, was found to involve an increase of about 25% in the volatile chloride content of the charge, which could readily be prevented by washing the fume and skimmings with cold water. Washing gave a residue very suitable for admixture with a fresh charge and prevented loss of zinc chloride and unnecessary escape of noxious gases, but it is pointed out that in all cases the combustible gases leaving the prolongs should, if possible, be burned. A study of the effect o "breezing-up" receivers showed that when properly worked and carefully fired, a furnace with breezed-up receivers should discharge no more fume than escapes when clay nozzles are in use. Preliminary experiments on the weight of spelter obtained did not support the view advanced by some zinc makers that clay nozzles are less efficient than breeze stoppers in preventing los of zinc.

In Scotland, the number of works registered was on more than in 1912. 63,150 tons of bones and phosphate were dissolved, as compared with 64,242 tons i 1912, and 137,350 tons of pyrites burned, as agains 138,782 tons in 1912. The production of ammoniu salts (expressed as sulphate) and pitch amounted t 125,446 tons and 174,884 tons respectively, the correspond ing figures for 1912 being 120,347 and 151,345 ton Again the shale works have been most busily engage The total shale mined and quarried in Scotland durin 1913 was 3,280,143 tons, as compared with 3,184,826 to in 1912, and the yield of ammonium sulphate, per to of shale, was 43·1 lb., against 43·7 lb. in 1912.—F. SODN.

Sulphuric acid of the I. Oesterreichischen Sodafabrik a K. Opl in Hruschau; The tower system for the manufactu of ——. K. Opl. Chem.-Zeit., 1914, **38**, 8—9.

THE system comprises six towers, through which t sulphurous gases are drawn by means of a suction fa a coke filter at the end of the series serving to retain sulphuric acid mist. The first tower is sprayed with the nitrous-vitriol of the sixth tower, the second tower with that of the fifth, and the third with that of the fourth. Water is introduced into towers 2, 3, and 4, by means of atomisers operating in the roofs. For complete denitration, the acid overflowing from the towers 2 to 6 is reconducted over the first tower. The passage of the acid to and from the towers is effected by emulsifying the liquid with compressed air, the light froth, which is produced, rising to the required height, and reacting rapidly owing to the large surface of liquor exposed. The reaction space is only one-tenth of that required by the chamber system, and the time required for the production of tower acid is only 20 minutes as against 4—6 hours in the case of chamber acid. For making sulphuric acid of 60° B. (sp. gr. 1·71), the consumption of nitric acid of 36° B. (sp. gr. 1·332) is 0·88% of such acid.—O. R.

Sulphuric acid tower processes. G. Schliebs. Chem.-Zeit., 1914, **38**, 966.

THE essentials of sulphuric acid manufacture are: (1), The intimate mixture of the gases; (2), the dissipation of he heat of reaction without the adoption of special neasures; and (3), the production of desired differences f temperature within the reaction space. These requirenents are fulfilled in the chamber process but are lacking n the ordinary tower process. By placing behind each ower an acid separator, capable of circulating the gases ack to the tower, the author claims that all the shortomings of the tower system may be surmounted, and dvantages acquired as regards control and efficiency, nd also economy of nitric oxide.—O. R.

Potassium chloride; Conversion of the mother-liquor from the manufacture of —— into non-deliquescent material. H. Hof. Chem.-Zeit., 1914, **38**, 512—513.

N the German potash industry, by partially evaporating he mother-liquors, which contain magnesium chloride, and ubsequently adding calcined kieserite, epsomite ($MgSO_4$, H_2O) and anhydrous magnesium chloride are formed, nd the mass acquires great hardness.—W. R. S.

odium silicates; Crystallised ——. E. Jordis. Chem.-Zeit., 1914, **38**, 922. (See also this J., 1914, 253.)

YNTHETIC and technical preparations of the silicates, a_2SiO_3,nH_2O, examined by dilatometric, tensimetric, nd thermometric methods, gave curves with haltingoints at 31°, 37·2°, 41·9°, 46·9°, 47·2°, and 62·3° C. The mperatures 62·3°, 47·2°, and 37·2° C. are the melting oints of hydrates with 6, 9, and about $10H_2O$, whilst 1·9° and 31° C. are the eutectic points of mixtures of the ydrates with 6 and $9H_2O$ and with 9 and about $10H_2O$ spectively; the readings 46·9° and 47·2° C. possibly refer the same compound. The various hydrates showed a ndency to decompose into mixtures of relatively more d less hydrated forms, and prolonged heating at 100° C. elded a product containing about $1·5H_2O$. The hexad nona-hydrates are described, but higher hydrates ere not isolated.—F. SODN.

organic syntheses [of silicates, aluminates, stannates, ferrites, chromites, manganites, titanates, and zirconates]. W. Pukall. Silikat-Zeits., 1914, **2**, 65—76, 87—99, 109—118.

LICATES were prepared (*a*) by interaction of pure alkali icates and metallic salts, in dilute aqueous solution, d (*b*) by prolonged heating of silicic acid with metallic ides, carbonates, or nitrates, at relatively low temperares. Potassium meta-, di-, tri-, tetra-, penta-, and xa-silicates, prepared by heating silica with potassium carbonate, were clear glasses, soluble in water; the rresponding sodium salts tended to crystallise and were s soluble (compare G. W. Morey; this J., 1914, 253). ethod *a* was applied to the preparation of numerous eta-silicates (see this J., 1910, 1011) and of lcium and ferrous disilicates (using potassium disilicate as precipitant). Aluminium chloride and alkali disilicate yielded, according to the conditions, either $6SiO_2,Al_2O_3,3H_2O$ or double silicates of aluminium with potassium or sodium, one of which corresponded in composition to a hydrated form of orthoclase. Calcium ortho- and di-silicates were prepared by the action of silicic acid on lime at the ordinary temperature, and aluminium hydroxide gave with lime, in the presence of water, a series of crystallised calcium aluminates, of which five are regarded as individuals; a second form of the tricalcium salt was obtained by heating on the water-bath. In method *b*, the materials were very intimately mixed and repeatedly ignited at 950° C. (and if necessary at 1270° or 1370° C.) until reaction was complete, the temperature of ignition being as a rule below the melting-point of the product. Ortho- and meta-silicates of Li, Ba, Sr, Ca, Mg, Be, Fe'', Mn, Co, Ni, Zn, Cd, and Pb were thus prepared and (using appropriate oxides or salts) ortho- and meta-stannates of Li, Ba, Sr, Ca, Mg, Be, Zn, Cd, and Pb, aluminates of types, RO,Al_2O_3, and $2RO,Al_2O_3$, of Ba, Sr, Ca, Mg, Fe'', and Mn, aluminates of type, $3RO,Al_2O_3$, of Ba, Sr, Ca, Fe'', and Mn, the ferrites, $CaFe_2O_4$, $Ca_2Fe_2O_5$, $Ca_3Fe_2O_6$, and $Ca_4Fe_2O_7$, calcium chromite, $Ca_4Cr_2O_7$, and ortho- and meta-titanates and zirconates of most of the above metals. In all cases, the microscopical appearance of the product and its behaviour towards dilute hydrochloric acid is described. Ortho-silicates, stannates, titanates, and zirconates were, as a rule, obtained more readily than the corresponding meta-salts. Both ortho- and meta-silicates of calcium exhibited hydraulic properties (the latter only in the presence of a strong base), but both were converted by further ignition into inactive β-modifications. The calcium aluminates prepared were all hydraulic, the speed of setting increasing with the proportion of calcium present; mortar made from the tri- and tetra-salts disintegrated. Powerful hydraulic properties were also possessed by the alkaline-earth orthostannates and by tetra-calcium ferrite ($Ca_4Fe_2O_7$) and the corresponding chromite, both of which gave a quick-setting mortar, disintegrating in the case of the ferrite. The hydrated calcium aluminates showed a plasticity little inferior to that of kaolin.—F. SODN.

Magnesia in magnesites; Determination of ——. H. Wdowiszewski. Chem.-Zeit., 1914, **38**, 949—950.

MAYERHOFER'S method (Z. angew. Chem., 1908, **21**, 592) has been found inaccurate, but gives good results when carried out in the following manner: 5 grms. of magnesite are decomposed by heating with *aqua regia* on the water-bath, the solution is evaporated to dryness, the residue heated for half-an-hour at 180°—200° C., treated with hydrochloric acid on the water-bath, filtered from silica, and made up to one litre. Forty c.c. of the solution (or 20 c.c. with burnt magnesite) are treated with 5 c.c. of strong sulphuric acid and 100 c.c. of ammonium citrate solution (100 grms. of citric acid and 333 c.c. of ammonia, of sp. gr. 0·91, to 1 litre), cooled to 1°—2° C., further treated with 20 c.c. of 10% sodium phosphate solution and 15 c.c. of strong ammonia, the mixture shaken vigorously for 5 minutes, and allowed to stand for 2 hours in ice-water; the precipitate is filtered off, washed with dilute ammonia (1 : 3), and dissolved in hydrochloric acid, the solution again precipitated with ammonia, allowed to stand for half-an-hour in ice-water, the mixture shaken for 5 minutes, filtered, and the precipitate washed with ammonia, dried, ignited, and weighed as $Mg_2P_2O_7$. —F. SODN.

Rare earths; Salts of the —— with hydroxydicarboxylic acids. G. Jantsch. Chem.-Zeit., 1914, **38**, 794. (See also this J., 1913, 140.)

SALTS of the rare earths with malic acid have been prepared in two different hydrated forms.

$$Me_2(C_4H_4O_5)_3.8H_2O(9H_2O) \text{ and } Me_2(C_4H_4O_5)_3.6H_2O(7H_2O).$$

They are soluble in presence of excess of malic acid or an alkali malate, and from these solutions alcohol precipitates crystalline complex salts of the types $Me(C_4H_4O_5)_2H,xH_2O$, $Me(C_4H_4O_5)_2R,H_2O$, or $Me(C_4H_4O_5)_3R_3,xH_2O$. ("Me" stands for "rare earth metal.") From solutions of these complex salts, ammonia did not give an immediate precipitate of the hydroxide, and electrical conductivity measurements confirmed their complex character.—G.F.M.

Radium; Technology of the extraction and utilisation of ——. R. Sternlicht. Chem.-Zeit., 1914, **38**, 49.

The working of pitchblende (average uranium content, 45%) at the Austrian State radium factory, Joachimsthal, by the Curie-Debierne method gives at most 80% of the radium present, and, at the French factory of Armet de Lisle, uranium mica, uranium ochre, carnotite, and autunite, in part decomposed directly with hydrochloric acid, yield about 70% of their radium content. Ebler's method of reduction with calcium hydride (this J., 1913, 976) is criticised on the ground of expense and because loss of radium is liable to occur through re-oxidation of sulphide to sulphate. The Ulzer-Sommer method (this J., 1910, 1156) gives yields of 97—98% and has been carried out on the large scale. The separation of radium and barium is usually effected by fractional crystallisation; Ebler's adsorption method (this J., 1913, 1154) is said to be little used at present. The total world's output of radium (mostly employed in making pharmaceutical preparations and radiation apparatus) is estimated at 7—8 grms. per annum.—F. Sodn.

Radio-elements in rocks; Distribution of ——. *I. Monazite sand.* M. Baltuch and G. Weissenberger. Z. anorg. Chem., 1914, **88**, 88—102.

Determinations of radium and thorium in the constituent minerals of monazite sand (from Brazil), which were separated partly by magnetic concentration and partly by the specific gravity method and then purified by chemical treatment, gave the following results:—

	Percentage in sand.	Radium, per 1 grm. of sand.	Thorium, per 1 grm. of sand.
		grm.	grm.
Monazite	74·95	$1{\cdot}54, 10^{-10}$	$4{\cdot}19, 10^{-2}$
Zircon	8·84	$7{\cdot}88, 10^{-12}$	$1{\cdot}19, 10^{-5}$
Ilmenite	12·36	$3{\cdot}60, 10^{-12}$	$4{\cdot}02, 10^{-5}$
Magnetite ..	0·47	$1{\cdot}54, 10^{-13}$	$2{\cdot}29, 10^{-7}$
Quartz	3·02	$1{\cdot}66, 10^{-14}$	$3{\cdot}53, 10^{-8}$
Felspar	0·29	$2{\cdot}24, 10^{-15}$	$4{\cdot}39, 10^{-9}$

Uranium (0·062%) was found in the monazite, and the ratio Ra/U harmonised with the results of Boltwood and Rutherford for uranium minerals. The zircon crystals exhibited a violet colour like that of glass after exposure to radium preparations.—F. Sodn.

Potash trade waste; Influence of —— *on the biological processes in river water.* Müller and Fresenius. *See* XIXb.

Mercuric chloride; Volumetric determination of ——. Stüwe. *See* XXIII.

Wood; Steaming of ——. Heuser. *See* V.

Report of National Physical Laboratory. [*Testing radium preparations.*] *See* XXIII.

French electrochemical and electrometallurgical industries. *See* X.

Patents.

Hydrochloric acid: Process of producing ——. J. H. Nield, Hackensack, N.J., Assignor to General Chemical Co., New York. U.S. Pat. 1,102,539, July 7, 1914; date of appl., Aug. 21, 1909.

Sulphuric acid is heated with common salt and an amount of substantially inert material (*e.g.*, an equal weight of saltcake) sufficient to prevent the formation of a pasty mass at any stage of the process.—F. Sodn.

Oxidation process [*for making sulphuric acid*]. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co., and C. L. Parsons, Washington, D.C. U.S. Pat. 1,103,017, July 7, 1914; date of appl., Sept. 16, 1912.

The oxidation of sulphur dioxide is effected by means of a substantially metalloidal catalyst, preferably by bringing a mixture of sulphur dioxide, oxygen, and water vapour into contact with heated material containing tellurium and traces of a selenium activator. The gases require only to be rendered free from dust, since the contact material is not appreciably affected by small quantities of bodies toxic to metallic catalysts.—F. Sodn.

Sulphuric acid; Manufacture of ——. U. Wedge, Ardmore, Pa. U.S. Pat. 1,104,590, July 21, 1914; date of appl., Sept. 18, 1909.

The gases leaving the Glover tower pass first through a number of tower-like lead chambers, connected in series alternately at the top and bottom, and presenting a surface area of 0·3 sq. ft. or more per 1 cb. ft. of chamber space, and then through a number of lead chambers presenting a much smaller area of surface per unit of cubic capacity. —A. S.

Nitrogen; Process and apparatus for fixing atmospheri ——. W. S. Landis, Niagara Falls, N.Y., Assignor t American Cyanamid Co., Nashville, Tenn. U.S. Pats 1,103,060, 1,103,061, and 1,103,062, July 14, 1914; dat of appl., April 3, 1914.

(1). An inner perforated vessel containing carbide i mounted within an outer vessel. The inner vessel has lining of porous fabric to prevent carbide passing ou through the perforations. Nitrogen is supplied to th carbide through the perforations, and the charge is heate electrically at one part to the point of ignition by mea of a resistor embedded in the charge. (2). Several resisto are embedded in the charge of carbide, and their expose upper portions are enlarged to prevent destruction l oxidation. (3). The resistor is embedded in the charge o of direct contact with the excess of nitrogen circulati through the charge. The resistor is heated to a temperatu sufficient to cause the desired reaction, and, in addition, he is supplied continuously to the charge, from an outsi source, during the process.—A. S.

Chromic salts; Production of ——. Badische Anilin u Soda Fabrik. Fr. Pat. 466,478, Dec. 22, 1913. Und Int. Conv., Feb. 1, 1913.

An oxide mineral, *e.g.*, chrome iron ore, is treated w chlorine or hydrogen chloride at a high temperature, the presence of a reducing agent, such as carbon or carb monoxide, and the more volatile ferrous or ferric chlor produced is collected separately from the less volat chlorides of chromium. The product is sufficiently p for industrial purposes.—F. Sodn.

Radio-active; Process for rendering liquid or gase substances —— *and activating substances for carrying the process.* J. Landin. Fr. Pat. 466,850, Dec. 1913. Under Int. Conv., Feb. 10 and April 11, 1913

Liquid or gas to be activated is treated with a radioact substance producing emanations (*e.g.*, a radium sa enclosed in an inert protective medium, such as para paraffin oil, or wax, which dissolves and transmits emanation. Zinc sulphide or other material rend fluorescent by the radiations may be incorporated with activating substance.—F. Sodn.

Radium and mesothorium; Process for the treatmen minerals and intermediate products containing ——. Ebler. Fr. Pat. 467,330, Jan. 15, 1914. Under Conv., Sept. 17, 1913.

Material containing radium or mesothorium in the of sulphate is intimately mixed with calcium carbid substances producing such (4 mols. for each mol. of sulpl and heated to bright redness, the product being extra with a feebly acid solution, preferably hydrochloric so as to give a solution of crude chlorides (see this J., 1913, 867). The reduction, which is very complete, may be rendered "autogenous" by mixing the carbide with calcium hydride or other substance reacting suitably with the sulphates present or added.—F. Sodn.

Alkalis present in a combined state in natural double silicates ; Process for the extraction, in a soluble form, of ——. R. van der Leeden. Fr. Pat. 466,952, Jan. 2, 1914.

The material is treated with an equal or smaller proportion of alkaline-earth chloride, or mixture of alkaline-earth oxides, in presence, if necessary, of a reducing agent such as carbon, and the product extracted with water. The process is specially applicable to the extraction of potassium salts from leucite-phonolite, furnishing a residue suitable for cement making.—F. Sodn.

Halogen compounds of alkalis, aluminium, silicon, titanium, and other bases ; Process for obtaining —— from natural double silicates. R. van der Leeden. Ger. Pat. 267,867, Jan. 4, 1913.

Natural double silicates, such as leucite, nepheline, muscovite, orthoclose, etc., are heated to a high temperaure, alone or mixed with reducing agents, in an atmosphere l chlorine, bromine, or iodine. The halogenides produced re recovered by sublimation or distillation. When hlorides are obtained by this process they are preferably lectrolysed to yield chlorine for the decomposition of a rther quantity of the silicate.—A. S.

ium nitrate and other salts ; Process for reducing —— a finely divided state without the formation of dust. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 466,963, Jan. 3, 1914. Under Int. Conv., Jan 17, 1913.

he molten substance is formed into globules and allowed o fall freely in a gaseous atmosphere, such as air, which may be circulated in the opposite direction and submitted o cooling. Powdered material may be added to the nelt immediately before granulating.—F. Sodn.

luminium nitride ; Process of decomposition of ——. G. Coutagne. Fr. Pat. 466,986, March 19, 1913.

n intimate mixture of aluminium nitride and caustic kali, alkaline-earth oxide, or mixture yielding such, is eated above 200° C., at atmospheric pressure, in presence f steam, preferably in a horizontal or slightly inclined steel ube which may be heated to about 300° C. and slowly tated. A series of fixed scrapers operate against the ner wall of the tube to detach adhering material, which then crushed by steel balls or the like present in the wer part, and a little water or steam may be injected gainst the wall or scrapers as required. The aluminate roduced is suitable for the production of alumina, whilst e liberated ammonia is preferably mixed with carbon xide and made to react with calcium sulphate in known anner to produce ammonium sulphate.—F. Sodn.

luminate-silicates allowing of the ready passage of liquids ; Manufacture of granular or laminated ——. Permutit Aktienges. Fr. Pat. 467,038, Jan. 6, 1914. Under Int. Conv., Jan. 6, 1913.

d silicates containing alumina, after preliminary treatent with common salt solution to remove alkaline-earth etals, are digested with a strong solution of alkali silicate.
—F. Sodn.

phurous acid [e.g. hydrosulphites, etc.] : Manufacture reduction products of ——. Chem. Fabr. Griesheim Elektron. Fr. Pat. 467,443, Jan. 17, 1914. Under Int. Conv., May 2, 1913.

e reduction of sulphurous acid or its salts is effected means of spongy zinc, obtained by electrolysis, which likewise employed, without addition, for the conversion alkali formaldehyde bisulphite or hydrosulphite into phoxylate.—F. Sodn

Sulphuric acid ; High concentration of ——. A. Zanner, Laeken, Belgium. Eng. Pat. 19,481, Aug. 28, 1913. Under Int. Conv., Aug. 30, 1912.

See Ger. Pat. 260,655 of 1912 ; this J., 1913, 751.—T. F. B.

Ammonia ; Process of producing ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,903, July 23, 1913.

See Fr. Pat. 460,859 of 1913 ; this J., 1914, 76.—T. F. B.

Ammonia from moist waste substances or peat ; Process and apparatus for obtaining ——. E. Stauber, Berlin, and W. Kochan, Charlottenburg, Germany. Eng. Pat. 41, Jan. 1, 1914.

See Fr. Pat. 464,227 of 1913 ; this J., 1914, 543.—T. F. B.

Evaporating or concentrating solutions and carrying out chemical reactions ; Method of and apparatus for ——. G. A. Krause, Munich, Germany. Eng. Pat. 17,508, July 30, 1913. Under Int. Conv., July 31, 1912.

See Fr. Pat. 460,895 of 1913 ; this J., 1914, 64.—T. F. B.

Salt ; Manufacture of fine ——. G. Berger and L. Stolz, Brunswick, Germany. Eng. Pat. 28,334, Dec. 9, 1913. Under Int. Conv., Dec. 9, 1912.

See Ger. Pat. 269,427 of 1912 ; this J., 1914, 312.—T. F. B.

Salt ; Manufacture of ——. J. H. Webster, Carrickfergus, Ireland. U.S. Pat. 1,104,854, July 28, 1914. Date of appl., Sept. 19, 1912.

See Eng. Pat. 20,706 of 1911 ; this J., 1912, 773.—T. F. B.

Radium and mesothorium ; Process of concentrating ores and the intermediate products of —— E. Ebler, Heidelberg, Germany. Eng. Pat. 1173, Jan. 15, 1914.

See Fr. Pat. 467,330 of 1913 ; preceding.—T. F. B.

Sulphurous acid and salts thereof ; Manufacture of reduction products of ——. Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 1550, Jan. 20, 1914. Under Int. Conv., May 2, 1913.

See Fr. Pat. 467,443 of 1914 ; preceding.—T. F. B.

Sodium bisulphate in a directly-calcinable form ; Process for the manufacture of ——. P. Löffler, Vienna. U.S. Pat. 1,104,913, July 28, 1914 Date of appl., Dec. 10, 1913.

See Ger. Pat. 263,120 of 1913 ; this J., 1913, 909.—T. F. B.

Perborates ; Stable mixture containing ——. H. H. Wünsche, Kirchsteinbek, Assignor to Pearson und Co., Ges. m. b. H., Hamburg, Germany. U.S. Pat. 1,105,739, Aug. 4, 1914. Date of appl., Feb. 6, 1912.

See Eng. Pat. 1578 of 1912 ; this J., 1912, 722.—T. F. B.

Stannic chloride from materials containing oxide of tin ; Process of manufacturing ——. H. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 1,105,902, Aug. 4, 1914 Date of appl., Feb. 5, 1908.

See Fr. Pat. 388,089 of 1908 ; this J., 1908, 856.—T. F. B.

Sulphides of the alkalis or alkaline earths ; Regeneration of ——. L. P. Wilson, Coventry, Assignor to Courtaulds, Ltd., London. U.S. Pat. 1,106,266, Aug. 4, 1914. Date of appl., Sept. 25, 1913.

See Eng. Pat. 29,711 of 1912 ; this J., 1914, 136.—T. F. B.

Halogen compounds of alkalis, aluminium, silicon titanium, and other bases, from natural double silicates ; Process for obtaining ——. R. van der Leeden. Fr. Pat. 466,721, Dec. 29, 1913. Under Int. Conv., Jan. 4, 1913.

See Ger. Pat. 267,867 of 1913 ; preceding.—T. F. B.

Silicon monoxide ; Process of producing ——. H. N. Potter, New York, Assignor to G. Westinghouse, Pittsburgh. U.S. Pat. 1,104,384, July 21, 1914. Date of appl., July 29, 1907.

SEE Eng. Pat. 26,788 of 1905 ; this J., 1906, 434.—T. F. B.

Boron suboxide ; Process of making ——. E. Weintraub, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,105,388, July 28, 1914. Date of appl., May 2, 1913.

SEE Eng. Pat. 15,757 of 1913 ; this J., 1914, 692.—T.F.B.

Hydrogen ; Impts. in and apparatus for the production of ——. A. Messerschmitt, Stolberg, Germany. Eng. Pat. 17,690, Aug. 1, 1913.

SEE Fr. Pat. 461,623 of 1913 ; this J., 1914, 313.—T. F. B.

Hydrogen ; Apparatus for the production of ——. A. Messerschmitt, Stolberg, Germany. Eng. Pat. 17,692, Aug. 1, 1913.

SEE Ger. Pat. 268,062 of 1912 ; this J., 1914, 137.—T.F.B.

Nitrogen and hydrogen ; Process for preparing a mixture of —— suitable for making ammonia. R. Koepp und Co. Fr. Pat. 466,679, Dec. 27, 1913.

SEE U.S. Pat. 1,098,139 of 1914 ; this J., 1914, 788.—T. F. B.

Use of chlorophyll extracts as fuel. Fr. Pat. 466,985. *See* IIA.

Process of recovering sulphur in elementary form from pyrite. U.S. Pat. 1,103,081. *See* X.

VIII.—GLASS ; CERAMICS.

Glass and fused silica ; Note on the resistivities of —— at high temperatures. A. Campbell. Proc. Phys. Soc. London, 1913, **25**, Part V. Nat. Phys. Lab., Collected Researches, 1914, **11**, 205—208.

THE tests were made on tubes about 30 cm. long, 1—4 cm. diam., and with walls 0·05—0·12 cm. thick. The voltage was either 200 or 500, and the time of electrification 1 min. With fused silica having a silky surface the resistivity in megohm-cm. was over 200,000,000 at 15° and 150° C., but fell to 20,000,000 at 230°, 2,500,000 at 250°, 200,000 at 300°, 30,000 at 350°, 800 at 450°, 30 at 700° and about 20 at 800° and 850° C. The values for different glasses were :—ordinary (soda lime) glass, 500,000 at 18° and 100 at 145° C., " Geräte " (zinc-aluminium) glass, 3,000,000 at 18° C., Jena glass (combustion tubing), over 200,000,000 at 18°, 36,000,000 at 115°, 18,000,000 at 150°, 0·01 to 0·04 at 750° C. (with 2 volts the apparent resistance rose quickly from 150 to 609 ohms owing to polarisation). The resistance of sheet mica (0·026 mm. thick) was over 300,000,000 megohms at 18° and 135° C. ; it was reduced considerably at higher temperatures but not so much as in the case of glass and fused silica.—A. S.

Inorganic syntheses [of silicates, aluminates, stannates, ferrites, chromites, manganites, titanates, and zirconates.] Pukall. *See* VII.

Cathodic spattering [of metals]. Kaye. *See* X.

Report of National Physical Laboratory. [Thermometer glasses.] *See* XXIII.

Government Laboratory. Report of Principal Chemist for year ended March 31, 1914. *See* XXIII.

PATENT.

Preparation of a refractory material with large pores for filters and for other applications. Fr. Pats. 466,657 and 466,659. *See* I.

IX.—BUILDING MATERIALS.

Wood preservation with substances soluble in water. B. Malenkovic. Z. angew. Chem., 1914, **27**, Aufsatzteil, 132—135.

THE treatment of wood with zinc chloride, copper sulphate, and even, on account of its high price, with mercuric chloride, is being superseded. Whilst the author's method of using zinc and sodium fluorides, or a mixture of 88·89% of sodium fluoride with 11·11% of the anilin salt of dinitrophenol (Basilit or Bellit) has given results in some cases equal to those obtained with tar-oil, th method must be properly used, and even then sometimes fails to reach the standard of " antiseptic power," $a=16$, which the author regards as requisite ; ($a=\frac{z}{p}$, in which z is the number of kilos. of antiseptic absorbed by 1 cub. m. of wood, and p the number of grms. required to keep 100 c.c. of culture medium, gelatin or agar, free from *penicillium*). For this purpose other substances, cheaper and more soluble, alone or in admixture with existing substances, are required.—O. E. M.

" Mammoth " pumps and sludge elevators for mixing an transporting slurry. Steen. Chem.-Zeit., 1914, 33 590.

THE stirring effected by these pumps (this J., 1914, 301 is so vigorous that slurry left standing for days is ready fo use soon after starting the pump, and considerable savin is effected, since constantly running stirrers are no necessary. The air lift pump is suitable for moderat lifts ; the elevator, which will deal with large stones is not thus limited. It consists of a large vesse suitably connected, into which the slurry is first drawn b suction, and from which it is then expelled by compresse air. The valves are automatically controlled by the liqui Three cub. m. of slurry are raised 15 m. in 3 minut by an expenditure of 23 amp. at 500 volts. The elevat is capable of transporting slurry varying widely in co sistency.—O. E. M.

Inorganic syntheses [of silicates, aluminates, stannat ferrites, chromites, manganites, titanates, and zirconate Pukall. *See* VII.

PATENTS.

Roofing-compositions [; Elastic fire-resisting ——]. E. White, Terenure, Ireland. Eng. Pat. 1805, Jan. 1914.

MELTED natural bitumen (1 part by vol.) is added t parts of calcined pure silica sand, both at 200° C., a with these are incorporated 10% by weight of lead ox and 10% of mixed alkali silicates (at 160° C.). T silicates are prepared by melting together finely grou silica sand 100 parts, potash 29, calcined ball soda and ground wood charcoal 9 parts, and boiling till mass is of a gelatinous consistence. The composit is spread as a layer (at least ¼ inch thick) on a foundat of felt or the like (preferably " Ruberoid ").—F. Sod

Wood ; Preservation of ——. R. A. Marr, Ghent, U.S.A. Eng. Pat. 2084, Jan. 26, 1914.

WOOD is immersed in an open bath containing a volatile material insoluble in water, and of m. pt. not 212° F. (100° C.), a somewhat volatile aromatic hy carbon, and a solid material so finely divided as t carried into the pores and ducts of the wood and sufficie hard to render it insect-proof. A suitable composi is paraffin wax 100, naphthalene 5—15, and diatomae earth 2—5 parts. Paris green or other solid insect may be used in addition to or instead of the diatomac earth. The bath should be maintained at 212° to a 240° F. (100°—116° C.), but a second treatment lower temperature may be given to secure supersatura Impregnation is complete even with green wood ha the bark intact.—F. SODN.

Impregnating wood and other porous materials under pressure; Apparatus for ——. P. F. Berk, London. From F. Moll, Berlin, and A. Kossel, Marktredwitz, Germany. Eng. Pat. 25,682, Nov. 10, 1913.

See Fr. Pat. 463,630 of 1913; this J., 1914, 356.—T. F. B.

Porous material [wood]; Apparatus for impregnating ——. W. J. Frame, Carmunnock, and H. L. Galloway, Kilmalcolm, Assignors to Saveoil Creosoting Machine Co., Ltd., Glasgow. U.S. Pat. 1,104,488, July 21, 1914. Date of appl., Sept. 16, 1913.

See Eng. Pat. 25,029 of 1912; this J., 1914, 315.—T. F. B.

Extraction, in a soluble form, of alkalis present in natural double silicates. Fr. Pat. 466,952. *See* VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Pig iron; Increase of the strength of iron obtained by the use of German —— low in carbon. A. Geissel. Stahl u. Eisen, 1914, **34**, 1291—1294.

Mechanical tests made on a number of bars cast from iron improved by addition of low-carbon pig iron of German production, showed an ncrease of strength of about one-fourth with 15% of the low-carbon ron, and a correspondingly greater ncrease with larger additions.—T. St.

Welds; Oxy-acetylene ——. *Experiments on their strength.* A. Campion and W. C. Grey. Times Eng. Suppl., July 31, 1914, 81.

Tensile tests, after various treatnents, on welded mild steel bars with about 0·25%, turned so that the racture would take place at the weld, howed considerable differences in the nean results of each treatment and n individual bars of each set. The veld had an average about four-fifths f the strength and one-fifth of the uctility of the unwelded steel, and ts ductility could not be made to pproach that of the unwelded portion. Repeated mpact tests made in the Stanton machine, the bars otched in the centre of the welded portion, also gave ery variable results. Hammering was the most effective reatment for increasing the fatigue-resisting properties f the material, but this should be done with the metal t a full red heat (800° C.) to remove strains and brittleness hich might result from hammering the comparatively ool metal near the weld. Reheating and annealing alone id not increase the fatigue-resistance of the welded ortion. The form of treatment which gave the highest trength in tension gave the lowest results in impact sts. To test the weld with reference to the over-heated ne immediately adjacent, another set of impact tests was nade on bars notched at the edge of the weld. The ariations in the energy of fracture were here even greater han in the first set, but reheating to 800° C. very nearly stored the material to its original strength. Results f repeated-impact tests on plates of different thickness howed very clearly that the thicker the plate the less liable was the weld, and the greater the reduction in rength. Autogenous welds must always be regarded s somewhat uncertain, there being no means, except y destruction tests, of ascertaining whether a weld good or bad; they should therefore be accepted with xtreme caution, if not entirely prohibited, in cases here failure would tend to endanger life or limb.

—T. St.

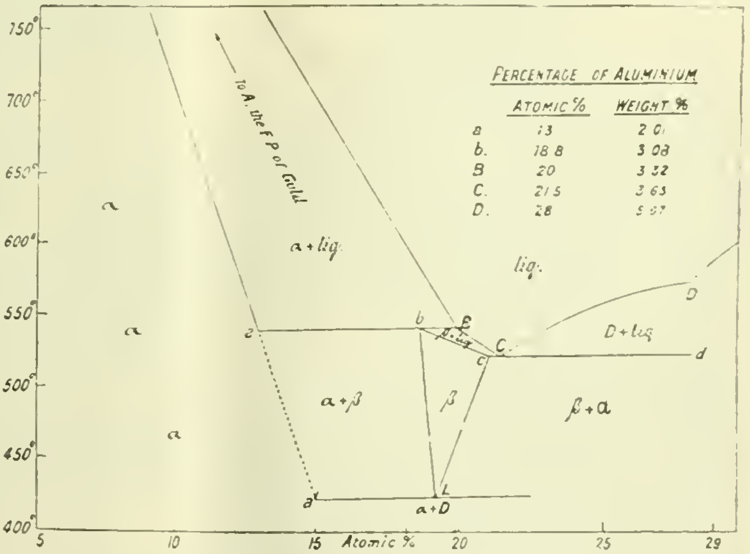
Blast-furnace for smelting [copper-bearing] concentrates. E. W. Honeyman. Eng. and Min. J., 1914, **98**, 199—201.

A furnace is described for smelting 440 tons per day of copper-bearing concentrates such as are usually treated in a reverberatory furnace. The blast furnace is 44 in. wide at the tuyères and 33 ft. long, and is worked with a blast of 20,000 cb. ft. of air per min. at 14 oz. pressure. It is constructed of single-tier water jackets, arranged one at each end and 11 along each of the longer sides. Three 4½ in. tuyères are provided in each side jacket. The upper part of the furnace structure is formed by a series of air jackets suspended from a separate frame, and the top is of gable form with 4 uptakes, 5 ft. in diameter. The paper includes detailed drawings with dimensions.—A. T. L.

Aluminium in gold; Dilute solutions of —— C. T. Heycock and F. H. Neville. Roy. Soc. Proc., 1914, A, **90**, 560—562.

The solid condition of gold containing up to 5% by weight (28 atomic per cent.) of aluminium is shown in the figure. Gold can dissolve up to about 2% of its weight of aluminium to form a uniform solid solution *a*. With rather more aluminium a new constituent β, which can also vary somewhat in composition, appears side by side with the *a*. Next the *a* disappears and with a further rise in the percentage of aluminium a new constituent D, probably Al_2Au_5 appears. The solid β may be regarded as a solvent for *a* and D. When the representative point passes by cooling out of the triangle b L c (see fig.), *a* or D crystallises from the previously uniform alloy and finally when the slowly cooled alloy passes below 424° C. the β phase breaks up to a "pearlite" complex of *a* and D. If cooled further, alloys with between 2 and 5% Al show a remarkable recalescence not indicated in the diagram. The *a* and D of the eutectoid apparently react forming a new and stable substance which the authors believe to be the definite compound Au_4Al.

—W. H. P.



Gun-metal; Mechanical properties of ——. *Influence of temperature.* J. C. Longbottom and A. Campion. Times Eng. Suppl., July 31, 1914, 81.

Admiralty gun-metal (Cu 88, Sn 10, Zn 2%) was tested mechanically at temperatures up to 750° C. The strength and modulus of elasticity remained fairly uniform up to about 200° C., and then fell. The ultimate elongation reached a maximum at 140° C. and fell to less than 1·5% at 350° C. The critical temperatures could not be associated with phase changes of the alloy, and it is considered that the results furnish strong evidence for the existence of some form of cement between the crystal boundaries of the metal, upon which the strength and other properties are largely dependent. The amorphous cement appears to lose its ductility at a lower temperature than that at which it loses its strength.—T. St.

Solution of metals in acids. A. Thiel. Z. Elektrochem., 1914, **20**, 460—463.

Commenting on the paper of Centnerszwer and Sachs (this J., 1914, 753), the author points out that the more modern data on the overvoltage of hydrogen at metallic surfaces, do not support the view that it is simply related to the solution tension of the metal. The use of the term "passivity" to describe the condition of slowly dissolving zinc is criticised as the retarding influences at work are probably mainly due to the state of the surface and to variations in the overvoltage, and not to passivity as that term is usually understood. It is also argued that the difference of potential of "local elements" in an impure metal is consequent on and not the cause of the discharge of hydrogen ions. The phenomena of solution will probably be most satisfactorily elucidated by a study of the magnitude of the surface, of the effect of foreign metals on the overvoltage and of capillary data.—W. H. P.

Cathodic spattering [*of metals*]. G. W. C. Kaye. Proc. Phys. Soc. London, 1913, **25**, Part III. Nat. Phys. Lab., Collected Researches, 1914, **11**, 191—196.

Cathodic spattering, observed when a current is sent through a discharge tube at low pressures, and resulting in the deposition of metal on the glass adjacent to the cathode, has proved very useful as a means of preparing films and mirrors, especially in the case of metals intractable by the usual methods. The spattered metal is expelled from the cathode as minute particles, apparently of the same order of magnitude as those present in colloidal solutions; they settle only on surfaces positive with respect to the cathode and in practice the surface to be coated is connected with the anode. Apart from certain exceptions the amount of spattering is roughly proportional to the chemical equivalent of the metal. The effect is usually marked with palladium, platinum, gold, silver, copper, cadmium, and tin, but is small in the case of aluminium and iron in air. With cadmium and zinc the effect is greatly increased by rise of temperature of the cathode. The amount of spattering is roughly proportional to the square of the current density and is increased by increasing the potential drop at the cathode, *e.g.* by diminishing the pressure of the gas in the tube. Hydrogen, nitrogen and carbon dioxide act unfavourably. Mercury vapour, oxygen, and more especially the monatomic gases, helium, neon, argon, krypton, and xenon bring about marked spattering of nearly all metals, argon being particularly effective. The appearance and properties of the deposit depend upon the nature of the gas. The spattering is usually confined mainly to points and edges of the cathode, where the potential gradient attains a maximum; and it is suggested that the blackening of X-ray tubes might be largely prevented by constructing the cathode wholly free from sharp edges and the anticathode of approximately spherical shape.—A. S.

Colloidal gold solutions; Reactions in the preparation of —— by the formaldehyde method, and the influence of carbonic acid on the formation of these solutions. W. v. Naumoff. Z. anorg. Chem., 1914, **88**, 38—48.

The preparation of colloidal gold solutions by Zsigmondy's method (this J., 1898, 767) is considered to involve the intermediate production of gold hydroxide and potassium aurate. Deep red stable solutions were prepared by direct reduction of the latter compound, the reaction being

$$2AuO_2K + 3H.CHO + K_2CO_3 = 2Au + 3HCO_2K + KHCO_3 + H_2O.$$

Carbon dioxide, in sufficient quantity, completely prevented the formation of colloidal solutions, but by boiling for 5—10 mins. before reduction, satisfactory results were obtained even cold, in presence of added nuclei (see Z. physik. Chem., 1906, **56**, 65; 1909, **66**, 129).—F. Sodn.

French electrochemical and electrometallurgical industries. For. Off. Ann. Ser. No. 5324. [T.R.]

A large company hitherto engaged in the manufacture of paper and sodium at Rioupéroux in the valley of the Romanche (Isère), from whose waters it derives its power, has given up these branches of industry as the result of a law suit, and has embarked instead on the manufacture of ferro-alloys and calcium carbide. The French syndicate controlling the manufacture of the latter product has recently made a substantial reduction in its price, with a view to combating competition.

The company working the Paul Girod patents for the manufacture of special steels and ferro-alloys at Ugines (Savoie) and elsewhere, has lately acquired further works and water-power on the Bon Nant near St. Gervais-les-Bains. In future the manufacture of ferro-alloys will be confined to the Ugines works of the company, while that of calcium carbide will be carried on at their works in Switzerland. Licences have been granted for working the Paul Girod processes to the Bethlehem steel works of America, and the French company is at present engaged in mounting extensive plant in the Ansaldo-Armstrong works in Italy and the Putiloff works in Russia. The two Paul Girod companies—for ferro-alloys and electric steels respectively—have lately reorganised their finances by means of a drastic reduction of capital.

Large hydro-electric works are about to be erected at Laroquebrou (Cantal) for the production of nitrate of soda in the electric furnace. The motive power will be furnished by means of a dam to be built across the Cère, causing a waterfall 488 ft. high. The cost of this enterprise is estimated at £800,000. Another works for the manufacture of artificial nitrates is in contemplation at Bouvillard, near Aiguebelle (Savoie), with power derived from the Arc at La Chambre. The manufacture of electrodes is actively carried on in the works of the Electrode Company situated at Venissioux on the outskirts of Lyons, whose output exceeded 5,000 tons in 1913. Up to the present time no nitrides have been produced by the Société Générale des Nitrures at their works at St. Jean de Maurienne. Arrangements are said to have been concluded with a Norwegian concern with works at Arendal (25,000 H.P.) for the production of nitrides on account of the French company for importation into France—this move being explained as necessitated by the lack of sufficient power in the St. Jean de Maurienne works. Another company is at present engaged in perfecting a rival process the invention of Coutagne.

Nickel cooking utensils. Vuk. *See* XIXb.

Iodate method for determination of copper. Brostrom. *Se* XXIII.

Sensitiveness of some reagents for lead. Eegriwe. *Se* XXIII.

Radium; Technology of the extraction and utilisation of —— Sternlicht. *See* VII.

Detection of antimony in qualitative inorganic analysi Petersen. *See* XXIII.

Report of National Physical Laboratory. [*Resistivity* *steel conductor rails.*] *See* XXIII

Patents.

Pig iron; Manufacture of ——. C. A. Keller, Pat Eng. Pat. 22,692, Oct. 8, 1913.

Scrap iron or steel is melted in an arc electric furna with suitable slags, and the desired amount of carb added. Other elements may be added in the form ferro-alloys, or as oxides with the carbon necessary their reduction. Dephosphorisation and desulphurisati are effected with an oxidising basic calcium slag and wh dephosphorisation is complete, finely divided coal introduced into the body of the metal, convenient through a hollow electrode, and the metal is then trai ferred to a second electric furnace where it is desulphurised by a non-oxidising calcium slag. Alternatively, the carbon for carburising the metal may be placed at the bottom of the second furnace. To obtain a metal with low silicon and high carbon content a slag containing a minimum amount of silica or other easily reducible oxide is employed in the smallest amount required for purification.—T. St.

Steel : Apparatus for manufacturing ——. G. H. Benjamin, New York. U.S. Pat. 1,102,382, July 7, 1914 ; date of appl., Nov. 7, 1913.

The plant consists of a mixer, movable tilting hearths running on two circular trackways which intersect, and a ladle for the refined metal. Hoods, movable vertically, occupy fixed positions on the trackways for use with the hearths. Some of the hearths are heated by gas, the others electrically.—T. St.

Ore separating and the like ; Process and apparatus for hydraulic jigging. ——. K. Kleinberg, Libuschin, Austria. Eng. Pat. 13,191, June 6, 1913.

The pressure of the air contained above the water is regulated in chambers distributed over the jig sieve, the regulation of the compression corresponding to the up-lift being effected independently of the rarefaction due to the descent of the water.—W. R. S.

Ores ; Concentration of ——. Minerals Separation Ltd., London. From T. M. Owen, Broken Hill, N.S.W. Eng. Pat. 16,141, July 12, 1913.

Complex sulphide (galena and blende) slimes are first agitated with a limited amount of air and a minute quantity of eucalyptus oil (1 oz. per ton of ore) at the ordinary temperature without the addition of acid. The greater proportion of the galena having been thus removed in the froth, the pulp is treated with a further addition of oil and increased air supply, and, if desired, with acid, to recover the blende. A preliminary flotation separation may be made without the addition of a frothing agent but with the use of an acidulated solution.—T. St.

Ores ; Concentration of ——. Minerals Separation, Ltd., and H. H. Greenway, London. Partly from H. Lavers, Broken Hill, N.S.W., and A. H. P. Lowry, Prahran, Victoria, Australia. Eng. Pat. 16,302, July 15, 1913.

Sodium carbonate (1%) is added to the warm sodium bichromate solution mixed with eucalyptus oil (see Fr. Pat. 458,051 of 1913 : this J., 1913, 1018) to separate certain sulphides such as galena and zinc blende by flotation.—W. R. S.

Ores ; Apparatus for recovering valuable constituents from ——. F. H. Prentiss, Assignor to L. B. Prentiss, San Francisco, Cal., and R. C. Lane, Berkeley, Cal. U.S. Pat. 1,104,132, July 21, 1914 ; date of appl., Jan. 17, 1910.

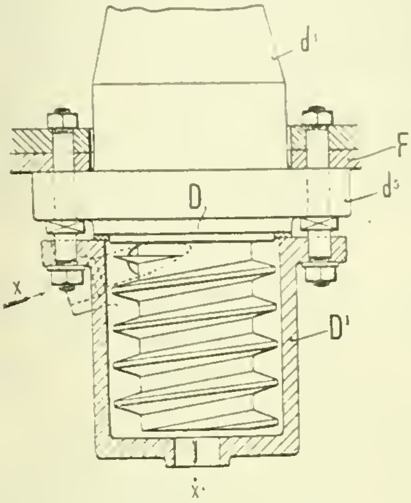
Within and permanently secured to a rotating vessel is a screen having the shape of an inverted cone. A layer of the ore rests upon the screen, forming a jig-bed, and the gangue is washed out by a pulsating stream of water forced into the annular space between the screen and the outer vessel, the valuable particles of high specific gravity being forced through the screen by centrifugal force.—A. S.

Melting furnaces. I. Hall, Birmingham. Eng. Pat. 5664, March 6, 1914.

The bottom of the melting-pot is fitted with a valve which can be worked by means of a lever pivoted outside the cover through which the valve spindle passes in an air-tight manner. The pouring-spout has a gate for checking the flow when charging moulds. A perforated shield surrounds the valve within the melting-pot to prevent dross from flowing out.—W. R. S.

Electrodes for electrical smelting furnaces ; Cooling lower ——. F. Krupp A.-G., Essen, Germany. Eng. Pat. 6731, March 17, 1914. Under Int. Conv., Dec. 13, 1913.

The rod-shaped electrode, D, is provided with a part, d^5, which is joined to the conductor, F, carrying the current, and this part, d^5, lies between the head-piece, d^3, of the electrode and a cooling pot, D^1. The lower end of the electrode, which is provided with helical ribs, is surrounded by the pot, D^1, with a slight amount of clearance, and water is circulated between the ribs, as indicated by the arrows, x, x^1.—B. N.



Electric fusion [of ores] ; Process and apparatus for ——. A. Grabowsky. Fr. Pat. 466,828, March 13, 1913.

The ore is melted in an inclined channel movable longitudinally between two electrodes arranged one behind the other, or the channel may be fixed and the electrodes displaced, or both may be made movable, the relative movement being in harmony with the rate of melting. The charging arrangement, near to the higher electrode, is displaced at the same time as the electrodes, thus automatically feeding the chamber with fresh charges according to the rate of fusion. The channel is formed of several sections, supported on insulated carriages which descend on inclined rails as required.—B. N.

Metal foil ; Manufacture of coloured bronze, and ——. Genthiner Cartonpapierfabrik, Ges. m. b. H., Berlin. Eng. Pat. 9384, April 15, 1914. Under Int. Conv., Dec. 23, 1913.

A layer of colour or bronze is applied to a carrier or backing of fibrous material such as thin paper, which is subsequently destroyed by treatment with hot 10% sulphuric acid and heating, *e.g.* by passing over a heated cylinder or heated plates. Or, the paper may be saturated with the dilute acid, the bronze or colour applied, and the paper then destroyed by heating.—W. R. S.

Metal alloy. S. Wein, New York, Assignor to J. A. Strauss, trustee. U.S. Pat. 1,102,618, July 7, 1914 ; date of appl., Oct. 6, 1913.

An alloy consisting of Al 50 to 85, Te ¼ to 1%, and Zn the remainder.—T. St.

Aluminium alloy. W. A. McAdams, Bay Shore, N.Y. U.S. Pat. 1,104,369, July 21, 1914 ; date of appl., Oct. 16, 1913.

An alloy of tin, silver, cadmium and aluminium.—A. S.

Ores; Apparatus for roasting and sintering ——. A. S. Dwight, New York. Assignor to Dwight and Lloyd Metallurgical Co. U.S. Pat. 1,102,982, July 7, 1914; date of appl., Feb. 2, 1910.

A SHALLOW vessel, divided into two parts by a perforated false bottom, is supported on trunnions, one of which is hollow, and opens into the vessel below the false bottom. Ore containing a combustible is placed on the latter in relatively thin layers and is kept in position by a grid placed on top. Air or other supporter of combustion is passed through the hollow trunnion and the lower compartment and upwards through the ore.—T. ST.

Ore-dust; Process for preparing —— for smelting. W. Cooper, Denver, Colo. U.S. Pat. 1,103,400, July 14, 1914; date of appl., April 20, 1914.

ORE-DUST is saturated with a solution of a calcareous binder, the mass allowed to harden, and then blasted into lumps by means of explosives.—T. ST.

Pyrite; Process of recovering sulphur in elementary form from ——. G. Rigg, Palmerton, Pa., Assignor to New Jersey Zinc Co., New York. U.S. Pat. 1,103,081, July 14, 1914; date of appl., Mar. 27, 1911.

PYRITE is heated at a temperature below its melting point, *e.g.*, at 600°—800° C., in the absence of air, whereby a portion of its sulphur is expelled and magnetic sulphide (pyrrhotite) is formed.—A. S.

Zinc blende; Process of preparing pyritiferous —— for magnetic separation. G. Rigg, Palmerton, Pa., Assignor to New Jersey Zinc Co., New York. U.S. Pat. 1,103,082, July 14, 1914; date of appl., Mar. 27, 1911.

THE ore is heated, in absence of air, at a temperature below the fusing point of pyrite and the dissociation point of zinc blende, in order to convert the pyrite into pyrrhotite (see preceding abstract).—A. S.

Zinc; Muffle furnace for the production of ——. H. Koppers, Essen-Ruhr, and N. Lengersdorf, Bunzlau, Germany. Eng. Pat. 6349, March 12, 1914.

THE furnace is made up of independent units each comprising a group of muffles and separate regenerators. The latter may be placed above or below the muffles but in both cases receptacles with inclined bases are provided to receive any slag escaping from the muffles, and so prevent it from reaching the regenerators. The burning gases in both cases pass over the receptacles so that the slag is kept fluid and can be run off when desired. Ash pockets are provided in front of the muffles, the ash passing down conduits into a discharge channel which is filled with water to cool the ash and prevent the development of dust.—T. ST.

Condenser for zinc vapours. M. Appel, Johnstown, Pa. U.S. Pat. 1,103,123, July 14, 1914; date of appl., Sept. 25, 1913.

THE condenser consists of an outer metallic casing with an inner refractory lining. The zinc enters at the bottom and passes around vertical cooling tubes, arranged in rows, those of each row being spaced apart, and those of adjacent rows being in staggered relation, the corners of the tubes of one row abutting the corners of the tubes in adjacent rows. A gaseous cooling medium is forced downwards through the tubes.—T. ST.

Smelter-fumes; Process of rendering —— useful and recovery of their values. C. S. Vadner, Salt Lake City, Utah. U.S. Pat. 1,103,165, July 14, 1914; date of appl., March 8, 1913.

THE fumes are mechanically purified, then mixed with hydrocarbon gases which have been passed through a column of red-hot coke, and the mixture heated to a high temperature in a gas-converting chamber. The products are cooled to remove moisture and part of the impurities, and then passed through scrubbers of lime rock and ferric oxide into receptacles for use for power and fuel purposes. —T. ST.

[Tungsten] Sintering and stretching process; Combined ——. K. R. R. Seifert, Charlottenburg, Germany. U.S. Pat. 1,103,382, July 14, 1914; date of appl., April 21, 1913.

WOLFRAM (tungsten) or other metals and their alloys are heated electrically in a reducing atmosphere to sintering point, and simultaneously stretched by being passed through a suitable water-cooled die.—T. ST.

Copper matte; Bessemerising ——. J. B. Herreshoff, jun., Assignor to Nichols Copper Co., New York. U.S. Pat. 1,103,925, July 14, 1914; date of appl., Aug. 12, 1912.

COPPER silicate is charged on to the molten mass in a converter and forms a thick viscous mass, without being affected chemically. The charge is then run off, and matte introduced upon the heated silicate, which forms the flux for the new charge.—T. ST.

Gold; Process for saving —— from sand. G. H. Hamilton, Oregon City, Oreg. U.S. Pat. 1,104,112, July 21, 1914; date of appl., Oct. 18, 1912.

THE thoroughly dried sand is passed through a fine-mesh screen and then through a device which is agitated so as to force the finest powdered gold through fine bolting cloth.—A. S.

Ores; Means for and process of treating ——. F. P. Arnold, Carbondale, Pa., and G. F. Wedeman, Washington, D.C. U.S. Pats. 1,104,239 and 1,104,287, July 21, 1914; dates of appl., May 23 and Feb. 12, 1914.

(I.) A RECEPTACLE is mounted on hollow trunnions so that it can be revolved. The trunnions have detachable covers and means are provided for closing their inner ends. The ore is fed into the receptacle from a hopper which can be moved longitudinally into and out of one of the trunnions and means are provided for supplying neutralising agents to the ore. Through the other trunnion passes a pipe for supplying a highly heated gas to the receptacle and fitted with a connection for withdrawing the reaction-gases charged with "values." (2. Live steam is expanded, the condensed water drawn off and the dry steam superheated and passed through charge of comminuted ore impregnated with a neutralisin agent composed of sodium bicarbonate, caustic potash and sodium chloride, the ore being heated and agitated and the effluent gases arrested and condensed.—A. S.

Metallurgical method [for titaniferous iron ore]. A. J Rossi, Niagara Falls, N.Y., Assignor to The Titaniun Alloy Manufacturing Co., New York. U.S. Pat 1,104,317, July 21, 1914; date of appl., April 10, 191

IRON ore containing not less than 3% of titanic oxide i smelted below 1700° C. with carbon and with manganiferous iron ore containing a quantity of manganese oxid amounting to not less than 10% of the titanic oxide.—A.

Electrolyte for use in electro-metallurgical processes. N. H. Dekker. First Addition, dated March 3, 1913, to F Pat. 457,816, July 22, 1912 (this J., 1913, 662).

TWO mols. of an alkali or alkaline-earth sulphate to or of zinc sulphate are employed in the electrolyte, th additional molecule of the alkali or alkaline-earth con pound forming sulphuric acid and oxygen in the anod compartment and alkali or alkaline-earth hydroxide i the cathode compartment. The hydroxide reacts with th metallic sulphate, precipitating zinc hydroxide and r forming the alkali or alkaline-earth sulphate.—B. N.

Copper, lead, and zinc; Separation of —— from sulphi or oxide ores or metallurgical products. W. Borchers a W. Menzel. Ger. Pat. 275,904, July 29, 1913.

SULPHIDE ores containing copper, lead, and zinc a roasted to produce oxides, which are smelted in th electric furnace with the requisite addition of carbonaceous matter; the volatilised zinc and lead are collected in a solution of sulphuric acid, or a mixture of sulphuric and sulphurous acids such as is obtained by passing the gases from the roasting furnace into water. The zinc dissolves whilst the lead is found in the residue. Oxide ores are mixed with sulphide ores and then roasted as described above.—T. F. B.

Steel; Process and apparatus for the manufacture of ——. N. E. Maccallum, Phoenixville, Assignor to F. P. Norris, Phœnixville, and The Phœnix Iron Co., Philadelphia. Reissue No. 13,782, July 28, 1914, of U.S. Pat. 1,057,564, April 1, 1913. Date of appl., May 26, 1914.

See this J., 1913, 492.—T. F. B.

Iron ores; Briquetting ——. W. Mathesius, Charlottenburg, Germany. U.S. Pat. 1,104,124, July 21, 1914. Date of appl., July 22, 1913.

See Fr. Pat. 460,954 of 1913; this J., 1914, 85.—T. F. B.

Rare metals such as thallium and radioactive metals from lead ores; Means for the extraction of —— and production of a white pigment. E. C. R. Marks, London. From Deutsche Felsen Oil Ges. Franzen und Co., Berlin. Eng. Pat. 16,892, July 23, 1913.

See Ger. Pat. 264,526 of 1912; this J., 1913, 1078.—T. F. B.

Chloridizing ores and residues; Process of ——. A. D. Ledoux, New York. Eng. Pat. 17,411, July 29, 1913. Under Int. Conv., Aug. 13, 1912.

See Fr. Pat. 460,579 of 1913; this J., 1914, 88.—T. F B.

Furnaces; Electric ——. W. N. Crafts, Oberlin, Ohio, U.S.A. Eng. Pat. 18,072, Aug. 8, 1913.

See U.S. Pat. 1,069,923 of 1913; this J., 1913, 915.—T. F. B.

Furnace; Electric ——. E Stassano, Turin, Italy. U.S. Pat. 1,105,859, Aug. 4, 1914. Date of appl., Oct. 15, 1913.

See Eng. Pat. 22,723 of 1913; this J., 1914, 89.—T. F. B.

Furnace; Electric ——. N. Testrup, London, and T. Rigby, Dumfries, Assignors to Wetcarbonizing, Ltd., London. U.S. Pat. 1,106,166, Aug. 4, 1914. Date of appl., Dec. 6, 1911.

See Eng. Pat. 19,923 of 1911; this J., 1913, 93.—T. F. B.

hromium and high percentage alloys thereof; Manufacture of ——. C. A. Keller, Paris. Eng. Pat. 23,566, Oct. 17, 1913. Under Int. Conv., Oct. 21, 1912.

See Fr. Pat. 461,098 of 1912; this J., 1914, 204.—T. F. B

Metal-pickling process. T. R. Davidson, Westmount, Canada. U.S. Pat. 1,104,107, July 21, 1914. Date of appl., July 11, 1913.

See Eng. Pat. 16,554 of 1913; this J., 1914, 355.—T. F. B.

Roasting-furnace. K. J. Beskow and A. Ramén, Helsingborg, Sweden. U.S. Pat. 1,104,288, July 21, 1914. Date of appl., Aug. 18, 1910.

EE Eng. Pat. 12,214 of 1911; this J., 1911, 1457.—T. F. B.

pen-hearth furnace; Regenerative ——. T. B. Rogerson, Tollcross, Glasgow. U.S. Pat. 1,104.448, July 21, 1914. Date of appl., Feb. 24, 1914.

EE Eng. Pat. 10.853 of 1913; this J., 1913, 1116.—T. F. B.

agnetic separator. H. J. H. Nathorst, Malmberget, Sweden. U.S. Pat. 1,105,293, July 28, 1914.

EE Eng. Pat 8485 of 1913; this J., 1913, 1116.—T. F. B.

ust-proofing products. Ger. Pat 276,122. *See* XIII.

XI.—ELECTRO-CHEMISTRY.

Electrochemical reactions in which the current passes to the electrolyte through a gas space. Haber. Chem.-Zeit., 1914, **38**, 695.

To determine whether the existence of an oxidising or reducing phase, consisting of the charged ions and the material of the electrode, is essential for the oxidation or reduction of depolarisers, a current was passed through dilute sulphuric acid between an ordinary electrode and a cathode arranged in an evacuated gas space. The gases in the cathode space were analysed and found to contain more hydrogen than would be expected from Faraday's law. The oxidation products, persulphuric acid and Caro's acid, were found in the electrolyte The effects of concentration, temperature, duration of experiment, and strength of current were studied.—A. T. L.

Resistivities of glass and fused silica at high temperatures. Campbell. *See* VIII.

Report of National Physical Laboratory. [*Standard cells.*] *See* XXIII.

Patents.

Anodes of massive manganese peroxide; Manufacture of ——. Siemens und Halske A.-G. and M. Huth, Berlin. Eng. Pat. 27,365, Nov. 27, 1913. Addition to Eng. Pat. 605 of Jan. 9, 1909 (this J., 1909, 1145).

The decomposition of the manganese nitrate is carried on in the mould in several phases, and further quantities of manganese nitrate are added continuously during the heating operation.—B. N.

Cells; Galvanic ——. E. Achenbach, Hamburg, Germany. Eng. Pat. 10,616, April 29, 1914.

Magnesia or lime is added to an alkaline electrolyte, and heated to about 100° C. for use in a dry cell.—B. N.

Positive electrodes of alkaline accumulators; Preparation of a mass for the ——. Svenska Ackumulator Aktiebolaget Jungner. Fr. Pat. 467,311, Jan. 14, 1914. Under Int. Conv., Jan. 16, 1913.

The mass is formed of higher oxygen compounds of nickel, which are reduced to a lower state of oxidation, before the formation of the accumulator, by the aid of a reducing liquid or gas. Finely divided zinc or aluminium may be mixed with the active material, so that hydrogen is formed by contact with the alkali of the accumulator or with a neutral liquid; or sugar may be mixed with the mass, so that on immersion in water the sugar is dissolved, thus effecting the desired reduction.—B. N.

Removal of water [by electro-osmosis] from organic and inorganic substances. Ges. für Elektro-Osmose m. b. H., Frankfort-on-Maine, Germany. Eng. Pat. 6993, March 19, 1914. Under Int. Conv., June 2, 1913.

The substance is sub-divided as finely as possible in the presence of an electrolyte before treatment, the operation being carried so far and the quantity of added electrolyte such that the degree of dispersion (fineness of subdivision) of the solid approaches the maximum value as nearly as possible.—B. N.

Organic or inorganic substances; Removal of water [by electro-osmosis] from ——. Ges. für Elektro-Osmose m. b. H., Frankfort-on-Maine, Germany. Eng. Pat. 6995, March 19, 1914. Under Int. Conv., July 21, 1913. Addition to Eng. Pat. 6993 of 1914 (see preceding abstract).

A colloid body, in addition to the electrolyte, is added to the material under treatment.—B. N.

Furnaces; Admission of gas into electric arc ——. Electrodes for electric arc furnaces. Norsk Hydro-Elektrisk Kvælstofaktieselskab. Fr. Pats. 466,961 and 466,962, Jan. 3, 1914. Under Int. Conv., Jan. 17, 1913.

(1) THE air, or other gas, is supplied through the walls of the furnace into the arc, spread into a disc-like form, by means of channels arranged in the forms of frustums of cones, the latter having a common base in the plane of the disc flame. The channels, which communicate in groups with annular distributing chambers, are narrowed towards the interior of the flame chamber, and their position is such that a movement of rotation may be given to the currents of air in a direction opposite to that of the flame; the external annular chambers may serve to feed the flame chamber with cooler gas. (2) Cross-bars, with arrangements for cooling, are adapted to the electrodes to prevent vibration, and both the electrodes and cross-bars are adjustable, the former longitudinally and the latter with respect to the walls of the furnace.—B. N.

Metallic sulphides; Electro-technical application of the electrical properties of ——, particularly for the construction of resistances. G. Mascarini. Fr. Pat. 467,167, Jan. 9, 1914. Under Int. Conv., Jan. 11, and Nov. 5, 1913.

METALLIC sulphides, such as iron sulphide, are used for the construction of resistances employed for the automatic starting of triphase motors with rotary coils, and for short-circuiting the rotor as soon as the speed of the object is attained.—B. N.

Furnace; Electric ——. A. Scott-Hansen, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,096,321, May 12, 1914. Date of appl., Jan. 6, 1914.

SEE Fr. Pat. 466,961 of 1913; preceding.—T. F. B.

Ozone-producer. H. A. Thomson, Assignor to Scientific Treatments, Ltd., Glasgow. U.S. Pat. 1,105,717, Aug. 4, 1914. Date of appl., Aug. 5, 1912.

SEE Eng. Pat. 18,626 of 1911; this J., 1912, 252.—T. F. B.

Electrode masses in alkaline accumulators, composed of oxygen compounds of nickel; Process for regenerating the positive ——. Svenska Ackumulator Aktiebolaget Jungner. Fr. Pat. 466,543, Dec. 24, 1913. Under Int. Conv., Jan. 16, 1913.

SEE Eng. Pat. 72 of 1914; this J., 1914, 796.—T. F. B.

Electrolytic and electrochemical process for de-gumming textile plants. Fr. Pat. 466,555. *See* V.

XII.—FATS; OILS; WAXES.

Fats; Determination of the iodine value of ——. S. Weiser and H. G. Donath. Z. Untersuch. Nahr. Genussm., 1914, **28**, 65—73.

THE iodine values of erucic, elaidic, oleic, ricinoleic and undecylic acids as determined by the methods of Hübl, Waller, Wijs and Winkler were practically concordant. With linolic acid only the iodine value obtained by Winkler's method agreed with theory, the other methods giving too high results. The iodine values of crotonic, tiglic and cinnamic acids could not be determined by the methods of Hübl, Waller and Wijs, whereas nearly theoretical results were given by Winkler's method. (Pharmacop. Hungarica, 1909, XI.). From 0·1 to 0·5 grm. of the fat is dissolved in 10 c.c. of carbon tetrachloride, and 50 c.c. of Winkler's solution (N/10 potassium bromate solution containing 1 to 1·5 grm. of potassium bromide and 10 c.c. of 10% hydrochloric acid) are added. After 30 mins. to 2 hours (according to the iodine value) 10 c.c. of 10% potassium iodide solution are added, and the liberated iodine titrated with thiosulphate solution (see also this J., 1914, 651).—C. A. M.

Shea butter and mowrah fat; Unsaponifiable matter of ——. P. Berg and J. Angerhausen. Z. Untersuch. Nahr. Genussm., 1914, **28**, 73—79.

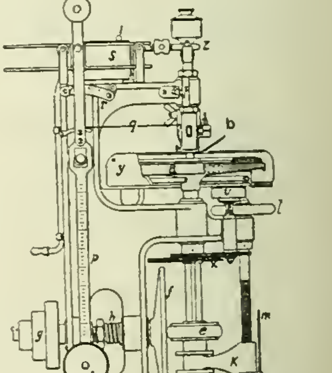
THREE samples of shea butter contained 6·3 to 6·86% unsaponifiable matter, of which 0·95 to 2·55% was insoluble in alcohol. The phytosterol (0·09 to 0·12%) melted at 152°—153° C. Mowrah fat (2 samples) contained 1·7 and 2·2% unsaponifiable matter, with 0·31 and 0·27% insoluble in alcohol, and 0·04 and 0·05% phytosterol (m. pt. 155° C.). After separation of phytosterol the unsaponifiable matter of shea butter had a specific rotation of +38·5 to 39·5 and iodine value 66·6, the corresponding values of mowrah fat unsaponifiable matter being +33·0 to 35·5 and iodine value 68·6. The greater dextro-rotation of this part of the unsaponifiable matter was the only material analytical difference between the two fats. The presence of 10% of the dextro-rotatory portion of the unsaponifiable matter of shea butter had a pronounced effect upon the refraction at 40° C., specific rotation, and saponification value of the fat and fatty acids.—C. A. M.

Oils; Hardening [hydrogenation] of ——. Häpke. Chem.-Zeit., 1914, **38**, 392.

THE largest German factories engaged in hydrogenating oils are the Bremen-Besigheimer Oelfabriken, where only edible fats are hardened to produce "*Brebesol,*" and the Germania Oil Works at Emmerich, which produce only technical products (*talgol* and *candelite*) from whale and fish oils. The hydrogen used in the Bremen Works is obtained from water-gas by the iron-contact process of Messerschmitt at a cost of about 4 pfg. per cb. m. (about 1s. 1¼d. per 1000 cb. ft.). According to the Customs returns the imports of crude oils, etc., int Bremen in 1913 were:—Copra, 37,581; palm and paln kernel oils, 34,271; arachis nuts, 28,624; cotton seed 82,795; and sesame seeds, 28,735; total, 212,006 metri tons, the value of which was estimated at M. 50,000,00 (nearly £2,500,000). Hitherto soya bean oil has not bee imported, although particularly suitable for hardene edible fats.—C. A. M.

Lubricating oils; Machine for testing —— at any ten perature and in connection with surfaces of differe metals. P. M. E. Schmitz. Z. angew. Chem., 191 **27**, 468.

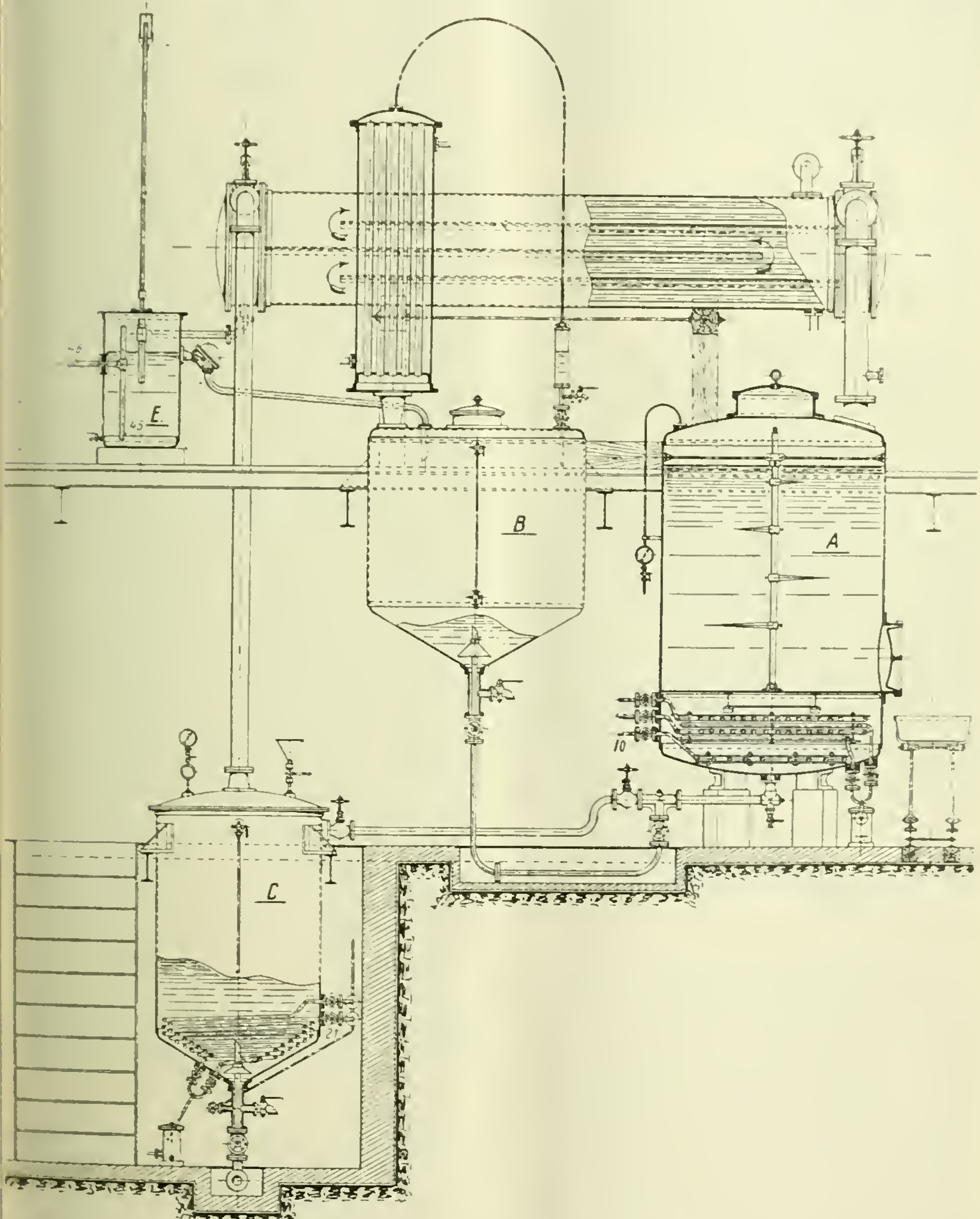
THE friction coefficient, consumption of oil, heat pr duced, etc., may be rapidly determined at 20° to 300° (and at pressures of 0 to 200 kilos. per sq. cm. by th



nachine shown in the diagram. The friction is applied etween the surface of the oil-box, *b*, and the movable lisc, *a* (of any desired metal), which is made to revolve by n electro-motor at a regulated speed, indicated by the osition of the fork, *k*, on the scale, *m*. The temperature f the lubricant is shown by a thermometer introduced nto *b*. The head of the oil-box, *b*, is supported by a ever, connected by the wire, *q*, with the pendulum, *p*. the other end of the lever is a scale pan into which ights are put to measure the pressure per sq. cm., F, the surface of *b* upon the disc, *a*. The friction coicient of the oil is reprsented by $\frac{\phi}{F}$, where ϕ represents the force which moves the pendulum to a point indicated upon the scale, and F the pressure applied to the surface.—C. A. M.

Oils; Apparatus for extracting —— G. Barnick. Chem. Apparatur, 1914, 1, 209—211.

THE material containing oil is extracted in A, by volatile solvent from the tank B. The solution of fat is distilled in C, and the condensed solvent returned from E to the tank B, whilst water is drawn off through 45, 46. Traces of solvent retained by the residue in A are driven off by direct steam admitted through the pipe, 10. An extraction is finished in 8 to 10 hours, and the loss of solvent is stated to be 1 to $1\frac{1}{2}$%.—C. A. M.



Hardened oils in competition with copra oil. E. W. Thompson. Amer. Perfumer, 1914, **9**, 139.

"COMPOUND" lard in the United States is now mainly made from hydrogenated cottonseed oil. The total capacity of plant for hardening oils in Europe for 1914 is estimated at 1,375,000 barrels (of 400 lb.), and the United States output for 1913 at 500,000 barrels. The composition of margarine in Europe (1913) is estimated at :—Copra oil, 169,000 ; palm-kernel oil, 35,000 ; animal fats, 143,500 ; and fluid oils, 150,000 metric tons (2204·6 lb.). Copra oil is being increasingly used for the purpose, and the estimated demand for 1914 is 250,000 tons, or two-thirds of the world's supply. Since 1906 the amount of copra oil produced has trebled. Small quantities of hydrogenated cottonseed oil are now used in the manufacture of margarine in Europe.—C. A. M.

Oil and soap-boiling trades of Marseilles. Diplom. and Consular Report. No. 5377, 1914, 9—13. [Cd. 7048—194.]

RESPECTING the trade of Marseilles in 1913, Consul-Gen. Gurney refers in his Report as follows to the oil, soap-boiling, glycerin, etc., trades, and to the hydrogenation of oils.

The oil and soap-boiling trades.—The oil and soap industries of Marseilles experienced a trying year in 1913, mainly attributable to the extremely high prices of oil and raw materials. Five firms suspended payment, while two others were taken over by a British soap firm. During the last five years, 1909-13, the price of copra oils has risen from the average of 73 fr. 50 c. to 108 fr. 80 c. per 100 kilos. (£1 9s. to £2 3s. per cwt.), while during the same period the price of groundnut (arachis) oil rose from 59 fr. 90 c. to 76 fr. 50 c. per 100 kilos. (£1 4s. to £1 10s. per cwt.). At one time during 1913 copra and arachis oils even fetched 124 and 88 fr. per 100 kilos. (£2 9s. and £1 15s. 6d. per cwt.) respectively. These high prices compelled the soap manufacturers to try and substitute tallow for these oils, and the demand for tallow caused the price of this article to rise from 10 to 47 fr. per 100 kilos. (4s. to 18s. 2d. per cwt.). Many reasons are adduced for the present high prices of the oils in question. The practical substitution of the gold standard for the silver one in India brought about an immediate rise in the price of oil seeds. Arachis seed, which used to sell at Marseilles at 8s. per cwt., rose to 14s. and 16s. per cwt. It might be thought that with the opening up and the exploitation of new countries of production, the price of oleaginous seeds would drop, but with the increased supply came increased demand. Oils were wanted for transformation into "cocose," vegetable butter, table oils, etc. Their use was no longer confined to the manufacture of soap, and accordingly demand outpaced supply. The following are the figures of importation of oils seeds at Marseilles during the last four years. They show a gradual annual decrease :—1910, 665,679 tons ; 1911, 643,634 tons ; 1912, 600,149 tons ; 1913, 589,597 tons.

A noteworthy event of last year was the application to these industries of the hydrogenation process whereby inferior oils are hardened and transformed so as to take the place of fats in the manufacture of soap. The new process has not met with a very enthusiastic reception, though it specially affects three industries, viz., the provision, soap, and stearine industries. Application of the process to the provision trade is hindered by the difficulty of removing all injurious ingredients. In the manufacture of soap hydrogenised oils are good substitutes for tallow, but so long as the price of these substances remains at the level of that of tallow, there appears to be no advantage in substituting the former for the latter. Moreover, at present only small quantities of tallow are employed in the manufacture of soap, otherwise the soap would not be sufficiently soluble. It is in the manufacture of stearine that the hydrogenation of fats and oils is likely to prove of the greatest utility, on account of their richness in stearic acid. There are firms already employing the process in the manufacture of this article with very satisfactory results. All oils are amenable to hydrogenation, but the ones generally used are those of inferior quality, and obtainable at low prices, such as fish oils. Fish oils are greatly sought after, on account of their cheapness, but fish oil imported into France has to pay a duty of 6 fr. per 100 kilos. (2s. 6d. per cwt.). Attempts are being made to get this duty abolished, and a Bill to this effect is already before the French Parliament. This Bill has the support of the soap and stearine manufacturers, but is opposed by the oil manufacturers. Meanwhile the Minister of Finance has stated that if fish oils are granted free entry into the country, it may be necessary to place these oils, when hydrogenised, in a special category, and that it may be found expedient to put a duty on them of 6 fr. per 100 kilos. (2s. 6d. per cwt.) with compulsory declaration of origin. This announcement of the Minister has caused profound dissatisfaction among oil manufacturers. They argue that oils, after having been subjected to the hydrogenation process, are so transformed that it is almost impossible to tell whence they originated, and that hydrogenised fats can be given all the characteristics of tallow. Accordingly it will be practically impossible to differentiate for tariff purposes between hydrogenised fish oils and other hydrogensed oils, and between tallow and hydrogenised fats. After a long discussion the Marseilles Chamber of Commerce has decided to support the proposition of the Minister of Finance with regard to these oils. He proposes to tax them after hydrogenation, if intended for industrial purposes, to the extent of 9 fr. per 100 kilos. (3s. 6d. per cwt.) maximum tariff and 6 fr. per 100 kilos. (2s. 6d. per cwt.) minimum tariff. These are the duties levied on cotton and soya oils intended for soap manufacture.

Oil cakes.—The amount of oil cakes manufactured in Marseilles during 1913 was 281,400 tons as against 285,900 in 1912, a decrease of 4,500 tons. The following figures show that there has been an annual decrease since 1910 :—1910, 317,000 tons ; 1911, 312,100 tons ; 1912, 285,900 tons ; 1913, 281,400 tons.

The neutralising, deodorising and hardening of oils by hydrogenation.—A British soap manufacturing company are building a factory in the Aygalades suburb of Marseille for the hardening of oils by the hydrogen process invented by Sabatier, some 20 years ago, and now being adapted t the industrial treatment of oils. These works will be on the branch line connecting the main railway line with the docks The oils will be pumped up to the works by pipes from th ships' tanks. The company have also bought up th business of two old-established firms of soap boilers, an will carry on business under the names of these two firm A French firm of candle makers has for two years pas manufactured hardened oils by the hydrogenation process for the use of their candle making business. Up to th present this firm has only employed the process in a sm way, but henceforward it will probably go in largely f the hydrogenation of oils. The third concern about t start here, also in the Aygalades suburb, is that of a limite liability company founded in London, with a capital 2,000,000 fr., and registered at Marseilles on February 2 1914 ; 20,000 100-fr. shares have been subscribe by 11 shareholders. As set forth in its statutes, the aim of the company are to acquire all patents, licences, etc to utilise all information and inventions relating to th hydrogenation, the solidification, or any other treatmen of oils, fats, or other similar substances, to buy, sel manufacture, refine, prepare, solidify, or treat in wh manner soever all kinds of oils, fats, soaps, glycerin cattle foods and all oleaginous substances. The rise price of copra oils, due to the enormous demand f edible coconut butter, has led to the hardening of all kin of oils by the hydrogenation process on a large scal notwithstanding the great initial cost of plant. Son 7,000 to 8,000 tons are being turned out weekly in Europ and the output may be doubled in 1914. The oils treate by this process have all the qualities of copra oil, and ca replace that oil in the manufacture of soap. Like cop oil, they can absorb water (10 to 12%) for inferior soap which contain 60% instead of 72% of oil as in the be qualities. The hardness of the hydrogenised oils (the high melting point) can be increased by intensifying th process, the oils becoming as hard as wood. Being al deodorised and neutralised by the hydrogen process, sorts of oils, hitherto considered useless, even rancid ev smelling fish oils, can be treated satisfactorily. A lar rm of candle makers are importing largely Japanese fish oils, which they treat by this process. The hydrogenated oils are now commanding the high prices fetched y copra oils, but as an unlimited supply may soon be placed on the market, a fall in price might be expected, yet he demand for copra oils is so great that it is hoped that prices will be maintained. The supply is not equal to the demand. The Philippines are now using copra very rgely, causing a shortage. Marseilles soap boilers still prefer the copra oil. They fear that with time the smell of these hydrogenated oils may reappear in the soap, and that the colour may vary. Hydrogenated oils somemes become considerably darker in colour on keeping. Copra, costing 120 fr. per ton at the close of 1913, is now at 95 fr. per ton.

Oil seeds. Copra.—Imports of copra in 1913 were 103,136 tons, as compared with 115,117 tons in 1912 and 173,056 tons in 1911. The falling-off is to be attributed to the enormous rise in values already referred to. Under these circumstances the soap manufacturers restricted their purchases and consumption of copra oil to strictest requirements, and replaced this ngredient with tallows, greases and other raw materials which could be supplied at comparatively cheaper cost, but which proved rather prejudicial to the standard quality of Marseilles soap. The crushing of copra was thus considerably reduced, and this industry was not profitable in 1913. Indeed, three of the mills closed or went into quidation. Other large mills making special qualities of refined oils for edible purposes such as "Vegetaline" and "Cocose," have gained profitable results and maintain heir importance.

Groundnuts.—The trade and crushing of groundnuts, decorticated and in shell, continues to increase steadily, and these form the largest and most important branch of he oil-crushing industry in Marseilles. Imports for the year 1913 attained 241,882 tons decorticated kernels and 138,985 tons groundnuts in shell, as compared with 239,195 tons and 120,100 tons respectively in 1912, nearly he whole of these imports being crushed by local mills and the oils sold for edible purposes and for the soap industry. A large portion of imports from the Madras and Coromandel coast, which in previous years all went o the soap kettle, is now being made suitable for edible purposes. This now forms a special and important trade in Marseilles, for French consumption, and also largely for xport to other countries.

Sesame or gingili seed.—Imports for 1913 show an ncrease on the previous year, viz., 26,108 tons as against 8,798 tons in 1912, but are considerably below 1910-11, when the totals were 90,979 and 80,266 tons respectively. The reason given for this diminution is the comparative heaper price of groundnut oils which are more largely aken and appreciated by consumers and margarine manufacturers.

Castor seed.—The imports in 1913 were 25,157 tons, as compared with 16,588 tons in 1912 and 11,509 tons in 1911. This branch of crushing has continued on profitable lines, and two leading crushers have gained high reputation and und a ready sale of their standard qualities, largely to the United Kingdom.

Glycerin.—The glycerin market continued fairly firm throughout the year, a slight downward tendency at the beginning of the year being compensated by a slight upward endency towards the close of the year. The increasing utilisation of oil residues for edible purposes is having, however, rather an adverse effect on the production of glycerin in Marseilles.

Patents.

Fatty acids ; Process of decolorising ——. G. Petroff and G. van Fischenko. Fr. Pat. 467,188, Jan. 10, 1914.

The fatty acids obtained by hydrolysing fats with sulphoacids are decolorised by exposure to a current of air. —C. A. M.

Fats ; Process for hardening and improving the odour of ——. W. Herbricht. Fr. Pat. 467,777, Jan. 27, 1914.

The fat is treated with 20 to 30% of a basic substance, such as milk of lime, or of a solvent, and is then slowly agitated with an acid to liberate oxygen, which will harden and deodorise the fat.—C. A. M.

Sulphonated palmitic products ; Production and utilisation of ——. I. Levinstein, Manchester. Eng. Pat. 16,578, July 19, 1913.

A soluble, miscible or emulsifiable sulpho compound is obtained by treating palmitin or palmitic acid with sulphuric acid, in the presence of a fat, wax, or the like, capable of forming a sulpho acid. The compounds formed will produce soluble, miscible or emulsifiable mixtures with fat, wax or the like. The salts of the sulpho acids may be subsequently formed.—B. N.

Fats and oils ; Process for improving the taste and smell of vegetable and animal ——. W. E. Evans, London. From F. Gössel, Stockheim, Germany. Eng. Pat. 17,510, July 30. 1913.

See Ger. Pat. 273,069 of 1912 : this J., 1914, 652.—T. F. B.

Regenerating decolorising carbon. Eng. Pat. 17,432. *See* IIb.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Plastic masses ; Preparation of ——. J. Gsell. Chem.-Zeit., 1914, **38**, 541.

Condensation products are formed in all reactions which yield hydroxybenzyl alcohols or aldehydes, *e.g.* from resorcinol and methylene chloride in the presence of alkali, which produce dihydroxybenzyl alcohols, which on further heating are condensed to solid products. Again by the interaction of phenol and chloroform in the presence of alkali, hydroxybenzaldehyde is obtained as primary product, and this, by the further action of alkali, is decomposed into hydroxybenzyl alcohol and a hydroxycarboxylic acid, which condense as plastic masses when heated. Similar condensation products are obtained by the interaction of phenols and ketones in the presence of hydrochloric acid. For example solid substances are produced by boiling 50 c.c. of acetone and 50 grms. of resorcinol with 3 to 5 c.c. of strong hydrochloric acid. Hitherto this reaction has been regarded as a characteristic of aldehydes only.—C. A. M.

Stick lac ; New alcohol and acid from ——. A. Gascard. Comptes rend., 1914, **159**, 258.

By treating stick lac with boiling 95% alcohol the resin and the greater part of the wax is removed. The insoluble residue consists of woody matter and the bodies of the lac insect, *Tachardia lacca*, gorged with colouring matter. On treating the latter with boiling benzene a waxy substance is removed, which is the ester of the new alcohol. When purified by recrystallisation from benzene it melts at 94° C. It is insoluble in alcohol, ether, and glacial acetic acid, but dissolves in chloroform and benzene. The yield is 0·4% of the original stick lac. When saponified with potash it yields a new alcohol, *laccerol*, $C_{32}H_{66}O$, crystallising from alcohol in lozenge-shaped lamellæ, melting at 88° C. It is sparingly soluble in cold alcohol, ether, chloroform, or benzene; but readily dissolves in those solvents when heated. The acid with which this alcohol is combined in the natural ester is also new. Liberated from its calcium salt it crystallises in lamellæ, melting at 95°—96° C. It has the formula $C_{32}H_{64}O_2$, and has been named *lacceroic acid*, and is closely allied to psyllostearylic acid, $C_{33}H_{66}O_2$, obtained by Sundwick from *Psylla alni*, an insect parasitic on the alder. The ester-wax itself is, therefore, lacceryl lacceroate, $C_{32}H_{63}O_2.C_{32}H_{65}$.

PATENTS.

Red lead; Production of ——. W. Innes, Liverpool. Eng. Pat. 16,700, July 21, 1913.

A CHAMBER, lined with refractory material and with lower inclined side walls and a flat base, is provided with a jacket completely surrounding it, but with a space between the two. A transverse shaft is arranged at each end of the chamber, with sprocket wheels mounted thereon carrying an endless chain, provided with blades or scrapers at intervals. The chain is revolved by suitable means, so that the blades scrape the bottom of the chamber; the blades are made plain for half of their width, and laterally or longitudinally curved for the other half. Lead oxide is supplied to a feed opening at the top of the chamber, and hot air or other gas through a pipe to the space between the jacket and the chamber, for heating the latter. An opening in the bottom of the chamber is controlled by a shutter, so that the product may be delivered into other similar chambers arranged in steps at different elevations, and finally into a suitable receiver.—B. N.

Lakes [from anthracene dyestuffs]: Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 464,948, Nov. 14, 1913. Under Int. Conv., Nov. 21, 1912, Jan. 8, March 20, July 31, and Aug. 4, 1913.

SEE Eng. Pat. 15,557 of 1913; this J., 1914, 492. Similar lakes are obtained from 1-amino-4-hydroxy- and 1-amino-2.4-dihydroxyanthraquinones.—T. F. B.

Paints suitable for wood and textiles; Preservative —— and process of preparing them. Comp. Française d'Injection pour la Conservation des Bois et Tissus. Fr. Pat. 467,113, Jan. 8, 1914.

NEUTRAL or basic pigments (*e.g.* aniline dyestuffs) are dissolved in preservative solvents such as petroleum oil, shale oil, coal-oils, "cresyls" (cresols), etc.—C. A. M.

Rust-proofing products. B. Zschokke. Ger. Pat. 276,122, Dec. 8, 1912.

A SOLUTION of chromic acid or of a salt which has the power to render iron passive, is emulsified with a fat or oil.—T. F. B.

Antifouling paint and varnish. L. Collardon, West Bromwich. U.S. Pat. 1,105.619, Aug. 4, 1914. Date of appl., Jan. 20, 1913.

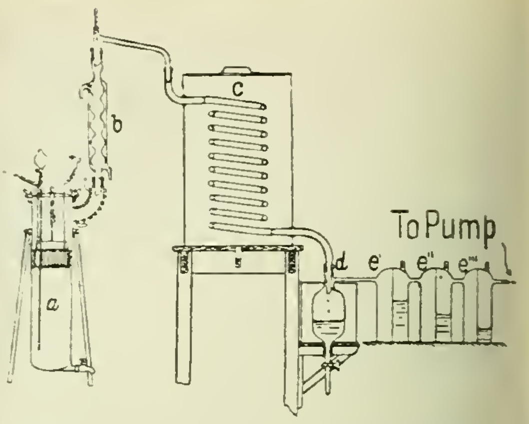
SEE Fr. Pat. 453.395 of 1913; this J., 1913, 799.—T. F. B.

Process for readily dissolving carbohydrates, proteins, horn, bone, etc., by alkali compounds of phenols and alkali acetate. [Manufacture of glue, varnish, etc.] Fr. Pat. 467,045. *See* XV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc; Synthetic ——. *[Preparation of isoprene from oil of turpentine.]* I. I. Andrejew. Ber. St. Petersburg. Polytechn. Inst. des Kaisers Peter d. Grossen, 1914, 21, 313—368. Chem. Zentr., 1914, 2, 325—326.

AN apparatus (see fig.) for the preparation of isoprene by the pyrogenic decomposition of oil of turpentine comprises a still, *a*, a reflux condenser, *b*, in which warm water (at 50° C.) is circulated, a condenser, *c*, cooled by ice-water, a receiver, *d*, for the crude isoprene, and washing bottles, *e'*, *e''*, *e'''*, containing oil of turpentine. The decomposition of the oil of turpentine is effected by means of a platinum wire of 0·2 mm. diam., electrically heated to incandescence.



Higher yields of isoprene are obtained if carvene and dipentene or aromatic hydrocarbons be added to the oil of turpentine.—A. S.

PATENTS.

Isoprene; Process for preparing ——. I. Ostromisslensky. Ger. Pat. 276,185, March 29, 1913.

CRUDE isoprene containing amylenes is treated with a neutral or basic oxidising agent, or with an alkali or alkaline-earth metal, or an alloy or amalgam of such metal, or with a mixture of an oxidising agent and alkali-metal. Under these conditions amylenes are oxidised or polymerised more rapidly than isoprene, which can be separated from the product of the reaction by distillation. The process can be carried out at the ordinary or at a higher temperature, and a solvent of the isoprene may be used.—T. F. B.

Vulcanising indiarubber solutions containing sulphur; Process of ——. G. Bernstein, Paris. Eng. Pat. 17,195, July 26, 1913. Under Int. Conv., July 26, 1912.

SEE Ger. Pat. 262,708 of 1912; this J., 1913, 919.—T. F. B.

Rubber; Reclaiming ——. H. W. Kugler, Akron, Ohio, U.S.A. Eng. Pat. 28,167, Dec. 6, 1913. Under Int. Conv., Dec. 20, 1912.

SEE Fr. Pat. 466,243 of 1913; this J., 1914, 605.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Galalith; Manufacture of ——. G. Bonwitt. Z. angew. Chem., 1914, 27, 2.

GALALITH is prepared from a specially pure casein, from sweet milk perfectly freed from fat by centrifuging; the casein is precipitated by rennet, since acids make it quite unsuitable. The curd is drained and dried, forming lumps 8—12 mm. thick. These are ground first in a fluted-roller mill then in a porcelain-roller mill to a gritty meal. The meal is moistened with a given quantity of water and must then be worked up within 12 hours, otherwise it begins to ferment. The moist meal, coloured as required, is worked up between steel helices to a plastic mass which is then hot-pressed in hydraulic presses. The pressed cake is hardened in a solution of formaldehyde of accurately adjusted concentration, which is circulated continuously to avoid the formation of paraformaldehyde The length of treatment varies from 2 to 30 weeks according to the thickness of the articles; the rooms are heated and well ventilated. Drying is effected in a current of warm air. The hardening takes away the extreme brittleness of the casein and imparts the qualities of natura horn. Galalith is a good electrical insulator: a plate 2 mm. thick will resist 16.000 volts. The specific gravity is 1·317—1·35 (celluloid 1·34—1·40) The hardness i

2·5 (celluloid 2). It resists oily liquids and acids but is welled by alkaline liquids. Its chief drawback is its hygroscopic nature; it absorbs 30% of its weight of water in 12 days. It is not elastic like celluloid and breaks when slightly bent. On account of its tendency to flake t cannot be worked so well as celluloid and sheets cannot be prepared less than 2 mm. in thickness. It is chiefly used in the turning trade, and for the manufacture of uttons, combs, and piano-keys; it does not turn yellow. —J. F. B.

Patents.

Tanning agents; Manufacture of soluble ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 18,259, Aug. 11, 1913.

Natural tanning agents which are partly insoluble can be endered soluble by treatment with substances other han those mentioned in Eng. Pat. 21,982 of 1912 (this J., 913, 919), *e.g.* aromatic sulphonic acids of a non-crystalline haracter which are soluble in water and capable of precipitating gelatin (see Fr. Pat. 462,635; this J., 1914. 66). Example: 10 parts of naphthalene are heated or 6 hours at 150° C. with 10 parts of sulphuric acid. After cooling to 100° C., 2 parts of water and 4·3 parts of 0% formaldehyde are added and stirred. Caustic soda s added till 10 grms. of the product require 10 c.c. of N/1 caustic soda solution for neutralisation. 2000 parts of the paste are introduced slowly with warming into 000 parts of solid quebracho extract in 2000 parts of water. Or, 100 parts of solid quebracho extract may be stirred into 100 parts of a warm concentrated solution of the product obtained by acting on sulphonated cresol with sulphur monochloride (see Addition to Fr. Pat. 13,730; this J., 1914, 209).—D. J. L.

Carbohydrates, proteins, horn, bone, etc.; Process for readily dissolving —— by alkali compounds of phenols and alkali acetates singly or mixed. [*Manufacture of glue, varnish, etc.*] P. J. Contant and J. B. F. Perrot. Fr. Pat. 467,045, Jan. 6, 1914.

The ground material (*e.g.* 100 parts of casein) is left in contact, say for 12—24 hours, with an aqueous solution 00 parts) containing 10% of crystallised sodium phenoxide r acetate. The solution is then filtered and treated with an acid (*e.g.* a 0·2—0·3% solution of sulphuric acid) and with sulphate or other salt of aluminium. The precipitate thus obtained is washed, dried, ground, and dissolved in an alcoholic solution of formic, lactic or acetic acid, or other solvent, and serves for the preparation of glue, varnish, etc.—L. E.

XVI.—SOILS; FERTILISERS.

Soils; Acid. G. Daikuhara. Bull. Imp. Cent. Agric. Exper. Stat., Japan, 1914, 2, 1—40.

The acidity of soils is due not only to the presence of humic acids but also to aluminium and iron compounds; he latter are absorbed by the colloids in the soil, and the absorption compounds act injuriously on vegetation owing to the liberation of acid aluminium and iron compounds when the soil is treated with fertilisers containing mineral salts. More than three-fourths of the soils of Japan and Korea have an acid reaction; those of mesozoic formation are the most acid, then follow the tertiary and palæozoic soils, whilst the alluvial soils are the least acid. To detect acidity in soils, 5 grms. are moistened in a test-tube with a 10% potassium nitrite solution and the tube closed with a plug of cotton-wool from which is suspended a strip of potassium iodide-starch paper. According to the degree of acidity of the soil a more or less deep blue coloration develops on the paper. The acidity may be determined by treating 100 grms. of the soil with 250 c.c. of N/1 potassium chloride solution, shaking the mixture from time to time for 5 days, then drawing off 125 c.c. of the supernatant liquid and titrating it, while boiling, with N/10 alkali solution, using phenolphthalein as indicator. The soil mixture is then treated with a further quantity of 125 c.c. of the potassium chloride solution and the determination repeated, these operations being continued until the soil ceases to yield any soluble acid.—W. P. S.

Manures; Recent advances in the manufacture and use of ——. A. Stutzer. Chem.-Zeit., 1914, **38**, 310—311.

Potassium salts have recently been used for the top dressing of cereals, and are better adapted than kainite for this purpose. Artificial nitrogen compounds from atmospheric nitrogen—nitrolim, calcium nitrate, ammonia, nitric acid, and urea—are being increasingly used in Germany.—O. E. M.

Nitrates; Reduction of —— to nitrites and ammonia by bacteria. M. Klaeser. Ber. deutsch. Botan. Ges., 1914, **32**, 58—61. Chem. Zentr., 1914, **2**, 341.

Of 28 different kinds of bacteria, 27 were capable of reducing nitrate and causing an accumulation of nitrite or ammonia, or both, in the nutrient medium; in presence of peptone, the bacteria withstood the action of large quantities of nitrite. The usual division of nitrate-reducing bacteria into those capable of forming nitrite and ammonia respectively was found to be incorrect; the nature of the reduction product depended upon the composition of the nutrient solution and the reaction (acidity or alkalinity) developed therein. Salts of organic acids produced an alkaline reaction in the medium, favouring the formation of nitrite; dextrose produced an acid reaction, favouring the formation of ammonia. In experiments with *Bac. subtilis*, *tumescens*, and *petasctis*, the quantity of nitrate reduced was approximately proportional to the number of bacteria present during a definite period.—A. S.

X-rays; Influence of —— on vegetation. E. Miège and H. Coupé. Comptes rend., 1914, **159**, 338—340.

The growth of *Raphanus sativus* (radish) and *Lepidium sativum* (garden cress) was promoted by exposure to X-rays, to an extent increasing with the frequency of exposure and the intensity of the radiation, even when the intensity was such as to injure animal tissues. In one case (radish) exposure increased the weight of the leaves by 46%, the bulb by 193%, and the total plant by 59%, as compared with a plant not exposed. The radiation affected slightly the morphology and anatomical structure of the plants, producing in general greater development and better differentiation of the vascular and supporting tissues.—J. H. L.

Hydrocyanic acid and its uses in horticulture. F. P. Sargeant and F. C. Edwards. (Gardeners Chronicle, July 25th, 1914.) Pharmaceutical J., 1914, **93**, 193—194.

In using hydrocyanic acid for fumigation it is necessary to use pure materials to avoid the production of gases (carbon monoxide, sulphur dioxide, etc.) capable of killing the plants. The authors recommend the use of phosphoric acid as being less liable to reduction than sulphuric acid. In carrying out the fumigation it is desirable to avoid the use of excessive quantities of gas, and aim rather at longer exposure to smaller quantities. The plants and atmosphere must be dry and the temperature not above 60° F. (15·5° C.). The fumigation should be performed at dusk when the plants have ceased active assimilation. The amount required under such conditions is about ⅛ oz. sodium cyanide with phosphoric acid per 1000 cu. ft. for green aphis, about ¼ oz. for black or white aphis, thrips and scale, and about 1 oz. to 2 oz. for mealy bug and red spider. The effect of the process on a number of plants was as follows:—

Plants uninjured by phosphoric-cyanide process, 2 oz. to 1000 cubic ft.:—*Anthuriums* (one in flower), *Amaryllis* (young growths), *Anthericum*, *Adiantum cuneatum*, *Abutilon Savitzii*, *Acacia dealbata*, *Asplenium bulbiferum*, *Allamanda*, *Azalea indica*, *Acalypha hispida*, *Bouvardia*, *Calanthe Veitchii*, *Crotons*, *Cattleya labiata*, Chrysanthemums, Cinerarias, *Celosia pyramidalis*, Carnations, *Clivia*, *Cyperus alternifolius*, Cactus, *Centropogon*, *Cypripedium* (in flower), *Dracœna*, *Dendrobium formosum*, *Dieffenbachia*, *Eucharis grandiflora*, *Eucalyptus Globulus*, *Eulalia japonica*, *Epidendron*, Fuchsias, *Francoa ramosa*, *Fittonia*, Gardenias, Gesneria, Gloxinia (in flower), *Habrothamnus*, *Humea elegans*, Ixora, *Impatiens Sultani*, *Lomaria gibba*, *Musa Cavendishii*, Marguerite Mrs. F. Sander, *Nephrolepis*, Orange, *Oncidiums*, *Pancratium fragrans*, Palms, Poinsettias, *Panicum plicatum*, *Pilea muscosa*, *Pandanus Veitchii*, Rondoletia, *Strobilanthes Dyerianus*, *Stephanotis*, Selaginellas, Tradescantias. Plants showing injury by phosphoric-cyanide process, 2 oz. to 1000 cubic ft.:—*Adiantum cuneatum*, young fronds slightly damaged; *Asparagus plumosus* and *Asparagus Sprengeri*, young growths, slightly damaged; Begonia Gloire de Lorraine, slight dropping of flower, foliage uninjured; Browallia; tips scorched slightly; *Coleus thyrsioideus*, defoliated, Cyclamens in flower, some flowers slightly damaged; Heliotrope, badly damaged; Jamaica peppers, slightly scorched; *Mimosa pudica*, leaves dropped after a week; *Mackaya bella*, slightly scorched; Marguerite Mrs. F. Sanders, tips scorched; *Salvia Bethellii*, tips scorched; Tacsonia, slightly injured; *Coelogyne cristata*, foliage injured slightly; Odontoglossum, leaves marked near tip.—W. H. P.

Government Laboratory. Report of Principal Chemist for year ended March 31, 1914. *See* XXIII.

Patents.

Phosphates; Process of rendering soluble insoluble ——. W. S. Landis, Niagara Falls, Ontario, Assignor to American Cyanamid Co., Nashville, Tenn. U.S. Pat. 1,103,059, July 14, 1914; date of appl., July 12, 1913.

A finely-divided mixture of phosphate rock, a soluble sodium salt, water, and carbon is burnt on a perforated grate before the salt has crystallised to an appreciable extent. Air is blown through the mass during the burning operation and the product is finely ground.—A. S.

Fertiliser and process of producing the same. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,103,115, July 14, 1914; date of appl., March 13, 1914.

An amorphous light-coloured fertiliser consisting essentially of ammonium phosphate mixed with small quantities of aluminium and iron phosphates, and practically devoid of constituents not available as a plant food, is prepared by treating phosphate rock with sulphuric acid, and adding the resulting crude solution of phosphoric acid to a solution containing excess of ammonia, *e.g.* to a solution of mono-ammonium phosphate containing di-ammonium phosphate. —A. S.

Fertilising compound. T. L. Willson and M. M. Haff, Ottawa, Assignors to Southern Investment Co. of Canada, Ltd., Montreal, Canada. U.S. Pat. 1,103,910, July 14, 1914; date of appl., Dec. 18, 1911.

A powder formed "from a fused mass containing an alkali and a phosphate enriched with vapours of potash, phosphoric acid, and ammonia."—A. S.

Manure-stuff; Non-hygroscopic —— and process of making same. H. Stoltzenberg, Breslau, Assignor to Melasse-Schlempe G. m. b. H., Berlin. U.S. Pat. 1,104,326, July 21, 1914. Date of appl., July 7, 1913.

See Fr. Pat. 459,872 of 1913; this J., 1913, 1165.—T. F. B.

Peat; Treatment of —— for manurial and other purposes. W. B. Bottomley, London. U.S. Pat. 1,106,275, Aug. 4, 1914. Date of appl., July 15, 1913.

See Eng. Pat. 17,487 of 1912; this J., 1913, 878.—T. F. B.

Use of chlorophyll extracts as fuel. Fr. Pat. 466,985. *See* IIa.

Method of treating garbage and sewage sludge. U.S. Pat. 1,102,532. *See* XIXb.

XVII.—SUGARS; STARCHES; GUMS.

Drying beet slices; Heat lost in ——. F. R. Janak. Deut. Zuckerind., 1914, 39, 641.

If 325,000 kilos. of wet pressed beet slices containing 14% of dry substance be desiccated to a product containing 90% of dry substance, the heat required is as follows: used in the actual operation of drying, 176,000,000 cals.; lost with the evaporated water passing into the flue, 24,840,000; lost with the fuel flue gases, 54,000,000; lost with the hot slices on their removal, 4,500,000; lost in the furnace ashes, 3,000,000; total 262,340,000 cals. Efforts should be made to utilise the heat escaping into the flue with the evaporated water and the furnace gases either in the slice desiccation apparatus or in a juice or syrup-heater, whilst the evaporated water passing into the flue might be condensed to give an oil-free water suitable for feeding to the boilers.—J. P. O.

Sucrose; Comparative study of different methods of determining —— by double polarisation. R. Gillet. Bull. Assoc. Chim. Sucr., 1914, 31, 992—1033.

Alkaline direct polarisation. The Clerget and Herzfeld methods, involving alkaline direct polarisation and acid inversion polarisation, cannot give accurate results on account of the interference of the optically active amino-acids. *Acid direct polarisation.* The use of hydrochloric acid and urea, as recommended by Andrlik (this J., 1911, 63) gives accurate results in the case of beet molasses, but is not practical, by reason of the rapidity with which it is necessary to work in order that the sucrose may not be affected by inversion due to the acid. With sulphurous acid, however, following the directions of Pellet and Ogilvie (this J., 1912, 1195) exactly the same result is obtained as in the Andrlik modification, while manipulation is easy. *Neutral double polarisation.* Theoretically, the modification elaborated by Saillard (this J., 1913, 836) is faultless, but practically it is difficult to operate, and cannot be recommended for routine factory work. *Hydrolysis with invertase.* Following the procedure devised by Ogilvie (this J., 1911, 62) results agreeing closely with those found by the Pellet and Andrlik modifications were found. As the result of a number of determinations with beet molasses it is concluded that the most accurate and also the most practical method is that of Pellet using sulphurous acid in excess for making the direct polarisation. —J. P. O.

Action of some amylases on dextrins. Gruzewska. *See* XVIII.

Government Laboratory. Report of Principal Chemist for year ended March 31, 1914. *See* XXIII.

Wood; Steaming of ——. Heuser. *See* V.

Patents.

[*Sugar.*] *Diffusion process and apparatus.* L. Naudet Fr. Pat. 466,590, March 6, 1913.

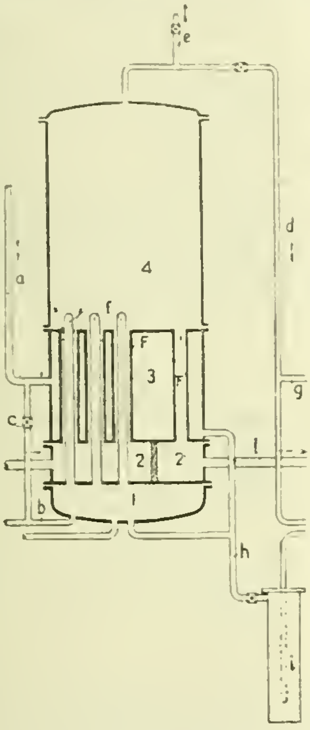
In a diffusion apparatus with forced circulation (see Fr Pat. 329,139 of 1903; this J., 1903, 1008) the juice fron a cell is forced into a vessel from which it can be made t flow, without passing through the heater, to the pip conveying the hot juice used for displacement, which i thus delivered in constant volume and at a relatively hig temperature.—O. E. M.

Syrups; Product for the refining of ——, which effects thei simultaneous decolorisation, defecation, and clarificatio P. Lagrange. First Addition, dated March 4, 1913, t Fr. Pat. 459,213, Aug. 29, 1912 (this J., 1913, 1166).

To regenerate the spent product, it is suspended in wat and treated with a solution of 15—20 parts of sodiu hypochlorite per 100 parts of dry product, and with hydr chloric acid, the latter being added in small portions with stirring. The whole is then made alkaline with milk of lime; the hydrated calcium phosphate and alumina thus precipitated, form with the charcoal still in suspension, a homogeneous product which is pressed and washed for use in refining a further quantity of syrup.—L. E.

Sugar juices; Apparatus for the rapid evaporation of —— under low pressure and with small differences of pressure between the effects, permitting complete utilisation of the waste steam without a condenser. E. Portemont. Fr. Pat. 467,629, Jan. 19, 1914.

THE apparatus comprises any number of effects of which the first is shown. Each effect is divided into compartments, 1, 2, 2′, 3 and 4, of which 1 and 4 are connected by the narrow tubes, *f*. Waste steam is admitted by the pipe, *a*, to compartment, 3, and fresh steam by the pipe, *b*, to compartment, 1; if desired, *a* and *b* may be connected by the branch pipe and cock, *c*. The water condensed in compartments, 1 and 3, passes to the siphon, , and thence to compartment, 1, of the next effect. The uice to be treated s admitted by the pipe, *k*, to compartment, 2, ascends hrough the concenric spaces of the ube system, F, flows over the upper tube plate, descends hrough the tube ystem, F′, to compartment, 2′, and asses by the pipe, *l*, o the next effect. eing sent from the ast effect to a concentrating apparatus. The vapour from the juice passes y the pipe, *d*, and branch, *g*, to compartments, 1 and 2, the next effect, whilst part of this vapour may be ithdrawn by the branch, *e*, and utilised elsewhere; the apour similarly withdrawn from the final effect is almost t atmospheric pressure.—L. E.



ugar masses; Colouring agent for viscous —— especially for masses destined for making caramels. Ungemach A.G., Els. Conserven-Fabrik & Import-Ges. Fr. Pat. 466,925, Dec. 31, 1913. Under Int.Conv., Feb. 25, 1913.

nown quantities of the colouring matter and sugar or latin are dissolved in water and concentrated at as low temperature as possible, the product being formed into blets; or the colouring matter is mixed with a quantity the mass used for making caramels, the whole being rmed into tablets. These tablets serve to colour sugar asses uniformly and to any desired degree.—L. E.

red products [adhesive]; Manufacture of ——. Norsk Tangsyndikat, Christiania. Eng. Pat. 5146, Feb. 27, 1914. Under Int. Conv., March 1, 1913.

U.S. Pat. 1,099,382 of 1914; this J., 1914, 840.—T. F. B.

cilage or gum; Manufacture of ——. C. V. Greenwood, indellsands, Assignor to A. S. White, Chicago. U.S. Pat. 1,105,195, July 28, 1914; date of appl., Feb. 23 1911.

Eng. Pat. 5018 of 1910; this J., 1911, 439.—T. F. B.

Adhesives giving with cold water strong cementing masses; Process of manufacturing ——. J. Kantorowicz, Breslau, Germany. U.S. Pat. 1,105,567, July 28, 1914. Date of appl., Aug. 17, 1909.

SEE Fr. Pat. 412,377 of 1910; this J., 1910, 1029.—T. F. B.

Gum or mucilage from locust-beans; Process for manufacturing ——. A. Pinel, Le Houlme, France. U.S. Pat. 1,106,335, Aug. 4, 1914. Date of appl., July 9, 1912.

SEE Fr. Pat. 443,275 of 1911; this J., 1912, 1002.—T. F. B.

Regenerating decolorising carbon. Eng. Pat. 17,432. *See* IIa.

XVIII.—FERMENTATION INDUSTRIES.

Hops; Nitrogenous constituents of ——. A. C. Chapman. Chem. Soc. Trans., 1914, **105**, 1895—1907. (See this J., 1913, 837).

A NUMBER of samples of hops were found to contain 1·72—4% of nitrogen of which 0·44—0·9% was in a form soluble in hot water. The average composition of the soluble portion (referred to dry hops) was as follows:—Soluble proteins and albumoses, 0·046; ammonium salts and amides, 0·100; amino-substances 0·095; bases and unclassified nitrogen precipitated by phosphotungstic acid, 0·218; unclassified nitrogen not precipitated by phosphotungstic acid, and taken by difference, 0·037%. Besides the compounds previously mentioned (*loc. cit.*), the following have been isolated:—Aspartic acid, potassium nitrate, and one which was probably arginine. A trace of an oily substance with an odour very like that of coniine was also obtained. Cultivated hops contain no morphine or, at most, traces which can have no physiological significance.—L. E.

Brewing water containing manganese. O. Fürnrohr. Z. ges. Brauw., 1914, **37**, 369—372, 381—384.

THE presence of manganese in brewing water is undesirable since it increases the protein-content of the wort and thus also tends to mask the hop flavour of the beer. The water may be freed from iron and part of the manganese by filtration and aeration in a coke tower and then from the remainder of the manganese by addition of lime water. This process is unsatisfactory, however, since the carbon dioxide-content of the water is liable to vary from day to day, and with addition of a constant proportion of lime water the alkalinity of the treated water would vary also. The best method for removing manganese from brewing water is to treat the latter with a certain proportion of lime water, filter from precipitated lime, magnesia, iron and manganese, and remove the remaining manganese by filtration through a special sand filter prepared with manganese dioxide.—L. E.

Yeasts and mould fungi; Recent investigations of the protein metabolism of ——. F. Ehrlich. Z. angew. Chem., 1914, **27**, 48—52.

A GENERAL account of the results of researches on the action of yeasts and moulds on amino-acids (see this J., 1905, 683; 1907, 28, 480; 1909, 848; 1910, 835; 1911, 231, 566; 1912, 505, 506; 1913, 986; 1914, 273). The acids and alcohols formed from amino-acids as by-products of fermentation (*loc.cit.*) give rise to esters which sometimes largely determine the flavour and aroma of alcoholic beverages. The transformation of tyrosin into tyrosol by yeast in presence of sugar is practically quantitative, but about 15—20% of the tyrosol is converted into esters, chiefly of acetic and succinic acids. Slow fermentation favours the formation of esters but the most important factor is the type of yeast employed. Many nitrogenous substances which are toxic towards animals are readily attacked by mycoderma-yeasts and moulds, and converted into innocuous substances: *e.g.*, aniline is precipitated from solutions as a flocculent oxidation-product, and alkaloids such as nicotine and quinine lose their nitrogen and are in part, assimilated.—J. H. L.

Alcoholic fermentation. P. Nottin. Bull. Assoc. Chim. Sucr., 1914, **31**, 956—959. (See this J., 1914, 37.)

In fermentation, the yeast crop increases at first, and then decreases slowly before fermentation is complete. For a given amount of sugar consumed, the yeast crop is greater the lower the concentration of sugar initially present. The proportion of yeast crop to sugar fermented and the rate at which the carbon dioxide escapes from the fermentation liquid are greatly affected by the nature of the glass of which the fermentation vessel is made.—L. E.

Dextrins ; Action of some amylases on——. Z. Gruzewska. Comptes rend., 1914, **159**, 343—345.

It has already been proved that pancreatic amylase acts less energetically on glycogen than on starch. Similar differences were observed with achroo dextrin and erythro-dextrin prepared respectively from glycogen and starch by the action of hydrogen peroxide at 37° C., though these dextrins were less rapidly hydrolysed than their parent carbohydrates. Further experiments with vegetable amylase, Taka diastase and juice from snails confirmed the author's conclusion that glycogen and dextrins prepared therefrom differ in constitution from starch and its dextrins.—J. H. L.

Saccharomycetes (yeasts) ; Behaviour of some —— to inulin. V. Grafe and V. Vouk. Z. Gärungsphysiol., 1913, **3**, 327—333. Chem. Zentr., 1914, **2**, 339.

Many kinds of *Saccharomyces* fermented pure solutions of inulin ; the organisms did not develop well. Yeasts incapable of fermenting inulin were able to assimilate it. Most of the yeasts tried were able to ferment inulin in chicory extracts, *i.e.*, in presence of lævulose ; *Schwanniomyces occident.* was specially effective. In many cases the quantity of carbon dioxide produced by fermentation was very small, and substances of the most varied odours were formed in addition to alcohol.—A. S.

a-Glucosidase ; Specific nature of——. A. Aubry. J. Pharm. Chim., 1914, **10**, 23—26.

An aqueous extract of a culture of *Aspergillus niger*, exhibiting strong hydrolytic activity towards maltose, was without action on α-methylglucoside. It is concluded that maltase and α-glucosidase though both present in air-dried bottom fermentation beer yeast are two distinct enzymes (see Bourquelot and others, this J., 1913, 251).
—J. H. L.

Wines ; Volumetric determination of sulphurous acid in ——. L. Ferré. Bull. Assoc. Chim. Sucr., 1914, **31**, 959—963.

Total sulphurous acid.—A slow current of carbon dioxide is passed through 100 c.c. of the wine acidified with 2 c.c. of syrupy phosphoric acid, and then through a reflux condenser (to retain all volatile products except carbon dioxide and sulphur dioxide) to two absorption vessels in series. The first of these vessels contains 40 c.c. of a solution of 3·968 grms. of iodine per litre, and the second contains 5 c.c. of an equivalent solution of sodium thiosulphate. When all the air has been expelled from the apparatus, the wine is heated and kept gently boiling for half an hour, the current of carbon dioxide being continued. The solutions in the two absorption vessels are then united and titrated with thiosulphate of the same strength as that previously used. If n c.c. of thiosulphate are required, the sulphur dioxide-content of the wine $= 10[40-(n+5)]$ mgrms. per litre. *Combined sulphurous acid.*—100 c.c. of the wine are treated with n c.c. (see above) of the iodine solution and then with n c.c. of an equivalent solution of sodium arsenite. Then if the whole of the sulphurous acid is in the free state, the iodine added just suffices to oxidise it, and if none of the sulphurous acid is free, the arsenite just suffices to reduce the iodine. The wine is then further treated as in the previous case.
—L. E.

Alcohol from wood waste ; Manufacture of ethyl——. Preliminary experiments on the hydrolysis of white spruce. F. W. Kressmann. J. Ind. Eng. Chem., 1914, **6**, 625—630.

The experiments were made in a rotary digester consisting of a thin cast-iron inner shell (5 ft. long by 2½ ft. diam.), lined with acid-proof enamel, and an outer shell of steel. Steam was introduced simultaneously into the inner shell and the jacket, and the digester was connected with an enamel-lined cast-iron tank so that sulphuric acid could be introduced from the latter whilst the digester was under pressure. The vapours blown off at the end of a digestion were condensed in a quartz coil. The digester was charged with sawdust equivalent to about 100 lb. of dry substance and with 2 lb. of 90—95% sulphuric acid diluted so that at the end of the digestion the amount of water was at least four times the dry weight of sawdust. The results are given in curve-diagrams and tables. The maximum yield of sugar was obtained at a pressure of 7·5 atmospheres. Increasing the time of digestion did not increase the yield but so affected the mechanical condition of the residue as greatly to increase the difficulty and cost of handling it ; with sawdust it was most advantageous to blow off as rapidly as possible from a pressure of 7·5 atmospheres as soon as that pressure was attained. From 22 to 23% of the dry weight of white spruce sawdust was converted into sugar and about 70% of the sugar was fermentable, giving a yield of alcohol equal to more than 91% of the theoretical quantity. The yield of acetic acid was about 1·4% and that of formic acid varied from 0·1 to 0·6% according to the experimental conditions.—A. S.

Denatured alcohol in the United States. Oil, Paint, and Drug. Rep., July 27, 1914. [T.R.]

The Committee on Ways and Means of the United States House of Representatives has reported favourably on a Bill introduced by Representative Palmer, the object of which is, briefly, to permit the manufacture of denatured alcohol by mixing domestic and wood alcohol while in process of distillation. The Bill has been drafted to permit the utilisation of a new process in respect to which application had been made to the Commissioner of Internal Revenue, it having been discovered that existing legislation did not cover such a process. The process in question consists in passing the vapours obtained in the distillation of wood, or similar vapours containing denaturing substances, into the usual apparatus of an ethyl alcohol distillery, so that the ethyl alcohol is mixed with the denaturant before distillation. The product is called "distol," and is claimed to be very cheap and suitable for industrial purposes in that it differs in no essential respects from what is generally known as denatured alcohol.

Distillation ; Theory of fractional —— of mixtures of water and alcohol. E. Chenard. Bull. Soc. Chim., 1914, **15**, 646—649.

A theoretical study of fractional condensation. The frequent removal of liquid during the condensation of aqueous-alcoholic vapours permits of the most effective separation of the constituents, and for this reason the best condensers are those with a large number of successive compartments each retaining only a small quantity of liquid. (Cp. Hirsch, this J., 1910, 1266.)—J. H. L.

Spirits ; Procedure to be observed in connection with the use in manufactures of —— on which duty has not been paid (Sec. 8 of the Finance Act, 1902). Memorandum prepared by the Board of Customs and Excise

1. Any person desiring to use spirits without payment of duty in any manufacture carried on by him must make application in writing to the Commissioners of Customs and Excise for authority to receive and use such spirits, and must prove to the satisfaction of the Commissioners that the use of methylated spirits would be unsuitable or detrimental.

2. The applicant must give full particulars of the situation of the premises upon which and the purpose for which

he spirits are to be used, together with a description of the rocess of manufacture. He must also state the means y which it is proposed to make the spirits unpotable before nd during use, and the quantity likely to be required in the ourse of a year.

3. Any person authorised to receive spirits on which uty has not been paid must, if so required by the Comissioners of Customs and Excise, provide upon his preises a warehouse, structurally secure to their satisfaction, nd all such spirits received must be deposited and retained herein until delivered on proper notice to, and in the resence of, the Officer. He must also, if so required, rovide a room approved by the Commissioners in which ust be fixed a vat or other vessel of sufficient size to dmit of at least one hundred bulk gallons of spirits being ndered unpotable at one time, and must also provide tisfactory accommodation for the Officer of Customs nd Excise in attendance at his premises. No charge is sually made for the services of this Officer.

4. Security to the satisfaction of the Commissioners of ustoms and Excise must be given for the due removal, fe custody, and proper use of the spirits, and the due servance of all regulations and conditions made by the ommissioners.

5. The substance or material to be used for the purpose rendering spirits unpotable, and the mode in which the irits are to be rendered unpotable must be approved by e Commissioners of Customs and Excise, and the person thorised to receive spirits upon which duty has not been id must, if so required by the Commissioners, provide a ore to be approved by them, and used solely for storing d keeping the substance or material so approved.

6. Spirits which have been rendered unpotable under ese regulations shall not thereafter be purified in any anner or be recovered by distillation or any other means, cept with the express sanction of the Commissioners of stoms and Excise.

port of National Physical Laboratory. [Sikes' hydrometers.] See XXIII.

vernment Laboratory. Report of Principal Chemist for year ended March 31, 1914. *See* XXIII.

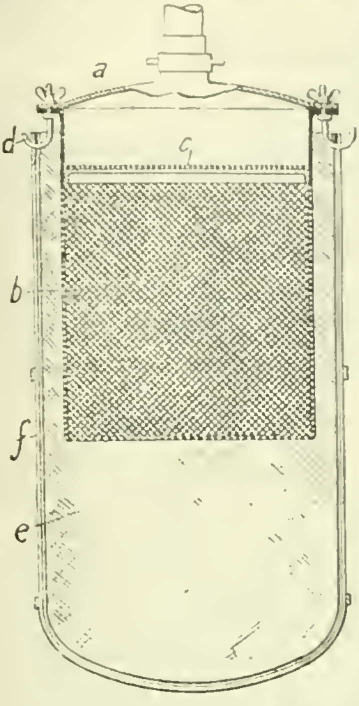
PATENTS.

negar; Process for the manufacture of —— by the application on a commercial scale of a new mycoderm. H. Boulard, Paris. Eng. Pat. 25,289, Nov. 5, 1913. Under Int. Conv., June 27, 1913.

PURE culture of *Mycoderma aceti Asiaticus Boulard* . 2, a mycoderma occurring abundantly in the Far East, grown in a flask containing an alcoholic liquid of high tract-content, *e.g.*, fermented malt wort, containing a grms. of reducing sugars per litre, and the vinegar thus tained is run, at 35° C., for 48 hours, in thin layers over faces consisting of half-round sticks of green bamboo, ich are soon covered with a thin layer of the mycoderma. etification may also be effected in casks, in which case litres of the liquid may be added to 100 litres of the egar, still containing the mycoderma, in a 225—250- e cask. The cask, which is placed on its side, should e a round opening of about 8 cm. diam. in the upper rt of one end and another opening in the side. The led wort is thus acetified in 12—14 days. Acetification not arrested by immersion of the mother of vinegar nor shaking the cask, as occurs with other processes.—L. E.

wing: Filter particularly adapted for use in ——. J. Bearman, London. Eng. Pat. 22,698, Oct. 8, 1913.

E filter (see fig.) is intended particularly for filtering the rt as it passes from the hop-back to the cooler. It nprises an inner vessel divided into two compartments a perforated partition, c; the lower compartment, *b*, perforated walls and contains spent hops or other ring material. Around the inner vessel and spaced apart therefrom is a filter-bag, *e*, supported in an open metal frame, *f*, suspended on hooks and secured to the cover, *a*. The filter is connected with the delivery pipe of the hop-back by means of the junction passage in the cover, *a*.—A. S.



Brewing apparatus. C. B. Davis, New York. U.S. Pat. 1,102,647, July 7, 1914; date of appl., Aug. 12, 1912.

THE apparatus comprises a sieve and a controlling member, and means for bringing them together to close the perforations of the sieve, or for spacing them apart.—L. E.

Still. B. S. Lindsay, Baltimore, Md. U.S. Pat. 1,100,834, June 23, 1914; date of appl., Sept. 25, 1908.

THE beer (wash) is passed through a heater and vaporiser and the spent "slop" from the latter passes to a dryer (evaporator). The steam given off in the evaporator is used to heat the vaporiser and the heater.—W. H. C.

Distilling apparatus. C. T. Hanna, Philadelphia, Pa. U.S. Pat. 1,102,910, July 7, 1914; date of appl., April 12, 1912.

THE spirit vapour passes upwards through a cylindrical conduit divided by partitions into chambers and containing inner perforated cylinders open below and closed above, a cup which is formed on the top of one cell forming a seal for the open bottom of the cell above. The perforated cylinders are provided with flanges which act as baffles compelling the vapours to pass inwards and outwards through the perforations. The heavier portions condense and are drawn off through drain pipes, whilst the lighter vapours pass on to a horizontal water-cooled separator of a similar type and the spirit vapours pass from this to a final condenser.—W. H. C.

Yeast; Manufacture of ——. T. Ruf. First Addition, dated Dec. 10, 1913, to Fr. Pat. 440,841, March 2, 1912 (this J., 1912, 834).

A MIXTURE of 125 parts of raw sugar and 150 of meal (consisting of equal parts of rye and potato meal) is treated with boiling water to dissolve the sugar and gelatinise the starch. The product is mixed at 30° C. with 1000 parts of yeast of any origin, which has been treated with a small quantity of amyl acetate or "pineapple ether."—L. E.

Marcs, wine lees, tartars, gritty matter, still crystals, etc., and any tartrate materials ; Processes and apparatus for treating ——, and the recovery, at the ordinary temperature, of the whole of the tartrates as cream of tartar of high purity. G. Arrivant and R. Teyssier. Fr. Pat. 467,413, March 28, 1913.

The material, contained in a number of vessels arranged like a diffusion battery, is treated with hydrochloric acid and then with water. The solution of tartaric acid and potassium chloride thus obtained is decolorised, *e.g.*, with ozone, and filtered ; it is then treated with calcium tartrate whereby potassium bitartrate of 98—99% purity is precipitated. The tartaric acid remaining in solution may be recovered as calcium tartrate by addition of calcium carbonate.—L. E.

Malt extracts ; Process of removing the bitter taste from ——. R. Weyermann, Bamberg, Germany. U.S. Pat. 1,105,119, July 28, 1914. Date of appl., March 4, 1914.

See Eng. Pat. 5025 of 1914 ; this J., 1914, 659.—T. F. B.

XIXA.—FOODS.

Foods for infants ; Analysis and composition of some proprietary ——. J. L. Baker. Reports to the Local Gov. Board, 1914, Food Report No. 20, 1—83.

One hundred and six samples of different brands of proprietary infants' foods were obtained from various parts of the country and submitted to examination ; certain of these samples were analysed fully. The suitability of foods containing starch is discussed and a synopsis is given of the recorded evidence regarding the effect of such foods on infants. Misleading statements in the labels or advertisements of the foods are noted, and suggested methods for exercising control over the foods are given together with the regulations obtaining in other countries. Results of the analyses of 29 of the foods are given in detail. Four of the samples contained dried milk and all contained sucrose ; usually the quantity of the latter was small, but in at least 8 cases the sugar must have been added, as the amount varied from 9·2 to 16%. The fat-content was small in almost all the foods, not exceeding that naturally present in the flour used ; the highest quantity of fat found was 16%. All the samples, except two, contained appreciable quantities of unaltered starch ; the majority contained over 60%, the highest amount found being 75%. Most of the foods were prepared from wheat flour, but oat, banana, and lentil starches were present in some of the samples. The proteins varied from 1·8 to 24·2%, and the mineral matters from 0·5 to 3·8%. Many of the foods contained saccharifying diastase whilst liquefying diastase was present in about one-half of the samples.—W. P. S.

Milk ; Capillary analysis of ——. F. Goppelsroeder. Sealed note 706, dated Oct. 26, 1892. Bull. Soc. Ind. Mulhouse, 1914, **84**, 281—284.

A proposal to use capillary analysis by means of strips of filter-paper or the like in the examination of milk. A bibliography of the authors' subsequent publications on the subject is given.—J. B.

Proteins of wheat and rye ; Physico-chemical properties of the ——. J. Gróh and G. Freidl. Biochem. Zeits., 1914, **66**, 154—164.

Examination by physico-chemical methods of proteins separated by fractionation from wheat and rye showed that gliadin is the only alcohol-soluble protein present in wheat gluten ; good and bad glutens yield the same substance. The protein extracted from rye flour consists of a mixture of substances which are exceedingly difficult to isolate ; rye flour does not contain a protein identical with the gliadin of wheat gluten.—W. P. S.

Tea ; Investigations of the manufacture of ——. S. Sawamura. Bull. Imp. Cent. Agric. Exper. Stat., Japan, 1914, **2**, 75—83.

Oxydases are much more sensitive to high temperatures than are other enzymes, such as diastase, and the usual operation of steaming tea leaves must be so regulated as to kill only the oxidising enzymes ; this may be effected by limiting the duration of the steaming to about 30 seconds. It is probable that the remaining enzymes play an important part in the first stage of rolling tea leaves and that the production of a fine aroma is due to their action. The chief effect of rolling tea leaves is the increase in the quantity of readily soluble constituents ; the rolling operation crushes the cells and the liberated juices dry on the surface of the leaves. Green tea is improved in quality by being fired at 70° C. for 1 hour ; black tea may be fired at 80° C. When the tea is not strongly heated, the amount of soluble constituents increases but slightly ; high temperatures cause a diminution in the quantity of total soluble matters.—W. P. S.

Preservatives ; Chemical ——. Cinnamic acid. H. Serger. Chem.-Zeit., 1914, **38**, 354—356.

The preservative action of cinnamic acid in foods, beverages, etc. is superior to that of benzoic acid. Better results are obtained with the free acid than with the sodium salt. Doses of 0·1 grm. taken three times daily for a period of 10 days had no ill effect on the human subject. (See this J., 1910, 367.)—F. Shdn.

Government Laboratory. Report of Principal Chemist for year ended March 31, 1914. See XXIII.

Hardened oils in competition with copra oil. Thompson. *See* XII.

Colour reaction of citric acid. Häussler. *See* XXIII.

Patents.

Grain ; Treatment of ——. E. Samuelson, Banbury, and J. Backhouse, Bootle. Eng. Pat. 17,214, July 28, 1913.

The whole grains are sprayed with a solution of an "improver" (*e.g.* a phosphate), then heated to not above 130° F. (54° C.), and ground.—W. P. S.

Cocoa, coffee, and tea residues ; Process of denaturing and defecating —— applicable to the extraction of the active principles. L. M. Rousseau. Fr. Pat. 466,888, Dec. 31, 1913.

The residues or waste products are treated with a solution of a ferrous salt ; subsequent addition of an alkali or alkaline-earth precipitates the iron together with tannin and colouring matters and the extraction of the active principles is facilitated.—W. P. S.

Malt flour for baking purposes ; Process of preparing ——. Hatt Freres. Fr. Pat. 467,158, Jan. 9, 1914. Under Int. Conv., Feb. 17, 1913.

Barley rich in proteins is allowed to germinate for 2 to 3 weeks at 10° to 15° C., then dried rapidly under reduced pressure at 45° to 50° C., and ground.—W. P. S.

Liquids containing fatty globules [milk and cream] ; Process and apparatus for the sterilisation of ——. N. J. Nielsen. Fr. Pat. 467,373, Jan. 16, 1914. Under Int. Conv., Jan. 16, 1913.

The milk or cream is passed successively through a series of heating and cooling tubes and, in order that the fatty globules may not be broken up by irregularities in the heating and cooling processes, the main pump supplying the liquid to the apparatus is supplemented by pumps o the heating and cooling tubes. The rate of flow of the liquid is controlled by regulating valves.—W. P. S.

Milk ; Process and apparatus for clarifying [removing di from] ——. Aktiebolaget Separator. Fr. Pat. 467,807 Jan. 28, 1914. Under Int. Conv., July 21, 1913.

A centrifugal apparatus is used, the milk being intro duced through a central opening, passing to a chambe at the circumference of the drum where the dirt is de posited, and then directed towards the centre and to th outlet.—W. P. S.

ood ; *Process for preserving —— or freeing it from germs.* Ges. f. Sterilisation G. m. b. H., and M. Riegel, Berlin. Eng. Pat. 17,400, July 29, 1913.

ee Fr. Pat. 460,912 of 1913 ; this J., 1914, 98.—T. F. B.

argarine and the like ; Method of manufacturing ——. E. V. Schou, Copenhagen. Eng. Pat. 17,616, July 31, 1913. Addition to Eng. Pat. 4278, Feb. 19, 1913.

ee Addition of July 30, 1913, to Fr. Pat. 454,640 of 1913 ; is J., 1914, 215. The emulsion is first cooled to about 7° C.—T. F. B.

alt-extract preparations ; Non-hygroscopic —— and process for making the same. F. Elger, Basle, Switzerland, Assignor to Hoffman-La Roche Chemical Works, New York. U.S. Pat. 1,100,176, June 16, 1914. Date of appl., Feb. 27, 1914.

ee Eng. Pat. 5001 of 1914 ; this J., 1914, 660.—T. F. B.

e of chlorophyll extracts as fuel. Fr. Pat. 466,985. *See* IIa.

XIXf.—WATER PURIFICATION ; SANITATION.

ter ; Removal of manganese from ——. J. Tillmans. J. Gasbeleucht., 1914, **57**, 713—724. (See also this J., 1914, 331).

eview of the methods used for the removal of manganese m drinking water, together with the results of an erimental investigation. The methods in use in ctice are filtration through manganese dioxide, or ough material containing it, and filtration through sand, h or without previous aeration ; in the latter methods may also be made of the biological activity of certain æ. Among the manganese-containing material cially suitable for filtration is a permutite containing % MnO_2 ; the latter removes the manganous hydroxide m the water, while the permutite itself accounts for acid radical ; after removal, the manganous hydroxide oxidised by the dissolved oxygen to the dioxide and acts as a fresh adsorbing surface. When complete eneration of the material is necessary, it can be brought out in the case of permutite by washing the filter with manganate, and in the case of ordinary manganese xide by washing with an alkali and blowing air through. he biological process, the manganese dioxide contained hin the algæ withdraws manganese by adsorption n the water and the vital processes of the organism lise it to the dioxide.—J. H. J.

ter ; Sterilisation of —— by filtration. K. Charitschkoff. Chem.-Zeit., 1914, **38**, 222.

eriments with filter paper impregnated with cobalt hthenate (see this J., 1910, 210) showed that all porous ies form hydrogen peroxide in presence of water. ilisation can be effected by passing water through ice, asbestos and other substances, and it is suggested oxidation takes place during the process.—J. H. J.

pipes for conveying water ; Use of ——. A. Rinck. Z. Untersuch. Nahr. Genussm., 1914, **28**, 99—103.

es of zinc were immersed in flasks of distilled water, water and water saturated with carbon dioxide, and quantities dissolved were determined colorimetrically r periods of 1 to 8 days. The amount of zinc dissolved eased, though not proportionately, with the time of act. After 1 day, 20 mgrms. per litre had been olved by distilled water, 12 mgrms. by tap water, 150 mgrms. by the carbonated water. After some ordinary water formed a deposit of basic carbonate the proportion dissolved was then much less. Tap r of medium hardness was sealed up in large zinc s with air excluded. After a year the amount of olved zinc was 2 to 3 mgrms. per litre. Physiological over a long period with water containing 7 to 8 mgrms. of zinc per litre gave no indications of injurious results. (See also this J., 1913, 957.)—C. A. M.

Potash trade-waste ; Influence of —— on the biological processes in river water. A. Muller and L. R. Fresenius. Arbeiten aus dem Kaiserlichen Gesundheitsamte, Berlin, 1913, **45**, pt. 4. Chem. Ind., 1914, **37**, 186—192.

A sewage percolating filter was used for the experiments, the changes taking place in the liquid passing through such a filter being similar to those taking place in the self-purification of rivers. To the sewage passed through the filter, known quantities of the waste lye were added, and the analysis of the effluent compared with that of the effluent from the filter without the addition of the lye. It was found that when the lye was added in quantity sufficient to raise the chlorine content of the mixture to 3 grms. per litre, there was no adverse influence upon the biological changes in the filter. A further increase of the chlorine to 6 grms. per litre diminished the nitrates in the effluent, while 20 grms. of chlorine prevented their formation altogether. No definite influence upon the oxygen absorption of the effluent could be detected. In partially purified sewage the addition of the lye delayed putrefaction, and on standing in contact, completely stopped it ; on diluting with clean water, putrefaction occurred as usual. The number of bacteria in the presence of 1·5 grm. of chlorine per litre was not influenced, but double the amount of chlorine caused a considerable reduction, and still higher amounts further reduction. The other forms of life present were not affected by 3 grms. of chlorine per litre, but 20 grms. prevented all life from developing. In cultivation experiments with pure cultures, the presence of chlorine up to 6 grms. per litre, slightly favoured nitrification, but over 7 grms. considerably reduced it. It is recognised that in a river water the addition of lye corresponding to 3 grms. of chlorine per litre does not interfere with its purification, but that double the amount does so. From these results it can be laid down as a guide for use in practice that the admission of lye to a river water so as to raise the amount of magnesium chloride to 3·5 grms. per litre is the danger point for all the lower forms of life in the river, but that from amounts even exceeding this, damage to fish is not to be expected. The interference of the waste lye with the self-purification of the river seems to exclude altogether the amounts entering in practice. —J. H. J.

Nickel cooking utensils. M. Vuk. Z. Untersuch. Nahr. Genussm., 1914, **28**, 103—104.

Discordant results obtained in experiments on the action of acids upon nickel cooking utensils are due to the nature of the nickel. Pieces of nickel of the same area were heated on the water-bath with 5% acetic acid for 2½ hours, and the quantities of metal dissolved per sq. m. were determined electrolytically, with the following results :—Wrought, 15·5 to 16·9 ; cast, 25·5 to 28·8 ; electrolytic, 30·6 to 30·8 ; drawn, 33·1 to 39·0, and Berndorf " pure " nickel, 61·4 to 65·4 mgrms.—C. A. M.

Ozone in ventilation. J. C. Olsen and W. H. Ulrich. J. Ind. Eng. Chem., 1914, **6**, 619—623.

A defence of the use of ozone in ventilation and a reply to papers by Jordan and Carlson and by Sawyer and others respectively (see J. Amer. Med. Assoc., Sept. 27, 1913). The view that ozone does not destroy odorous substances but merely masks their odour has been based on experiments in which the quantities of ozone used have been far too small, this being due mainly to the fact that the odour of ozone is at least 100 times more intense than that of other substances having a pronounced odour. Experiments are described showing that ozone oxidises hydrogen sulphide and oil of cloves. Moist bacteria are quickly destroyed by ozone even in low concentrations, and the works of Chapin, Doty, and Winslow and Robinson have shown that infection from air-borne bacteria occurs only when the latter are in a moist condition. No single instance of harm to a person from the proper use of ozone in ventilation has been published and all efforts to produce harm experimentally with low concentrations of ozone have failed.—A. S.

Physiological [*bactericidal*] *and physico-chemical action of neutral salts; Relation between the* ——. L. Berczeller. Biochem. Zeits., 1914, **66**, 173—190.

Experiments were made with Traube's stalagmometer (compare this J., 1911, 448; 1912, 839, 845) on the influence of salts on solutions of physiologically active substances. In unsaturated solutions of alcohol, phenol, thymol, menthol, camphor, quinol (hydroquinone), α-naphthol, sodium glycocholate, glycocholic acid, albumose, and casein, the surface tension was lowered to a greater extent in presence of dissolved salts than when these were absent. The physiological action of the substances mentioned is affected in a similar manner by salts, as is shown in the following table, in the case of the bactericidal action of phenol:—

Phenol solution.	Bactericidal action.	Lowering of surface tension.
Plus a neutral salt	greater (potassium salts less active than sodium salts, iodides less active than chlorides)	greater (potassium salts less active than sodium salts, iodides less active than chlorides)
Plus alcohol	lesser	lesser
Plus urea	no effect	no effect

The most satisfactory explanation of the results is one based on the assumption of the formation of hydrates of the salts, whereby a portion of the water is rendered inactive as a solvent. Sodium benzoate forms an apparent exception to the rule formulated above, for although it lowers the surface tension more than other salts, it is less effective in increasing the bactericidal action of phenol: this is probably due to the fact that sodium benzoate is itself strongly adsorbed and hence is capable of displacing adsorbed bactericides.—A. S.

Phenol; Action of —— *on the surface tension of albumin solutions.* L. Berczeller. Biochem. Zeits., 1914, **66**, 191—201.

The surface tension of serum and of solutions of different albumins, peptone, and ereptone is lowered to a greater extent than is that of distilled water by addition of phenol. *p*-Cresol and chloral hydrate produce a similar effect but not alcohol, propyl alcohol, triacetin and camphor. Since, according to Ehrlich and Bechhold (this J., 1906, 555) the bactericidal action of phenol is diminished by addition of serum, the rule that bactericidal activity and lowering of surface tension (see preceding abstract) vary in a similar manner appears not to hold in this case. If, however, from a solution of serum-albumin to which phenol has been added, the phenol be removed by passing the solution several times in a fine stream through benzene, the resulting solution has a considerably lower surface tension than before the addition of phenol, so that the lowering of the surface tension must be due not to the phenol, but to the serum-albumin or to a substance produced therefrom by the phenol. Moreover the lowering of the surface tension due to the phenol, *i.e.* the difference between the surface tensions of the solution of serum-albumin plus phenol and of the same solution after removal of the phenol, is somewhat smaller than that of aqueous phenol solution.—A. S.

Aluminium sulphate; Relation between —— *and colour in mechanical* [*water*] *purification.* F. E. Hale. J. Ind. Eng. Chem., 1914, **6**, 632—637.

As evidence in favour of the view that part of the organic colouring matter of natural waters is of an acid character, results are quoted showing that on precipitation with basic aluminium sulphate, the acidity produced was lower than that expected by an amount proportional to the colour removed. On blowing air through highly coloured water to remove carbonic acid, a residual acidity was left equivalent to the colour acidity; this residual acidity was not destroyed by boiling. When the colour acid was neutralised by sodium carbonate, a larger quantity of aluminium sulphate was required to effect decolorisation than before neutralisation. Commercial basic aluminium sulphate has an average composition corresponding to $2Al_2(SO_4)_3,Al_2(SO_4)_2(OH)_2$, and according to the alkalinity of the water, either a basic sulphate-carbonate, $2Al_2(CO_3)_2(OH)_2,Al_2(SO_4)_2(OH)_2$, or a basic aluminium carbonate is precipitated, the hydroxyl groups of which combine with the colour acid. The colour acid will also combine with other hydroxides, and good results have been obtained at Grand Rapids, Michigan, with excess of magnesium hydroxide. Regarding basic aluminium carbonate as the colour precipitant, the precipitate produced, at ordinary temperatures may be formulated as $Al_2(CO_3)_2R_2$, where R is the radical of the colour acid. At 100° F. (38° C.), a precipitate of $Al_2(CO_3)R_4$, is produced. double the quantity of colour being removed, and this is also the case if excess of basic aluminium sulphate over the quantity corresponding to the alkalinity of the water be used. At Springfield, Mass., U.S.A., for example, double the usual quantity of colour is removed per unit of precipitant by adding excess of aluminium sulphate, and after a definite period mixing with a further quantity of untreated water. At the boiling temperature, the colour is intensified by addition of aluminium sulphate, probably owing to the formation of a soluble compound, Al_2R_6, analogous to the known soluble iron compound.—A. S.

Pharmacological activity and lowering of surface tension. Berczeller. *See* XX.

Patents.

Water fed into steam generators; Apparatus for treating and removing amalgamated oil, grease and carbonates of lime and magnesia, sodium and the like held in suspension in —— *and for heating and softening and purifying such feed water.* J. Pomeroy, Southsea. Eng. Pat. 1103, Jan. 15, 1914.

The feed water flows down a series of inclined planes provided with cross baffles into a set of precipitating boxes. The apparatus is placed in the steam space of the steam generator and heated by the steam. The impurities collected in the bottom of the precipitating boxes are blown out of the boiler at intervals and the purified and heated water overflows into the water in the generator —W. H. C.

Garbage and sewage sludge; Method of treating ——. A. F Matlack, Philadelphia, Pa., Assignor to Sewage an Garbage Power Co. U.S. Pat. 1,102,532, July 7, 1914 date of appl., June 9, 1911.

The garbage or sludge is distilled at a temperature belo that at which the solid matters are charred, and t volatile products are collected and separated. The d residue is then treated in a gas-producer to convert it in a combustible gas and an ash which may be used as fertiliser.—W. P. S.

Elevating liquids [*e.g. sewage*]; *Process of and apparat for* ——. A. Priestman, New York. U.S. Pa 1,102,683 and 1,102,684, July 7, 1914; dates of ap April 27, 1912, and July 17, 1913.

The liquid (sewage) is fed into a settling well whence t liquid portion overflows into a second well. The liq is pumped out of the second well and the partially separat solids are elevated from the first well by an ejector work by compressed air and controlled by the height of level of the liquid in the second well.—W. H. C.

Disinfectant. Schülke und Mayr Akt.-Ges. and P. Flemmi Fr. Pat. 467,636, Jan. 22, 1914. Under Int. Co Jan. 24, May 6, and Oct. 16, 1913.

A mixture of chloro-xylenols and chloro-cresols or al compounds of the latter.—W. P. S.

Disinfectants. Schülke und Mayr Akt.-Ges., and Flemming, Hamburg, Germany. Eng. Pat. 25. Nov. 11, 1913.

See Fr. Pat. 467,636 of 1913: preceding.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

lorphine ; New test for —— *[and copper].* T. H. Olver. Chem. and Drug., 1914, **85,** 219.

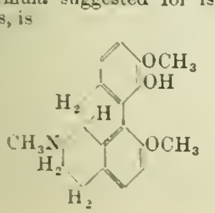
n adding a few c.c. of hydrogen peroxide and a small antity of strong ammonia solution to a solution of orphine or one of its salts, and stirring with a copper ire, gas is evolved and a deep port-wine coloration is oduced ; 0·00002 grm. of morphine can be detected by e test, but with very small quantities, a few drops of tassium cyanide must be added, after stirring, to destroy y blue colour due to copper. Monomethylamine may used in place of ammonia, but not dimethylamine nor ustic soda. Apomorphine gives an orange coloration der similar conditions, but codeine and dionine (ethylorphine), which are indistinguishable from morphine by dinary tests, do not give the reaction, nor do strychnine, ucine, atropine, narcotine, heroine, cocaine, nicotine, phaline, emetine, veratrine, physostigmine, pilocarpine, d coniine. Copper (0·00001 grm.) may also be detected the test.—A. S.

orphine and phenols ; Characterisation of —— by uranium alts. J. Aloy and C. Rabaut. Bull. Soc. Chim., 1914, **15,** 680—682.

LTS of uranium give a red coloration with morphine d with substances containing free phenolic (OH) groups. e reaction can be carried out by adding a crystal or few drops of a saturated solution of uranium nitrate acetate to the substance dissolved in water or in methyl ohol ; free acids must be absent. In cases where traces ly of morphine are suspected the liquid should be aporated to dryness. 0·05 mgrm. of morphine hydroloride can be detected.—R. G. P.

paver orientale ; Alkaloids of ——. W. Klee. Arch. Pharm., 1914, **252,** 211—273.

paver orientale contains two alkaloids, thebaine and a w crystalline alkaloid *isothebaine*, m. pt. 203°—204° C., $_D = -285·1°$ in alcohol. When the plant is in vigorous wth thebaine is the chief alkaloidal constituent, whilst er ripening and withering, the roots contain chiefly thebaine. Isothebaine is isomeric with thebaine and the formula $C_{17}H_{14}N(OCH_3)_2OH$, the nitrogen atom ng tertiary and attached to a methyl group. The stalline sulphate, hydrochloride and *l*-bitartrate were pared. When boiled with acetic anhydride isothebaine lded a diacetyl derivative with rupture of the nitrogen g, and with nascent diazomethane, a monomethyl ether formed. Methylation with dimethyl sulphate gave *hebainemethylethermethylsulphate*, crystallising from er-alcohol in needles, m. pt. 237°—238° C., $[\alpha]_D =$ 58·1°. This compound when boiled with caustic soda e two methine bases, *isothebainemethinemethylether*, orphous and optically inactive, and 9.10-*dihydroxy*-9-*ethylamino*-3.4.5-*trimethoxy*-8-*vinylphenanthrene*, m. pt. —105° C., $[\alpha]_D = -283·9°$. Both methine bases combd with dimethyl sulphate yielding *isothebainemethinehyletherdimethylsulphate* which crystallised in needles, pt. 195°—196° C., and was optically inactive. On ting with caustic soda in methyl alcohol this latter stance was decomposed into *trimethoxyvinylphenrene* and trimethylamine. Trimethoxyvinylphenanae on oxidation with potassium permanganate gave *trimethoxyphenanthrenecarboxylic acid* which when ted with glacial acetic acid gave the 3.4.5-trimethoxynanthrene previously obtained synthetically by horr and Koch (Annalen, 1912, **391,** 40). The conutional formula suggested for isothebaine, based on e reactions, is



Isothebaine gives a highly characteristic intense violet coloration with concentrated nitric acid. It can be separated from thebaine by heating the mixture with dilute hydrochloric acid, which converts thebaine into thebenine, insoluble in ether, but leaves isothebaine unaffected. It is considered that the alkaloids of *Papaver orientale*, unlike those of *Papaver somniferum* (Muller, Arch. Pharm., 1914, **252,** 280—293), do not serve as reserve stores of nitrogen to be subsequently used for albumin formation.—T. C.

Hydrastis alkaloids ; Determination of ——. J. Gsell. Chem.-Zeit., 1914, **38,** 511.

HYDRASTINE is precipitated from hydrastis extract with sodium hydroxide, and separated from the berberine (which remains in solution), by centrifugalising. Each alkaloid is then determined from the amount of methoxy-groups found by means of Benedikt's apparatus and method, viz., boiling the compound with hydriodic acid of sp. gr. 1·71. One grm. of hydrastine corresponds to 1·248 grm. AgI, and 1 grm. of berberine hydrochloride to 0·985 grm. AgI. The lactonic group in hydrastine is quantitatively separated, by boiling with $N/10$ sodium hydroxide solution under a pressure of 1 to 1½ atmos. One grm. of hydrastine = 26·4 c.c. $N/10$ alkali.—C. A. M.

Clematis vitalba ; Constituents of ——. F. Tutin and H. W. B. Clewer. Chem. Soc. Trans., 1914, **105,** 1845—1858.

THE flowering branches of *Clematis vitalba*, Linné ("traveller's joy" or "old man's beard") were dried, ground and extracted with hot alcohol. In addition to much chlorophyll and resin the extract yielded the following definite compounds : 3.4-dihydroxycinnamic acid, caulosapogenin, $C_{42}H_{66}O_6$, identical with the substance isolated by Power and Salway from *Caulophyllum thalictroides* (this J., 1913, 211), a *glucoside of caulosapogenin*, $C_{54}H_{86}O_{16}$, having the characters of a saponin, dextrose, myricyl and ceryl alcohols, hentriacontane, a mixture of sitosterol and stigmasterol, a phytosterolin consisting essentially of stigmasterol-glucoside, and a mixture of acids consisting of melissic, cerotic, palmitic and unsaturated acids including linolic acid and an acid, $C_{22}H_{44}O_2$, of m.pt. 69·5° C., isomeric with behenic acid. Some of the derivatives of caulosapogenin gave on analysis anomalous results. No alkaloid and only a trace of volatile substance could be detected. No confirmation of the alleged irritant properties of *Clematis vitalba* could be obtained.—T. C.

Anthemis nobilis [chamomile] ; Constituents of flowers of ——. F. B. Power and H. Browning, jun. Chem. Soc. Trans., 1914, **105,** 1829—1845.

21·09 kilos. of the ground flower-heads of *Anthemis nobilis*, Linné (chamomile) from plants grown in Belgium were extracted with hot alcohol, the alcoholic solution concentrated and the extract distilled in steam. 34·3 grms. of an essential oil were obtained but not further examined. The following compounds were isolated from the extract : 3.4-dihydroxycinnamic acid, apigenin $C_{15}H_{10}O_5$, a new *glucoside of apigenin*, $C_{21}H_{20}O_{10},H_2O$, m.pt. 178°—180° C., which gave a hexa-acetyl derivative, m.pt. 144°—146° C., choline, *i*-inositol, triacontane, taraxasterol, $C_{29}H_{47}\cdot OH$, m.pt. 217°—219° C., a phytosterolin consisting chiefly of sitosterol-*d*-glucoside, a mixture of fatty acids consisting of cerotic, stearic, palmitic, oleic and linolic acids, together with a considerable amount of a sugar yielding *d*-phenylglucosazone. The substances "anthemic acid" and "anthesterol" of previous investigators could not be confirmed. The bitter taste of chamomile flowers is due to dark-coloured amorphous material and not to any well-defined constituent.—T. C.

Podophyllum resin ; Method for the determination of ——. W. M. Jenkins. J. Ind. Eng. Chem., 1914, **6,** 671—672.

IN previous methods for the determination of Podophyllum resin (compare Dunstan and Henry ; this J., 1898, 268), it has been assumed that the resin is insoluble in water. The resin is, however, slightly soluble in water, and the solubility is increased even by small percentages of alcohol. A method is described based on the ready solubility of the resin in a mixture of 1 part of alcohol and 2 parts of chloroform. 5 c.c. of the fluid extract of Podophyllum are shaken with 5 c.c. of alcohol, 10 c.c. of chloroform, and 10 c.c. of acidulated water (0 6% HCl). The lower layer is drawn off and the aqueous solution extracted twice with 15 c.c. of alcohol-chloroform each time. The united extracts are washed with 10 c.c. of acidulated water, and the aqueous layer again shaken twice with 15 c.c. of alcohol-chloroform. The combined extracts are evaporated and the residue dried at 100° C. The drug is extracted with alcohol by hot maceration and 10 c.c. of the extract (=2 grms. of drug) are treated as described above, except that the addition of 5 c.c. of alcohol is omitted. A standard of 5% of resin for the fluid extract is suggested.—A. S

Pharmacolojical activity and lowering of surface tension. L. Berczeller. Biochem. Zeits., 1914, **66**, 202—206.

The results of the author's experiments confirm the view expressed by Traube (this J., 1912, 839) that there is a relation between the pharmacological activity of medicinal substances and their action in lowering the surface tension of water. Experiments were made with phenol, the di- and tri-hydroxybenzenes, aromatic hydrocarbons, vanillin, the cresols, the naphthols, thymol, menthol, camphor, *p*- and *o*-nitrophenol, *p*-, *m*-, and *o*-nitrotoluene, *m*- and *o*-toluidine, *p*- and *o*-nitrobenzaldehyde, chloralose and *p*-chloralose, phenanthrene and anthracene. Certain exceptions were observed: *e.g.*, quinol (hydroquinone) is more poisonous than resorcinol, but the latter causes the greater lowering of surface tension, and *o*-cresol is a better antiseptic than *m*-cresol although it has less effect on the surface tension.—A. S.

Essential oils free from terpenes and sesquiterpenes used in perfumery. H. Mann. Amer. Perfumer, 1914, **9**, 135—136.

The odorific intensity of terpeneless essential oils compared with the ordinary oils as unity was as follows:—Angelica root, 20; anise, 1½; star anise, 1½; bay leaves, 2½; bergamot, 2½; birchbuds, 2—3; birch tar, 10—12; cananga, 10—12; cassia, 1½; cedar wood, 8, chamomile, 1½—2; cinnamon, 1½; cinnamon leaves, 1½; citronella, 2—2½; celery, 3; cumin, 2—3; cypress, 30; eucalyptus, 1½; fennel, 2½—3; geranium, 1½; guaiacum wood, 1½; hops, 8—9; kuro-moji, 3—4; lavender, 1½—2; lemon, 30; lemongrass, 1½; lime (distilled), 12—15; lime (expressed), 8—10; linaloe, 1½; mandarin, 60; myrrh, 2½; myrtle, 3—4; neroli, 2½; nutmeg, 6—8; opopanax, 4—6; orange (sweet), 60; (bitter), 60; origanum, 1½; patchouli, 4—5; peppermint, 1½; petitgrain, 1½; pimento, 1½; pine (leaves) 3—4; cones (*A. pectinata*), 60; leaves (*A. pectinata*), 60; rose, 1½; rosemary, 2; sandalwood, 1¾—4; thyme, 4—5; vetiver, 1½; and ylang-ylang, 2—2½. Terpeneless lemon oils are used in the preparation of cheap eau-de-cologne since their alcoholic solution can be diluted with more water than in the case of the ordinary oil without becoming turbid.—C. A. M.

Cedar wood; The oil of Port Orford —— and some observations on d-a-pinene. A. W. Schorger. J. Ind. Eng. Chem., 1914, **6**, 631—632.

The Port Orford cedar [*Chamaecyparis lawsoniana* (Murr.), *Parlatore*] is found along the Pacific Coast from Coos Bay, Oregon, to Mad River, California. The oil obtained from the wood has a strong pleasant odour and a pronounced physiological action on the kidneys. Selected "resinous" pieces of wood yielded, by steam distillation, 10% of oil of sp. gr. 0·891 at 15° C., $n_D^{15}=1{\cdot}477$; the oil left a blood-red distillation residue. The oil examined by the author had been kept for four years in a tightly-stoppered bottle. It was rectified by shaking with 10% sodium carbonate solution and distilling with steam over soda solution: the rectified oil left no blood-red residue on distillation and did not produce the characteristic physiological action of the freshly-distilled oil. The rectified oil had the sp. gr. 0·8905 at 15° C., $n_D^{15}=1{\cdot}4758$, $a_D^{25}=+39{\cdot}60°$, acid value 0·30, ester value 32·8, ester value after acetylation 71·57, and gave the following fractions on distillation: 155°—157° C., 60·5; 157°—170°, 3; 170°—180°, 4; 100°—130° at 15 mm., 20·5; 130°—160° at 15 mm., 7; and 160°—190° C. at 15 mm., 1%. It contained approximately 60—61% of *d-a*-pinene, 6—7% of dipentene, 11% of free *l*-borneol, 11·5% of esters (calculated as bornyl acetate), and 6—7% of cadinene. The combined borneol was present mainly as bornyl acetate, but to some extent also as formate and caprinate. In the old oil free formic, acetic, and caprinic acids were present. By fractionation over sodium the fraction distilling at 155°—157° C. yielded 65% of its quantity of pure *d-a*-pinene of b.pt. 156°—156·1° C. at 760 mm., sp. gr. 0·8631 at 15° C., $n_D^{15}=1{\cdot}4684$; $[a]_D = +51{\cdot}52$.—A. S.

Cus-Cus [vetivert] oil of India. P. Singh. Chem. and Drug., 1914, **85**, 225—256.

Seven samples of roots of vetivert (Cus-Cus or Khas-Khas grass, *Andropogon muricatus*, Retz) from different localities in India were examined as to yield of oil, 25 grms. being distilled with steam for about 3 days, and the oil extracted from the distillate with chloroform. The yield of oil was from 0·45 to 1·14%, varying according to the season in which the roots were collected. To obtain a good yield of oil (0·7—1%) the roots should be collected from towards the end of the winter till the commencement of the rainy season. A sample of the oil was purified by re-distillation with steam, leaving as residue a resinous mass from which, by extraction with alcohol, there was isolated a dark red resin (9·4 grms. from 75 grms. of oil) of m.pt. 70° C., sp. gr. 1·132 at 30° C., acid value 46·9, saponif. value 111·2, iodine value (Hübl, 18 hours) 268·2, optical rotation (calculated to 10 c.c. of solid resin from observation with a dilute solution), +488. The yellowish brown redistilled oil was quite transparent and had the following characters: sp. gr. 1·011 at 15° C., optical rotation (100 mm. tube) —30·7, $n_D^{20}=1{\cdot}5165$, acid value 10·5, saponif. value 80·1, saponif. value after acetylation 132·8, iodine value (Hübl, 18 hours) 194·4, soluble in 2 parts of 80% alcohol.—A. S.

Esters; Determination of —— in essential oils. J. Niviere Bull. Soc. Chim. 1914, **15**, 677—680.

The author criticises Béhal's recommendation that ester should be saponified in closed vessels (this J., 1914, 765) Concordant results were obtained by saponification i an open flask fitted either with an air tube or a reflu condenser. Higher results were obtained with close flasks than with open flasks, *e.g.*, lavender oil gave saponification value of 114·2 in an open flask and 117 in closed flask; bergamot oil, open flask 104·1, closed flas 150·7. Pure linalyl acetate gave practically identica results either in open or closed flasks, viz., 242, but linal acetate containing 2% of œnanthol gave saponificatio values, open flask 239·8—239·9; closed flask 241·7—24 The differences therefore appear to be due in part to th presence of aldehydes and not to the loss of volatil esters.—R. G. P.

Salicylic acid [and acetylsalicylic acid and salol]; Man facture of ——. Chem. and Drug., 1914, **85**, 313—31

Salicylic acid. In Kolbe's process, the patent f which expired in 1887, crystallised phenol is dissolved the equivalent quantity of caustic soda, the soluti is evaporated in shallow iron vessels, with vigoro stirring, and the reddish-yellow, very hygroscopic sodiu phenoxide thus obtained is ground and heated to 100° in a metal retort; the mass is constantly stirred a subjected to the action of a rapid current of dry heat carbon dioxide. The temperature is raised gradual in the course of several hours to 180° C.; phenol dist over, at first in small quantity, later more abundantl The mass is heated finally to 200° C., and after 6—8 hou when no more phenol distils over, the greyish white resid is dissolved in water, resinous and coloured impurities a separated by fractional precipitation with hydrochlor or sulphuric acid, and the salicylic acid is then precipitated by addition of more mineral acid. (See also Thorpe Dictionary of Appl. Chem., 1913, Vol. IV., p. 619)., Potassium phenoxide is now usually employed instead of the sodium compound (compare Eng. Pat. 17,002 of 1893; this J., 1893, 1055), and a modified process is also used, in which carbon dioxide under pressure is used at 120°—145° C. (See Eng. Pats. 10,167 of 1884 and 7801 of 1886; this J., 1885, 551; 1886, 501). The acid is purified from cresotic acid by Williams' process (see G. G. Henderson, this J., 1890, 591), a hot aqueous solution being neutralised with calcium carbonate, and the calcium salicylate filtered off, recrystallised from hot water till colourless, decomposed with hydrochloric acid, and the precipitated acid washed with water and recrystallised from dilute alcohol. It is difficult to obtain a product of permanent pearl-white appearance, details of certain stages of the purification and of the final crystallisation being secret.

Acetylsalicylic acid (*aspirin*). No patent rights cover the manufacture of acetylsalicylic acid, two methods for which are as follows:—(1) A mixture of 50 parts of salicylic acid and 75 parts of acetic anhydride is heated for 2 hours at 150° C. under a reflux condenser. On cooling, acetyl salicylic acid crystallises; it is freed from acetic anhydride by pressing, and recrystallised from dry chloroform, yielding white needles, m. pt. 135° C., readily soluble in benzene, alcohol, glacial acetic acid and chloroform, soluble with difficulty in cold water. (2) A mixture of 25 parts of salicylic acid and 20 parts of acetyl chloride is heated for several hours at 80° C. under a reflux condenser, then the excess of acetyl chloride is distilled off, and the residue recrystallised from dry chloroform.

Salol (*phenyl salicylate*) is produced by treating salicylic acid and phenol with phosphorus pentachloride or oxychloride. The process of manufacture was patented in England in 1886 (see Eng. Pat. 8018 of 1886; this J., 887, 561; also Levinstein, this J., 1886, 577), and the patent rights (now expired) were transferred to German firms. (See also Eng. Pats. 10,260 of 1887, 14,224 of 1891, and 23,449 of 1892; this J., 1888, 587; 1891, 1026; 894, 274.)—A. S.

Acetanilide and phenacetin in admixture; Determination of ——. Studies in synthetic drug analysis. I. W. O. Emery. J. Ind. Eng. Chem., 1914, **6**, 665—669.

The method proposed depends on the fact that phenacetin in aqueous solution forms an insoluble periodide $C_2H_5O.C_6H_4.NH.C_2H_3O)_2.HI.I_4$, when treated with an acid solution of iodine in potassium iodide. 0·2 grm. of the sample is dissolved in 2 c.c. of hot glacial acetic acid in a small lipped Erlenmeyer flask, the solution is diluted with 40 c.c. of water previously warmed to 70° C., transferred to a stoppered 100 c.c. flask containing 25 c.c. of standard iodine solution (30 grms. of iodine and 40 grms. of potassium iodide per litre) warmed to 40° C., two 10 c.c. portions of warm water being used for rinsing. After mixing, 3 c.c. of concentrated hydrochloric acid are added: the insoluble periodide separates at first apparently in an emulsified condition, but after some time forms bronze-coloured leaflets. When the crystals have formed, the mixture is allowed to cool, diluted with water to 97—98 c.c., allowed to stand overnight, made up to 100 c.c., mixed, allowed to settle for ½ hour, and a portion of the solution filtered through a dry 5·5 cm. filter: the first 15 c.c. are collected separately, and then 50 c.c. are collected and the excess of iodine titrated with $N/10$ thiosulphate. Or, the periodide may be filtered off, decomposed by means of sodium sulphite, the phenacetin extracted with chloroform and weighed. In the filtrate from the phenacetin periodide, acetanilide may be determined by adding sodium sulphite to remove free iodine, extracting the acetanilide with chloroform, hydrolysing it with sulphuric acid, and titrating the resulting aniline sulphate with potassium bromide-bromate solution. In the case of complex mixtures containing caffeine or antipyrine or both, the sample is first digested with hot dilute sulphuric acid, the caffeine and antipyrine then removed by extraction with chloroform, and the sulphates of phenetidine and aniline present in the acid aqueous solution re-converted into phenacetin and acetanilide respectively by adding a slight excess of solid sodium bicarbonate and a few drops of acetic anhydride (Proc. A.O.A.C., U.S. Dept. Agric., Bureau of Chem., Bull. 162 (1912), 197).

The formation of the insoluble periodide may also be used as a test capable of detecting 0·5 mgrm. of phenacetin. —A. S.

Manufacture of antipyrine. Chem. and Drug., 1914, **85**, 273.

The following are the steps in the method of making antipyrine:—

1. *Formation of phenylhydrazine from benzene.*—Benzene is converted into nitrobenzene by the action of concentrated nitric acid, then reduced to aniline by nascent hydrogen formed by the action of hydrochloric acid on scrap iron. The aniline is diazotised with nitrous acid, and a paste of stannous chloride is added to the clear, mobile, brown diazo-solution which becomes creamy white and so stiff that it can only just be poured. A couple of hours' standing ensures complete reduction; neutralisation with caustic soda follows, and the phenylhydrazine formed is then distilled under reduced pressure.

2. *Preparation of aceto-acetic ethyl ester.*—This is accomplished by the action of metallic sodium upon ethyl acetate followed by treatment with acetic acid. The ethyl acetate is obtained by acting upon sodium acetate with a mixture of alcohol and sulphuric acid. Ethyl alcohol added in small portions to sulphuric acid produces ethyl sulphuric acid. This is poured upon dried fused and broken pieces of sodium acetate previously placed in a copper still. After standing twelve hours the contents of the still are raised to the boiling-point, in order to form ethyl acetate, which distils over. The collected distillate is then freed from water by redistilling over calcium chloride. In order to form aceto-acetic ethyl ester, the ethyl acetate with small pieces of metallic sodium drawn into wire are placed in a still having a reflux condenser and left until the sodium has disappeared, after which a moderate excess of 50% acetic acid is added and the contents agitated. On standing, the contents separate into two layers, the upper one of which is subjected to fractional distillation, and the portion which passes over between 175° and 185° C. collected.

3. *Condensation of phenylhydrazine and aceto-acetic ethyl ester to form phenyl-methyl pyrazolone.*—When the phenylhydrazine and the ester are mixed in the proportion of 1 to 1·3 the solution boils vigorously; globules of water separate and float through the mass of the liquid, which rapidly changes in colour from light yellowish-brown to reddish-brown. Upon warming this over a water-bath for a couple of hours the liquid darkens and thickens until it can only just be poured. During the heating alcohol is eliminated, a second condensation takes place, with formation of the pyrazolone ring. After removal of the alcohol and water, the dark, thick fluid is stirred, and poured while warm into a little over its own volume of ether. In a few minutes reddish particles begin to separate, and soon solidify into a dark-reddish crystalline magma insoluble in ether. This mass is allowed to stand until cold, when it is filtered and washed very thoroughly with ether until it forms a white crystalline powder.

4. *Methylation of the pyrazolone compound and the formation of antipyrine.*—This is accomplished by taking equal weights of freshly distilled methyl iodide, pyrazolone, and methyl alcohol, mixing them together in sealed glass pressure tubes, and heating to 100° C. in a bomb-furnace that allows of careful regulation. The temperature must not go much above 100° C., or there will be great danger of explosion from excessive internal pressure due to sudden liberation of vapours produced by decomposition. At the end of three hours the containers are allowed to cool. When the tubes from the furnace have thoroughly cooled, the contained hydriodide solution is removed into an open vessel. In order to avoid spattering, care must be taken in opening the tubes to allow the internal pressure to be relieved gradually. Water and sulphurous acid are next added, and the solution boiled until most of the methyl alcohol has been driven off. The sulphurous acid acts upon the hydriodic acid, forming free

iodine, sulphur, water, and basic 1-phenyl-2·3-dimethyl-5-pyrazolone (antipyrine). The chloroform solution is evaporated to a paste and just sufficient warm toluene added to dissolve it. Upon slowly cooling the antipyrine crystallises out. According to Riedel, the production of antipyrine upon a commercial scale involves but one operation for condensation and methylation. He states that phenylhydrazine 100 parts, aceto-acetic ethyl ester 125 parts, sodium methylsulphonate 150 parts, sodium iodide 150 parts, hydriodic acid 5 parts, and methyl alcohol 100 parts are heated to 160° to 180° C. in an autoclave under a pressure of twelve to fifteen atmospheres for ten hours. A still later report states that the sodium iodide is not necessary in this process, provided four to five times the above-quoted amount of hydriodic acid be used. The contents of the autoclave are taken up with a mixture of alcohol and ether, filtered, and washed, thus separating the antipyrine from the by-product—sodium sulphate. The alcohol and ether are distilled off, the residue dissolved in water and made alkaline, the solution extracted by chloroform, the chloroform distilled off, and boiling toluene added, from which, on cooling, the antipyrine crystallises.

The cost of the ingredients for antipyrine is given as, roughly, 3s. 6d. per lb., this being based on the production of 100 tons per annum.

Dimethylenediol peroxide (*Diformal peroxide hydrate*). H. J. H. Fenton. Roy. Soc. Proc., 1914, A, **90**, 492—498.

When a mixture of concentrated solutions of formaldehyde and hydrogen peroxide is further concentrated *in vacuo* over sulphuric acid a brilliant crystalline mass is obtained having the molecular formula, $H_2O_2.2H.CHO$. The compound is remarkably stable at low temperatures in the dark, and it dissolves unchanged in water and in acetic acid. It gives the normal molecular weight by the cryoscopic method, and this value remains constant in aqueous solution even after 48 hours at 0° C. When the crystals are heated to about 70° C. they explode, and they take fire spontaneously in contact with reduced iron or platinum black. They decompose slowly in bright sunlight. Treatment of the aqueous solution with platinum black causes rapid evolution of oxygen and a pure solution of formaldehyde remains. The general behaviour of the substance leads to the conclusion that it is not one containing hydrogen peroxide of crystallisation but rather an "atomic" compound in the ordinary sense of the term.—W. H. P.

Grignard reagent ; Oxidation of the ——. E. Ferrario. Chem.-Zeit., 1914, **38**, 794.

The oxidation with sodium or barium peroxide proceeds according to the schemes: (1) $R.MgBr+O=R.OMgBr$; (2) $(RMgBr)_2+O=R.R+O(MgBr)_2$. The relative amounts of hydrocarbon, R.R, and of alcohol or phenol, R.OH, produced depends on conditions. In the aromatic series with sodium peroxide the hydrocarbon predominates, whilst in the aliphatic series the reverse is the case. Better results were obtained by this method than by using atmospheric oxygen as oxidising agent according to the method of Boudroux.—G. F. M.

a-Bromonaphthalene : its physical properties and its application to the determination of water in moist alcohol. M. Jones and A. Lapworth. Chem. Soc. Trans., 1914, **105**, 1804—1809.

a-Bromonaphthalene is purified by fractional distillation of the commercial article in steam and crystallisation of the distillation residue from absolute alcohol at a low temperature; the product is freed from alcohol by a current of steam and from water by treatment first with calcium chloride and then with a stream of dry air or carbon dioxide at 100° C. The compound is dimorphous; the stable modification melts at 6·20° ± 0·02° C. and has sp. gr. at 20°/4° C., 1·4834; the other melts between 0° and 2° C. The refractive index is $n^{20}_{D}=1{\cdot}6582$. The pure compound may be used for determining water (up to 10%) in moist alcohol, known quantities of bromonaphthalene and alcohol being mixed, the solution slowly cooled until it becomes opaque, and the temperature noted with a sensitive thermometer; an opalescence which first appears is easily distinguished from the opacity at the critical point. A table is given showing the temperatures of clouding of various mixtures.—L. E.

Phenolphthalein ; New method for the determination of ——. A. Mirkin. Amer. J. Pharm., 1914, **86**, 307—308.

One grm. of phenolphthalein, 0·8 grm. of hydroxylamine hydrochloride, both finely powdered, and 0·52 grm. of 90% sodium hydroxide are dissolved in 35—40 c.c. of absolute alcohol, and boiled in a reflux apparatus for 2 to 3 hours, when the liquid should be yellow. The liquid is diluted with water, 10 c.c. of 10% sulphuric acid added and the whole made up to 250 c.c. 50 c.c. are made neutral to methyl orange and then the excess of hydroxylamine is titrated with *N*/10 potassium hydroxide using phenolphthalein as indicator. A control test is carried out using the above quantities and omitting the phenolphthalein. The difference in the number of c.c. of *N*/10 potassium hydroxide multiplied by 316 gives the quantity of phenolphthalein.—F. Shdn.

Mercuric benzoate. E. Rupp and A. Herrmann. Arch. Pharm., 1914, **252**, 3.

Normal mercury benzoate, official in the French Pharmacopœia, has been recommended as the most suitable salt for hypodermic injection. The method of the French Pharmacopœia for preparing it, by precipitation from sodium benzoate and a mercuric salt, is the best; it cannot be recrystallised from water, as one part is only soluble in 230 at boiling point, and it undergoes partial hydrolysis. When dissolved with the aid of sodium chloride, as in making the hypodermic injection, double decomposition occurs, the solution contains sodium benzoate and mercuric chloride, and the latter can be shaken out with ether; the solution usually recommended, mercuric benzoate, 1·0; sodium chloride, 0·75; water, 100, is identical with one prepared from mercuric chloride, 0·59; sodium benzoate (cryst.), 0·72; sodium chloride, 0·5; water, 100. The solubility of the salt on the addition of ammonium benzoate is due to the formation of a mercuri-ammonium complex. The effect of mercuric benzoate solution on albumin is exactly the same as that of a solution of mercuric chloride containing the same amount of sodium chloride; sufficient of the latter prevents precipitation of albumin in any case.

Colloid-chemical studies. [*Colloidal selenium for use in medicine.*] A. Gutbier. Chem.-Zeit., 1914, **38**, 295. (See also this J., 1911, 1318.)

By the use of hydrazine hydrate as reducing agent the author has produced colloidal preparations of arsenic, antimony, selenium, mercury, silver, platinum, palladium, gold, etc., of high concentration and great stability, and readily soluble in water. Colloidal selenium is now prepared on a commercial scale for use in medicine. It does not give rise to the unpleasant secondary effects produced by other selenium preparations.—A. S.

Lanthanum from a physiological-chemical standpoint. T. Bokorny. Chem.-Zeit., 1914, **38**, 153—154.

Experiments on algæ and yeast showed that lanthanum, although so closely resembling calcium in chemical attributes, is in no way similar in physiological action. Not only was it impossible to replace calcium nitrate by lanthanum nitrate in culture solutions, but lanthanum was found to be an active poison, especially towards plants containing chlorophyll.—F. Sodn.

Mercuric chloride ; Volumetric determination of —— Stüwe. *See* XXIII.

Cinnamic acid as chemical preservative. H. Serger. *See* XIXa

Citric acid ; Colour reaction of ——. Häussler. *Se* XXIII.

Synthetic caoutchouc. [*Preparation of isoprene from o of turpentine*] Andrejew. *See* XIV.

'elation between the physiological [bactericidal] and physico-chemical action of neutral salts. Berczeller. *See* XIXb.

odine in organic compounds; Determination of ——. Eckardt. *See* XXIII.

Patents.

Mineral] Oils [for medicinal purposes], Treatment of ——. L. C. Wallach, London. Eng. Pat. 15,551, July 5, 1913.

ineral oil, for example highly refined white mineral oil *paraffinum liquidum*, is exposed to, and allowed to sorb, the emanations from radio-active substances. ee also Eng. Pats. 14,885 of 1905, 11,988 of 1908, and 78 of 1911; this J., 1911, 1115).—A T. L.

nsaturated organic compounds; Manufacture of ——. F. E. Matthews, H. J. W. Bliss, and H. M. Elder, London. Eng. Pat. 16,828, July 22, 1913. Addition to Eng. Pat. 17,234, July 24, 1912 (see this J., 1913, 884).

he principal patent described the removal of the elements halogen acids from halogenated hydrocarbons by means water or steam. It is now found that this process is plicable to the removal of halogen acid from other logenated organic compounds. Such compounds are eated with steam at a temperature between 100° and 0° C., with or without the use of a catalyst. In some ses it is advantageous to subject the mixed heated pours to the action of the silent electric discharge or ultra-violet light. The following example is given:—ne hundred grms. of β-bromohydrocinnamic acid is spended in water and introduced gradually into a silica be heated to 600—650 C.; hydrobromic acid and rbon dioxide are split off and styrolene is formed, which isolated by steam distillation and fractionation. The changed bromohydrocinnamic acid is recovered and ain passed through the silica tube.—T. F. B.

ridine carboxylic acids and pyridine; Manufacture of ——. A. Heinemann, London. Eng. Pat. 17,003, July 24, 1913.

omologues of pyridine, the phenylpyridines, and inolines can readily be oxidised to pyridinecarboxylic ids by means of ozone, ozonised oxygen, or ozonised air, the ordinary temperature. The ozone can be passed to a vessel containing the pyridine derivative, or it can generated electrolytically at the anode of an electro-ic cell, in which the pyridine derivative is oxidised; in is case it is advisable to surround the cathodes by aphragms to prevent reduction of the carboxylic acids. hen it is desired to prepare pyridine, the carboxylic acid distilled, and, if necessary, the oxidation process is eated until the product consists of pure pyridine.—T. F B.

oculating substances from bacteria; Process for preparing efficacious ——. S. Sokal, London. From Kalle und Co. Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 22,288, Oct. 3, 1913.

e "opening up" of bacteria by means of dilute acids, th or without addition of lecithin, can be considerably celerated by adding a small quantity of common salt the acid solution. For example, 50 grms of paratyphoid cilli are finely ground and digested at about 60° C. th one litre of a solution containing 0·5% of lactic acid d 0·85% of common salt. After two to three weeks formation of flakes is sufficiently complete, and the ar liquid can be separated from the residue by filtration centrifuging. In this case the residue is used for rapeutic purposes. With other bacteria, *e.g.*, with htheria bacilli, the filtrate possesses a high immunising wer. The preparations obtained in this way are highly cient, and do not exhibit the unpleasant effects perienced with inoculations with "complete" bacteria. e residues obtained by this "opening up" process be separated by extraction with alcohol and then h ether, into three portions, *viz.*, a mixture of fatty ds and lipoids, neutral fat and wax, and the insoluble teria bodies (albuminous substances). These different stituents can be made into solutions of any desired concentration, and mixed in suitable proportions for inoculating purposes.—T. F. B.

Therapeutic compounds [aminophenylselenonic acid, etc.]; Manufacture of ——. H. S. Wellcome, London, and F. L. Pyman, Dartford. Eng. Pat. 2787, Feb. 3, 1914.

Phenylseleninic acid or its nitrate is converted by nitration with sulphuric acid and potassium nitrate into a nitrophenylseleninic acid, $NO_2.C_6H_4.SeO_2H$, of m. pt. 156°—157° C. This is converted by reduction with sodium bisulphite into nitrophenyldiselenide, $NO_2.C_6H_4.Se.Se.C_6H_4.NO_2$, of m. pt. 83 C.; reduction of the diselenide with sodium sulphide results in the production of the aminophenyldiselenide, which forms a crystalline hydrochloride, of m. pt. 291—292° C. Acetaminophenyldiselenide, m.pt. 185—186° C. is obtained by treating aminophenyldiselenide with acetic anhydride; when oxidised with nitric acid it is converted into acetaminophenylseleninic acid, m. pt. 209 C., whilst further oxidation of this with permanganate in alkaline solution results in the formation of salts of acetaminophenylselenonic acid. The free acid is converted into aminophenylselenonic acid, $NH_2.C_6H_4.SeO_3H$, m.pt. 229 C., by boiling with water. This acid can be combined with alkalis and forms crystalline salts. The acid and its salts are said to possess "valuable physiological properties."—T. F. B.

Quinoline-4-carboxylic acids arylated in the 2-position; Manufacture of ——. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 11,836, May 13, 1914. Under Int. Conv., Aug. 1, 1913. Addition to Eng. Pat. 15,684 of 1912, dated July 5, 1911 (see this J., 1912, 953).

Largely increased yields of the 2-arylquinoline-4-carboxylic acids are obtained by adding less than one mol. of pyroracemic acid to a boiling alcoholic solution of one mol. of benzylidene-aniline or other condensation product of an aromatic amine and an aromatic aldehyde. The best results are usually obtained when about three mols. of pyroracemic acid are used to four mols. of benzylidene-aniline. The solution of pyroracemic acid is preferably added cold (*e.g.*, at 0° to 5° C.), and it is not necessary to use the pure acid. Further, the process can be carried out without decreasing the yield, if dilute alcohol be used as the solvent; in this case the 2-phenylquinoline-4-carboxylic acid, for example, crystallises quantitatively from the solution on cooling. The yields obtained correspond to about 180—185% of the pyroracemic acid used, when benzylidene-aniline is employed.—T. F. B.

Diethylacetylisocyanate. J. Callsen, Elberfeld, Germany. Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,098,938, June 2, 1914. Date of appl., Dec. 12, 1913.

Diethylacetyl isocyanate, $(C_2H_5)_2CH.CO.N:CO$, is obtained by treating diethylacetyl chloride or bromide with a silver or mercury salt of isocyanic acid. It is a limpid oil of b. pt. 67°—72° C. at 50 mm. pressure; it is soluble in petroleum spirit and benzene, and yields diethylacetylurea when treated with ammonia.—T. F. B.

Beta-acetylalkylene-tetra-alkyldiamines. G. Merling and O. Chrzescinski, Elberfeld, and H. Köhler, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,101,754, June 30, 1914. Date of appl., June 5, 1913.

The β-acetylalkylene-tetra-alkyldiamines,

$$CH_3.CO.CR(CH_2.NR'_2)_2,$$

when R represents hydrogen or alkyl and R′ alkyl, are colourless, odourless oils, soluble in water, which are valuable intermediate products for making erythrene or its homologues. They may be prepared by the two-fold introduction of the residue, $CH_2.NR'_2$, into the corresponding ketone, and can be separated from the monoamines by fractional distillation. $\beta\beta$-Acetylmethyltrimethylenetetraethylenediamine,

$$CH_3.CO.C(CH_3)[CH_2.N(C_2H_5)_2]_2,$$

is obtained by adding gradually 292 parts of a 50%

aqueous solution of diethylamine to 75 parts of aqueous 40% formaldehyde, adding 210 parts of methylethylketone, and boiling the mixture under a reflux condenser for several hours, until a test portion, after acidification with acetic acid, does not become turbid on adding a solution of aniline acetate. The solution is then dehydrated over potash, the excess of ketone removed by distillation *in vacuo*, and the remaining mixture of bases separated by fractionation *in vacuo*, the desired product having a b. pt. of 105°—110° C. at 7 to 8 mm. β-Acetyltrimethylenetetraethylenediamine, prepared in a similar manner, boils at 90°—110° C. at 7 to 8 mm.—T. F. B.

Organic iodine compounds; Preparation of ——. J. Sander. Ger. Pat. 275,441, March 1, 1913.

Saponin is heated with iodine in presence of water. Easily soluble compounds, suitable for therapeutic purposes, are obtained.—T. F. B.

Cyanhydrins of aldehydes and ketones; Preparation of derivatives of ——. A. Albert. Ger. Pat. 275,442. March 5, 1913. Addition to Ger. Pat. 259,502 (see this J., 1913, 673).

Cyanhydrins of aldehydes or ketones are converted into acyl derivatives and treated with hydrogen selenide in presence of an alcohol. The resulting compounds are esters of selenamidines: for example, the compound, $CH_3 \cdot CO \cdot O \cdot C(CH_3)_2 \cdot C(:NH)SeC_2H_5$, is obtained by treating the cyanhydrin of acetylacetone with hydrogen selenide and ethyl alcohol. (See also Ger. Pat. 273,053; this J., 1914, 667.)—T. F. B.

Organic mercury compounds; Process for preparing ——. E. Schossberger and G. Friedrich. Ger. Pat. 275,932. May 22, 1912.

Free terpenic keto-carboxylic acids or their esters react quantitatively with mercury salts, forming stable compounds which are soluble in alkalis and do not split off mercuric oxide on heating. The compound from camphorcarboxylic acid and mercuric acetate contains about 44% Hg. The products are suitable for use in medicine.—T. F. B.

Bismuth gallocarboxylate; Process for preparing basic ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 276,072, Aug. 1, 1913. Addition to Ger. Pat. 268,932.

A salt, identical with that obtained according to the principal patent (see this J., 1914, 277), is obtained by the action of a basic bismuth salt or bismuth hydroxide on gallocarboxylic acid in presence of alkali.—T. F. B.

Hydrogenation or reduction. A. Brochet, Paris. Eng. Pat. 16,936, July 23, 1913. Under Int. Conv., July 27, 1912.

See Fr. Pat. 458,033 of 1912; this J., 1913, 1031. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 2520 of 1907, 3752 of 1910, 25,326 of 1911, and 72 of 1912.—T. F. B.

Auric compounds from cantharidylethylenediamine and process of making same. G. Spiess, Frankfort, and A. Feldt, Oberursel, Germany. U.S. Pat. 1,104,149, July 21, 1914. Date of appl., July 28, 1913.

See Ger. Pat. 269,661 of 1912; this J., 1914, 375.—T. F. B.

Camphene and isobornyl acetate; Process of producing a mixture of —— from pinene hydrochloride. C. Ruder, Wandsbek, Germany. U.S. Pat. 1,105,378, July 28, 1914. Date of appl., Feb. 13, 1913.

See Fr. Pat. 453,992 of 1913; this J., 1913, 884.—T. F. B.

Amyl acetate and its homologues; Method of producing ——. F. Kaufler, Brückl, Austria-Hungary. U.S. Pat. 1,106,047, Aug. 4, 1914. Date of appl., Feb. 8, 1913.

See Eng. Pat. 2779 of 1913; this J., 1913, 767.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Colour photographs and process for their production. F. E. Ives, Woodcliffe-on-Hudson, N.J., U.S.A. Eng. Pat. 17,799, Aug. 2, 1913. Under Int. Conv., Aug. 5, 1912.

See Fr. Pat. 461,078 of 1913; this J., 1914, 44.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Accidents and injuries to life and limb in explosives works, etc., in Germany. Chem. Ind., 1914, **37**, [14] (Beilage). 29—31.

Three explosions in dynamite factories were attributed respectively to the dropping of a wooden stemmer, used in making dynamite cartridges, which contained absorbed nitroglycerin, to an unknown cause in the case of an after-separating plant, and to the dropping of a box of finished dynamite in an incorporating house. In the last case, a pipe 80 metres long was detonated up to a flange at the filter-house, from which it conveyed nitroglycerin; a ferro-concrete tunnel showed weakness due to the want of lateral tying of the round iron rods with which the concrete was reinforced. The removal of a stoneware wash-water pipe caused an explosion at a nitroglycerin factory. The premature explosion of a dynamite cartridge connected to the leads ready for firing, on the testing-ground of a dynamite factory, was caused by lightning. An experimental nitroglycerin powder fired in the press, because it had been locally over-heated during rolling or in the press, or was ignited by the residue of a previous batch. The accumulation of a static charge in a zinc-lined cupboard in which strands of nitrocellulose powder were hung to dry, produced a spark which fired the ether vapour from the powder. No cause could be assigned to a case of firing of a rolled-sheet of propellant when being placed in the press. Two accidents in black powder mills were caused respectively by the accumulation of powder dust in mill-gearing, which in future will be placed outside the house, and to the overloading of a granulating machine, with consequent slipping and heating of the belt, on which was powder dust. In consequence of an explosion in a detonator factory the transference of detonators to the sieve for the removal of sawdust will in future be effected mechanically from outside. An explosion in an ammunition factory was caused by the dropping of a packet of rim-fire cartridges on another packet Carelessness on the part of workmen who left a detonator lying about caused injury to the man who found it. A foreman was injured by treading on fulminate spilt by workman, who failed to warn him. An attempt to remov the contents of a cap with a pointed object, caused sligh injuries to a girl. Several explosions due, among othe causes, to carelessness, such as attempting to remov caked composition with a wire brush, occurred in th manufacture of toy caps (amorces), and the effect in on case was aggravated by the presence in the workroom o excessive quantities of the article. An explosion of re phosphorus and chlorate was due to ignorance of th sensitiveness of such mixtures, and the absence of prope moistening. Numerous minor injuries to the face b burning occurred at firework factories.—O E. M.

Government Laboratory. Report of Principal Chemi for year ended March 31st, 1914. See XXIII.

Patents.

[Nitro] derivatives of toluene; Manufacture of — A. E. Vergé, Vincennes, France. Eng. Pat. 17,12 July 25, 1913. Under Int. Conv., May 31, 1913.

The "liquid trinitrotoluenes," used in the manufacture gelatinous explosives, are of variable composition ar always contain certain amounts of mononitrotoluen which evaporate gradually from the mixture, causing t solid nitro compounds to crystallise, with the result th the explosives gradually harden. This invention relates to the production of mixtures of nitrotoluenes which are true liquids, *i.e.*, no solid separates on cooling until the whole mass of liquid freezes, and which contain no mononitrotoluenes. To obtain such products, it is necessary to use as raw material a mixture of mononitrotoluenes containing between 45 and 85% of the *m*-nitro compound. When mixtures beyond these limits are used, only solid or pasty products are obtained. Liquid mixtures of dinitrotoluenes may be obtained by nitrating uch mixtures of mononitrotoluenes with sulphuric acid-nitric acid mixtures in the usual way, or by mixing in uitable proportions the dinitro compound obtained from *m*-nitrotoluene with the dinitro-compounds from *o*- and *p*-nitrotoluenes. "Super-nitrated" liquids are obtained by dissolving suitable amounts of pure or commercial olid trinitrotoluene (m.pt. 82° C. or 70°—72° C.) in the iquid mixtures of dinitro compounds; by nitrating in he usual manner the liquid dinitro compounds and dissolvng certain quantities of these trinitro compounds in the iquid dinitro compounds; by nitrating a mixture of olid trinitrotoluene with *m*-nitrotoluene containing the ecessary proportions of the *o*- and *p*-nitrotoluenes; by nitrating the mixture of mononitrotoluenes in such a anner as to produce directly the desired amount of rinitrotoluenes. This last method is not recommended, as t requires a higher temperature, and always entails a oss of the product by oxidation. By these methods it is ossible to obtain a series of liquids containing up to 16% itrogen, which show no appreciable loss or change after eating to 60° C. for 24 hours.—T. F. B.

xplosives. A. E. Charbonneaux, San Francisco, U.S.A. Eng. Pat. 6608, March 16, 1914.

EE U.S. Pat. 1,093,767 of 1914; this J., 1914, 569.—T.F.B.

xplosive priming composition. A. Jaques, Redding, and G. Wells, St. Albans, Assignors to Nobel's Explosives Co., Ltd., Glasgow. U.S. Pat. 1,106,147, Aug. 4, 1914. Date of appl., Oct. 4, 1913.

EE Eng. Pat. 23,450 of 1912; this J., 1913, 674.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

opper; Iodate method for determination of ——. W. W. Brostrom. Eng. and Min. J., 1914, **98**, 215—216.

HE copper is reduced with sodium sulphite solution in he presence of hydrochloric acid, and precipitated with otassium thiocyanate. The precipitate is washed, decomosed with hydrochloric acid in the presence of a little arbon tetrachloride and the solution titrated with potasium iodate, until the red colour produced at first is disharged. An accurate determination of copper in ore can e made in 40 mins. Results obtained by different hemists and by three different methods are given, showing he accuracy of the iodate method.—A. T. L.

ead; Sensitiveness of some reagents for ——. E. Eegriwe. Z. anal. Chem., 1914, **53**, 420—426.

EUTRAL aqueous solutions of lead nitrate of successively ecreasing concentration were treated under standard nditions with the reagents, the best quantities of hich were determined. The results for 16 reagents are corded in a table. Potassium bichromate (1 grm. Pb in 100,000 c.c.) and sodium sulphide (1 grm. Pb in 2,840,000 hen the test liquid was compared with its own volume f water containing the reagent) showed the highest nsitiveness. Usually very small quantities of reagent ere best, but in the case of hydrochloric acid, potassium dide, and sulphuric acid the use of comparatively large uantities, by suppressing the ionisation of the lead salt rmed, increased the sensitiveness.—O. E. M.

eroxydase reaction; The sensitiveness of the —— A. Bach. Ber., 1914, **47**, 2122—2124.

HE peroxydase was obtained free from impurities by ubmitting the juice from horse-radish to ultrafiltration rough a collodion film. The solution was used directly after determining its content of solid matter by evaporation. Tested by oxidation of pyrogallol the new preparation gave 98 mgrms. of purpurogallin per mgrm. of enzyme against 36 mgrms. from a preparation by Bach and Tscherniack's method (basic lead acetate and dialysis; see this J., 1908, 823) and 2 mgrms. from a preparation by Bach and Chodat's original method (this J., 1903, 384). An improved method for testing the sensitiveness of peroxydases makes use of guaiacol and hydrogen peroxide. This reagent shows the extraordinary sensitiveness of peroxydase, a solution of 1 part of enzyme in 1,000,000,000, giving a brown-red coloration after 20 mins. and a solution of 1 : 2 billions giving a reaction after standing for 24 hours.—J. B.

Antimony; Detection of —— in qualitative inorganic analysis. J. Petersen. Z. anorg. Chem., 1914, **88**, 108.

The sulphide precipitate, containing possibly arsenic, antimony, and tin, obtained in the course of qualitative analysis, is treated with sodium peroxide, in the presence of a little water, the mixture heated to boiling, and any precipitated stannic acid filtered off. Antimony is indicated by a separation of sodium metantimoniate on cooling. Arsenic may be detected in the same solution by adding concentrated hydrochloric acid and then Bettendorff's reagent (stannous chloride in fuming hydrochloric acid).
—F. Sodn.

Mercuric chloride; Volumetric determination of ——. W. Stüwe. Chem.-Zeit., 1914, **38**, 320.

10 c.c. of 2% mercuric chloride solution are placed in a 100 c.c. measuring flask and 10 or 15 c.c. of 1% hydrazine sulphate solution added. A small amount of sodium bicarbonate is added and the flask warmed slightly and shaken for 15 mins. The liquid is made up to the mark after cooling and 50 c.c. filtered from the reduced mercury into a 300 c.c. stoppered bottle. After acidifying with acetic acid and the addition of some sodium acetate, excess of $N/10$ iodine is added and titrated back with $N/10$ thiosulphate after another 15 mins. standing. 1 c.c. of $N/10$ iodine corresponds to 0·013576 grm. of mercuric chloride.
—F. Sodn.

Iodine in organic compounds; Determination of ——. F. Eckardt. Pharm. Zeit., 1911, **44**, 441. Pharm. J., 1914, **93**, 223.

To determine the iodine in iodo-albumins, a weighed quantity of the substance is moistened in a platinum crucible with sodium hydroxide solution. The mixture is heated until dry and finally until completely charred. The carbonised residue is then extracted with water and sufficient tartaric acid added to give a weak acid reaction. The liquid, without filtering from particles of carbon, is treated with sulphuric acid and sodium nitrite and the iodine thus set free is extracted by shaking out with carbon bisulphide. It is then placed in a flask with water and titrated with sodium thiosulphate solution.

Citric acid; Colour reaction of ——. E. P. Häussler. Chem.-Zeit., 1914, **38**, 937.

The solution is evaporated to dryness after the addition of an alcoholic solution of vanillin, and the residue treated with 3 drops of dilute sulphuric acid, heated on a water-bath for 15 mins., dissolved in water, and ammonia added. A bright red coloration is obtained with 0·002 grm. of citric acid. This red coloration is not given, under similar conditions, by tartaric, malic, oxalic, malonic, benzoic, salicylic, acetic, lactic, succinic, and teresantalic acids, and the presence of these acids does not interfere with the reaction given by citric acid. To detect citric acid in raspberry syrup, 50 c.c. are neutralised, 50 c.c. of water and 75 c.c. of alcohol are added, and the organic acids, etc., precipitated with lead acetate. The lead precipitate is decomposed with hydrogen sulphide, the solution evaporated, the syrupy residue extracted with alcohol, and the alcoholic solution evaporated with the addition of calcium carbonate. The calcium salts are collected, washed with alcohol, and tested as described.
—W. P. S.

Government Laboratory; Report of the Principal Chemist of the —— on the work of the Laboratory for the year ended March 31, 1914. [Cd. 7562.]

The total number of samples examined in the two branches of the Government Laboratory during the year was 234,754, against 209,502 for the preceding year, and 157,613 samples were examined at the Chemical Stations in the provinces.

Beer, brewing materials, cider and perry. Ninety-one samples of beer were examined for saccharin, saponin, and other prohibited substances, but excepting in two samples which contained saponin, no deleterious or illegal substance was found. Of 511 samples of herb beer and other temperance beverages, 401 did not contain more than the legal limit of 2% of proof spirit, 74 contained 2—3%, 31 contained 3—5% and 5 contained 5—7%. Of 1596 samples of beer and brewing materials, only 7 contained arsenic in excess of the limits laid down by the Royal Commission on Arsenical Poisoning; none of the 306 samples of malt and sugar tested contained arsenic, and only one of the 1143 samples of wort and beer tested contained arsenic in excess of the limit, the amount in this case being one-thirty-sixth of a grain per gall.; of 147 miscellaneous samples, 6 contained excess of arsenic, the highest amount being one-eighth of a grain per gall.; the substances in which the arsenic exceeded the limit were not allowed to be used in brewing. Of 15 samples described as cider, 12 were found to contain no apple juice; of 286 samples of imported cider, one was factitious and was assessed for duty on the basis of the spirit which it contained, and another proved to be liable to duty as "wine."

Spirits. Of 40 samples of fusel oil from distilleries in this country, 2 contained more than the permitted proportion (15%) of proof spirit, and of 124 samples of imported fusel oil, none exceeded the 15% limit. Of 3884 samples of exported liniments, hair washes, and other spirituous preparations, 2 liniments were found to have been made from methylated spirit, but this was due to carelessness on the part of the exporters' employees and not to a deliberate illegal use of denatured spirit. Of 39,700 samples of imported spirits and spirituous preparations, one sample, described as "Molasses," was found to contain 29·1% of proof spirit, and 15, entered as wood naphtha or crude methyl alcohol, consisted of methyl alcohol so purified as to be liable to spirit duty. Of 961 samples of wood naphtha submitted for approval in the preparation of methylated spirit, 7 were rejected as unsuitable; all the samples of mineral naphtha—224 in number—for use in conjunction with wood naphtha for denaturing, were approved. The marked reduction, referred to in the last Report, in the quantity of petroleum ether used in admixture with methylated spirit in the manufacture of felt hats has continued, only 32 samples, representing 2901 galls., being submitted as against 57 samples representing 3245 galls., in the preceding year. For controlling the use of methylated spirit in connection with manufacturing operations where the use of stills is permitted, 57 samples of preparations made with methylated spirit, and 37 samples of industrial methylated spirit, "finish," and methyl alcohol, were received for examination. Forty-one samples of mineralised methylated spirit were analysed in connection with the unlicensed sale of this article, or with the illegal substitution of industrial methylated spirit for the mineralised variety.

Sugar, glucose, saccharin. The number of samples of sugar and articles containing sugar examined for assessment of duty or drawback was 42,644. Owing to the heavy duty on saccharin, the presence of this substance has to be searched for in all preparations likely to contain it; of 304 samples tested, mainly consisting of condiments, dentifrices, and medicinal preparations, 105 contained saccharin.

Matches. Of 1333 samples examined, none was found to contain white phosphorus.

Imported dairy products. The following numbers of samples were examined: Milk, 12; condensed milk (sweetened, unsweetened, and powder), 172; cream, 98; butter, 1258; margarine, 716; cheese, 72. All the samples of fresh and sterilised milk were free from preservatives, but one sample of sterilised milk was slightly deficient in non-fatty solids. Of the butters, 355 samples contained boron preservative and 148 contained added colouring matter. None of the samples of margarine contained more butter fat than is legally permissible (10%) but 22 contained water in excess of the legal limit of 16%. All the samples of margarine were free from paraffin wax, a substance occasionally present in cheap margarine.

Apples. Apples with a slight deposit on the skin near the stem and near the "eye" were found to contain a trace of copper equal to three-hundredths of a grain per lb., due probably to spraying with Bordeaux Mixture. The amount of copper found in the apples was not greater than has been found to occur naturally in wheat, potatoes and beans.

Lead glazes and leadless glazes. The samples of leadless glaze examined were generally found to comply with the Home Office requirement according to which the glaze must not contain more than 1% of lead monoxide. Numerous samples of glazes, avowedly containing lead, were examined for total lead-content, and for the amount soluble in hydrochloric acid of the concentration present in gastric juice. In 51 cases where lead poisoning had occurred, it was found that almost all the lead was soluble in the dilute acid. In one case, the glaze contained 70% of lead monoxide of which practically the whole was soluble.

Board of Trade. Experiments on the suitability, from a hygienic point of view, of galvanised iron vessels as milk measures, showed that fresh milk dissolved no zinc or only traces in 2 hours. When, however, milk was allowed to go sour in the vessel, appreciable quantities of zinc were dissolved. At the end of 24 hours, the milk contained zinc equal to about half a grain per pint. Traces of arsenic and antimony, present as impurities in the zinc coating of the vessel, were also found in the milk which had been kept for 24 hours in the vessel, the amount of arsenic in one case being one-hundredth of a grain per gall.

Sale of Food and Drugs Acts. Seventy-three samples were referred by magistrates under the provisions of these Acts, viz., milk, 52; whiskey, 4; jam, 3; butter, 2; pepper, 2; rum, 2; and margarine, almond oil, coffee, dripping, gin, lard, jelly and vinegar (1 sample of each). The results of the examination at the Government Laboratory differed from those of the public analyst in 8 cases out of 65.

Fertilisers and Feeding Stuffs Acts. Twenty-four samples, comprising 9 fertilisers and 15 feeding stuffs, were submitted by the Board of Agriculture and Fisheries in connection with applications for consent to take proceedings against the sellers. The nitrate of soda examined contained a considerable amount of perchlorate, and the other fertilisers were deficient in phosphates, nitrogen, or potash. Several of the feeding meals were deficient in oil or albuminoids.—L. E.

National Physical Laboratory. Report for the year 1913—1914.

In order to allow of changing the financial year of the Laboratory so that it will end on March 31st, the present report covers a period of 15 months, viz., from Jan. 31, 1913, to March 31, 1914.

Standard cells. The slow steady fall of electromotive force which occurs in many Weston normal cells is probably due to hydrolysis of mercurous sulphate, a solution of hydrolysed mercurous sulphate having a lower concentration of mercury ions than one in contact with non-hydrolysed salt. If the hydrolysed and non-hydrolysed salts are in contact with a solvent and with mercury, the latter acts as an electrolytic catalyser, accelerating a reaction which tends to diminish the concentration of mercury ions in the layer of liquid in contact with the mercury. Displacement of the contact layer by agitation or by convection currents due to rise of temperature, produces an increase of e.m.f., as the replacing liquid is richer in mercury ions. The hydrolysis of mercurous sulphate can be prevented by adding 1 part of sulphuric acid per 10,000 parts of water.

Resistivity of steel conductor rails. The usual practice o specifying the resistance of steel rails in terms of copper is deprecated; the results differ according to whether th comparison is made between copper and steel of the sam length and weight or of the same length and sectiona area. The resistance should be expressed in ohms or microhms, and the rail defined in terms of the weight in b. per yard as is customary in commerce. The resistance expressed in different ways), temperature coefficient, and composition of electrolytic iron (No. 1), a piece of ordinary running rail (No. 6), and four samples of conductor rails (Nos. 2, 3, 4 and 5) are given in the following able :—

Sample.	Microhms per 100 lb. yard.	Relative resistivity.		Temp. coeff. % for 1° C.	Percentage composition.								
		Mass.	Volume.		C.	Si.	S.	P.	Mn.	As.	Cu.	Ni.	Cr.
1	13·9	5·00	5·67	0·55	—	—	—	—	—	—	—	—	—
2	15·9	5·72	6·48	0·51	0·040	trace	0·044	0·035	0·165	0·03	0·025	0·017	trace
3	16·9	6·08	6·89	0·47	0·035	0·011	0·076	0·017	0·100	0·028	0·0048	0·330	trace
4	18·35	6·59	7·47	0·45	0·092	trace	0·097	0·072	0·362	0·065	0·046	0·094	trace
5	20·5	7·38	8·37	0·43	0·103	trace	0·060	0·027	0·365	0·012	0·048	0·081	trace
6	25·3	9·1	10·3	0·35	0·561	0·068	0·028	0·066	0·605	0·021	—	—	—

Thermometer glasses. Using thermometers specially made about 11 years ago and which had never been raised above room temperature, the thermometric behaviour of the four glasses, Jena 16^{III}, Jena 59^{III}, *Verre dur*, and Kew glass was studied. The values found for the emporary depression of the zero corresponding to 30°, 60°, 75°, 100°, and then at every 50° C. up to the temperature of anneal were smaller than almost all of the orresponding values published by other investigators. n regard to the secular rise of the zero over a long period of years, the rate of change was found to be very small, he greater part of the change occurring within a few months of the anneal. The *Verre dur* was found to contain rom 2 to over 6% Pb. One of the *Verre dur* thermometers was a standard certified by the Bureau International, nd it is pointed out that the International Scale of Temperature was originally interpreted on a scale employing *Verre dur* free from lead.

Sikes' hydrometers. Accurate comparison of metal ydrometers in alcohol solutions of specific gravity pproaching that of water is very difficult, as such solutions o not wet the stems properly, but concordant results an be obtained with instruments of the same size by dding a small quantity of a dilute solution of sodium arbonate, the density being brought to the original alue by addition of a little more alcohol. In comparing instruments of different sizes or a metal instrument with glass one, this method cannot be used owing to the isturbing effect of surface tension, and in such cases large number of readings must be taken under varying conditions, and the mean value calculated. The stems f metal instruments must be kept scrupulously clean. nd the hydrometers are therefore kept immersed in lcohol.

Mercurial barometers. The baromil scale has been dopted by the Meteorological Office. A "baromil" is efined as the height of a mercury column which, at 0° C. n latitude 45°, at sea level, produces a pressure of 1 millibar (1 kilodyne or 1000 dynes per sq. cm.). 1 baromil =0·0295306 inch=0·750076 mm. Barometric inch scales re graduated to be standard at 62° F. and millimetre nd baromil scales to be standard at 0° C., and the following conversion factors must be used to express the relations etween the actual lengths at any common temperature f inch scales standard at 62° F., and mm. or baromil cales standard at 0° C., all being graduated on International brass (coefficient of expansion=0·0000184 per C.): 1 in.=25·3922 mm.=33·8528 baromils ; 1 mm.= ·0393822 in.=1·33320 baromil ; 1 baromil=0·0295396 in. =0·750076 mm.

Radium. The British Radium Standard consisting of 1·1 mgrms. of radium chloride, purified and standardised y Prof. S. Meyer, of Vienna, and compared directly with he International Standard, at Paris, by Mme. Curie, as been in use since the middle of December last, and early £3000 worth of radium in the form of relatively ure preparations of radium and mesothorium, have een tested. The samples must be enclosed in a sealed tube for 5 or 6 weeks before testing. The γ-ray activity will then have reached a practical maximum and the intensity of the penetrating γ-rays which are emitted serves as a measure of the radium content. Three different methods are used :—(1) a combined gold-leaf electroscope and ionisation chamber ; (2) Rutherford and Chadwick's method, in which the ionisation produced by the sample is balanced against a steady source of ionisation (viz., a film of uranium oxide prepared by McCoy's method of deposition), and the distance from the ionisation chamber observed both for the standard and the sample being tested : for distances above 50 cm. the inverse-square law holds with considerable accuracy ; (3) an apparatus modelled on one designed by Mme. Curie, in which an aluminium plate, 60 cm. diam., is interposed between two thick lead plates of the same diameter, adjoining plates being separated by an air-gap of 2 mm. : the sample is placed on the centre of the upper plate, and the aluminium plate is insulated and connected with an electrometer ; the two outer plates are then put in metallic contact and charged to a high potential, and the γ-ray ionisation measured in the air-gaps between the plates. All results are expressed in terms of radium metal.

Balloon fabrics. Comparative tests in which samples were "weathered" for some months on the roof, showed the greater value of "metallising" as compared with coating with yellow pigments for protecting rubbered fabrics.—A. S.

Fractional distillation of petroleum. Sanders. *See* IIA.

Preparation and requirements of cellulose for making cellulose solutions. Piest. *See* V.

Determination of magnesia in magnesites. Wdowiszewski. *See* VII.

Determination of the iodine value of fats. Weiser and Donath. *See* XII.

Acid soils. Daikuhara. *See* XVI.

Comparative study of different methods of determining sucrose by double polarisation. Gillet. *See* XVII.

Volumetric determination of sulphurous acid in wines. Ferré. *See* XVIII.

Capillary analysis of milk. Goppelsroeder. *See* XIXA.

New test for morphine [and copper]. Oliver. *See* XX.

Characterisation of morphine and phenols by uranium salts. Aloy and Rabaut. *See* XX.

Determination of esters in essential oils. Nivière. *See* XX.

Determination of acetanilide and phenacetin in admixture. Emery. *See* XX.

o-Bromonaphthalene: its physical properties and its application to the determination of water in moist alcohol. Jones and Lapworth. *See* XX.

Determination of phenolphthalein. Mirkin. *See* XX.

Determination of podophyllum resin. Jenkins. *See* XX.

Patents.

Pyrometer; Optical ——. Siemens und Halske Akt.-Ges. Fr. Pat. 466,063, Dec. 11, 1913. Under Int. Conv., Aug. 4, 1913.

The pyrometer is of the kind in which an electric incandescence lamp of known candle-power is mounted within a telescope containing a photometric screen, and a test is made by securing an equal illumination of the screen by the incandescence lamp and by the source of light tested. The fittings on the telescope tube for the electric lamp and for its leads are arranged so that the telescope will normally be held in such a position that the lamp filament is vertical. In order to ensure constancy in the illuminating power of the lamp, a second lamp having a filament with a different temperature-coefficient is arranged in series with it and with a regulating resistance. This second lamp is arranged in a branch tube of the telescope so that different parts of the screen can be illuminated by the two lamps, and the resistance is adjusted until the illumination from both lamps is the same, which can only occur with one particular current. The second lamp is then withdrawn sufficiently for its light to be entirely cut off from the screen and the photometric test is made by moving a wedge of dark glass, or by adjusting a set of dark glasses between the tested source of light and the telescope.—A. T. L.

Calorimeter for gas and other fuels. C. Féry. Fr. Pat. 467,180, Jan. 10, 1914.

A rose-burner for gases, or a wick burner for liquid fuels, is arranged within a lamp-chimney into which air is drawn by the natural draught through a tube provided with a device sensitive to the velocity of the air current. This device indicates the calorific power on a scale, or records it on a drum, the instrument being calibrated by means of a gas of known calorific power. If the fuel is not burned at the standard rate, the rate of fuel consumption is also determined. The device sensitive to the velocity of the draught may be a wheel with inclined vanes suspended by a torsion thread, or a horizontal disc carried on one end of a balanced lever and displaced vertically by the current of air.—A. T. L.

XXIV.—MISCELLANEOUS ABSTRACTS.

Tobacco; Studies in the curing of leaf ——. W. W. Garner, C. W. Bacon, and C. L. Foubert. Bull. 79, U.S. Dept. Agric., April 13, 1914. 40 pp.

The investigation, mainly a comparison of curing on the stalk with curing of the picked leaf, refers to Connecticut cigar wrapper leaf. The curing of picked leaf is due chiefly to respiration, while curing on the stalk is accompanied by a considerable transference into the stalk of nitrogen compounds from the protein, mineral constituents, nitrate, and carbohydrates. The loss of dry material from the leaf is correspondingly about twice as great as the 12 to 15% loss from picked leaves. It is reduced when the stalks are split, as in the case of manufacturing types, the loss from which, and from cigar-filling types, reaches 40%, even with picked leaves. Thorough air curing, by the action of diastatic, proteolytic, and deamidising enzymes, and probably oxidases, causes a disappearance of starch and reducing sugar, a decrease of pentosans, malic acid, proteins, nicotine, and total nitrogen, and an increase in citric acid. The rate of curing is rapidly increased by rise of temperature up to the point at which the protoplasm is killed, viz., about 130° F. (54·4° C.). The moderate use of artificial heat does not affect the composition of the product. Thorough wilting early in the process promotes the curing if the further drying of the leaf is not too rapid.—O. E. M.

Factories and Workshops; Annual Report of the Chief Inspector of —— *for the year* 1913. pp. vi+191. [Cd. 7491.] Price 1s. 7d.

Dust explosions. Nine carbonaceous dust explosions were reported in the United Kingdom during the year, as compared with seven during 1912; they include coal 2, shoddy 2, dextrin, starch, and flour 1, malt 1, cork 1, distillery meal 1, and copal gum 1 That at a gum and starch factory was serious, causing 3 fatalities and wrecking a seven-floored building; it was due to dust from a beam falling on a naked light (compare Report for 1911; this J., 1912, 698). An inquiry into a violent explosion of paper dust brought about by the use of lanterns during the cleaning of a dust chamber at a paper tube works in France confirms the view expressed in a previous Report, that the use of a stive room in connection with grinding and cleaning machinery is unnecessary and should give place to more modern methods of intercepting dust, such as the cyclone collector or bag filter. The testing of carbonaceous dusts by R. V. Wheeler (this J., 1913, 447) has been extended; "syrolit," a composition of milk curd and formaldehyde, used as a substitute for celluloid, showed a relative ignition temperature of 1050° C. and was placed in Class I. as a dangerous dust; distillery meal dust, with relative and lowest ignition temperatures 970° and 640° C. respectively, was also placed in Class I.; and dust of myrabolans and valonia nuts from a tannery, giving no ignition up to 1400° C. in the relative test, and lowest ignition temperature 660° C., was placed in Class II. as inflammable but not dangerous. Three explosions in the crank chambers of high speed engines were caused by the ignition of fine spray produced by action of the cranks on oil which had a flash point of 400°—450° F. (204°—232° C.).

Industrial poisoning. The number of cases of poisoning and the fatalities (in brackets) notified during 1913 and 1912 respectively were: lead 535 (27), 587 (44); arsenic 6, 5; mercury 14, 17; anthrax 70 (7), 47 (6). The total for lead poisoning compares favourably with that for any preceding year except 1910, although an increase in the number of deaths has been noted since 1906; the latter is, however, considered due to a greater inclination on the part of medical practitioners, since the application of the Workmen's Compensation Act, 1906, to associate the occupation with the chronic nephritis and cardiac failure so frequently appearing on the death certificates of lead workers A serious outbreak of poisoning in the *heading of yarn*, dyed with lead chromate, led to analyses of the fluff and dust from beams in the work rooms. These showed amounts of lead varying from 3·1% (calculated as oxide) in rooms where chrome green yarns, containing only 3·7% of lead, were headed, to 22·2% in those where lead-dyed yarns were picked. All the samples were practically free from arsenic, but antimony (0·31%, calculated as oxide), probably used as a mordant and present as a tannate in the finished yarn, was found in royal blue and (0·23%) in aniline green yarns, and the symptoms were such as to suggest the combined toxic action of lead and antimony. Improved exhaust draught and remodelling of the dust-collecting orifices has led to improvement in the health of the workers. Some cases of lead poisoning reported involved very little exposure to lead, *e.g.*, scraping labels off cans and occasionally painting them, handling pipes covered with dry paint, or working brass containing a small percentage of lead. Other cases occurred in the burning of old ship plates coated with red lead, the fixing of iife handles by means of lead, and the testing of springs mpered in molten lead. Cases of plumbism in chandelier ters have diminished in consequence of "caulkite" ving largely ousted white lead as a jointing material, d the use of the air pump and pressure gauge replaced e testing of fittings by mouth suction; and lessened verity of symptoms, with fewer cases, are reported in the llow ware industry, as a consequence of the Tinning gulations. The use of leadless paint is extending, and k of poisoning in the repairing of old paint drums has en reduced by boiling them in a bath of sodium sulphate. ie following table shows the attack-rate from lead poison- g in certain industries for 1913 and 1912.

Industry.	Approximate number employed in lead processes.	Attack-rate per thousand	
	1913.	1912.	1913.
ute lead	1201	17	24
reous enamelling	933	5	10
ning of metals	878	17	10
etric accumulators	1475	30	30
nts and colours	1400	13	16
thenware and china	7085	13	9
elting of metals	2878	23	9
ch painting	29,308	3	2
cutting	5556	2	3
ating	58,777	0·6	0·4

)f the six cases reported under *arsenic poisoning*, two urred in the manufacture of sheep dip, one in the raction of arsenic, and one in bronzing. A case of lrogen arsenide poisoning was caused by dissolving containing 0·08% of arsenic (calculated as oxide) in lrochloric acid containing 0·14% of arsenic (compare milar case in Report for 1912; this J., 1913, 764), and ther case at a shale oil works in Scotland has been traced gases generated by the action of acid residues from a turator" on a new galvanised iron pail.

Iercurial poisoning was reported in connection with the nipulation of mercury fulminate (4 cases), the manufac- e of mercury compounds (3), felt hats (3), and ther- meters and barometers (2), and the making of electrical ters (1) and mercury vapour lamps (1). Cases of *hrax* reached a higher figure than in any previous r owing to an increased number contracted from wool. inquiry by the Anthrax Investigation Board showed that t, applied by steaming or otherwise, is impracticable as isinfecting agent for wool, from the bale, except of such od-stained material as is removed in preliminary sorting, account of the expense and damage to the colour, lustre, ngth, and elasticity of the fibres, but the proved disin- ion of blood-stained material is regarded as an important). Reference is made to the work of Hilgermann and rmann and of Abt (this J., 1913, 1078) on the relative its of the Seymour-Jones formic-mercury process s J., 1912, 35) and the Schattenfroh hydrochloric acid salt method (this J., 1911, 1127) for disinfection of s and skins infected with anthrax. The latter seems more reliable for sterilising contaminated hides, Abt prefers the Seymour-Jones process for disin- ing large batches of skins as a preventive measure. rt from disinfection, the formic-mercury process ears to have remarkable properties in bringing dry s into a soft and supple state.

ttention is drawn to the frequent reports of the value xygen in restoring the unconscious after gassing, but hasis is laid on the danger of working alone or in fined spaces where there is a risk of gas poisoning.) of the cases under *benzene and naphtha* occurred to painters working in confined spaces, one (fatal) was to "flushing" (*i.e.*, an uncontrolled rush of vapour ing distillation), and another (also fatal) occurred to a employed in dry cleaning. Two cases are reported in manufacture of dinitrotoluene and trinitrotoluene and cases of toxic amblyopia from the use of dinitro- zene at an explosives works; but at a large works in the Huddersfield district manufacturing nitro- and amino-derivatives of benzene, cases of poisoning have been reduced from 20 in 1911 to 1 in 1913, owing largely to the adoption of more efficient systems of exhaust ventilation and better observance of the Regulations by the workers. A case of slight poisoning by nickel carbonyl is also reported, the symptoms being moderate cyanosis. The dipping of metal in acids, carried on in the Birmingham and Coventry districts, has been noticed to have a very marked corrosive effect on the teeth, and there was evidence of bronchial trouble (a well-known result of inhaling nitrous fumes, leading to death within a short period if the symptoms become severe).

Accidents due to *fumes and gases* during 1913 and 1912 are given in the following table, with fatalities in brackets.

	1913.	1912.
Carbon monoxide	59 (7)	91 (13)
Carbon dioxide	12 (1)	3 (2)
Hydrogen sulphide	8 (1)	6
Sulphur dioxide	1	5
Chlorine and hydrochloric acid	1	3
Nitrous fumes	nil	12 (1)
Ammonia	3	1
Benzene and naphtha	6 (2)	3 (1)
Nitro- and amino-derivatives of benzene	2	9 (1)
Other	2	2 (1)

Pitch ulceration. The draft Regulations dealing with the manufacture of patent fuel, with addition of pitch, have been withdrawn upon agreement with the manufacturers as to the provision of extra lavatory, bath, and cloak room accommodation and the further encasement of elevators. In one works a method of treating tar with formaldehyde is being tested; this, it is alleged, eliminates the auxetic elements in the tar, so as to produce pitch having less effect on the skin than ordinary pitch. The number of cases of pitch warts or of epitheliomatous cancer, the result of them, was 19, and 2 cases of serious skin affections in creosoting factories are also reported. There were a few cases of *paraffin cancer*, a disease to which shale oil workers are peculiarly liable The shale is heated in vertical retorts and the resulting crude oil distilled by heating and blowing steam through it; the "green oil" thus obtained is treated with 2% sulphuric acid and 1% caustic soda and is then again distilled with steam and fractionated, giving 'light oil," "intermediate," and "heavy oils." The light oil, after treatment with acid and alkali, gives upon distillation "burning oil," ready for use, and more of the intermediate oil. The heavy oil is cooled, pumped through ammonia freezers and filter-presses, washed with acid and alkali, and again distilled, yielding intermediate oil and "lubricating oil." All the intermediate and lubricating oil is passed through coolers, freezers, and filter-presses, and the residual "scale," which causes the eruption on the arms of the workers, is pressed, purified by slow heating, treated with animal black, and finally converted into wax. Rubbing the hands and arms after washing with a solution of carbolic acid and glycerin has been found to lessen the irritation produced by the scale. The Glasgow inspector reports that at a factory where crude paraffin wax was refined, the workers suffered from large boils, but personal cleanliness was said to be a certain preventative. The addition of a small amount of a disinfecting fluid (creosote or carbolic acid) to mineral oils used as lubricants (particularly shale oils) has been found effective in preventing eczema in engineering factories. During the year, the Special Rules of 1900 for the manufacture of chromate and bichromate of potassium and sodium, introduced in consequence of *chrome ulceration* among the workers, have been replaced by Regulations (this J., 1913, 750). In the Scotch works the effect of chrome dust on the nasal septum has been evident, despite elaborate exhaust ventilation at packing, and perforation sooner or later is said to be the rule. It is questionable whether the bichromate is the actual poison which causes the ulcers or whether their formation is not rather due to microbic attack supervening on the action of bichromate, which by preventing healing, prepares the way for microbic infection. Promising results as a preventative in chrome tanning have been obtained with a disinfecting ointment made from mineral lard 3 lb., paraffin wax 6 oz., and "cyllin" 3 oz., to be rubbed into the parts exposed to the liquor before starting work. Poisoning rarely if ever occurs in chrome tanning where the one-bath process (with a solution of chromic salt) is in vogue, but is well known where the two-bath (bichromate and thiosulphate) method is adopted. Cases of chrome ulceration amongst French polishers are also reported, although it is said the trouble can be avoided by applying linseed oil to the hands and arms before work. Inquiries into the prevalence of *salt ulcers* among herring- and gut-curers have shown that common salt, in the dry or wet state, has an effect very similar to bichromate. Frequent washing has proved most beneficial in these cases, and promising trials have been made with the ointment mentioned above.

A study by Collis of the effects of *dust* in producing diseases of the lungs has led to the following conclusions:—(1) Inhalation of all forms of dust is accompanied by diminished power of chest expansion, with correspondingly high blood-pressure. (2) Animal dusts, apart from the presence of pathogenic micro-organisms, produce less effect than vegetable or mineral dusts. (3) Vegetable dusts tend to produce an asthmatic type of chest affection. (4) Mineral dusts which do not contain free silica tend to produce irritation of the upper air-passages and respiratory diseases other than phthisis, those composed of calcium salts being least injurious. (5) Inhalation of mineral dusts which contain free silica is associated with an excess of phthisis; an excess which bears a direct relation to the amount of free silica present. (6) In general, dusts appear to be more injurious as their chemical composition differs from that of the human body, or from the elements of which the body is composed.—F. Soddy.

Trade Report.

Prohibited exports. Order-in-Council, dated Sept. 8th, 1914, supplementing and amending previous lists.

The following are deleted from the list of articles included in His Majesty's Proclamations, dated August 5th and 10th, 1914 (see this J., 1914, 810):—

Tin, tungsten, nitro-toluol, castor oil, boric acid, digitalis and its preparations, all fine chemicals.

The heading "Manganese" should read "Manganese, including ferro-manganese."

The exportation of iron ore, raw rubber, and castor oil, is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas other than those of Russia (except Baltic Ports), Belgium, France, Spain and Portugal.

The following are added to the list of prohibitions to all destinations contained in former proclamations:—Tungsten, wolfram ore, nitro-toluol, acetanilide, acetylsalicylic acid (aspirin) and salicin, aconite and its preparations and alkaloids, adrenin (adrenalin) and its preparations, ammonium sulphocyanide, antipyrine (phenazone), balsam of Peru, benzoic acid (synthetic) and benzoates, cantharides and its preparations, chloral and its preparations, including chloramid, chrysarobin, citrate of magnesia, citric acid, alkaline citrates and calcium citrate, coal tar products for use in dye manufacture, diethylbarbituric acid (veronal) and veronal sodium, dulcite, dyes and dyestuffs obtained from coal tar, emetin hydrochloride, eucaine hydrochloride, ergot of rye and its preparations and alkaloids, gentian and its preparations, glacial acetic acid, hexamethylene tetramine (urotropin) and its preparations, hydrobromic acid, hydroquinone, mannite, neo-salvarsan, novocain, oil of turpentine, paraldehyde, paraffin (liquid, medicinal), pastilles, jujubes, lozenges and cachous generally containing prohibited ingredients, "peptone Witte," phenacetin, pilocarpine salts, potassium and its salts and preparations (including bichromate and prussiate of potash), pyrogallic acid, saccharin (including "saxin"), santonin and its preparations, sulphonal, sulphate of zinc, tartaric acid and alkaline tartrates, thymol and its preparations, trional.

Competition with Germany and Austria-Hungary. List of articles in connection with which applications have been made to the Board of Trade with a view to getting into touch with buyers or sellers. August, 1914.

Firms who can supply any of the articles asked for or who may wish to buy any of the articles offered below should communicate with the Director of the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, London, E.C.

A. *Articles which inquirers wish to buy*:—Acetic acid; aluminium discs, powder, rods, foil, and sheets; aluminium nitrate; asbestos fibre jointing; beryllium nitrate; black lead; brassware, general; bronze powder; carbons for lamps; celluloid, various; ceresine; chemicals, general, and for cleaning and glassworks; china and earthenware; cloth and fibre for incandescent mantles; cork; cotton, mercerised; dextrin and dextrose; drugs; dyes, general, aniline, and naphthylamine black; enamel ingredients, enamel ware; formaldehyde; fuller's earth, prepared for oil filtration; gelatine, tubes; glass and glassware, heat resisting, lamp glass, Jena glass; glass wool, gold foil; graphite, powdered and cake; hydrofluori acid; lighters, automatic; magnalium sulphate; magnesia (oxide); magnesium chloride and nitrate; magnesite manganese sulphate; mantles, incandescent, and magnesi rings therefor; mercury iodide; metals, various; meta foil; methyl chloride; oils, essential; ores and minerals general; paints; paper (impregnated discs and rolls) pearl ash; perfumes; potash, caustic, carbonate, prussiate nitrate, and sulphate; potassium cyanide and iodide rubber (thin gutta percha); silica; silk, artificial silver foil; soap, castile and olive oil; soapstone; soda ash, caustic, carbonate, bicarbonate, and hyposulphite mono-sodium sulphite; starch; sugar; tartaric aci and tartrates; thorium nitrate; tinned hollow-ware vulcanite (mouldings, rods, and sheets); wire, barbe enamelled copper, mild steel, soft basic; zinc, ores, shee oxide, carbonate, and sulphate.

B. *Articles which inquirers desire to sell*:—Acetic acid acetone; acetyl-cellulose; anticorrosives; bleaching powd (chloride of lime); butyl alcohol; capsules (metal calcium sulphate; charcoal powder; chemicals, genera china and earthenware; chrome liquor; cochinea colours; cosmetics; dextrines (white and yellow disinfectants; drugs and veterinary medicines; dye aniline and vegetable; electroplating materials; ename ware; esparto grass; firebricks and fireclay good gelatin; glass and glassware; graduated apparatu glues and gums; gypsum; iron liquor; kaolin; kieselgu and bricks; lampblack; lead, white and red; lithopon machinery for bleaching; mantles, incandescent; manure oils and greases; oxyacetylene welding plant; paint paper; plating; polishes; rubber, synthetic; sod caustic, bicarbonate, washing; tungsten ores; va nishes; vitreosil; vulcanite.

Competition with Germany and Austria-Hungary neutral markets.

In pursuance of the Board of Trade scheme for assisti British manufacturers and traders to secure trade w British Possessions and Foreign Countries, formerly the hands of their German and Austrian or Hungarian co petitors, bulletins have been issued on hollow glass war hollow-ware, enamelled or tinned; iron and steel wi cotton prints; pottery and earthenware; brass war soaps; products of the colour printing industry; linole and oilcloth; pumps and pumping machinery; paint colours and materials; photographic goods.

Inquiries should be addressed to the Director, Commercial ntelligence Branch, 73, Basinghall Street, London, E.C.

aly : Prohibition of certain exports from ——. Board of Trade J., Aug. 20. 1914.

N Italian Royal Decree, dated August 1st, prohibits he exportation of certain articles, including coal, etroleum, petrol, glycerin, lubricating materials, copper, luminium, lead, silicon, sodium nitrate, sulphuric acid, itric acid, calcium carbide, acetone, sulphuric anhydride, icric acid, sodium carbonate, and medicines and sanitary aterial in general, together with the goods enumerated 1 Article 216 of the Mercantile Marine Code (contraband f war).

aly and Norway : Opportunities for British trade in ——. Board of Trade, Sept. 8, 1914.

'HE British Ambassador at Rome states that the present me would be favourable for a competent Italian commercial traveller or agent to go to Milan and obtain orders for oods hitherto supplied by Germany. Amongst such oods for which there would be a demand are carbons for re lamps, magnesium, silica, bricks, and special types of eel.

His Majesty's Minister at Christiania reports that supplies f medical drugs, which are usually drawn from Germany, re reported to be very low in Norway at present. Representatives of the drug industry who were sent to America ave reported that drugs are very expensive there, and it is onsidered that there is a good opening for British products f this nature in Norway.

ndustrial chemistry ; Some economic aspects of —— B. C. Hesse. J. Ind. Eng. Chem., 1914, 6, 678—682.

s the thirteenth census (1910) of the United States, ie following nine principal divisions are included under hemicals and allied products, viz., paint and varnish ; hemicals ; fertilisers ; explosives ; dyestuffs and extracts ; lphuric, nitric and mixed acids ; wood distillation ot including rosin and turpentine) ; essential oils ; one, carbon and lampblack. Comparison of the data for ese industries with those for the manufacturing industries s a whole shows that per unit of plant, the number of ersons engaged in manufacture is 50% greater in the verage chemical plant than in the average manufacturing lant ; the number of salaried employees is more than times as many ; the number of wage-earners is 34% eater ; the expenses (salaries, wages, materials, iscellaneous) are all greater ; the value of the products roduced is 161% more and the excess of the value of the roduct over that of the raw material is 148% more an in the case of the average manufacturing plant. he amount of capital required for the average chemical lant is however 3·3 times that required for the average anufacturing plant ; hence per unit of capital invested, ie expenses and the number of persons employed, laried or otherwise, are lower in the chemical and allied dustries than in other branches of manufacture. Of ie total value of products in the nine principal divisions chemical industry mentioned above, viz., 425,084,540 ollars, the percentage share of each division was :), paint and varnish, 29·4 ; (2), chemicals, 27·4 ; (3), rtilisers, 24·5 ; (4), explosives, 9·4 ; (5) dyestuffs and tracts, 3·8 ; (6), sulphuric, nitric and mixed acids, 3 ; (7), wood distillation, 2·3 ; (8), essential oils, 0·3 ; bone, carbon, and lampblack, 0·4. The percentage ares of the sub-divisions in each of the principal divisions ere :—

Paint and varnish.	Per cent. of total.
gments	13·6
ints in oil	45·4
rnishes and japans	25·0
llers	2·5
ater paints and kalsomine	1·6
Linseed oil	1·5
Bleached shellac	0·5
All other products	9·8

Chemicals.	Per cent. of total.
Acids	10·1
Sodas	18·1
Potashes	0·7
Alums	2·2
Coal tar products	2·3
Cyanides	1·6
Bleaching material	1·4
Chemical products made by the aid of electricity	15·2
Plastics	6·1
Compressed and liquefied gases	4·2
Fine chemicals	9·3
Chemicals not elsewhere specified	29·1

Fertilisers.	Per cent. of total.
Superphosphates	12·8
Ammoniated fertilisers	9·7
Concentrated phosphate fertilisers	3·5
Complete fertilisers	55·0
Other fertilisers	7·8
Sulphuric acid for sale (as 50° B. acid)	0·9
Other acids for sale	0·6
All other products	9·7

Explosives.	Per cent. of total.
Dynamite	46·6
Permissible explosives	2·2
Nitroglycerin	7·9
Blasting powder	24·9
Gunpowder	4·3
Other explosives	9·7
Materials not elsewhere specified	5·4

Dyestuffs and extracts.	Per cent. of total.
Artificial dyestuffs	21·6
Extracts for dyeing	6·2
Extracts for tanning	40·4
Other tanning materials	1·0
Mordants	0·6
Sizes and finishes	15·0
Ground and chipped woods, etc.	2·2
All other products	9·7

Sulphuric, nitric and mixed acids.	Per cent. of total.
Sulphuric acid	57·0
Nitric acid	5·1
Mixed acid	14·6
All other products	23·5

Wood distillation (not including rosin and turpentine.)	Per cent. of total.
Wood alcohol, crude	16·7
Wood alcohol, refined	29·8
Acetate of lime	20·3
Charcoal	21·0
Turpentine	2·6
All other wood distillation products	3·7
All other products	2·8

Bone, carbon and lampblack.	Per cent. of total.
Bone black	50·0
Carbon black	30·3
Lampblack	20·6

Essential oils.	Per cent. of total.
Peppermint oil	29·8
Black birch oil	5·9
Spearmint oil	4·8
Wintergreen oil	3·9
Other oils	19·3
Witch-hazel extract	23·7
All other products	12·4

Within these nine divisions the United States is, in a large measure, self-sustaining, but metals and metallurgy, production of refined petroleum, and many other large industries (glass, oils, fats and soaps, pottery, starch, sugar, etc.) depending upon chemical reactions and chemical control are not included. If the official German classification be adopted, then of a total foreign trade (U.S.A.) of 4,241,484,592 dollars in 1913, 1,302,274,994 dollars, or 30%, represented products of, or materials used in, chemical industry ; of these 18% (759,193,688 dollars) represented imports and 12% (543,081,306 dollars) represented exports. Some of the larger items were :—

Imports.	Dollars.	*Exports.*	Dollars.
Sugar	204,212,581	Refined petroleum and its products	139,882,905
Hides and skins	117,386,174	Copper as metal	120,605,914
Unmanufactured indiarubber	101,333,158	Beef and hog products	82,890,777
Paper and paper-stock	27,706,697	Leather	42,384,199
Potash compounds	14,408,124	Naval stores	26,471,492
		Fertiliser material	11,400,888
		Cement industry	5,822,107

In regard to the German coal-tar dye industry, this is so dependent upon interlocking chemicals and has reached such a stage of complexity and interdependence that it is difficult of transplantation as a whole, but of the relatively few staple products—products consumed in quantities to be measured by tons—several are manufactured successfully in the United States. Moreover, the chemical and engineering work involved, for example, in the production of a useful illuminating oil or a medicinal preparation from crude petroleum, compares very favourably with that involved in the production of most of the coal-tar dyes, and the petroleum products are of greater economic value. Again, the money value of the inorganic chemical industry exceeds that of the dye industry by at least 15 to 1. As as indication of the importance of accurate analytical control of chemical operations, it is pointed out that the United States exports copper to the value of 120 million dollars per annum and that an error of 1% in the determination of copper would mean a loss of 100,000 dollars per month.—A. S.

Books Received.

HISTORY OF THE INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND (1877—1914).

VOLUME (8¾ by 5¾ ins.), containing 300 pages of subject matter, and an alphabetical index. There are four illustrations. The matter is subdivided and classified as follows :—I. Preface. II. Introduction (Professional organisation generally. The Royal Society, the Chemical Society and other Societies interested in Chemical Science. Progress of education in Chemistry). III. Origin and foundation of the Institute. IV. The title "Chemist." V. History of the Institute (1877—1914). VI. Appendix. VII. Constitution and Management.

DIE FLÜSSIGEN BRENNSTOFFE. IHRE BEDEUTUNG UND BESCHAFFUNG. Sammlung Vieweg. Tagesfragen aus den Gebieten der Naturwissenschaften und der Technik. Heft 7. Von ED. DONATH und A. GRÖGER. Friedr. Vieweg und Sohn. Braunschweig. 1914. Price M. 2.

VOLUME (8⅝ by 5½ ins.), containing 86 pages of subject matter. The contents are classified as follows :—I. Liquid fuels and their advantage. II. Varieties of liquid fuels. (*a*), Petroleum. (*b*), Coal tar and lignite tar production, in the improved methods of utilising those fuels. (*c*), Spirits. (*d*), Fatty oils. III. General conclusions.

A MANUAL OF PRACTICAL PHYSICAL CHEMISTRY. By FRANCIS W. GRAY, M.A., D.Sc., Lecturer. Physical Chemistry Department, Aberdeen University. Macmillan and Co., Ltd., St. Martin's Street, London, 1914.

VOLUME (7½ by 5 ins.), containing 203 pages of subject matter with 61 illustrations, and 18 pages of tabular matter. An alphabetical index closes the work.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS FOR THE YEAR 1913. [Cd. 7,491.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 7d.

THIS publication contains the general report of the Chief Inspector upon the work of the Factory Department of the Home Office in 1913, as well as statistical tables. A comprehensive report by the Senior Superintending Inspector of factories and the Inspector for dangerous trades is introduced for the first time, and reports are included by the principal lady inspector, and the Electrical and medical inspectors. At the end of the year there were upon the registers 120,062 factories and 154,507 workshops.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Davies*, G. H. : The Rating of Machinery. 2nd ed. Cr. 8vo. swd. Manufacturers' Assoc. London. 1914. Net 2s.

King, A. G. : Progressive Furnace Heating. 8vo. Spon. London. 1914. Net 10s. 6d.

V. *Stirm*, K. : Chemische Technologie der Gespinstfasern. Berlin, Gebr. Borntraeger. 1914. M. 12.

VII. *Ebler*, E., u. W. *Bender* : Weitere Untersuchungen üb. die Aufschliessung der "Rohsulfate" bei der Darstellung des Radiums. (11 S.) gr. 8°. Heidelberg. C. Winter. 1914. 50 Pf.

Fajans, K. : Ueber die Endprodukte radioaktive Zerfallsreihen. (22 S.) gr. 8°. Heidelberg. C. Winter. 1914. 80 Pf.

IX. *Frank*, Dr. W. : Eisenbetonbau. Kurzgefasste Lehrbuch unter besond. Berücksicht. der Bedürfnisse der Praxis. 2. verm. u. vollständig umgearb. Aufl (VIII, 303 S. m. 163 Abbildgn.) gr. 8°. Stuttgart K. Wittwer. 1914. Cloth M. 6.50.

X. *Granjon*, R., and P. *Rosemberg*, : A Practical Manua of Autogenous Welding. (Oxy-Acetylene.) 2n ed., revised. 8vo. pp. 256. C. Griffin. London. 1914 Net 5s.

Hiorns, A. H. : The Principles of Metallurgy. 2nd ed Cr. 8vo. Macmillan. London. 1914. 6s.

Jones, J. H. : The Tinplate Industry. With Specia Reference to its Relations with the Iron and Steel Industries. A Study in Economic Organisation. 8vo, pp. 30 P. S. King. London. 1914. Net 7s. 6d.

Sprague, J. T. : The Elements of Electro-Platin Being a reprint of the Chapter on Electro-Metallurgy fro "Electricity : Its Theory, Sources, and Applications. Cr. 8vo, pp. 80. Spon. London. 1914. Net 1s. 6d.

XII. *Krauss* : Der praktische Schmiermittel-Fabrikan (205 S.) kl 8°. Trier, N. Besselich. 191 Cloth M.6.

XIV. *Akers*, C. E. : The Rubber Industry in Brazil an the Orient. Illustrated. Cr. 8vo, pp. 33 Methuen. London. 1914. Net 6s.

XV. *Grasser*, G. : Handbuch f. gerberei-chemisc Laboratorien. (XIII, 395 S. m. 40 Abbildgn gr. 8°. Leipzig, Schulze & Co. 1914. Cloth M. 15.

XIXA. *Laessig*, A. : Die moderne Kakaopulve Fabrikation. (87 S.) 8°. Trier, N. Besselic 1914. Cloth M. 5.

XXIII. *Gardiner*, G. L. : Chemical Analysis, Qualitative and Quantitative. 8vo, pp. 50 Black. London. 1914. Net 7s. 6d.

Treadwell, Prof. F. P. : Kurzes Lehrbuch der anal tischen Chemie in 2 Bdn. I. Bd. Qualitative Analys Mit 25 Abbildgn. u. 3 (farb.) Spektraltaf. 8, verm. verb. Aufl. (XV, 522 S.) 8°. Wien, F. Deuticke. 191 Cloth M. 11.50.

Helmbold, Dr. : Eine Methode der Farbensinnprüfung variabelen Pigment-Farbengleichungen auf drehbar Scheiben. 20.5×38.5 cm. Nebst : Text. (15 S.) gr. Wiesbaden. J. F. Bergmann. 1914. M. 9.

XXIV. *Jaques*, A. : Complex Ions in Aqueo Solutions. 8vo. Longmans. London. 191 Net 4s. 6d.

Lummer, O. : Verflüssigung der Kohle u. Herstellu der Sonnentemperatur. Braunschweig. F. Vieweg & Soh 1914. M. 5.

Michaelis, Prof. L. : Die Wasserstoffionen-Konzent tion. Ihre Bedeutg. f. die Biologie u. die Methoden ih Messg. (XIV, 210 S. m. 41 Abbildgn. 8°. Berl J. Springer. 1914. Cloth M. 8.80.

Walle, P. : Bolivia : Its People and Its Resourc Its Railways, Mines, and Rubber Forests. Illustrat 8vo, pp. 408. Unwin. London. 1914. Net 10s. 6d.

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* Compiled by H. Grevel and Co., 33, King Street, Cov Garden, London. W.C., from whom all the works in the preced list can be obtained.

Journal of the Society of Chemical Industry.

No. 18, Vol. XXXIII. SEPTEMBER 30, 1914. No. 18, Vol. XXXIII.

Official Notices.

PATENTS, DESIGNS, AND TRADE MARKS FEES.

Board of Trade, September 25th, 1914.

The Board of Trade have given a general licence permitting all persons resident, or carrying on business, or being in the British Dominions, to pay any fees necessary for obtaining the grant, or for obtaining the renewal of patents, or for obtaining the registration of designs or trade marks, or the renewal of such registration in an "enemy country," and also to pay on behalf of any "enemy" any fees payable on application for or renewal of the grant of a British patent or on application for the registration of British designs or trade marks or the renewal of such registration.

COMPETITION WITH GERMANY AND AUSTRIA-HUNGARY.

Board of Trade Action.

Attention is directed to page 946 of this issue, on which appears an abstract of a second list, issued by the Board of Trade, of articles which inquirers desire (a) to purchase, and (b) to sell. The first list is referred to in the September 15th issue of this Journal, pages 847 and 896.

PROCEDURE TO BE OBSERVED IN CONNECTION WITH THE USE IN MANUFACTURES OF SPIRITS ON WHICH DUTY HAS NOT BEEN PAID.

Sect. 8 of the Finance Act, 1902.

A memorandum on the above subject, prepared by the Board of Customs and Excise, was printed in the September 15th issue of this Journal, page 880.

Sydney Section.

Meeting held at Sydney on Wednesday, 15th July, 1914.

PROF. C. E. FAWSITT IN THE CHAIR.

A THERMO-REGULATOR FOR THERMOSTATS AT TEMPERATURES VERY CLOSE TO ROOM TEMPERATURE.

BY CHARLES W. R. POWELL.

When the temperature of a thermostat containing water is to be maintained above room temperature, the addition of heat is necessary and for this purpose different forms of thermo-regulators are in use.

If a temperature below room temperature is desired, a Foote regulator may be employed. This regulator allows a stream of ice-cold water to circulate through the bath if the temperature becomes too high but diverts the stream if the temperature is too low.

Both these types of regulator are sensitive and by their use an accurate adjustment of temperature is possible, provided that the temperature desired is not too close to room temperature.

If a temperature of say 30° C. is desired when the room temperature is 27° C., it is rather difficult to arrange a gas flame which will not be too readily blown out and not give more than the amount of heat required. However, even if a suitable flame is obtained and the bath should then become slightly overheated, the time taken to fall to the correct value will be longer than is desirable, owing to the small difference in the temperatures inside and outside the bath. A similar case arises with thermostats maintained at a temperature slightly below room temperature.

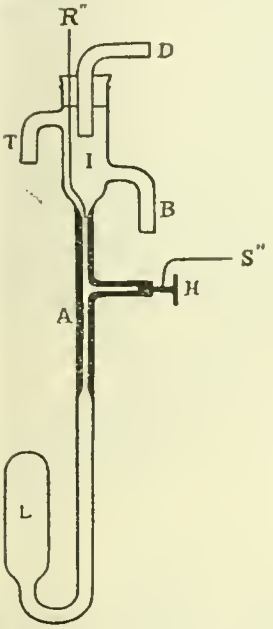


Fig. 1.

To meet such cases as these the thermo-regulator here described was designed; the essential feature is the provision for both the addition and removal of heat by means of the one regulator. The heating is carried out by one or more electric lamps and the cooling by running in ice-cold water to the thermostat.

A part of the regulator used (Fig. 1) is similar to the ordinary gas regulator. The bulb, L, is filled with toluene, and mercury is then poured in till it occupies the lower part of L and the whole of the U-tube and capillary, A. The height of the mercury in the capillary tube is adjusted by means of the screw, H. A glass tube, D, carries ice-cold water into the top chamber of the regulator, I, which is provided with two outlets, B at the bottom and T at the top.

The switch that regulates the supply of heat is shown in Fig 2. R and S, the two arms of a small electromagnet with a soft iron core, are joined to the terminals, R′ and S′. Two wires, R″ and S″ (Fig. 1), lead to R′ and S′; an accumulator or cell being placed in the circuit. Heat is applied to the thermostat by means of an electric globe lamp, which is suspended in the bath. One wire from the lamp enters the switch at C′ and leaves it at D′. C′ is joined to the brass pin, C, and D′ to the fixed metal piece, D. N is a small strip of wood pivoted at P. Opposite the poles of the electromagnet a strip of iron, M, is attached to N. A wire passes from D along N and terminates in a brass strip opposite to C. The portion of this wire between D and the wooden bar is coiled and serves as an extended spring to keep N away from the electromagnet when the latter is not magnetised. It was sometimes

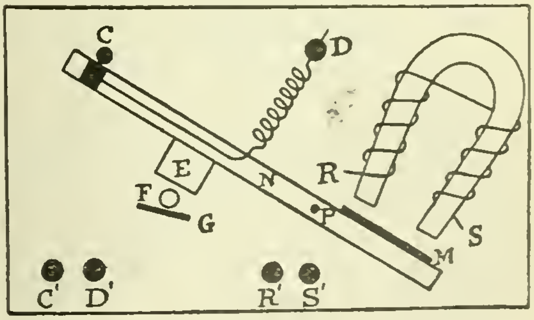


Fig. 2.

found necessary to place a piece of paper between the poles of the magnet and the strip of iron, M, in order to prevent the latter being still attracted by the magnet after the magnetising current had been broken.

A rubber tube attached to the lower outlet, B, of the upper chamber, I, of the regulator (Fig. 1) passes through F (Fig. 2), which is a hole bored in the wooden base of the switch, and thence runs to a sink. The top outlet, T, runs direct into the bath.

When the temperature of the bath is correct, the mercury in A (Fig. 1) stands just below the end of the wire, R″. If the temperature rises the mercury rises and touches the end of R″, thus completing the circuit, producing the electromagnet, RS, which then attracts the strip of iron, M (Fig. 2) and breaks the lighting circuit at C, thus removing the source of heat.

At the same time the rubber tube leading from B (Fig. I) is squeezed flat between the metal edge, E, and the small brass pillar, G (Fig. 2). The cold water, being now unable to escape to the sink through B, commences to flow into the bath through T and reduces the temperature accordingly. As the temperature sinks to its correct value the current electrifying the magnet is broken when the mercury in A draws away from R″. The spring from D then draws the bar back to its original position allowing the water to flow to the sink and again completing the lighting circuit at C.

Dimensions of the regulator.

Diameter of A	1·0 mms. internal.	Length of A	10 cms.
B	7 mms.	I	15 cms.
I	9 mms.	L	10 cms.
D	5 mms.	overall	38 cms.
T	7 mms.		
L	20 mms.		

Dimensions of the switch.

Wooden base 18 cms. × 10 cms. × 2 cms.
N 13 cms. × 1 cm. × 3 mms.

Circulation was maintained in the bath by means of a revolving shaft carrying propellor blades.

DISCUSSION.

Mr. POWELL, in reply to questions, said the bath could be maintained within half a degree of the desired temperature. The capacity of the bath used was 3 litres. The lamp used was the ordinary carbon lamp, and the voltage of the current 240.

ON THE VOLATILISATION OF ARSENIOUS ACID FROM AQUEOUS SOLUTIONS CONTAINING HYDROCHLORIC ACID.

BY BERTRAM JAMES SMART, B.SC., AND JAMES T. PHILPOT.

It is well known that when solutions of arsenious acid in hydrochloric acid are boiled the arsenic volatilises. In the report of the Arsenic Committee this method is indeed suggested as a means of completely removing arsenic when present as an impurity in the acid. Having encountered some difficulties in preparing pure hydrochloric acid free from arsenic, it was decided to determine to what extent arsenious acid is removed on boiling from solutions of hydrochloric acid of different strength. The importance of this matter was further accentuated in carrying out a series of determinations of the arsenic in impregnated timbers, since it was desired, if possible, to extract the timber with warm hydrochloric acid and to estimate the arsenic by means of the Gützeit test.

The question has been investigated by Hinds (Eighth Intern. Congress Applied Chem., 1912, **1**, 227), who found that the quantity of arsenic lost on boiling is a function of the concentration both of the arsenic and of the acid. With the concentrations usually employed in qualitative analysis the loss of arsenic on boiling the solution to half its bulk may be disregarded.

At the time this work was carried out it was not possible to obtain a full account of Hinds' results, and since the concentration of solutions of hydrochloric acid changes with evaporation it was decided to carry out a series of fractional distillations of solutions containing varying quantities of arsenious acid and hydrochloric acid, the distillates in each case being titrated to determine the quantities of hydrochloric acid and arsenious acid which had passed over.

For this purpose 200 c.c. of solution were placed in a flask fitted with a still-head to prevent splashing, and connected to a condenser. The distillates were received into small flasks in equal fractions of 20 c.c., the last 20 c.c. being left undistilled.

A series of solutions was studied, the concentrations being arranged as nearly as practicable as follows :—

Arsenious acid :—	grms. per litre.
Series I.	1·0
,, II.	0·75
,, III.	0·5
,, IV.	0·25
Hydrochloric acid :—	grms. per litre.
A.	220—230
B.	210
C.	190
D.	160

In this way the behaviour of hydrochloric acid above and below the concentration corresponding to the constant boiling mixture was studied with varying concentrations of arsenious acid.

It should be mentioned that the experiments were carried out at an altitude of 3,000 feet above sea level *i.e.* under a pressure of about 676 mm.

The results are shown in the following curves indicating :

1. Concentration of arsenious acid and hydrochloric acid in the liquid remaining undistilled after each fraction.
2. Ratio of the above concentrations compared against the concentration of hydrochloric acid in liquid remaining undistilled after each fraction.

Conclusions.

1. Solutions containing hydrochloric acid and arsenious acid when distilled give off the arsenic more rapidly the greater the concentration of hydrochloric acid.

2. When the hydrochloric acid is present to the extent of about 190 grams per litre or more, the concentration of arsenic in the solution remaining undistilled rapidly fall as the liquid is fractionated.

3. With solutions containing less than 180 grams o hydrochloric acid per litre, the concentration of arseni in the solution remaining undistilled rises, althougl some of the arsenic passes over, the ratio between aci and arsenic remaining practically constant until th solution contains about 185 grams of HCl per litr It is worthy of note that this point would correspon to a hydrate, $HCl.10H_2O$.

When the acid becomes more concentrated the pro portion of arsenic volatilised increases rapidly.

Experiments are being put in hand to study this subje by means of actual measurements of the vapour pressu of both arsenious acid and hydrochloric acid, with a vie of ascertaining whether any further evidence can b obtained as to the possible existence of this hydrate hydrochloric acid.

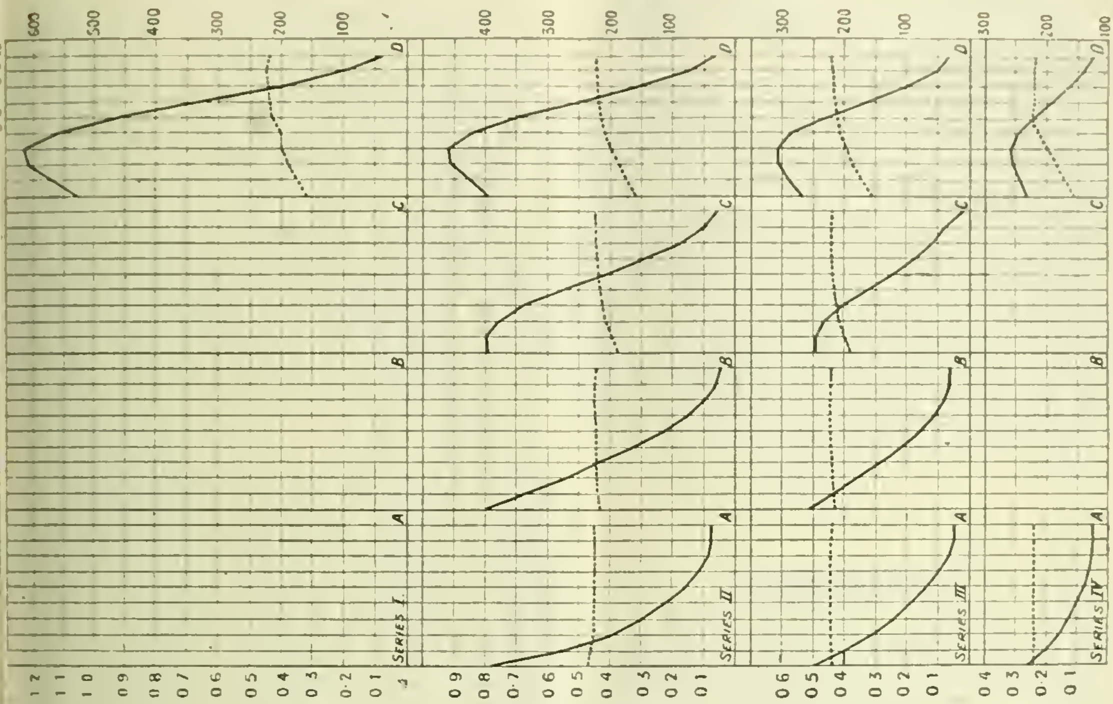
DISCUSSION.

The CHAIRMAN said he was interested in the referen to a hydrate of the composition $HCl,10H_2O$. It h already been shown by J. Gibson a few years ago th the specific electrical conductivity of hydrochloric ac solutions showed a maximum value at the poi $HCl.10H_2O$.

Mr. T. STEEL thought the author had very clea indicated one of his main points, namely the large p portion of arsenic volatilised with higher concentratio But it was puzzling to see two scales of figures—grn per litre and grms. per 200 c.c. ; would it not be bet to express all the results in grams per litre ? The aut

Diagram 1.

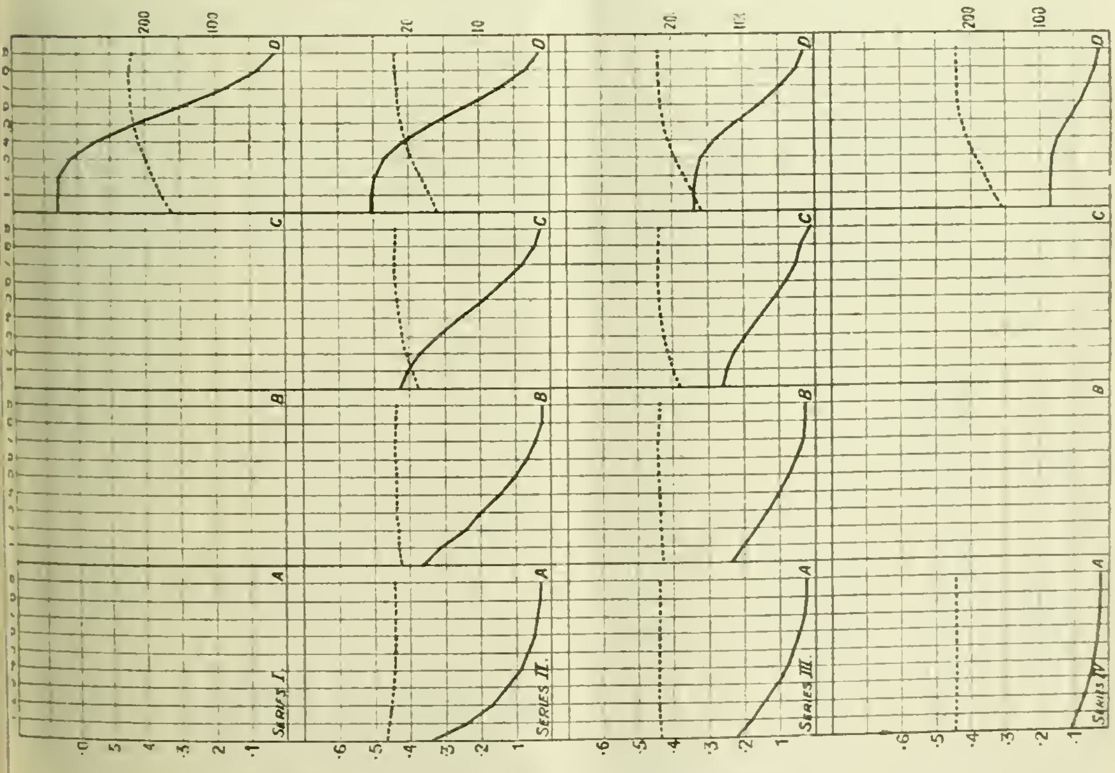
Concentration of hydrochloric acid (grms. per litre). Dotted line.



Concentration of arsenious acid (grms. per litre). Continuous line.

Diagram 2.

Concentration of hydrochloric acid (grms. per litre). Dotted line.



Ratio between arsenious acid and hydrochloric acid. Continuous line.

had worked with acid containing much larger proportions of arsenic than were usually met with in commercial acid; but what would be of greater interest was to know what became of the arsenic in commercial acid when submitted to similar treatment. He asked what was the significance of the ratio 100×As/HCl?

Dr. G. **Harker** said that in carrying out an investigation as to the rate of removal of arsenic, one would expect to find some relation to the constant boiling strength, but the results did not seem to show any. He pointed out that it would be possible to calculate the vapour tension of the arsenic from the weight present in a known volume of solution.

Mr. **Smart**, in reply, referring to Mr. Steel's question about the ratio column, said he thought this expressed in a better way than any other the effect of acid concentration on rate of volatilisation. He had worked with different degrees of concentration of arsenic, and as he had found a similar character for each curve, he thought it not unreasonable to conclude that the results would still be similar at lower degrees of concentration. With regard to acid of constant boiling strength, it was at first thought that there might be some relation between this and the rate of volatilisation of arsenic, but such was not found to be the case.

Communication.

THE WAXES OF TEXTILE FIBRES AND THEIR BEHAVIOUR IN THE BLEACHING PROCESS.

BY S. H. HIGGINS, M.SC.

The flax stalks as they are taken from the fields are first subjected to the retting process and afterwards undergo such operations as breaking, scutching, hackling and preparing. Each of these treatments separates some of the adventitious components of the flax, but still the fibre going through the spinning process has a large amount of non-cellulose matter attached to it. For example, on extracting linen yarn with organic solvents a wax is separated. Hoffmeister (this J., 1903, 639) stated that the flax wax extracted by benzene contains principally an unsaponifiable residue (70—80%) similar to ceresin and consisting of hydrocarbons, ceryl alcohol and phytosterol. The rest consists chiefly of a mixture of fatty acids and also a small quantity of a volatile aldehyde-like substance. Then Hodges (Pro. Roy. Irish Acad. 3, 460) and Cross and Bevan (Jour. Chem. Soc. 57, 196) found that the green wax extracted from linen yarn by alcohol contained 0·09% of nitrogen, 1·7 of mineral matter and 7·0 of phosphoric acid. Saponfication with alcoholic potash showed a large amount of cerylic alcohol and also a mixture of ketones. A large number of extractions of linen yarn and cloth by solvents were now made.

Extraction of linen by solvents.

A hank of 50's weft yarn was extracted in a Soxhlet apparatus for two days with ether. It was then dried in the air and extracted for two days with benzene, then similarly treated with ethyl alcohol for two days. After this treatment it was thoroughly dried in a stove and weighed. The yarn was not stove dried before extraction because of the danger of volatilising some of the constituents of the yarn, *e.g.*, the volatile aldehyde mentioned above. This aldehyde could be plainly noticed in the ether extract for on evaporating off the ether and warming the residue the vapour produced caused coughing just as acetaldehyde does. During the extraction with benzene the liquid became yellow but only very gradually, showing that only a small amount of matter remained for the benzene to dissolve out. Indeed, it seemed possible that on continuing the extraction with the ether long enough all the matter which the benzene removed would also be dissolved out by the ether, but although this point was tested at least six times, it was always found that after the ether extraction benzene dissolved out more wax. For example, a hank of dew retted yarn gave up 0·92% of wax to ether on extracting two days and a further 0·27% on after treatment with benzene for the same time. The melting point of the wax lies between the boiling points of ether and benzene, hence the hot benzene by melting the wax dissolved it much more quickly. The wax extracted by the ether was light yellow and sometimes bright green, but on melting it assumed somewhat the same colour as that produced from the benzene extract. On extracting the same yarn with (1) ether, (2) petroleum ether, (3) gasoline, and (4) benzene, it was seen that the lower the boiling point of the solvent the lighter the colour of the extracted wax. The darkening of brown cotton and linen cloth on heating is due to the melting of the wax, which thus changes in colour from yellow to brown. The alcoholic extract was dark coloured, and on cooling separated a large amount of the wax. On evaporating off the alcohol, the residue was brownish and had a strong smell. At this point the observation (to be described later) that brown linen after extracting with benzene yields more matter to the benzene if soured, washed and dried must be mentioned. Any matter of a saponaceous nature in the linen would be taken up by the alcohol. The linen yarn after the three successive extractions did not show much alteration except that it was a little lighter in colour, but a dark green sample of yarn became much browner on extracting the wax (dark green) from it. After the alcohol extraction the yarn was treated with hot distilled water until apparently no more matter was removed. The extract obtained evaporated to dark brown brittle scales. On boiling with ammonia a large amount of matter was now separated from the fibre, yet most of the non-cellulose matter still remained attached to the fibre in spite of long treatment with the boiling ammonia. Even further treatment with sodium hydroxide did not remove these matters entirely so that the treatment was finished by boiling under pressure with sodium hydroxide solution, the drop in weight being in this case obtained by weighing the yarn before and after treatment. After washing the yarn was extracted with pure hydrochloric acid and the weight of the matter extracted was obtained by evaporation. The following results were obtained:— Extracted by ether, 1·39%; benzene, 0·29%; alcohol 0·49%; water, 2·03%; ammonia, 3·27%; NaOH afte pressure boiling, 14·06%; HCl, 0·33%.

If the brown linen had been treated with all the reagent mentioned and not successively in the order given, quit different results would have been obtained. Thus th benzene would remove all the matter which the ethe extracted besides that stated above; the alcohol woul also account for most of the matter taken out by th benzene. Water had no apparent effect on the wa taken out by benzene, for linen before and after boilin with water under pressure had the same wax content but water might have some effect on the saponaceou matters mentioned above. Linen cloth boiled with wate under pressure showed a drop of 3·3 to 4·5%, but this als included the size of the warp yarn. Sometimes the clot became greener in colour owing to the removal of dar brown matter. Again, ammonia and sodium hydroxi would have removed a large amount of the waxy matte if they had not been previously extracted, and furth experiment showed that brown untreated linen extracting with cold dilute hydrochloric acid for thr hours then, evaporating and incinerating the residue, ga 1.10% of matter extracted.

Of the extracts obtained, those taken out by ethe benzene, and alcohol separated from solution on coolin The wax obtained from the ether and benzene extrac on melting and cooling, showed a peculiar fracture and t wax obtained from brown linen by alcohol showed t same peculiarity. The alcohol extract in the abo tests, however, was sticky and golden brown in colo After these three extractions the linen had no percepti smell. Similarly jute gave up 0·9% of a greenish brow strongly smelling oil, the extracted fibre having no smell.

After a number of extractions it was noticed that wat retted flax contained more wax than dew retted, e. 1·89%, water retted; 1·19%, dew retted. This differe in the proportions of wax in the two classes of fibre is interesting, since these waxy matters are supposed to be products of the decomposition of cellulose bodies during the retting and other processes. It is also known that water retted yarn becomes cream coloured and dew retted greyish on treatment with alkalis.

From a large number of extractions the author found that benzene took out from 1·57 to 1·95% of wax from brown linen. The water extract from linen cloth was found to be only slightly combustible and to contain some tannic acid and a trace of starch.

Effect of the extractions on the tensile strength of the yarn.

After each of the extractions above described a number of yarns were separated and kept to ascertain their breaking strengths. They were all left in the air for three days and thirty yarns from each sample were broken in a Schopper testing machine (Higgins, this J., 1911, **30**, 1295) to give the following average results :—

	Breaking strength.
Original yarn	730 grms.
After ether extraction	790 ,,
,, benzene ,,	750 ,,
,, alcohol ,,	720 ,,

It is seen that the extraction with ether caused an increase in strength of the yarn. Knecht (J. Text. Inst., 1911, **2**, 22—29) has shown that for cotton the addition of waxes causes a decrease in the breaking strength due probably to the slipping of the fibres and the above results show that the ether removes the excess of wax which evidently causes a slipping of the fibres. Further extraction by benzene produces a decrease of tensile strength, the benzene apparently extracting certain waxy matters which have a consolidating effect on the fibres. Yet after the benzene extraction the yarn is stronger than the original yarn. The treatment with alcohol brings the strength down to the original value or a little lower. Other tests gave the following results :—

	Water retted flax. Strength.	Dew retted flax. Strength.
Original yarn	1130 grms.	1450 grms.
Extracted by ether	1410 ,,	
,, ,, benzene	1200 ,,	1420 ,,
,, ,, alcohol	1100 ,,	1450 ,,

The results with the water retted yarn are similar to those previously given, but in the case of the dew retted flax the extractions had little apparent effect on the strength. It has been stated above that dew retted yarn contains less wax than water retted and the wax which causes the slipping of the fibres in the latter yarn may not be present in the former.

Other tests were the following :—

	Strength.	Wax extracted.
		%
Original yarn	801	—
Extracted by ether	832	1·42
,, ,, petroleum ether	826	1·03
,, ,, benzene	816	1·52

	Strength.
Original yarn	850 grms.
Extracted by benzene	1020 ,,
do. then boiled with water	1020 ,,
,, by ether	1080 ,,
,, ,, carbon disulphide	940 ,,
,, ,, ,, tetrachloride	960 ,,
,, ,, alcohol	880 ,,
,, ,, alcohol and water	860 ,,
,, ,, ligroin	910 ,,

Linen yarn of strength 730 grms. was put into bleaching powder solution to "cream" it, then soured, washed well nd dried, when it was found to have decreased to an verage strength of 610 grms. From the figures given it is evident that the removal of the wax increases the tensile strength of the linen, and it may be for this reason that lye-boiled linens are sometimes stronger than the original goods, since much of the wax is removed during the boiling with alkaline solutions (Higgins, this J., 1911, **30**, 1295). Experiment showed that this wax was apparently emulsified by resin soap solution and by benzene brought into an emulsion in water by Turkey red oil, so that an attempt was made to increase the strength of linen yarn by treatment with these solutions. At the same time this treatment gave the yarn somewhat the same handle as is aimed at in boiling yarns before weaving. In an actual test the original yarn was of 730 grms. strength and this was found to drop to 670 grms. (resin soap) and 650 grms. (benzene emulsion). So that this treatment did not achieve the purpose for which it was designed.

Effect of the bleaching process on the amount of wax retained by the fibre.

Pieces of linen were taken out at certain definite stages during the bleaching process and washed and dried. Their wax was extracted by benzene to give the following results :—

	Wax.
	%
Original linen	1·47
After water boiling	1·42
,, lime boiling and souring	1·59
,, 1st lye boil	0·25
,, 2nd lye boil	0·11
,, 1st chemic	0·11
Fully bleached	0·036

The stages mentioned are not the total number of operations, but definite points chosen for the tests. When a piece of linen cloth was taken out of the lye boil, for example, it was washed, dried, and weighed, then extracted. The percentage of wax was not then calculated on the weight found, but on the weight of the brown linen to which this lye-boiled linen corresponded. To arrive at these figures a parallel series of tests had to be carried out, showing the drop in weight of the linen at the different stages mentioned. The figures show that the wax is gradually eliminated during the bleaching until the fully bleached linen contains only a very small amount. A large number of tests showed that this amount varied from 0·02 to 0·045%. After the lime boil the wax is greater in amount than before this operation, but it must be remembered that the linen after lime boiling was soured and that, as before mentioned, linen treated with acid gives up more wax to benzene than untreated linen. Moreover, if during the saponification of the waxes by lime the alcohol liberated during the formation of the lime soap was insoluble and was deposited on the fibre, this might affect the figures obtained. A large number of experiments were carried out to determine this increase of weight of the wax during lime boiling. In one case the wax in the brown linen was 1·65% and after lime boiling and souring 1·88%. On souring the brown linen before extraction, however, the amount of wax was 1·81%, which amount considering the above explanation is very near that for the lime boiled linen. The lack of effect of the chemic on the weight of the wax present will also be referred to later. The wax after this process was of the same colour as that extracted from the linen after the second lye boil and fractured on cooling in the same peculiar manner as the original wax did. These waxes were all brownish and the extracted linen in all cases was lighter in colour due to the removal of the brown wax. Linen lye boiled without previous lime boiling gave 0·9% of wax.

The property of linen in yielding more wax to benzene after souring was tested for in the case of cotton yarn. American cotton yarn was extracted with benzene for four days and yielded 0·503% of wax. On putting in warm dilute hydrochloric acid for a few minutes, washing well with boiling distilled water, drying and again extracting a further 0·058% of wax was eliminated. Cotton therefore behaved exactly like linen in this respect

Saponification of the waxes.

The wax from brown linen was found to contain 72·2% of unsaponifiable matter and 27·8% saponifiable. The wax extracted from the linen after lime boiling and souring contained 40·0% of saponifiable matter. This point was carefully investigated by a large number of experiments. Thus it had been previously found that on extracting brown linen with ether for two days only 78·5% of the wax was removed, whereas lime boiled and soured linen yielded 95·7% of its total wax in the same time. It therefore appeared that the waxes were changed during the lime boiling. A piece of linen cloth was now lime boiled and washed thoroughly but not soured. It was then extracted with benzene, the unsaponifiable part of the wax being thus removed; the lime soap produced during the lime boil by the union of the lime and the saponifiable part of the wax still remained on the fibre. The linen was now soured and washed well, then dried and extracted. It was found that the sum of these two extracts equalled that obtained by souring at first and extracting. Moreover, 40% of the wax was again found to be saponified during the lime boiling. Further experiment showed that the difference between the proportion of saponifiable matter in the waxes before and after the lime boiling was due to the fact, previously mentioned, that brown linen has to be soured before yielding up all its wax. A piece of brown linen extracted with benzene gave 0·55 grm. of wax and on souring, drying and again extracting a further 0·10 grm. of wax. Applying this result to the figures obtained in the previous test we have :—

Wax extracted by benzene	0·876	grm.
do. after souring	0·16	„
Total wax	1·036	„
Saponifiable portion	0·246	grm.
do. adding wax after souring	0·16	„
Total saponifiable wax	0·406	„
Unsaponifiable wax	0·63	grm.

Making the correction shown it is seen that from 1·036 grms. of wax 0·406 grm. is saponifiable which accounts for the 40·0% observed after the lime boiling. The melting points of the waxes were found after the lime boil to be:—before souring, 80—82° C.: after souring, 65—67° C., but the points were not definite.

The wax after the first lye boil was still a mixture of saponifiable and unsaponifiable matter and the effect of the chemicing was, as described later, to make the wax more saponifiable.

Similar tests to the above were also performed on cotton yarn. Hanks of yarn were boiled with lime under pressure, washed well, extracted with benzene then soured and again extracted when it was again found that the sum of the amounts of wax extracted was approximately equal to the wax obtained on souring directly after liming and then extracting. It was also noticed that the wax extracted before souring was dark brown and brittle whereas after souring the wax obtained was much softer.

The effect of successive lime and lye boils on the waxes.

To test the effect of different boiling agents on the yarn the following tests were made. Hanks of linen yarn 55's weft were stove dried and weighed, then boiled with lime and lye (a mixture of sodium hydroxide and sodium carbonate) under pressure in the order given. They were then well washed, dried and weighed. The weight of wax still present in each hank was found :—

	Decrease in weight.	Wax.
	%	%
(1) Lime, lye, lye	21·8	0·06
(2) Lye, lime, lye	23·1	0·046
(3) Lye, lye, lye	22·1	0·16

It was noticed that (3) was by far the dullest in appearance and the figures show that it contained much more wax than the other two hanks. The lime boil has long been a topic of argument between chemists and bleachers. The former state that caustic soda is the best saponifying agent and the latter reply that the lime boil cannot be replaced for certain classes of goods. It is well-known to those engaged on bleaching that if any classes of cottons are coming up soft in the finishing a resort to lime-soda ash boiling in place of caustic soda soon puts them right. Lime boiling is not a mere survival of the days of empiricism: it is the best treatment for some classes of goods for the figures given show that it is the best means of removing the waxy matters from the cloth. It was noticed on putting lime boiled and soured cloth into hot alkali solution, even for only a short time, that a large amount of matter was separated from the cloth and its wax contents considerably reduced; this is probably due to the unsaponifiable and saponifiable constituents of the wax existing together the alkali producing a soap with the latter, and at the same time removing some of the former constituent by disturbing it and producing an emulsion. The soap is produced quickly as the fatty acid is free (unlike the wax in the linen not lime boiled) and a concentration of the soap in the neighbourhood of the unsaponifiable wax is produced. It is well-known that soaps are useful in removing these waxes and the case mentioned is evidently one where the action of the soap is very effective.

The steeping and chemicing of cloth without boiling.

Many methods of bleaching without boiling the goods have been from time to time suggested. An investigation of the statements made concerning these methods was now made. 65·3 grms. of linen which were found to weigh 60·69 grms. when stove dry were placed in 500 c.c. of water along with 3% soda ash and $\frac{3}{4}$% Turkey red oil and heated to 80° C. for two hours. The cloth was then rinsed, washed well and the operation repeated, using a freshly prepared bath. It was again washed well and then put into a solution of bleaching powder solution for four hours. By titrating the solution before and after the bleaching it was found that the cloth had required 2·87 grms. of chlorine to bleach it. A similar piece of lime and lye boiled linen required 0·55 grm. of chlorine to bleach it, so that to bleach by the steeping method would require more than five times the amount of bleaching powder that the ordinary method requires. Since bleaching powder is the most expensive chemical the bleacher uses and represents a large proportion of the cost of bleaching, the bleaching powder required for the steeping method would make that process extremely costly and there is also the cost of the soda ash and Turkey red oil to add. Even after the treatment mentioned the linen was still yellow and unsuitable for any market. Moreover, on boiling it and chemicing to produce a fair white it lost a great amount in weight. It contained 0·32% of wax, which is enormously greater than properly bleached linen, and the small gain in weight at which the steeping process aims had only been achieved by retaining much of the original impurities of the fibre. The author has shown (this J., 1911, **30**, 1295) that the drop in weight during bleaching takes place during the boiling operations if the process is properly conducted, and the figures given above show that good boiling is the cheapest way of getting rid of th impurities of the cloth besides being the only way t produce a good white. If the bleaching is properl conducted the weight and strength must be equal to that o linen bleached on the grass, that is, without the applicatio of any bleaching powder solution (*loc. cit.*).

Bleaching tests on wax-extracted linen showed tha the extraction of the wax did not hasten its bleachin to any large extent. Brown linen (untreated and als wax-extracted) and lime-boiled and soured line (untreated and also wax-extracted) were placed in th same solution of bleaching powder, when the rate o bleaching was only slightly greater on the wax-extracte material.

The effect of various additions to the boiling liquors.

On heating linen wax with water it melted, but di not form a good emulsion. On adding a little Turke red oil to the water a good emulsion was produced: resi soap had the same effect. The addition of these tw substances to boiling liquors ought therefore to assist i the removal of the waxy matters from the cloth. large number of experiments were performed to ascertai if this were the case. Thus a piece of linen was boiled in caustic soda solution and then divided into two parts: one part was further boiled in caustic soda containing resin soap, then both portions were washed and dried. On extracting the wax that remained in each piece of cloth the amount was found to be about the same, pointing to the conclusion that the resin soap had not assisted in the removal of this wax. It was found, however, that even after washing well some resin remained in the cloth and interfered with the test.

Recently a number of substances have been introduced for adding to the boiling liquors in order to eliminate the waxy matters of the cloth. Benzene is the substance used in some of these, whereas in others a liquid of similar properties is used. In order to make these liquids mix with water, Turkey red oil and other substances are used, for in this way an emulsion is formed which does not readily separate. These preparations act splendidly in extracting the waxy matters from cloth placed in them, but the author finds that their cost does not admit of extensive adoption on the large scale.

The effect of hypochlorites on the waxes.

Previous tests showed that the weight of wax in linen cloth was not appreciably affected by the chemicing process, and further experiment confirmed this conclusion. The process of "creaming" linen yarn was now carried out by leaving linen yarn immersed in strong bleaching powder solution until it became of a cream colour. It was then soured, washed well and dried. A decrease of 9% in weight and 16·1% in tensile strength was found. This process of "creaming" cleans the yarn of a certain amount of straw and other matters, making it better for weaving and causing less weaving faults. During the "creaming" the yarn rapidly changed colour, and a thick precipitate of calcium carbonate was formed from the carbon dioxide produced by the oxidation of some of the constituents of the yarn. This oxidation is a selective one, the non-cellulose portion of the yarn and also the pectocelluloses being attacked before the cellulose of the fibre proper, but if long continued the latter is also attacked. The amount of bleaching powder required for this operation of creaming makes the method very costly, as can be understood from figures previously given (p. 904). The drop in weight of 9% is made up of 1·01% due to the hydrochloric acid (p. 902), 2·03% due to the hot water washing, and 5·96% due to the actual oxidation.

The "creamed" yarn was now extracted by benzene and found to contain 1·21% of wax on the original weight of the yarn. This wax was of a brownish colour and apparently little different from the original wax. It was saponified by alcoholic potash, when a white powder (evidently potassium chloride) separated out. The alcohol was evaporated and the residue washed well through a filter paper to remove the soap. The filter paper was dried and extracted with benzene to obtain the unsaponifiable matter, while the fatty acid was separated from the filtrate.

Unsaponifiable matter	11·21%
Saponifiable matter (fatty acid)	59·79%

There was a disappearance of some of the wax, as seen from the figures; it is probable that during the "creaming" the wax became chlorinated and afterwards lost this chlorine to produce potassium chloride during saponification. At any rate it is evident that the chemicing process changed the wax into products which yielded to a larger extent to saponification, and thus explained the observation that chemicing prepares the impurities of linen for subsequent removal by "scalding." Cotton was now "creamed" in the same way as linen until a fair white was produced. Extraction by benzene gave 0·52% of brownish wax which fractured on cooling just as linen wax did. On saponifying with alcoholic potash the wax behaved just as had been noticed for the linen wax, potassium chloride separating:—

Weight of wax treated	0·170 grm.	
,, ,, ,, unsaponifiable	0·040	0·123 grm.
,, ,, fatty acids	0·083	

As a confirmation of these results linen yarn was left in bleaching powder solution until almost white before souring, washing, drying and extracting with benzene. The figures in this case were:—

Weight of wax treated	0·3800 grm.	
,, ,, ,, unsaponifiable	0·2035	0·2145 grm.
,, ,, fatty acids	0·0110	

The results point to the wax taking up chlorine during chemicing and becoming changed.

In all the investigations described above it is probable that the deductions from the experiments with linen can also be applied to cotton, for in all cases where the two fibres were carefully compared they behaved remarkably alike.

Obituary.

EDWARD RILEY.

Edward Riley died at Marlow, on the 12th inst., 83 years old. His education was obtained at King's College School, The Putney Engineering College, and later as regards chemistry from Dr. Lyon—afterwards Lord—Playfair, to whom he became assistant. In 1853 he went to Dowlais as research chemist, and while there conducted the first experiments on the Bessemer process; but in a few years he started a private practice as an analytical and consulting chemist, which he followed until the end. He, however, assiduously maintained his association with the Bessemer process, hence figured actively in its various stages of progress, and at the appearance of the basic process, along with Thomas and Gilchrist, he was interested in it as patentee, and later as investigator as well as director of companies working it. He was author of many contributions relating to the chemistry and technology of iron and steel; several of these appeared in the Journals of the Chemical Society and of the Iron and Steel Institute. The latter institute awarded Riley its Bessemer Gold Medal as recently as May last. He was an original member of this Society.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Liquids in tanks; Apparatus for sampling ——. E. Schmitz. Les Matières Grasses, 1914, 7, 1914—4194.

THE apparatus consists of a 3-litre cylinder, containing a suction piston, suspended from a winch by a chain which passes from the bottom of the cylinder over the pulley of a counterweight below, the other end of the chain being connected with the top of the piston rod. As the cylinder is drawn upwards through the liquid, the piston rod is simultaneously raised, and the liquid is drawn into the cylinder. It is also possible to maintain the cylinder at any desired height in the liquid, as shown by an outside indicator, and to raise the piston without altering the position of the cylinder.—C. A. M.

PATENTS.

Distillation or evaporation of liquids or solutions. T. Boberg, O. Söderlund, N. Testrup and The Techno-Chemical Laboratories Ltd., London. Eng. Pat. 13,607, June 12, 1913.

IN evaporating apparatus of the type described in Eng. Pats. 12,462 and 22,670 of 1911 (this J., 1912, 971, and 1913, 183), the work of evaporation is so distributed between two systems of evaporators that the steam required for the compressor is obtained from the first system. The second evaporator, which may be of the film type, is heated by exhaust gases from the gas engine which supplies power for the system, and an internal combustion pump is used as a source of energy for the compressor and for circulating the liquids.—W. H. C.

Evaporating apparatus; Liquid ——. A. Chapman, Liverpool. Eng. Pat. 17,145, July 26, 1913.

LOW-PRESSURE steam is withdrawn from the steam space of a tubular evaporator by an injector actuated by an external supply of high-pressure steam and fixed in the centre of the upper tube-plate, so that the low-pressure steam inlet is above the liquid level. The low-pressure steam is compressed and introduced with the high-pressure steam into the space surrounding the heating tubes of the central chamber. (Reference is directed to Eng. Pat. 2967 of 1878.)—W. H. C.

Evaporating apparatus; Multiple-effect ——. R. Lougher, Papaikou, Hawaii. U.S. Pat. 1,105,443, July 28, 1914; date of appl., June 28, 1912.

A NUMBER of superposed evaporator sections are separated by spaced sheets between which are water-condensing spaces, and a pan is placed below the bottom section. Each section has an inlet above to receive the liquid to be treated and an outlet below, and is fitted with open vapour tubes extending downwards acoss the water-condensing space and connected with the lowermost sheets. Evaporating tubes closed at their upper ends and arranged over the vapour tubes, are supported at their lower ends in the uppermost sheets, extend through each section and communicate with the water-condensing spaces. Pipes leading from these spaces are connected with a main pipe. A pipe leading from the water-condensing space of the uppermost evaporator section, and the above-mentioned main pipe, are connected with an auxiliary evaporator.—L. E.

Rotary furnaces or the like; Removing sediments or crusts from ——. N. Ahlmann, Copenhagen. Eng. Pat. 16,893, July 23, 1913. Under Int. Conv., Feb. 1, 1913.

THE crust or clinker is removed by means of a disc which carries a number of consecutively acting scrapers and which is rotated within the furnace about an axis oblique to the axis of the furnace.—W. H. C.

Kiln; Rotary ——. H. E. Riisager, Frederiksberg, Denmark. U.S. Pat. 1,103,381, July 14, 1914; date of appl., April 18, 1912.

THE lining of the shell of a horizontal rotary kiln is partly replaced by chambered blocks secured to the shell by hooks and an angle iron and forming a corrugated transversely longitudinal partition.—W. H. C.

Regenerative furnaces; Reversing ——. L. L. Knox, Allegheny, Pa., U.S.A. Eng. Pat. 25,588, Nov. 8, 1913. Under Int. Conv., May 16, 1913.

THE removable cooling box described in Eng. Pat. 8883 of 1912 (this J., 1912, 801) is so constructed that it only surrounds the upper part of the gas port, the middle portion forming the only connection between the end portions of the box. The box is inclined in order to facilitate the escape of any steam formed, has a depending hollow flange which protects the arch, and is provided with water-supply pipes which enter the end of the box and discharge near the centre.—W. H. C.

Churns or other mixing and agitating apparatus. R. M. Williams, Oswestry, Salop. Eng. Pat. 18,055, Aug. 8, 1913.

THE barrel of the churn has hollow trunnions mounted on a frame and is rotated from a countershaft by toothed wheel gearing, the beaters being rotated in the opposite direction by a chain and sprocket wheel driven from the same countershaft. The shaft on which the beaters are mounted can be withdrawn by removing a wedge key, leaving the beaters free to be taken out, without disturbing the sprocket wheel.—W. H. C.

Mixing machine. A. McKaig, Buffalo, N.Y. U.S. Pat. 1,105,812, Aug. 4, 1914; date of appl., Oct. 15, 1912.

A HORIZONTAL drying drum has a shoot at the outlet end which is connected with a discharge spout. A door, which forms part of the wall of the spout, rotates about a transverse shaft so that when it is turned inwards the spout is closed to the air but open to the shoot, and when it is turned outwards the spout is open to the air and closed to the shoot.—W. H. C.

Catalysis; Apparatus for facilitating chemical reactions by means of ——. H. A. A. J. Lelarge, Paris. Eng. Pat. 18,579, Aug. 15, 1913.

A NUMBER of open spirals of constant pitch, *e.g.*, of metal or of porous material impregnated with the catalyser, are arranged in layers in a vessel, alternate layers being at right angles to one another. The top and bottom layers are formed of a material which is a good conductor of electricity and are connected with the poles of a battery or other source of electricity. The intermediate layers are formed of non-conducting material. —W. H. C.

Pulverising, gasifying and re-heating liquefied gases; Apparatus for ——. J. L. Laurent, Paris, and L. Peltier, Clichy, France. Eng. Pat. 18,621, Aug. 15, 1913. Under Int. Conv., Aug. 21, 1912.

THE liquefied gas (*e.g.*, carbon dioxide) is passed direct by a pipe reaching to the bottom of the reservoir, through on or more gratings, to a pulveriser situated in the lower part of a gilled expansion chamber which is suitably heated The gas then passes from the upper part of the expansio chamber through a series of coils arranged round the outside of the chamber and is heated further. The heated ga passes through a pressure-regulating valve, preparator to using it for motive power purposes.—W. H. C.

Filtering materials; Manufacture of ——. L. von Jarac zewski, Berlin. Eng. Pat. 23,736, Oct. 20, 1913. Unde Int. Conv., Dec. 7, 1912.

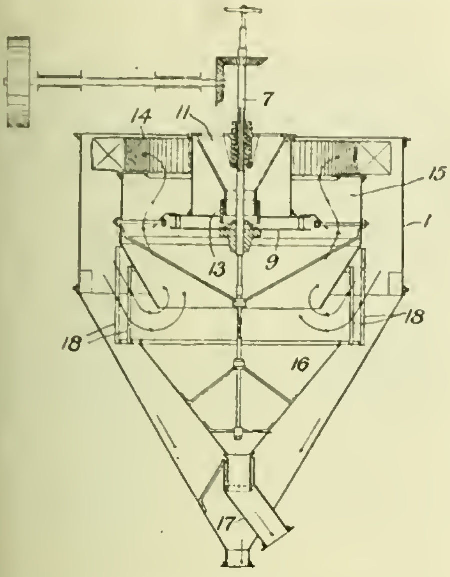
FILTERING material having a hairy surface (*e.g.*, fustia is boiled for 5 mins. in a mixture of water, alcohol, bon black and magnesia, then allowed to cool, dried and passe between heated rollers. A mixture of bone black, asbest fibre, magnesium carbonate, "perhydrol of magnesia and water is then spread on the hairy surface of the fabr which is again dried and pressed for several hours betwee sheets of glazed paper or polished metal.—W. H. C.

Filtering valuable compounds; Apparatus for ——. N. . Burgess, New York. Assignor to Butters Patent Vacuu Filter Co. U.S. Pat. 1,103,345, July 14, 191 date of appl., Sept. 3, 1913.

A FILTER-LEAF is provided with a valve which allows cle water to be discharged from the leaf into the slimes wh the internal and external pressures are equal, but whi closes and prevents the entry of liquid when the inter is less than the external pressure.—W. H. C.

Separators. C. von Grueber, Berlin-Weissensee. Eng. Pat. 27,130, Nov. 25, 1913.

The materials are fed through the hopper, 11, into the inner conical vessel, 15, where they meet a current of air produced by the fan, 14, the lighter particles being carried into the outer vessel, 1, and the heavier particles falling into the lower conical vessel, 16, and being discharged through the opening, 17. A double row of vertical curved baffles, 18, serves to prevent any of the lighter particles from returning to the inner chamber with the air. An adjustable ring, 13, fits over the lower end of the hopper above the spreader pipe, 9, and the lower cone, 16, is carried by a spider from the rod, 7, which slides within the hollow shaft so that the height of the cone, 16, can be adjusted.—W. H. C.

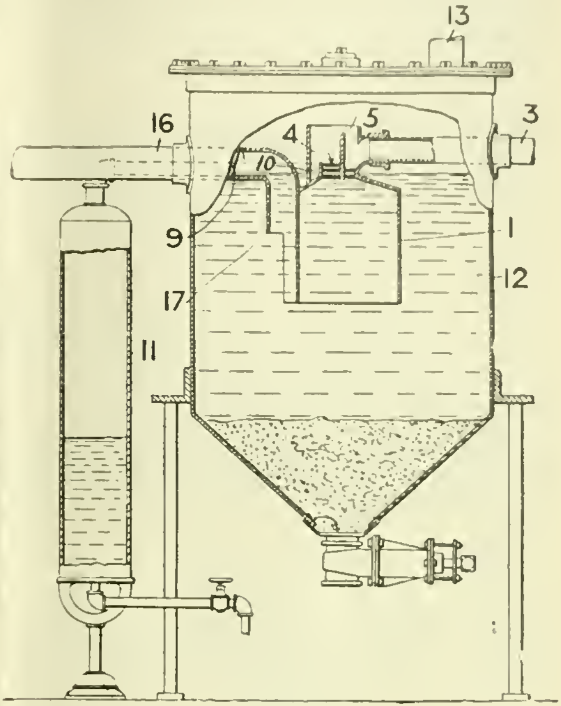


Wet-grinding; Compound mill for ——. E. C. R. Marks, London. From G. Polysius Eisengiesserei und Maschinenfabrik, Dessau, Germany. Eng. Pat. 484, Jan. 7, 1914.

The rotating drum is divided by a transverse hollow partition into two chambers, serving respectively as a granulating chamber analogous to a ball mill and a fine grinding chamber analogous to a tube mill. The liquid in the granulating chamber is maintained at a lower level than that in the fine grinding chamber, so that it has a lesser damping effect on the blow caused by the fall of the crushing bodies. The transference of the material from the granulating to the fine grinding chamber is effected by a number of curved blades in the hollow partition, which lift the material over the edge of the sill that keeps back the liquid.—W. H. C.

Separating liquids of different densities; Apparatus for ——. E. C. Kelly, Boston, Mass., U.S.A. Eng. Pat. 9955, April 22, 1914. Under Int. Conv., April 28, 1913.

The mixture of liquids enters the separator, 1, which is open above and below and is contained in the larger closed vessel, 12, through the pipe, 3, and strikes against the baffle, 5. The lighter liquid collects at the surface and enters the compartment, 4, overflows into the space, 10, and is discharged through the pipe, 9, into the receiver, 11. The heavier liquid sinks into the larger volume of heavier liquid contained in 12, and overflows through the pipe, 16, which is of such dimensions as to ensure a constant level. The large volume of liquid in 12, serves as a tranquiliser and prevents any light liquid from being carried away, and also allows any sediment to settle out from the heavier liquid. A baffle, 17, prevents any light liquid which may have escaped into the vessel, 12, from overflowing by the pipe, 16, and allows it to float up to the surface where it is volatilised and escapes through the vapour pipe, 13.
—W. H. C.



Grinding, pulverising and like mills. W. H. Kniskern, San Antonio, Spain. Eng. Pat. 5437, March 3, 1914.

To obviate the great wear and tear experienced at the angle between the liner and the plates in tube mills having peripheral liners and transverse plates, a fillet or thickened portion is provided, which is integral with either the liner, or the plate, or with both.—W. H. C.

Emulsions; Machine for producing or treating ——. Silkeborg Maskinfabrik Zenthen and Larsen, Silkeborg, Denmark. Eng. Pat. 4657, Feb. 23, 1914. Under Int. Conv., Feb. 24, 1913.

The machine consists of a horizontal drum provided with beaters and baffle-plates which are spaced alternately and rotated on a horizontal axial shaft. The beaters are transverse plates perforated with radial slots which have their edges bent outwards. The baffle-plates which are near the inlet end of the drum have radial apertures and those near the outlet end are perforated with smaller round holes.—W. H. C.

Reaction or absorption towers; Filling materials for ——. F. Raschig, Ludwigshafen, Germany. Eng. Pat. 6288, March 12, 1914.

The towers are filled with a number of small cylinders of suitable material which are simply dropped into the tower and have in consequence an irregular arrangement.
—W. H. C.

Desiccation of air or gases. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Procédés G. Claude), Paris. Eng. Pat. 11,094, May 5, 1914. Under Int. Conv., May 6, 1913.

The cooling agent, *i.e.*, the expanded gas, passes down through a nest of vertical tubes and the gas to be desiccated and cooled is passed upwards around the tubes through a spiral of very low pitch so that the path of the gas is almost horizontal. To remove any deposit of hoar frost, the region of lowest temperature is from time to time caused to shift temporarily upwards by cutting out the lower stages of the cooling coils at intervals. The rise of temperature so obtained causes the frost to melt, the water draining into a reservoir below.—W. H. C.

Drying machine. O. S. Sleeper, Assignor to Buffalo Foundry and Machine Co., Buffalo, N.Y. U.S. Pat. 1,103,443, July 14, 1914; date of appl., Oct. 2, 1912.

The materials are dried on the outer surface of a drum which is rotated on a horizontal axis and enclosed in a casing one end of which is fixed, the remainder being movable horizontally to allow access to the drum. —W. H. C.

Dry-kiln. G. F. Moranz, Chicago, Ill., Assignor to Chicago Varnish Co. U.S. Pat. 1,103,608, July 14, 1914; date of appl., April 16, 1913.

The drying chamber has valved air-inlets near the bottom, air-outlets near the top, and heating coils on the bottom. Above the heating coils is a double floor formed of removable gratings spaced apart, the bars and spaces of the upper grating being narrower than those of the lower and the spaces of the upper grating being over the bars of the lower.—W. H. C.

Drying-drum; Rotary ——. K. H. G. A. Gerlach, Nordhausen, Germany. U.S. Pat. 1,105,417, July 28, 1914; date of appl., Aug. 7, 1913.

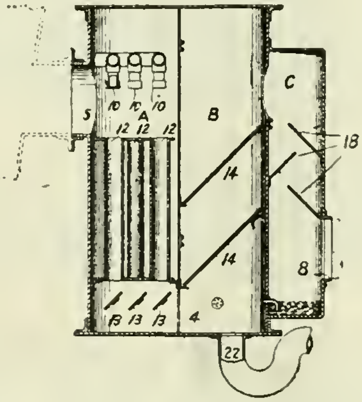
A rotary drying-drum is provided with a series of removable radial partition plates, having tangential mixing vanes on each side and supported between the shell of the drum and a series of central removable rings.—W. H. C.

Extinguishing fires; Compound for ——. W. O. Snelling, Pittsburg, Pa., Assignor to F. L. Dyer, Montclair, and J. W. Aylsworth, East Orange, N.J. U.S. Pat. 1,103,092, July 14, 1914; date of appl., June 7, 1912.

The compound consists of a non-inflammable solvent in which is dissolved a carbon compound of the aliphatic series containing a halogen atom and more carbon atoms in the molecule and having a higher boiling point than the solvent.—W. H. C.

Scrubbing and cooling gases for use in fumigating and fire extinguishing and like purposes; Apparatus for ——. G. Harker, Assignor to The Harker Fire Extinguisher and Fumigator Co., Ltd., Sydney, N.S.W. U.S. Pat. 1,103,509, July 14, 1914; date of appl., March 28, 1913.

The waste combustion gases enter the first chamber, A, of the apparatus through the pipe, 5, and are drawn into the tubes, 12, by the action of the water sprays, 10. The water spray cools and washes the gases which strike against the baffles, 13, as they issue from the lower ends of the tubes. The gases next enter the chamber, B, through the opening, 4, and pass upwards through the gauze baffles, 14; any water which may be separated being drawn off by the pipe, 22. The gases next pass down the chamber, C, provided with the baffles, 18, and are discharged through the port, 8. —W. H. C.



Distilling apparatus. J. A. Houser, Marion, Ind., U.S.A. Eng. Pat. 27,642, Dec. 1, 1913.

See U.S. Pat. 1,082,525 of 1913; this J., 1914, 127.—T.F.B.

Liquid suspended in another liquid; Process and apparatus for separating a ——. Comp. Française pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 468,455, Feb. 14, 1914. Under Int. Conv., Feb. 18, 1913.

See Eng. Pat. 13,465 of 1913; this J., 1914, 780.—T. F. B.

Drying [gases] by cooling; Temperature exchangers for ——. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. G. Claude). Fr. Pat. 468,917, May 6, 1913.

See Eng. Pat. 11,094 of 1914; preceding.—T. F. B.

Filtering apparatus. K. Kiefer. Fr. Pat. 469,041, Feb. 10, 1914. Under Int. Conv., April 8 and June 5, 1913.

See Eng. Pat. 14,136 of 1913; this J., 1914, 632.—T. F. B.

Filter-press. E. J. Sweetland. Fr. Pat. 469,108, Feb. 28, 1914. Under Int. Conv., April 12, 1913.

See U.S. Pat. 1,083,305 of 1914; this J., 1914, 341.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Producer gas from low-grade fuels. R. H. Fernald. J. Franklin Inst., 1914, **178**, 161—179.

The total horse-power of gas producer power plants in the United States was 160,000 in 1911, of which 80,000 was obtained from bituminous coal, 70,000 from anthracite and 10,000 from lignite. Lignites usually contain much moisture, but make gas of excellent quality. Many low-grade bituminous coals and lignites may be utilised for power purposes by briquetting, though this considerably raises the price. Peat dried by exposure to the sun to a moisture content of 25—30% is very suitable for use in gas producers. The cost of producer gas installations is about equal to that of reciprocating steam engines; the cost of maintenance is only about one-half, while the economy has been shown in several cases to be 2—3 times as great; the heat losses in typical steam and gas plants given are :—

	Steam plant.	Gas plant.
Heat lost in ashes	2·00	1·10
,, ,, ,, radiation and cooling	4·60	18·60
,, ,, ,, smoke	24·60	—
,, ,, ,, radiation and friction	3·30	4·30
,, ,, ,, exhaust	53·50	23·70
,, ,, ,, jacket water	—	33·50
,, ,, ,, auxiliaries	7·30	—
Total losses in entire plant	95·30	81·20
Net efficiency of plant	4·70	18·80

—W. R. S.

Carbon; Latent heat of vaporisation of ——. C. Hering. Met. and Chem. Eng., 1914, **12**, 526—528.

The energy liberated when solid carbon combines wit gaseous oxygen: $C+O=26·1$ kilo.-cals., and $C+O_2=94·$ kilo.-cals., is represented by the difference between th chemical energy of combination and the physical energ required to render the carbon gaseous. Richards estimate the latter value at 45·7 kilo.-cals. By reducing this figur from 45·7 to 42·1 (about 9%), the equations are: $C+O = 26{\cdot}1 + 42{\cdot}1 = 68{\cdot}2$ (which is identical with $CO+O = 68{\cdot}2$), and $C+O_2 = 94{\cdot}3 + 42{\cdot}1 = 136{\cdot}4$, or $68{\cdot}2 \times 2$, kilo.-cals. It would thus appear that carbon develops exactly as much energy in combining with the first atom of oxygen as it does with the second.—W. R. S.

Gas; "New" or "double" —— for small works. C. B. Tully. J. Gas Lighting, 1914, **127**, 452—453.

"DOUBLE" gas is a mixture of coal-gas and water-gas having a calorific power from 380 to 400 B. Th. U., made by the gasification of coal and the generation of water-gas from the resulting coke in the same plant. The gas can be made in small gas-works (5 million cb. ft. per ann.) and sold more profitably at 2s. 6d. per 1000 cb. ft. than coal gas (550 B. Th. U.) at 6s. 3d. It is suitable for heating, and can compete with suction producer gas for gas engines. The plant consists of two gas producers connected at the lower part, each surmounted by a vertical retort chamber surrounded by chequer-brickwork. The producers are "blown" to incandescence for about 1 min. by an up-draught, and the hot gases burnt with a secondary air supply in the chequer-brickwork around the retorts, coal-gas passing from the retorts to the scrubber during this period. Steam is then passed downwards through the hot chequer-brickwork of one producer, then through the two producer chambers in series and upwards through the second retort chamber. During the next gas-making period, the direction of flow is reversed.—A. T. L.

Surface combustion. W. A. Bone. J. Roy. Soc. Arts, 1914, **62**, 787—796, 801—811, 818—827.

DESCRIPTIONS of the results obtained in the technical application of surface combustion have been given previously (see this J., 1909, 512; 1911, 527; 1912, 61, 524; 914, 303).—A. S.

Gas; Firing of —— by adiabatic compression. I. Photographic analysis of the flame. H. B Dixon, L. Bradshaw, and C. Campbell. *II. Ignition-points of mixtures containing electrolytic gas.* H. B. Dixon and J. M. Crofts. Chem. Soc. Trans., 1914, **105**, 2027—2053.

A DESCRIPTION of the experimental investigation, the chief results of which have been given previously (this J., 1914, 409). The ignition temperatures of different gases determined by the compression method were: $2H_2+O_2$, 526°; $2H_2+O_2+4H_2$, 602°; $2H_2+O_2+O_2$, 511°; $2H_2+O_2+7O_2$, 478°; $2H_2+O_2+N_2$, 537°; $2H_2+O_2+2N_2$, 549°; $2H_2+O_2+4N_2$, 571°; $2H_2+O_2+$ N_2, 615° C.—A. S.

Sulphur; Determination of —— in spent oxide. H. Marsden. J. Gas Lighting, 1914, **127**, 335.

THE usual errors in the carbon bisulphide method of estimation, due to the solubility of certain organic substances, may be avoided by treating the extract with strong sulphuric acid at steam-bath temperature. 5 grms. of the oxide are extracted as usual with carbon bisulphide, the extract being run into a weighed 250 c.c. flask. The latter with extract is dried in an oven and weighed, then heated with 10—20 c.c. of strong sulphuric acid on a steam-bath for about 4 hours, treated with about 200 c.c. of distilled water, and filtered. The residue is washed free from acid, dried and extracted with carbon bisulphide. The extract evaporated and the sulphur weighed. The difference in the weighings gives the amount of soluble organic matter.—W. F. F.

Petroleum; Production of —— in Canada, 1913. Oil, Paint, and Drug Rep., Aug. 31, 1914. [T.R.]

THE Department of Mines reports that the total output of petroleum in 1913 was 228,080 barrels, or 7,982,798 gallons, on which a bounty of $119,741.97 was paid. The total value of the production at the average price for the year $1.782 per barrel was $406,439. The total imports of petroleum oil, crude and refined, in 1913 were 22,779,293 gallons, valued at $13,230,429, in addition to ,628,837 pounds of wax and candles, valued at $108,897. The oil imports included crude oil 162,062,201 gallons, refined and illuminating oils 19,393,827 gallons, gasoline 29,525,170 gallons, lubricating oils 6,789,151 gallons. There was an increased importation in 1913 of all classes of oil with the exception of gasoline, the increases being most pronounced in crude oil and refined illuminating oil. There was comparatively little change in the production of natural gas in Ontario, but a large increase in the production in New Brunswick and Alberta. The total production in 1913 was approximately 20,345,000,000 feet, valued at $3,338,314 of which 828,000,000 feet was from New Brunswick; 12,487,000,000 feet from Ontario and 7,030,000,000 feet from Alberta.

Italian petroliferous zone; Importance of the ——. B. Galdi. L'Ind. Chimica, Min. e Metall., 1914, 1, 264—270.

THE petroleum industry in the province of Emilia has worked successfully with a moderate profit, and systematic prospecting for petroleum throughout the whole of Southern Italy is now recommended.—A. S.

Ceresin wax. E. J. Parry. Chem. and Drug., 1914, **85**, 376.

PARAFFIN waxes of different kinds have recently been adulterated with large amounts of rosin. The samples were sticky, showed uncertain m.pts., and had a taste of rosin. They gave the colour reactions for rosin, and had high acid and iodine values. Four samples gave:—Acid value, 48—60; saponif. value, 51—72·5; and iodine value, 40—56.—C. A. M.

Bagasse and molasses; Utilisation of ——. N. Deerr. *See* XVII.

Determination of carbon monoxide. Graham and Winmill. *See* XXIII.

Peat; Utilisation [excavation] of ——. T. Rigby, Dumfries, and Wetcarbonizing Ltd., London. Eng. Pat. 17,944, Aug. 6, 1913.

THE peat deposit is worked in relatively small, isolated portions, say of about 30 acres, separated by walls of peat of about 20 ft. thickness. When the peat is subsequently subjected to a heat treatment, *e.g.* wet carbonisation, the expressed water is returned to the excavations being worked. A worked-out excavation is used as a store from which water may be supplied to excavations being worked.—W. F. F.

Fuel; Process of manufacturing artificial —— from organic matter, e.g. peat. F. C. C. T. A. Osius, Grand Rapids, Mich. U.S. Pat. 1,105,206, July 28, 1914; date of appl., April 22, 1911.

THE organic matter, such as peat, is pressed to remove moisture, disintegrated, and treated with sulphuric acid until carbonised into a semi-plastic state. The acid may be removed by immersion in water, and the material moulded into briquettes.—W. F. F.

Briquettes and other articles; Manufacture of ——. C. M. Reynolds, Sparks, Nev. U.S. Pat. 1,103,078, July 14, 1914; date of appl., June 29, 1912.

WASTE wood is carbonised, the carbonaceous residue is mixed with a suitable binder, part of which consists of a portion of the tarry distillate, and the mixture briquetted. The briquettes are subsequently heated to a temperature sufficient to drive off the volatile portion of the binder and to harden them.—W. H. C.

Regulating combustion. G. W. Parker, New York, Assignor to The Parker-Russell Mining and Manufacturing Co., St. Louis, Mo. U.S. Pat. 1,104,000, July 21, 1914; date of appl., Dec. 9, 1909.

THE products of combustion from a deep bed of fuel are divided into a number of currents, air and steam being mixed with one of the currents in regulated proportions. This current is led by a circuitous path through the other currents, and the resulting heated gases are discharged into the bed of fuel.—W. F. F.

Combustion; Process of controlling ——. J. M. Rusby, Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,106,319, Aug. 4, 1914; date of appl., Feb. 13, 1911.

THE temperature effect of a fluid combustible is controlled by adding to the mixture of combustible and air definite proportions of the newly-formed products of combustion before the latter leave the combustion chamber.—W. H. C.

Inflammable gases; Means for detecting ——, *especially adapted for use in mines.* J. W. Manley, New Barnet, Herts., and W. J. L. Sandy, London. Eng. Pat. 18,166, Aug. 9, 1913.

THE catalytic substance used consists of a wire or plate of base metal coated with "granular palladium" prepared by mixing resin oil, oil of myrrh or oil of rosemary with palladium chloride, separating the resulting black precipitate and making it into a paste with oil of lavender. —W. E. F. P.

Mines; Detecting dangerous gases in ——. G. Schauli, Cheshunt, Herts. Eng. Pat. 14,498, Jan. 23, 1914.

AIR is drawn through pipes extending to various workings and tested for inflammable gases by ignition at a flame, the heat acting on a thermo-electric indicator. Heavy gases are indicated by passing the air through a balanced hollow chamber, the movement of which closes an electric-alarm circuit.—W. F. F.

Coke-ovens; Charging ——. H. Koppers, Essen-on-the-Ruhr, Germany, Assignor to H. Koppers Co., Chicago, Ill. U.S. Pat. 1,105,522, July 28, 1914; date of appl., Nov. 15, 1913.

To prepare a charge for a top-charged oven chamber, finely divided coal is dropped in, thus effecting a packing of the coal, and a loosening member is raised through the coal from the bottom of the chamber.—W. F. F.

[*Gas*]. *Retorts; Regenerator settings for vertical* ——. S. Glover, St. Helens, and J. West, Southport. Eng. Pat. 18,599, Aug. 15, 1913.

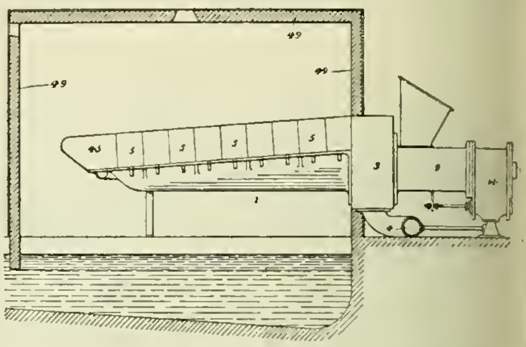
IN a regenerator setting of the type having independent combustion chambers around the retorts and additional chambers, around the lower ends of the retorts, for heating the secondary air, an independent supply of coal-gas is provided for each of the combustion chambers and the gas is preheated by being passed through coils disposed in the waste-gas flues and so arranged that they may be short-circuited when desired.—W. E. F. P.

[*Gas*] *Retorts; Discharging apparatus for vertical* ——. S. Glover, St. Helens, and J. West, Southport. Eng. Pat. 28,055, Dec. 5, 1913.

AT the lower end of the vertical retort one or more trays are provided to form a horizontal platform of adjustable size. The coke rests on this platform at its angle of repose, and a displacer in the shape of a sector of a cylinder is given a rocking motion about an axis in the plane of the platform, thereby causing the coke to fall from the edge of the platform without breakage and formation of "breeze."—W. F. F.

Gas producer. R. F. Boak, London. From C. F. Boak, Calcutta. Eng. Pat. 2578, July 22, 1913.

THE apparatus (see fig.) consists of a water-sealed chamber, 49, containing a horizontal "retort" or trough, 1, the upper part of which is formed by a series of hollow tuyère-blocks, 5: with the exception of the curved end-block, 45, each of the latter has a horizontal partition by means of which two parallel channels, one above the other, are formed within the series; and the lower part of each block has openings ("tuyères") communicating with the interior of the trough. Fuel is supplied to the latter from the chamber, 9, by means of a plunger or similar reciprocating device actuated from the cylinder, 14, of a steam engine; and around that end of the casing, 9, which adjoins the trough, an annular chamber, 3, is disposed, to which air, steam and exhaust gas (separately or together) are supplied by the pipe, 4. The annular chamber, 3, being in communication with the upper channel in the tuyère-blocks, the air, etc., from the former is preheated during its passage to the end-block, or chamber, 45, from which it passes to the lower channel and thence, through the tuyères, into contact with the fuel.—W. E. F. P.



Gas from liquid hydrocarbons; Means and methods of producing ——. W. Cameron, Warwick, and H. G. Burford, London. Eng. Pat. 17,241, July 28, 1913.

THE process consists in burning completely a small portion of the hydrocarbon with excess of air and then decomposing the remainder, together with the products of combustion, by contact with a bed of incandescent, refractory or carbonaceous material, the temperature of which is maintained by the incomplete combustion of a further small portion of the hydrocarbon.—W. E. F. P.

Gas from oil; Process of making ——. W. A. Hall New York. U.S. Pat. 1,105,772, Aug. 4, 1914; dat of appl., June 25, 1913.

A MIXTURE of water and oil is brought into contact with a mass of metallic nickel, containing a small proportior of cobalt, at 650°—750° C.—W. H. C.

Air-gas; Manufacture of ——. P. C. Pace, Billingshurst Sussex. Eng. Pat. 17,854, Aug. 5, 1913.

THE apparatus is of the type in which the air is supplie by a steam injector, the boiler is of the flash type, an the pressure of air and steam can be regulated. I starting, the gas-bell is drawn up to its highest point and supplies air-gas to the flash boiler, the compresse air from the injector passing through the carburetto which, together with the hydrocarbon tank, is situate within the gasometer. At the upper limit of its move ment, the bell opens a valve in the air-supply pipe or i may close the water supply to the boiler. In a modifica tion, the compressed air passes into the gasometer befor reaching the carburettor, which, together with the hydr carbon tank, is external to the gasometer.—W. F. F.

Combustible gases; Method and apparatus for produci ——. H. Strache, Vienna. Eng. Pat. 5730, March 1914. Under Int. Conv., Jan. 13, 1914.

IN an apparatus for continuously producing a mixture coal-gas and water-gas, the producer in the lower pa is charged with coke, and the distilling chamber or reto in the upper part with coal. Air is blown in under t grate, until the column of coke glows; the carbon mo oxide produced is burned in the space around the distilli chamber by blowing in additional air, and the produc of combustion escape to the chimney. During this period the gas-outlet valve of the distilling chamber is closed and coal-gas accumulates in the space above the coal, which is of relatively large dimensions, and gradually fills the chamber. During the subsequent steam blow, the gas-outlet valve is kept open until the coal-gas is completely displaced by the water-gas. The valve is then closed and the cycle of operations repeated.—W. E. F. P.

Gaseous fuel ; Production of ——. G. H. Benjamin, New York. U.S. Pat. 1,105,241, July 28, 1914 ; date of appl., Jan. 13, 1913.

A gas-producing material such as sawdust is distilled, and after separation of tar and ammonia by washing, the mixture of carbon monoxide and dioxide is passed through a zone of carbonaceous material strongly heated by an electric current, in order to reduce the dioxide to monoxide. This gas may be added to the "gas originally produced." —W. F. F.

Gas ; Purifying ——. C. J. O'Donnell and A. F. Kunberger, Philadelphia, Pa., Assignors to United Gas Improvement Co. U.S. Pat. 1,105,578, July 28, 1914 ; date of appl., April 18, 1913.

Gas is purified from carbon bisulphide by passing it through heated precipitated hydrated ferric oxide, or through ferric oxide heated to 400°—500° F. (204°—260° C.) —W. F. F.

Bituminous material ; Treating ——. J. C. Ross, Colorado Springs, Colo., Assignor to The Hydrocarbon Co. U.S. Pat. 1,104,140, July 21, 1914 ; date of appl., Sept. 27, 1911.

The bituminous material is mixed with a "suitable quantity" of litharge, the temperature being lowered and kept low, whilst the mixture is pulverised.—W. F. F.

Oil refining ; Apparatus for ——. J. R. Timmins, Assignor to O. Swain, Okmulgee, Okla. U.S. Pat. ,105,383, July 28, 1914 ; date of appl., April 10, 1913.

From the still, a valved pipe leads to the lower end of a primary condenser, and from the upper end of the latter a pipe leads to the lower end of a second condenser. A vapour pipe leads from the latter to a separator, and pipes from the second condenser and the separator lead to a cooling coil. A vapour-outlet pipe also leads from the separator to a cooling coil. A valved pipe leads from the first-mentioned cooling coil back to the still.—W. F. F.

Gasolene : Process of producing ——. J. W. Waitz, Oil City, Pa. : J. D. Trax and W. M. Parker, executors. U.S. Pat. 1,105,727, Aug. 4, 1914 ; date of appl., July 6, 1912.

Gasolene is obtained by compressing a suitable gas, cooling it, and then injecting it into a stratum of earth containing, or a well producing, fluid hydrocarbons. The saturated gas is recovered. and the hydrocarbon vapour condensed from it.—W. F. F.

Gasolene ; Manufacture of ——. W. M. Burton, Chicago, Ill., Assignor to Standard Oil Co., Whiting. Ind. U.S. Pat. 1,105,961, Aug. 4. 1914 ; date of appl., Aug. 25, 1913. Renewed May 25, 1914.

The liquid portions of the paraffin series of petroleum-distillation which boil above 500° F. (260° C.) are treated o obtain volatile products of the same series by distilling at 650°—850° F. (343°—454° C.). The distillate is condensed under a pressure of 4 to 5 atmospheres, and redistilled under atmospheric pressure. The final distillate s mixed with more of the original liquid, and subjected o the first-named treatment.—W. F. F.

Coking retorts : Vertical ——. J. Lütz, Bredeney, Germany. Eng. Pat. 17,887, Aug. 5, 1913. Under Int. Conv., Aug. 5, 1912.

See Ger. Pat. 263,767 of 1912 ; this J., 1913, 1058.—T. F. B.

Vertical retorts ; Regenerators for ——. S. Glover and J. West. Fr. Pat. 469,140, March 2, 1914. Under Int. Conv., Aug. 15, 1913.

See Eng. Pat. 18,599 of 1913 ; preceding.—T. F. B.

Gas for lighting and heating purposes ; Process for the production of ——. L. Vignon, Lyon, France. Eng. Pat. 29,624, Dec. 23, 1913. Under Int. Conv., Jan. 2, 1913.

See Fr. Pat. 465,129 of 1913 ; this J., 1914, 472.—T. F. B.

Coal gas ; Apparatus for producing ——. Ritter-Conley Manufacturing Co. Fr. Pat. 469,142, March 2, 1914.

See U.S. Pat. 1,091,111 of 1914 ; this J., 1914, 471.—T.F.B.

Manufacture of hydrogen gas. Eng. Pat. 6155. *See* VII.

Manufacture of hydrogen by the decomposition of steam. Fr. Pat. 466,739. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

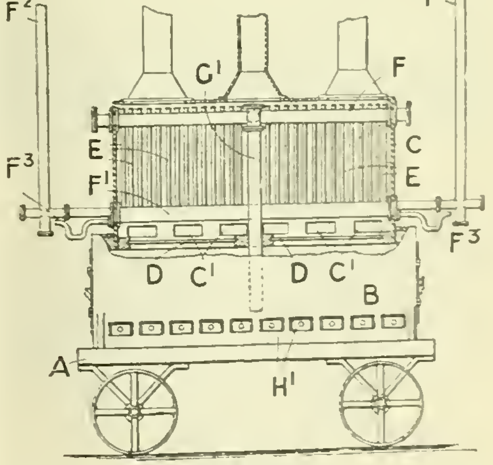
Patents.

Peat ; Treatment of ——. T. Rigby and G. W. Andrew, Dumfries, and Wetcarbonizing Ltd., London. Eng. Pat. 9392, April 21, 1913.

To facilitate the removal of water in the heat treatment of wet peat (heating and pressing), cutting or grinding of the fibres is avoided as far as possible. The hot effluent from peat, pressed at about 100° C., is passed into and through fresh peat for economy.—W. F. F.

[Wood] Distillation apparatus ; Retorts or ——. H. Sykes, Bideford, Devon. Eng. Pat. 17,722, Aug. 1, 1913.

The condenser, C, is superposed upon the retort chamber, B, and comprises a number of tubes, E, the ends of which open into headers, F, F¹. The upper header is connected by pipes, G¹, with the interior of the retort chamber, while the lower header collects the products of distillation, which are removed by pipes, F³. Pipes, F², extending upwards, are connected with the lower header to induce draught through the openings, H¹, which can be controlled, and through the retort chamber and condenser tubes, whilst



orifices, C^1, which can also be controlled, are provided to induce draught through the condenser casing. The material to be treated (*e.g.*, wood, etc.) is packed between the casing and tubes for preliminary heating, and is fed to the retort by opening the slides, D. The whole apparatus is mounted upon a wheeled carriage, A.—W. F. F.

Peat; Treatment of ——. T Rigby, Dumfries, and Wetcarbonizing, Ltd., London. Eng. Pats. (A) 11,133, May 10, 1913, and (B) 18,030 of 1914; date of appl., May 10, 1913.

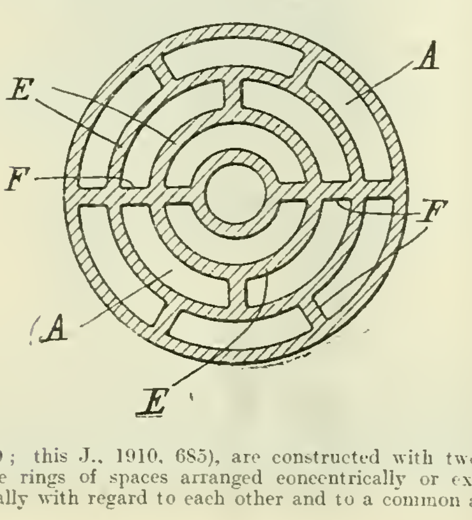
(A.) Peat as wet pulp is passed continuously through a heating apparatus in which it is heated sufficiently to destroy its water-binding properties (*e.g.*, to about 100° C. See Eng. Pats. 5873 and 9392 of 1913; this J., 1914, 783 and preceding), without evaporation of the water; when it has been heated sufficiently to render the water easily expressible, the heat of the treated mass is transferred to fresh material entering the heating system. The hot peat may be removed to a space in which a lower pressure prevails than that corresponding to the vapour tension of steam at that temperature, and the steam thus produced is passed over fresh peat. In another method, a current of gas is circulated between two vessels containing the hot treated peat or liquid expressed from it and the fresh peat. (B.) Peat which has been wet-carbonised or otherwise heat treated, to render its water more easily removable, is filter-pressed at a high temperature (60° C. or above) and the hot effluent so obtained is mixed with raw peat awaiting treatment. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 1046 of 1911.)—T. F. B.

Wood; Distillation of ——. W. Danner, Slidell, La., Assignor to Forest Products Co. U.S. Pat. 1,096,687, May 12, 1914; date of appl., Sept. 6, 1912.

The ovens are disposed in pairs and are operated alternately. When the charged retort has been placed in position in the oven, live steam is injected, volatile products such as turpentine are driven off, and rosin is run off. The second retort of the pair is now treated in this way, and superheated steam admitted into the first retort to drive off heavier vapours. The first retort is withdrawn and replaced by another, and then superheated steam admitted to the second retort, this cycle of operations being repeated as desired.—W. F. F.

Retorts for the distillation, carbonisation, and the like of coal and other carbonaceous materials; Construction of ——. C. W. Tozer, London. Eng. Pat. 7116, March 20, 1914.

Retorts in which distillation or carbonisation is effected in a number of chambers of approximately the same size, grouped round a central axis (see Eng. Pat. 20,158 of 1909; this J., 1910, 685), are constructed with two or more rings of spaces arranged concentrically or eccentrically with regard to each other and to a common axis, all the spaces having approximately the same cross-sectional area. A retort with three such rings of spaces is shown in cross-section in the figure. The spaces, AA, are formed by the walls, EE, and the ribs, FF, which are tapered so as to facilitate charging and discharging. Passages may be provided in some of the ribs through which heating gases are introduced from the furnace to the central passage. One retort with twelve chambers capable of holding half a ton in all, will carbonise that quantity in about one-twentieth of the time necessary when using a plain tubular retort of equivalent diameter. —T. F. B.

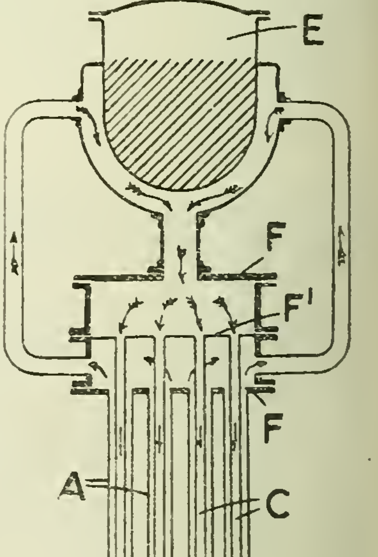


Oils and other products from carbonaceous matter or other materials containing hydrocarbons; Method of and apparatus for obtaining ——. W. G. Wilson, Farningham. Eng. Pats. 18,406, Aug. 13, 1913, and 2428, Jan. 29, 1914.

Shale or other substance to be treated is introduced into a vertical or inclined chamber, in which combustion and distillation are maintained by introducing continuously a relatively large amount of the distillation gases below th combustion zone; a relatively small quantity of air is als admitted, either intermittently or continuously, at th same point, and steam may also be introduced if desired The distillation gases are passed through a condenser an then freed from the last traces of condensable products b mechanical separation, preferably in a circulating fan o pump which forces the gases into the heating chamber a pipe is provided in the casing or compression chambe of the fan or pump, through which the condensate is ru off. A suitable hopper is attached to the heating chambe to enable the material to be introduced without admittin air, and the bottom of the chamber is provided with water seal or arrangement of sliding valves to enable th spent material to be removed without allowing air to ente —T. F. B.

Oil-baths, and means for heating liquid therefor. E. I Higgins, Wallasey, Cheshire. Eng. Pats. (A) 17,190 1914, date of appl., July 28, 1913, and (B) 17,334, July 2 1913.

(A). The bath is jacketed and is heated by oil circulat through the jacket and through a separate heating devic



The latter consists of a number of thermal siphons or l tubes, the outer and inner tubes of which are conne espectively with the upper and lower parts of the jacket. s). The apparatus is similar in principle to the preceding. The outer tubes, A (see fig.), of the Field tube units are arried by the casing of a reservoir, F, while the inner tubes, , are carried by the partition, F^1, which divides the reser-oir into two compartments for the hot and cold oil. The irculation of oil round the jacketed receptacle, E, is shown y the arrows. The reservoir, F, may be dispensed with, he tubes, A, being connected with the wall of the jacket, nd the inner tubes, C, with a partition which divides the acket into two concentric annular chambers.—W. F. F.

hale ; Retorts for the distillation of ——. J. W. Fell, Sydney, N.S.W. Eng. Pat. 12,254, May 18, 1914. Under Int. Conv., March 30, 1914.

CAST iron retort for shale distillation is made slightly apering and in sections, the top of each section being nlarged to form an annular space in conjunction with the ottom of the section next above it ; flues or passages re provided in the enlargements in each section, through hich the products of distillation pass to the vertical nain.—T. F. B.

amps ; Electric incandescent ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 18,447, Aug. 13, 1913.

. TUNGSTEN filament lamp is provided with a "getter" ich as potassium thallium chloride, contained in a small pen tube (see Eng. Pat. 14,048 of 1913), and after exhaus-on a gas, preferably nitrogen, is admitted up to a pressure f 10 to 50 microns. An improved efficiency and longer fe is thereby obtained.—W. F. F.

rc lamps ; Carbon electrodes for electric ——. C. Conradty, Nürnberg, Germany. Eng. Pat. 22,223, Oct. 2, 1913. Under Int. Conv., July 2, 1913.

o improve the adhesion of chemical coatings to carbon ectrodes, the surface of the carbon is roughened and ndered porous by the removal of the outer skin after haping.—W. F. F.

eating apparatus. G. T. Voorhees, New York. Eng. Pat. 13,881, June 16, 1913.

EE U.S. Pat. 1,066,348 of 1913 ; this J., 1913, 782.—T. F. B.

lectrode for arc lighting. C. Conradty. Fr. Pat. 468,836, Feb. 23, 1914.

EE Eng. Pat. 22,223 of 1913 ; preceding.—T. F. B.

III.—TAR AND TAR PRODUCTS.

olycyclic hydrocarbons ; Hydrogenation of —— *by sodammonium. Preparation of the tetrahydro-derivatives of naphthalene and acenaphthene, and dihydro-anthracene.* P. Lebeau and M. Picon. J. Pharm. Chim., 1914, **10**, 97—100.

HE tetrahydronaphthalene produced by treating a ixture of naphthalene and sodium with liquid ammonia his J., 1914, 637) is the 1.2.3.4-derivative. Acenaphthene, nder like conditions, furnishes a tetrahydro-derivative, oiling at 251° C., and anthracene yields dihydro-anthra-ene (b.pt. 313° C.).—F. Sodn.

nthracene derivatives ; The sensitiveness of —— *to light. I. Anthracenecarboxylic acids.* F. Weigert and L. Kummerer. Ber., 1914, **47**, 898—908.

HE three anthracenecarboxylic acids undergo a reversible olymerisation under the influence of light, and in the bsence of oxygen. The reaction is most conveniently rought about by exposing the acids in solution in acetic cid, toluene, or alcohol to the light of a mercury vapour mp for from one to eight hours, the solution being con-tined in a specially devised vessel, and allowed to boil under the influence of the lamp. On cooling, the products crystallise out. They are dimeric forms of the original acids, and depolymerisation occurs at the same temperatures as those of their formation, thus demonstrating the reversibility and energy-storing nature of the photochemical action. The *photo*-acids are all white substances and do not give the fluorescence with ammonia characteristic of the original acids. They do not melt sharply, owing to partial depolymerisation occurring at a lower temperature. In presence of oxygen the photo-chemical action results also in the formation of anthraquinone which, if an aqueous solution of the sodium anthracenecarboxylate is used, separates out after a very short exposure. In absence of oxygen, even in aqueous solution polymerisation occurs exclusively and this provides the first instance of an energy-storing photo-chemical action in homogeneous aqueous solution.—G. F. M.

The European war and U.S. chemical industries. See IV.

Patents.

4-*Chloro*-1-[*hydr*]*oxyanthraquinone and its derivatives ; Manufacture of* ——. F. Ullmann, Charlottenburg, Germany. Eng. Pat. 15,058, June 23, 1914. Under Int. Conv., Dec. 22, 1913.

1-Hydroxyanthraquinone or a derivative thereof is treated with sulphuryl chloride, in presence of nitrobenzene or other solvent, and with or without the addition of iodine or other catalyst. The chlorine atom enters the *para*-position with respect to the hydroxyl group, 4-chloro-1-hydroxyanthraquinone or a derivative thereof being produced. By further action of sulphuryl chloride in presence of a catalyst, polychloro derivatives are obtained.—T. F. B.

Pitch and tar ; Process and apparatus for treating ——. H. W. Robinson. Fr. Pat. 468,320, Feb. 11, 1914. Under Int. Conv., Feb. 18 and April 30, 1913.

See Eng. Pats. 4159 and 10,156 of 1913 ; this J., 1914, 412.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Fusarium ; The colouring matters of ——. Bezssonoff. Comptes rend., 1914, **159**, 448—450.

A red and a yellow colouring matter were isolated from the fungus *Fusarium orobanchus.* The former had the properties of a carotine ; it crystallised in tablets and yielded different coloured solutions when dissolved in various solvents. The absorption bands exhibited by these solutions (violet in chloroform, red-violet in benzene, and yellow in cumene after boiling) showed a gradual displacement in the order given. The yellow colouring matter was crystallised from its aqueous solution ; it acted as a feeble acid and was always accompanied by sugar.—W. P. S.

U.S. imports of dyestuffs. Oil, Paint, and Drug Rep., Aug. 31, 1914. [T.R.]

The American situation in dyestuffs is still acute. The authorities at Washington have tried to make arrangements for importing these materials from Germany, but without success. It is stated that other countries will not require the stocks now held in Germany, and if means can be found to transport them to this country the textile mills here will be enabled to operate for another year. Otherwise many of the cotton, wool, and silk mills will be forced to close in sixty days.

The European war and U.S. chemical industries. Metall. and Chem. Eng., Sept. 1914, 551.

"Metallurgical and Chemical Engineering" has asked a few men, prominent in American chemistry, the following questions :—

1. How does the cutting-off of the supply of certain raw materials by the European war affect the continuity of operation of the various chemical industries in this country ? Can any of these raw materials be procured in

the United States so as to make our industries independent of other countries? What is the situation of the potash industry?

2. Will the forced industrial restriction in Europe, if it continues long enough, warrant the development in this country of chemical industries which have so far been almost exclusively European? What are the possibilities of an American coal tar industry?

3. In the case of a long continued war, do you think that the personnel of the American chemical and metallurgical industries will be affected? Do you think it possible that there may be a scarcity of chemically trained men or of unskilled workmen?

4. Is there enough demand in South American countries for products of the chemical industries to make exports from this country worth while and open new markets for the chemical industries of this country?

In reply Dr. W. H. Nichols stated:—

1. The supply of raw materials for heavy chemicals called for little uneasiness. Stassfurt potash salts being entirely cut off, the farmer might have to do without them, but substitutes would take their place. Potash for other industries might be secured from sea weed or felspar.

2. The prospects of the American coal tar industry would depend on the encouragement which the buyer gave to the manufacturer. The experience of the Benzol Products Co., which started in a small way to manufacture aniline oil, was that although a tariff of 10% was placed on aniline oil by Congress, foreign manufacturers reduced the price to a point where it was impossible to compete.

4. The South American market for chemicals was an important one, and though not yet developed, might grow into an outlet for American products. The difficulties of doing business in South America had been caused by lack of banking facilities. All U.S. copper mines had reduced production by 50% and the refineries had followed suit. As one-half of the copper produced had heretofore gone abroad, this curtailment should provide for all local requirements.

Interviews on the coal-tar industry.—Mr. William J. Matheson commented on question (2) as follows:—

In regard to intermediate products, such as aniline oil, aniline salts, beta-naphthol, paranitraniline, etc., the industry is already developed, and its growth depends in large measure upon the supply of cheap benzol.

Dr. B. C. Hesse commented on question (2), and divided coal-tar products into—

I. Products from coal-tar by distillation, expression and like operations.

II. Products obtained from I. by chemical transformation but not themselves dyes.

III. Dyes made from II.

Germany's foreign trade in 1913 in these three classes was as follows (in metric tons):—

	Imports into Germany.	Exports from Germany.	Excess of exports over imports.
I.	67,501	342,893	275,392
II.	673	16,311	15,638
III.	3,238	163,874	160,636

Division II. included aniline oil and salt, naphthol an naphthylamine, anthraquinone, nitrobenzol, toluidin resorcinol, and phthalic acid.

Division III. included aniline dyes, anthracene dye other than alizarin red, alizarin red, and indigo.

At present the United States produced about 30% its requirements of aniline dyes (Division III.), but almo entirely from materials of Division II. brought fro Germany.

In Division II. Germany controlled the world's market This control was due to the field becoming much inte woven, each of its hundred or more products being depe dent upon or made up of one or more other products, one of which was of use without others. Not one of t 22 factories in Germany was independent of other factori in Germany, whereas together they were independent sources outside Germany. It would not do merely transplant even the largest German works to this countr a part of each German works would be necessary to p duce anywhere a complete and self-contained industry.

Except Switzerland, no country had succeeded selling to Germany more coal-tar dyes than it bought fr Germany, but all of them bought more of intermedia products from Germany than they sold Germany.

German exports of tar products and dyestuffs were follows (in metric tons):—

	Division II.			Division III.				Net totals.
	a	b	c	d	e	f	g	
	Aniline oil.	Naphthol and naphthylamine.	Anthraquinone, etc.	Aniline dyes.	Varicoloured alizarins.	Alizarin red.	Indigo.	
1. United States....	2,428	638	965	13,855	2,164	493	3,461	24,00
2. Great Britain....	340	333	34	10,793	1,130	1,493	1,180	15,23
3. Austria..........	655	109	284	5,582	223	207	1,361	7,97
4. Italy	650	—	825	4,097	158	—	662	6,39
5. Russia	602	1,117	998	1,098	156	174	434	4,57
6. Belgium	120	—	108	2,400	96	—	313	3,03
7. France	—	217	776	1,301	124	98	323	2,83
8. Switzerland	1,217	272	1,201	941	—	259	—	2,00
Net totals	6,012	2,686	5,123	38,185	3,605	2,724	7,734	66,06
No. of countries Germany exported to	11	6	11	32	12	9	21	

The number of coal-tar dyestuff works was as foll 22 Germany, 11 France, 11 Great Britain, 9 United St 4 Austria-Hungary, 4 Switzerland, 2 Holland, 2 Ru 1 Belgium, 1 Greece, 1 Italy. Sixteen plants that coal-tar dyes had abandoned it, 11 in Germany, and each in Austria, Belgium, France, Great Britain Switzerland. Fourteen had been absorbed by ot six in Germany, four in Switzerland, two in France, one each in Belgium and Holland.

A complete coal-tar dye industry in America would to make about 700 different dyes. In the fiscal 1913—1914 America imported indigo worth $1,093 alizarin $845,459, both free; $7,464,134 worth of a dyes with a duty of 30% and aniline oil with a du 10%. These 700 different aniline dyes would aver gross annual income each of about $10,000. To intr 700 different sets of operations and perhaps 350 diff sets of apparatus at *one time* to produce on the av for each set of operations a gross of $35 per day require an initial outlay of $5,000,000. Eac these 700 products required good manufacture fro start because good qualities of each were already on the market. It was one thing to develop such an industry and to maintain it against newcomers, but another to build it up in the face of competition and to hold it against those who developed the business, knew all its ins and outs, had their experience and plant bought, paid for, and written off long ago. It could hardly be expected that if successful this would employ as many as 7000 people, and the gross made out less than 0·4% of the total import business.

This industry could not be successfully transplanted and attempts to transplant part only had not resulted in any self-contained and independent industry anywhere but in a thing whose roots were still in German soil. If it could be transplanted as a whole the net result would not be commensurate with the expense, effort and risk connected with it.

Dr. L. J. Matos said that the question was primarily, whether they produced enough coal tar to make them independent of any foreign source of tar, and also whether higher prices could be obtained for certain tar distillates than the colour industry could afford to pay.

It was not so much a question of inability of chemists to produce dyes, but of the *temporary handicap of not having the especially designed and constructed appliances* for the proper conduct of the technical operations in elaborating the several raw materials to middle and ultimate products.

Tar products, dyestuffs, and hydrochloric acid, etc.: German prohibition of export of ——. Consular Repts. No. 115. [T.R.]

The British Consul-General at Rotterdam reports that the *Reichsanzeiger*, Berlin, of September 15th contains a decree prohibiting the export of hydrochloric acid, dyestuffs, and all materials used in the manufacture of explosives, as well as coal-tar dyes, tar, and other products of the chemical industry, except benzoic acid.

Patents.

Azo-dyestuffs from the arylides of 2.3-hydroxynaphthoic acid; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim Elektron, Frankfort a/M., Germany. Eng. Pat. 10,085, April 23, 1914.

The arylides of 2.3-hydroxynaphthoic acid are combined with diazo- or tetrazo-compounds of the anthraquinone series to form red lake colours, fast to oil, or the combination may be effected on the fibre to give dyeings which are faster than the corresponding ones from β-naphthol. Cotton padded with the anilide of 2.3-hydroxynaphthoic acid and developed with the diazo-compound of 1-aminoanthraquinone is dyed a brilliant red, fast to soap and light.—J. B.

Vat dyestuffs; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Second Addition, dated Jan. 26, 1914, to Fr. Pat. 447,592, Aug. 23, 1912. Under Int. Conv., June 11, Sept. 18, Oct. 6 and 13, 1913.

See Eng. Pat. 3682 of 1914; this J., 1914, 743.—T. F. B.

Polyazo dyestuffs; Process for producing blue ——. L. Cassella und Co. G. m. b. H. Fr. Pat. 468,065, April 11, 1913.

See Eng. Pat. 17,030 of 1913; this J., 1914, 743.—T. F. B.

Azo dyestuff which can be developed on the fibre; Process for making an ——. Kalle und Co. A.-G. Fr. Pat. 468,902, Feb. 25, 1914.

See Ger. Pat. 275,660 of 1912; this J., 1914, 828.—T.F.B.

Anthraquinone series; Process for preparing sulphurised products of the ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 468,373, Feb. 12, 1914. Under Int. Conv., June 4, 1913.

See Ger. Pat. 271,947 of 1913; this J., 1914, 545.—T. F. B.

Patent Case.

Black colouring matter directly dyeing cotton; Manufacture of a ——. C. D. Abel, London. From the Actiengesellschaft für Anilinfabrikation, Berlin, Germany. Eng. Pat. 1151 of 1900; this J., 1900, 1010. Reports of Patent Cases, Vol. XXXI. Illus. Off. Jnl. (Patents) Suppl., May 6, 1914. By permission.

This was an action for infringement brought by the patentees against Levinstein, Ltd. One of the claims in the patent was for the manufacture of the colouring matter by boiling meta-dinitrophenol 1 : 2 : 4 with an aqueous solution of sulphur and a sulphide of an alkali metal. The defendants alleged (*inter alia*) that the patent was invalid for want of subject matter by reason of a prior specification of Cassella (Eng. Pat. 19,831 of 1896; this J., 1897, 734), and for insufficiency of the specification. They contended that if a wide construction was put upon the specification and the patent was for a boiling process, instead of a melting one as in Cassella's specification, there was no sufficient subject matter; that the plaintiffs' specification did not sufficiently define the limits of variation; and that the defendant's process differed from the patented process in the fact that in it not meta-dinitrophenol 1 : 2 : 4 but a sodium salt thereof was used. The plaintiffs contended that their specification ought to be widely construed and that the sodium salt was an equivalent of meta-dinitrophenol. The Court held, that a narrow construction must be put on the specification; that the substitution of a comparatively long boiling process for the comparatively short melting process of Cassella was of great commercial importance, and that the patent was not wanting in subject matter; that the patent was not invalid by reason of the limits of variation not being defined; but that the sodium salt was not a known chemical equivalent of meta-dinitrophenol; and the patent had not been infringed. The action was dismissed.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Plastic materials [artificial silk, etc.]. Recovery of volatile solvents used in the manufacture of ——. H. Barthélemy. Les Matières Grasses, 1914, 7, 4208—4213.

The absorption capacity of sulphuric acid for ether is a function of its sp. gr. From air containing only a few parts of ether per 1000 (as in artificial silk factories), sulphuric acid of 66° B. (sp. gr. 1·84) will absorb only about one mol. of ether, and acid containing one or more mols. of water will absorb little or none. An equimolecular mixture of ether and strong sulphuric acid is deprived of its ether by passage of a current of moist air, after sufficient hydration of the acid (compare Fr. Pat. 350,298 of 1905; this J., 1906, 71, 925). Of other volatile solvents carbon bisulphide could be absorbed as potassium xanthate by alcoholic potassium hydroxide, or by alkali-cellulose for conversion into viscose; whilst toluene (or benzene) vapours might be absorbed by hot concentrated sulphuric acid or by sulpho-nitric acid, to obtain toluenesulphonic acid or *p*-nitrotoluene.—C. A. M.

Wood pulp and cellulose: Withdrawal of German prohibition of export of ——. Consular Reports. No. 115. [T.R.]

The British Consul-General at Rotterdam reports that the *Reichsanzeiger*, Berlin, of September 15th contains a proclamation cancelling the prohibition of exports and transit of mechanical and chemical wood pulp and cellulose.

Patents.

Fibrous and like materials [wool]; Apparatus for drying ——. G. Stone, North Andover, Mass., U.S.A. Eng. Pat. 201, Jan. 3, 1914.

Heated air is forced through a conduit having side-branches each terminating in a valve-controlled orifice pointing upwards. Over each orifice is fitted a vertical perforated pipe fixed into the centre of the base of a stage and keeping the valve open by depressing a pin so long as it remains in position. The material is built up on the stage around the central pipe and the whole supported by a bag or other porous envelope. The stage is suspended by means of frame standards to a counter-balancing lever, the weight on which is so adjusted that when the material has dried to a sufficient degree the frame and stage are lifted off the hot air orifice over which they fit, at the same time releasing the valve so as to close the orifice.—J. F. B.

Animal wool; Process of making substitutes for ——. C. Chavez, Mexico City. U.S. Pat. 1,104,105, July 21, 1914; date of appl., May 20, 1913.

WASTE fibre is steeped in water and submerged successively in baths of caustic soda at 1·027 sp. gr., bleaching powder solution at 1·041 sp. gr., and sulphuric acid and sodium bisulphite at 1·034 sp. gr., remaining in each bath for 3—4 hours. The material is then treated in a boiling "basic" bath of sulphuric acid and sodium bisulphite at 1·02 sp. gr., then in cold caustic soda at 1·152 sp. gr. for mercerisation; lastly it is again treated with bleach liquor at 1·041 sp. gr. and finished with sulphuric acid and sodium bisulphite at 1·02 sp. gr.—J. F. B.

Cellulose esters of organic acids; Process for preparing ——. Knoll und Co. Ger. Pat. 275,962, July 15, 1911.

To effect a regular and systematic reaction of cellulose with organic acids, the esterifying agent is circulated through a series of vessels containing cellulose in various stages of esterification, in such a manner that it comes in contact in successive vessels with cellulose in a lower state of esterification. A diluent in which the resulting ester is insoluble, may be added to the esterifying agent, and the presence of a catalyst is advantageous.—T. F. B.

Acetylcellulose solutions; Production of white or coloured opaque objects from primary ——. Knoll und Co. Ger. Pat. 276,013, Nov. 14, 1912.

AN aromatic acid, ester, or ether which does not dissolve or decompose acetylcellulose (phthalic acid, ethyl, methyl, or β-naphthyl benzoate, benzyl chloride, anisol, etc.), is added to a solution of acetylcellulose in acetic acid, or to the mixture before acetylation. The resulting mixture is heated for a short time until a clear solution is obtained, and this is precipitated in the usual manner by means of water, salt solutions, etc., to form stable, white, opaque filaments or other objects. Coloured opaque products may be obtained by adding suitable dyestuffs to the solution.—T. F. B.

Paper pulp; Machines for straining ——. W. W. Beaumont, London. Eng. Pat. 17,552, July 31, 1913.

IN the type of strainer consisting of a rotating and vibrating drum partly immersed in the pulp, which passes upwards from the outside through the slits and is discharged from the ends of the drum (see Eng. Pat. 23,191 of 1912), the open ends of the drum are provided with flanges, faces or grooves, forming a joint with similar arrangements on the ends of the vat, the joint being packed with flexible or adjustable metal or "woodite" rings kept in position by pneumatic or other extensible rubber filling, or by a spring or tension device or a metal spiral band which may be filled with felt.—J. F. B.

Bleaching lignocellulose and pectocellulose; Process for ——. A. R. de Vains, Paris. U.S. Pat. 1,106,994, Aug. 11, 1914; date of appl., Aug. 18, 1913.

SEE Fr. Pat. 449,497 of 1912; this J., 1913, 482.—T. F. B.

Beating engines for the manufacture of paper and similar purposes. R. Marx. Fr. Pat. 469,011, Feb. 27, 1914. Under Int. Conv., April 17, 1913.

SEE Eng. Pat. 9049 of 1913; this J., 1914, 20.—T. F. B.

Treatment of seaweeds. U.S. Pat. 1,103,283. *See* VII.

Composition [for varnish] containing sulphite waste and shellac. U.S. Pat. 1,103,267. *See* XIII.

Manufacture of syrup and other products from alfalfa. U.S. Pats. 1,104,135 and 1,104,136. *See* XVII.

Apparatus for separating solid matter, more particularly fibrous matter, from liquids such as waste water. Eng. Pat. 6793. *See* XIXB.

Protecting clothing, furs, skins, etc., against moths, beetles, and insects. Eng. Pat. 10,379. *See* XIXB.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Silk; Cause and prevention of the defect in piece-dyed fabrics supposed to be due to a splitting of the fibre of ——. B. Leech. J. Soc. Dyers and Col., 1914, 30, 272—277.

THE defect known as soap-mark, break-mark, chafe-mark, fiochetti, lousiness (American), etc., is shown to be due to a mechanical scarring of the fibre, the resulting particles and minute fibrillæ giving the optical effect of a lighter shade owing to their broken surface. Mechanical injury is the cause of the defect and may occur through adhesion during degumming and through friction during dyeing, degumming, or other treatment of the wet goods. The trouble is most frequent in goods which offer the greatest opportunities for mechanical strains during dyeing, etc., *i.e.* spun silk woven in unions with a harder fibre, or even thrown silk in heavy cloths or when woven with a harder fibre. Skein silk also sometimes shows the marks when the thread is very thick or stiff. The defect is avoided by handling the goods as little as possible, for which purpose the cloth is pinned out in separate folds on a rigid frame for immersion in dye-baths, etc. —J. B.

Sodium sulphide; Rapid determination of —— in a standing sulphide dye-bath. R. N. Len. J. Soc. Dyers and Col., 1914, 30, 277—278.

THE sodium carbonate is removed by means of barium chloride and the dyestuff is precipitated by adding an excess of sodium chloride. After settling, the sodium sulphide is titrated with zinc sulphate using sodium nitroprusside as an external indicator. If sodium chlorid does not clear the solution sufficiently a little pure cotto may be added. The method was tested on dyebath made up from Kryogen Yellow GG., Kryogen Violet 3R. Kryogen Direct Blue G. and Katigen Brilliant Green G. and except in the case of the violet was found to give sharp end-point.—J. B.

PATENTS.

Bleaching; Washing apparatus used in ——. W M'Murray and T. Knowles, Lambeg, Ireland. Eng Pat. 17,971, Aug. 7, 1913.

A MACHINE for washing in rope form consisting of a numbe of adjacent boxes, having separate water inlets an outlets, through which the cloth passes in successio A squeezing roller runs over the set of boxes and th cloth preferably enters the apparatus at opposite end and is taken off at the middle.—J. B.

Yarns, slubbings, rovings and slivers; Cleaning, washin and otherwise treating textiles in the form of ——. F. Larivei, Milan, Italy. Eng. Pat. 26,073, Nov. 13, 191

THE material travels between pairs of corrugated rolle so arranged that the peaks of the corrugations con opposite one another. The upper rollers are mount on a frame which can be moved to adjust the distance between the rollers. An automatic reversing gear is used.—J. B.

Dyeing machines. C. Callebant and J. de Blicquy, Brussels. Eng. Pat. 24,721, Oct. 30, 1913.

Cylindrical receptacles of inert material (*e.g.* earthenware), which hold the material to be dyed, have perforated false bottoms and perforated covers. The cylinders rest in seatings at the bottom of the dye-vat, through which they are in communication with the circulating pump. —J. B.

Dyeing; Method of ——. H. C. Brook, Hartford, Conn. U.S. Pat. 1,096,997, May 19, 1914; date of appl., Sept. 30, 1913.

Material in the form of piece-goods is doubled longitudinally and joined together at the selvedges to form a tube; the two ends are joined and the endless tubular belt is passed between a pair of pressing rolls situated above the dye-bath so that the lower portion of the fabric hangs freely in the liquor. The fabric is guided into and out of the press by two guide-rolls as it moves forward; the air imprisoned in the tube "balloons" the fabric as it passes through and out of the liquor, thus smoothing out all wrinkles by a gentle tension during its treatment with the dye-liquor.—J. F. B.

Fabrics; Decoration of ——. Winsor and Newton, Ltd., and H. Emens, London. Eng. Pat. 21,160, Sept. 19, 1913.

The threads, constituting the design of the fabric, are first impregnated with a liquid which reduces the porosity, such as a solution of wax in a hydrocarbon or a chloro-derivative of a hydrocarbon, and then, when dry, with one or more colouring fluids, *e.g.*, with a finely sub-divided pigment incorporated with a thickened drying oil, or an artist's water colour or dyestuff incorporated with an aqueous solution of gelatin.—B. N.

Printing machines for textiles, paper or other fabrics. Elsässische Maschinenbau-Ges., Mülhausen, Germany. Eng. Pat. 28,503, Dec. 10, 1913. Under Int. Conv., March 15, 1913.

In machines for printing in intaglio in which a small, yielding impression roller is interposed between the engraved roller and the pressure roller, the latter is replaced by a pair of pressure rollers of larger diameter than the impression roller, which is disposed between them in such a way as to prevent lateral deflection.—J. B.

Dyeings on the fibre; Producing fast ——. R. Herz, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 1,107,164, Aug. 11, 1914; date of appl., Feb. 21, 1913.

See Eng. Pat. 25,897 of 1912; this J., 1913, 1007.—T.F.B.

Dyeing apparatus. A. R. Whitehead and J. Farrar. Fr. Pat. 468,713, Feb. 12, 1914.

See Eng. Pat. 28,245 of 1912; this J., 1914, 20.—T. F. B.

Prints and colours; Production of fast ——. H. Levinstein, and Levinstein, Ltd. Fr. Pat. 468,246, Feb. 9, 1914. Under Int. Conv., Feb. 10 and 20, 1913.

See Eng. Pats. 3427 and 4316 of 1913; this J., 1914, 309, 350.—T. F. B.

Prints on fabrics; Process for obtaining fast —— by means of dyestuffs applied by reduction. K. Gross. Fr. Pat. 468,762, Feb. 20, 1914. Under Int. Conv., Feb. 27 and Sept. 2, 1913.

See Ger. Pats. 272,526 and 272,527 of 1913; this J., 1914, 547.—T. F. B.

Bleaching solutions containing titanous chloride and method of producing the same. U.S. Pat. 1,105,308. *See* VII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphurous acid; Volumetric method for the determination of ——. G. S. Jamieson. Amer. J. Sci., 1914, 38, 166—168.

Sulphurous acid is titrated with potassium iodate in the presence of 15—20% HCl and a small volume of an immiscible solvent such as chloroform, the solution being cooled to 15°—18° C. The potassium iodate is standardised with pure, resublimed iodine, and the end point in each case is indicated by the disappearance of the violet coloration of the chloroform. The equations are: $KIO_3+2H_2SO_3+2HCl=2H_2SO_4+ICl+KCl+H_2O$; and $4I+KIO_3+6HCl=KCl+5ICl+3H_2O$.—O. R.

Sodium bichromate; Manufacture of ——. G. Ulm. Chem.-Zeit., 1914, 38, 670.

Chrome iron ore, quicklime, and a portion of the necessary sodium carbonate, are finely ground, thoroughly mixed, and calcined to the sintering point (900°—1000° C.) without fusion of the mass, the fuel consumption being about 180—200 parts of coal for 100 parts of ore. Leaching with a solution of the remainder of the requisite sodium carbonate takes place under pressure in autoclaves fitted with stirring gear, the insoluble residue being thoroughly exhausted and filter-pressed. The concentrated chromate liquor is treated with not quite the equivalent quantity of sulphuric acid, a slight excess of chromate preventing the formation of chromic acid, which would attack the iron evaporating vessels. The latter are cast in one piece with the necessary heating coils and are provided with a stirring device to prevent the deposition and burning of sodium sulphate on to the heating surfaces. The solution is evaporated to 60° B. sp. gr. 1·71), filtered and concentrated in iron basins to a paste containing 67% of chromic acid. The separated sodium sulphate is freed from bichromate by reduction with sulphur dioxide or hydrogen sulphide, and precipitation of chromic hydroxide. Newer methods of manufacture are the treatment of monochromate with ammonia, followed by carbonation and deposition of sodium bicarbonate; the use of caustic alkali in the place of alkali carbonate; and a method devised by the author, according to which only half the necessary sodium carbonate is used for decomposing the ore, the remainder being replaced by sodium sulphate, formed in the later stages of manufacture.—O. K.

Hypochlorites; Stability and oxidation potential of ——. *Contribution to catalysis and a hypochlorite-carbon cell.* K. A. Hofmann and K. Ritter. Ber., 1914, 47, 2233—2244.

Behaviour of hypochlorites at increased temperatures and in presence of carbon dioxide. The stability of nearly pure calcium hypochlorite (now available in large quantities), a mixture of hypochlorite and chloride, and bleaching powder under different conditions was compared, with the following results:—

Treatment.	Content of available chlorine* fell from:—		
	Hypochlorite.	Hypochlorite + chloride.	Bleaching powder.
	%	%	%
Seven hours at 90° C. in a current of dry, CO_2-free air	76·62 to 70·6	—	36·51 to 22·47
Eight days in shallow dishes in still, moist air containing CO_2	76·52 to 52·45	46·30 to 21·05	36·51 to 18·18
Five hours in dry carbon dioxide ..	76·52 to 66·66	46·3 to 36	36·51 to *nil*

* Total oxidising power as determined with acidified potassium iodide solution, calculated to free chlorine.

In a current of moist carbon dioxide the three products all lost the whole of their available chlorine, but whilst chlorine alone was evolved from the bleaching powder and the mixture of hypochlorite and chloride, the pure hypochlorite gave a mixture of chlorine and hypochlorous acid. The free hypochlorous acid produced by the action of a slow current of carbon dioxide on a solution of calcium hypochlorite was largely decomposed: $4HClO = HClO_3 + HCl + Cl_2 + H_2O$; with a solution of bleaching powder the free chlorine was increased at the expense of the chlorate. With ammonia both bleaching powder and calcium hypochlorite gave a nearly quantitative yield of nitrogen.

Behaviour of hypochlorite and bleaching powder with catalysers. Distinction between oxygen-carriers and oxygen-evolving catalysers. The experiments were made with solutions of calcium hypochlorite and bleaching powder respectively, which had been shaken with excess of lime and filtered. With both solutions vigorous decomposition was effected by oxides of cobalt, nickel, and iridium, whilst oxides of chromium, iron, manganese, uranium, bismuth, palladium, osmium, thallium, and vanadium had practically no effect. In presence of ruthenium and rhodium salts the hypochlorite was more stable than the bleaching powder, whilst the reverse was the case in presence of copper sulphate and lead nitrate. The view that the activity of hypochlorites and other oxidising agents such as hydrogen peroxide, can be increased by addition of oxygen-evolving catalysers is incorrect, and in this respect a distinction must be drawn between the catalysers mentioned and oxygen-carriers. With the latter, *e.g.*, osmium tetroxide, intermediate products of higher oxidation-potential are formed, and hence the oxidising power is increased, but oxygen-evolving catalysers, *e.g.*, iridium and cobalt oxide, are capable only of inducing (presumably by surface condensation) the interacion of at least two mols. of hypochlorite with liberation of gaseous oxygen, without any appreciable effect on oxidisable substances which may be present.

Oxidation-potential of hypochlorites and its electromotive utilisation. Using unattackable electrodes of platinum, magnetite, or gold, the potential of calcium hypochlorite solution saturated with calcium hydroxide, in two experiments, was 0·938 and 0·931 volt respectively referred to the standard hydrogen electrode; that of a bleaching powder solution saturated with calcium hydroxide was 0·953 volt. Solutions of sodium hypochlorite gave somewhat higher values when made alkaline with sodium carbonate and somewhat lower values when made alkaline with sodium hydroxide. A cell of the following construction:

platinum in a solution of sodium hypochlorite containing sodium carbonate	20% solution of sodium chloride	zinc in 10% solution of caustic soda + zinc oxide

gave an E.M.F. of 2·24 volts and a current yield of 92·2% of the oxygen consumed. A cell of the Meidinger type, of similar composition to the foregoing, except that a 50% solution of potassium carbonate was used instead of the sodium chloride solution gave a nearly quantitative current yield, and after continuous withdrawal of current a potential of 2·1 volts was always again obtained. Cells were also constructed with carbon anodes. The cell:

platinum in alkaline sodium hypochlorite solution	2N-caustic soda solution	beechwood charcoal in platinum wire gauze immersed in 2N-caustic soda

gave an initial E.M.F. of 0·76—0·91 volt, falling to 0·7—0·87 volt after withdrawal of current; the current-yield was 74—76%, and the electromotively active oxygen was converted almost quantitatively into carbon dioxide. It is thus possible to oxidise carbon at the ordinary temperature in a cell from which current can be withdrawn continuously, but an improved carbon electrode capable of combining more rapidly with oxygen is necessary before such a cell will be useful for practical purposes.—A. S.

Ammonium chloride; Mixed crystals of —— with manganese chloride. H. W. Foote and B. Saxton. J. Amer. Chem. Soc., 1914, **36**, 1695—1704.

THE solubility of varying mixtures of ammonium chloride and manganese chloride in water at 25° C. was determined, both residues and solutions being analysed, and the composition of the solid phases thus ascertained. The results are given in tables and a curve diagram and show that one double salt, $2NH_4Cl,MnCl_2,2H_2O$, is formed, and that this forms with ammonium chloride two series of solid solutions; there is a gap between the limiting compositions of each type, which are approximately:—α-crystals: NH_4Cl 74, $MnCl_2$ 20, H_2O 6%; β-crystals: NH_4Cl 64, $MnCl_2$ 28, H_2O 8%.—A. S.

Calcium nitrate. Part III. The three-component system: calcium nitrate, lime, water. H. Bassett, jun., and H. S. Taylor. Chem. Soc. Trans., 1914, **105**, 1926—1941. (See also this J., 1912, 332.)

BY the investigation at 25° and 100° C. of the solid phases in equilibrium with calcium nitrate solutions containing free lime, the basic nitrate, $Ca_2N_2O_7$, and its several hydrates, but no series of solid solutions $CaO, x N_2O_5, y H_2O$ (Cameron and Robinson, this J., 1907, 1197) were found. —O. E. M.

Polysulphides of calcium. G. A. Barbieri. Atti R. Accad. dei Lincei, Roma, 1914, **23**, II., 8—12.

THE author has shown previously (Atti R. Accad. dei Lincei, Roma, 1910, **19**, II., 584; Z. anorg. Chem., 1911, **71**, 347) that unstable hydrated salts may frequently be isolated in the form of addition-compounds with hexamethylenetetramine. By the interaction of calcium chloride with ammonium pentasulphide and with an ammonium polysulphide solution containing a smaller proportion of sulphur, in presence of hexamethylenetetramine, the two compounds, $CaS_5,10H_2O,2C_6N_4H_{12}$ and $CaS_4,10H_2O,2C_6N_4H_{12}$, respectively were formed as orange-yellow crystalline substances By treating aqueous solutions of calcium polysulphides with hexamethylenetetramine and analysing the precipitates produced, it was found that the solution obtained by boiling sulphur with milk of lime contained the tetrasulphide and that obtained by heating sulphur with calcium hydrosulphide solution contained the pentasulphide of calcium.—A. S.

Niobium; Reduction of quinquevalent ——. A. Stähler Ber., 1914, **47**, 841—843.

SOLUTIONS of niobic acid in hydrochloric or sulphuric acids and of niobium pentachloride in hydrochloric acid whe reduced electrolytically became intensely blue, but n chlorides or sulphates of the type, $NbCl_3,6H_2O$ o $Nb_2(SO_4)_3$, could be isolated as is the case with titaniu and vanadium. Evidence was forthcoming that the blu solution was of a colloidal character and contained substance which separated on the addition of ammoniu chloride, and was very similar to molybdenum blue Th reduction of solutions of quinquevalent niobium with zin or by electrolysis using a lead amalgam cathode gav brown solutions which behaved with ammonia, hydroge peroxide, mercuric chloride, etc., in a manner similar t trivalent titanium. This solution also reduced copp sulphate to metallic copper. The blue solution obtaine by electrolysis gave with gold chloride a "niobium purple similar to "purple of cassius," probably consisting colloidal gold adsorbed by niobic acid.—G. F. M.

Radium emanation, Action of —— on mixtures of hydrog and oxygen O. Scheuer. Comptes rend., 1914, 15 423—426.

IN mixtures of hydrogen and oxygen produced by electr lysis, rapid combination occurs under the influence radium emanation, whether the latter is mixed with t gases or enclosed in a bulb. The ratio of the number molecules of gas combined to the number of pairs of io formed per Curie-second, is independent of the pressu of the gas and amounts to 5·4—5·6 : 1 when the emanati is mixed with the gas. The products are water and smal quantities of hydrogen peroxide; the greater part of the former is probably produced by decomposition of hydrogen peroxide. No ozone is produced and only minute quantities are formed by the action of radium emanation on pure oxygen.—J. H. L.

Bromine hydrate. H. Giran. Comptes rend., 1914, **159**, 246—248.

The method of thermal analysis showed that bromine hydrate has the formula, Br_2+8H_2O, and this was confirmed by a determination of bromine in the crystals dried in a centrifuge.—F. Sodn.

Kelp industry; The ——. Report to the Board of Agriculture for Scotland on Home Industries in the Highlands and Islands, 1914, 118—131. [Cd. 7564.]

There has been a marked increase in the production of kelp since 1905, and the conditions are favourable for further extensions and developments, especially in respect to improved methods of collection and utilisation, since the South American sodium nitrate deposits, from which four-fifths of the present supply of iodine is derived, are being gradually depleted. The Scottish sea-weeds are considerably richer in iodine than the giant kelps of the Pacific and the Japanese seaweeds. Two methods of utilisation of the algæ are available, the dry method of burning or carbonising and the wet method (see Stanford, this J., 1884, 297; 1886, 218; 1894, 698), although up to the present the latter has proved expensive in actual commercial working. In the United States a large company is now engaged in the manufacture of potassium salts from kelp on a commercial scale. The kelp is collected at sea by a boat fitted with a power-driven cutting device which can be lowered to about 8 ft. below the keel. From the boat the kelp is delivered to an elevator and carried to a closed dryer in which it is kept in constant motion at not above 100° C. The drying should follow as soon after collection as possible, since the value of the sea-weed is reduced by exposure to the air. The dried weed is calcined at not above 400° C. in a brick kiln having a fireclay lining and a cast-iron grate through which air enters. The volatile products pass to condensers through a tar chamber kept at an uniform temperature at the top and superheated at the bottom. The ash is treated for the recovery of potassium salts, iodine, etc. The following products are manufactured at the factory: calcium, sodium and magnesium sulphates, potassium chloride, cyanide, chlorate, and nitrate, sodium chloride, calcium carbonate, carbon, iodine, bromine, ivory black, varnish gum, creosote, alcohol, acetone, and combustible gas. (See also this J., 1910, 150.)—A. S.

Hydrogen; Dissociation of —— into atoms. I. Langmuir and G. M. J. Mackay. J. Amer. Chem. Soc., 1914, **36**, 1708—1722.

Evidence in favour of the view that at high temperatures hydrogen is dissociated into atoms is summarised as follows:—The loss of heat from electrically heated tungsten wires in nitrogen, mercury vapour, argon, and carbon monoxide varies with the temperature exactly in accordance with theory (Phys. Rev., 1912, **34**, 401). In hydrogen, however, the loss of heat rapidly increases above 1900° K. (K signifies absolute scale of temperature) and at 3500° K. is more than four times the calculated value; no secondary electrical effects capable of explaining the increase can be detected. At low pressures the loss of heat from tungsten wires is greater than at atmospheric pressure in hydrogen, but not in other gases. When a wire of tungsten, platinum, or palladium is heated above 1300° K. in hydrogen at a very low pressure (0·001—0·02 mm.), the hydrogen slowly disappears. It is not absorbed by the wire but is deposited on the glass (sometimes in tubing a long distance from the bulb), especially when this is cooled by liquid air; ordinary hydrogen is liberated when the cooled portions are heated. The hydrogen which deposits in this way on glass is very active chemically, reacting with oxygen and phosphorus at the ordinary temperature. It is capable of diffusing through long tubes (at low pressures) and will then dissolve in platinum (at 50° C.), causing a marked increase in the electrical resistance of the metal and a corresponding decrease in its temperature-coefficient. The active hydrogen is not affected by an electrostatic field and therefore does not consist of hydrogen ions. Tungstic oxide, platinum oxide, and other substances contained in a tungsten filament lamp together with hydrogen at very low pressure, are rapidly reduced when the filament is heated above 1700° K., although otherwise they are not affected by hydrogen. (See also Langmuir, J. Amer. Chem. Soc., 1912, **34**, 1310; Freeman, *ibid.*, 1913, **35**, 927.) —A. S.

Potash in California. Oil, Paint, and Drug. Rep., Sept. 7th, 1914. [T.R.]

The first American potash will be produced by the Searles Lake plant within three months. The initial output will only be about five tons a day, but the plant under construction is expected to produce 120 tons a day.

Detection of nitric acid with ferrous sulphate. Bellucci. *See* XXIII.

Determination of sulphur in spent oxide. Marsden. *See* IIa.

Patents.

Sulphuric acid and other liquids; Concentration of ——. J. F. Carmichael, Liverpool, and F. Guillaume, Brussels. Eng. Pat. 15,678, July 7, 1913.

In apparatus for the concentration of sulphuric acid by the "cascade" process, each basin is provided with a half-tube of semi-circular cross-section, curved so as to lie with its edges against the sides of the basin, from near the bottom up to, beyond, and overhanging the lip of the vessel; the arrangement, which is detachable, ensures the overflow of the densest liquid from the bottom of each basin.—O. R.

Sulphuric acid; Method of manufacturing ——. I. P. Lihme, Lakewood, Ohio, Assignor to The Grasselli Chem. Co., Cleveland, Ohio. U.S. Pat. 1,103,522, July 14, 1914; date of appl., June 12, 1913.

Burner gases are filtered and brought in contact at not above 100° C. (preferably at 70°—90° C.) with a metallic oxide (*e.g.*, iron oxide) capable of absorbing hydrogen arsenide and the like. After further filtering, the gases may then be subjected to the catalytic action of platinum. —F. Sodn.

Radio-active barium compounds; Method of treating ——. H. N. McCoy, Chicago, Ill. U.S. Pat. 1,103,600, July 14, 1914; date of appl., March 27, 1914.

The separation and concentration of radio-active substances, such as radium, mesothorium-one, and thorium-X, from barium compounds is effected by converting the barium and radio-active elements into hydroxides, and fractionally separating the barium hydroxide from the solution. Partial precipitation of the hydroxides of barium and the radio-elements is preferably brought about by adding alkali hydroxide.—F. Sodn.

Bisulphite of soda; Process of making ——. H. Howard, Boston, Mass. U.S. Pat. 1,104,897, July 28, 1914; date of appl., March 17, 1913.

A calcium compound, such as "lime mud," is heated, between 30° and 90° C., in contact with sodium sulphate and sulphur dioxide in a suitable vehicle.—B. N.

Bleaching solutions containing titanous chloride and method of producing the same. A. J. Rossi, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., Ltd., New York. U.S. Pat. 1,105,308, July 28, 1914; date of appl., April 18, 1912.

An alloy of iron and titanium containing less than 50% Ti is dissolved in dilute hydrochloric acid; the solution is evaporated under reduced pressure below 100° C. and the crystals of ferrous chloride are removed until the proportion of titanous chloride is predominant, the liquid being finally filtered.—J. F. B.

Titanium-oxygen compounds; Process for preparing ——. P. Farup. Ger. Pat. 276,025, July 2, 1913.

ILMENITE or other titaniferous iron ore is finely ground and mixed with one to two parts by weight of concentrated sulphuric acid, the mixture being heated if necessary; the sulphate mass is heated to about 600° C., whereupon the titanium sulphate is decomposed, but not the iron sulphate, which can be removed by washing, leaving 80% crude titanic acid. This may be purified by heating with sulphuric acid or an acid sulphate, mixing with common salt or other metallic chloride, and heating the product to 700° C. and extracting with water; white titanium oxide is thus produced.—T. F. B.

Hydrosulphites; Electrolytic preparation of ——. Badische Anilin und Soda Fabrik. Ger. Pats. (A) 276,058 and (B) 276,059, July 7, 1912.

(A.) A DILUTE solution of sodium bisulphite is electrolysed in the cathode compartment of an electrolytic cell; a neutral salt, such as a chloride or sulphate, but not a normal sulphite, may be added to the bisulphite. (B.) During the electrolysis, free acid, especially sulphurous acid, or more bisulphite, is added to the bisulphite solution, and the process is carried out at a low temperature (0°—5° C.).—T. F. B.

Seaweeds; Process for the treatment of —— for the extraction of their elements. M. P. P. Gloess, L. P. J. Darrasse, and E. R. Darrasse, Paris, France. U.S. Pat. 1,103,283, July 14, 1914; date of appl., July 1, 1913.

SEAWEED is treated with a non-alkaline oxidising agent, to extract iodine and mineral salts, then with an alkaline oxidising agent, to dissolve, and render more viscous and detersive, the mucilaginous constituents, and, finally, the cellulose is obtained as a residue.—F. SODN.

Iodine from marine algae; Industrial extraction of ——. L. Laurent. Fr. Pat. 467,768, April 4, 1913.

THE raw material is washed with fresh water, macerated, treated with liquors containing potassium salts and or sodium bicarbonate, pressed, and filtered; the filtrate is clarified with alum and treated with chlorine or other reagents for the liberation of iodine.—O. R.

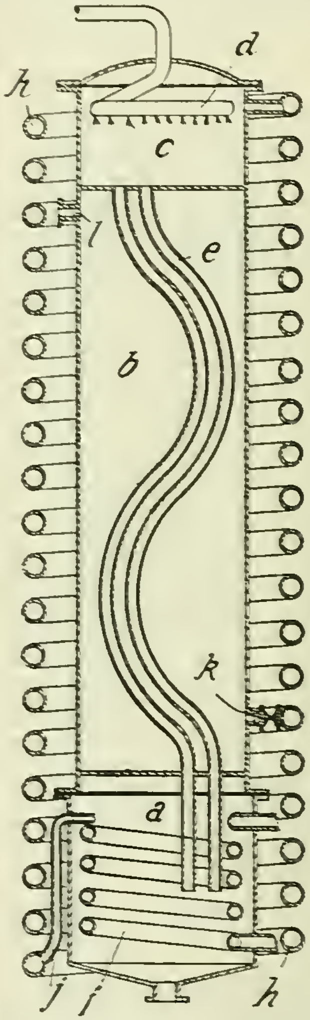
Hydrogen gas; Process for the manufacture of ——. Berlin-Anhaltische Maschinenbau-A.-G., Berlin. Eng. Pat. 6155, March 11, 1914. Under Int. Conv., March 12, 1913.

IN the manufacture of hydrogen by the alternate reduction and oxidation of ferric oxide and iron respectively, a gas producer is ranged alongside of an ore or reaction chamber, and is separated from it by a gas purifier. Compressed air from a blower and superheated steam have access to both the producer and the reaction chamber. Producer gas is first generated in the producer and burnt with an excess of air in the reaction chamber, thereby raising the latter to the desired temperature, burning carbon, which has been deposited, and destroying iron sulphide, which has been formed, throughout the reaction mass. Water-gas is then generated in the producer and slowly admitted to the reaction chamber for the reducing phase, after which steam is passed over the spongy iron for the generation of hydrogen.—O. R.

Hydrogen by the decomposition of steam: Manufacture of ——. J. Pintsch A.-G. Fr. Pat. 466,739, Dec. 30, 1913.

FOR the manufacture of hydrogen from steam and iron, blocks or briquettes are prepared from natural or artificial iron oxides or carbonates, and natural or artificial oxides or carbonates of magnesium, barium, strontium, or aluminium. The ferruginous material is made into a paste with water and one of the above-mentioned materials, moulded, dried, and calcined. A mixture of the oxides or carbonates of calcium and magnesium, containing 75% of the latter in excess over the former, forms a suitable binding material for furnishing the requisite porosity and strength.—O. R.

Oxygen; Process for the manufacture of —— by the fractional distillation of liquid air. L. Simon. Fr. Pat. 466,685, Dec. 27, 1913. Under Int. Conv., May 28, 1913.



LIQUID air is introduced through *d*, into the chamber, *c*, and is fractionated in the worm, *e*, liquid oxygen flowing into the chamber, *a*, and nitrogen passing through the top of the apparatus into the interchanger, *h*. Oxygen, heated by the coils, *f*, passes through the conduit, *j*, into the interchanger, *h*, in counter-current to the stream of nitrogen. The latter passes into the chamber, *b*, by way of the valve, *k*, and serves to heat the worm, *e*, before escaping at *l*, the fractionation of the liquid air by the escaping nitrogen being an essential feature of the process.—O. R.

Marine plants; Process of treating —— [extraction of iodine, etc.]. M. P. P. Gloess, Paris. Eng. Pat. 15,159, July 1, 1913. Under Int. Conv., July 4, 1912.

SEE U.S. Pat. 1,103,283 of 1914; preceding.—T. F. B.

Ammonium sulphate; Producing ——. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,106,919, Aug. 11, 1914; date of appl., April 19, 1913.

SEE Eng. Pats. 12,845 and 14,114 of 1912; this J., 1913 363.—T. F. B.

Calcium cyanamide; Process and furnace for the continuous manufacture of ——. J. H. Lidholm, and Dettifoss Power Co., Ltd. Fr. Pat. 468,128, Feb. 6, 1914. Under Int. Conv., Feb. 18, 1913.

SEE Eng. Pat. 3546 of 1914; this J., 1914, 644.—T. F. B.

Alkali peroxides : Process and apparatus for making ——. E. Marguet. Fr. Pat. 468,375, April 22, 1913.

See Eng. Pat. 11,174 of 1913 ; this J., 1914, 136.—T. F. B.

Electrolysis of alkali halides ; Process and apparatus for the ——. Siemens und Halske A.-G. Fr. Pat. 468,645, Feb. 19, 1914. Under Int. Conv., Feb. 20, 1913.

See Eng. Pat. 18,102 of 1913 ; this J., 1914, 23.—T. F. B.

Hydrosulphite ; Process for producing anhydrous ——. Kinzlberger und Co. Fr. Pat. 469,060, May 9, 1913.

See Eng. Pat. 11,010 of 1913 ; this J., 1914, 643.—T. F. B.

Manufacture of cement from spent or waste lime. Eng. Pat. 25,572. *See* IX.

Feeding devices for rotating furnaces [for pyrites]. Eng. Pat. 3581. *See* X.

VIII.—GLASS ; CERAMICS.

Glass ; The cohesion point, a new constant of ——. E. Zschimmer. Silikat-Zeits., 1914, 2, 129—135.

When two clean plane polished glass surfaces are pressed together a firmly adhering combination is obtained, in which however the surfaces are separated by an air layer at least 0·047 mm. thick, and a greyish blue interference colour is produced. The condition is merely one of *adhesion*, the intimate molecular contact of the glass being wanting which is the necessary condition for *cohesion* between the two surfaces. At high temperatures the adhesion slowly passes within a certain length of time into cohesion. The temperature required to bring this about in a specified time is named the *cohesion-point*. It is a constant of the particular variety of glass, which relatively defines its specific softening properties, and allows the course of liquefaction to be exactly followed. It is, in fact, a substitute for the melting point constant of crystalline substances. If cohesion points are plotted against corresponding times of heating a representation of the softening of the heated glass is obtained. In practice 30 mins. may be adopted as the standard time of heating required to produce coherence of the surfaces. The glass, in the form of discs, 10 mm. diam. and 2 mm. thick, adhering in pairs, is heated in an electric tube furnace (see Zschimmer and Schielz, Silikat-Zeits., 1914, 2, 45). The course of the coherence is easily followed ; a black spot surrounded by Newton rings first appears, and gradually increases in size, eventually at the completion of coherence extending over the whole disc. The end-point is easily recognised. Numerous tables and curves are given showing the values of the constant for many varieties of glass.—G. F. M.

Patents.

Glass or the like ; Process for shaping, graduating, or calibrating tubes of ——. K. Küppers, Aachen, Germany. Eng. Pat. 20,192, Sept. 6, 1913.

Glass tubes of definite length and cross-section are produced by heating and softening the walls of the tube which are then by gradual stages pressed into contact with a suitably shaped mandrel. The necessary external pressure may be either mechanical or produced by suitably exhausting the tube enclosing the mandrel. A tube rotated about an axis may also be melted on to the mandrel by means of a progressive heating apparatus. The mandrels may be dissectible, and also provided with words, figures or graduations which are accurately transferred to the glass tube pressed on them.—W. C. H.

Glass furnace. R. H. Miller, Assignor to Laclede-Christy Clay Products Co., St. Louis, Mo. U.S. Pat. 1,104,375, July 21, 1914 ; date of appl., April 11, 1912.

The walls of the furnace enclose a rectangular hearth-chamber, and each of the end walls contains a number of mixing-chambers, with burner openings leading therefrom to the hearth-chamber. Gas- and air-ducts lead to the mixing-chambers, the gas and air mixing on entering the chamber. The bottom wall of the hearth-chamber is provided near the centre with a down-draught opening, and a deflecting wall located beneath this opening serves to divide the discharged gas.—B. N.

Glass furnaces. Soc. Française d'Exploitation de Fours Spéciaux à Haute Température. Fourth Addition, dated Dec. 4, 1913, to Fr. Pat. 390,102, May 11, 1908 (this J., 1908, 1020 ; 1909, 141 ; and 1910, 1311).

Each furnace is combined with two regenerative chambers and provided with a fan, affording communication with each regenerator and a central column.—O. R.

Pottery or china-ware ; Method of producing translucent ornaments or designs in ——. R. Greifelt, Berlin. Eng. Pat. 10,985, May 4, 1914. Under Int. Conv., May 6, 1913.

The required pictures, patterns or designs are produced by applying to the plaster mould in which the pottery article is cast, a layer of highly translucent material of a lower melting temperature and by covering this with a less translucent material of a higher melting temperature but with the same coefficient of shrinkage. Only a thin layer of the latter is left on the translucent material and the articles are burned, glazed and finally burned in ordinary pottery furnaces.—W. C. H.

Enamels and process of making them. M. Mayer, Templehof, and B. Havas, Assignors to Chemisch Metallurgische Indus. G. m. b. H., Berlin. U.S. Pat. 1,104,266, July 21, 1914 ; date of appl., Nov. 19, 1912.

A white opaque enamel is produced by adding to the enamel proper a suitable white refractory material and an agent containing spinel for rendering the material opaque. —B. N.

Enamelling composition. I. Kreidl, Vienna. U.S. Pat. 1,104,679, July 21, 1914 ; date of appl., April 25, 1914.

The enamel contains a colloidal metallic oxide, such as zirconium oxide, to render it opaque.—B. N.

Kilns for making tiles, pottery, and similar articles. C. Dressler. Second Addition, dated Jan. 31, 1914, to Fr. Pat. 432,427, July 21, 1911. Under Int. Conv., April 10, 1913.

See Eng. Pat. 8505 of 1913 ; this J., 1914, 540.—T. F. B.

Enamels ; Opaqueing agents for the production of white ——, *and process for the manufacture of such opaqueing agents.* Verein. Chem. Fabriken, Landau, Kreidl, Heller und Co., Vienna. Eng. Pat. 17,998, Aug. 7, 1913. Under Int. Conv., Oct. 1, 1912.

See Fr. Pat. 462,587 of 1913 ; this J., 1914, 314.—T. F. B.

IX.—BUILDING MATERIALS.

Gypsum ; Dehydration of ——. C. Gaudefroy. Comptes rend., 1914, 159, 263—264. (See also this J., 1914, 791.)

The hemihydrate was obtained as prismatic needles which underwent no change of form when converted into the anhydride, but evidence is adduced to show that the two states are chemically distinct.—F. Soddy.

Patents.

Cement; Process for the manufacture of —— out of spent or waste lime. R. Illemann, Glasgow. Eng. Pat. 25,572, Nov. 8, 1913.

Spent or "killed" lime (from the manufacture of soda by the Leblanc process), which has been exposed to atmospheric influences, is heated to 1000°—1500° F. (538°—816° C.), according as a quick- or slow-setting cement is required, then ground and mixed with water. (Reference is directed to Eng. Pats. 15,406 of 1889 and 9412 of 1903; this J., 1890, 944; 1904, 61.)

—W. E. F. P.

Magnesite and dolomite; Process of making sintered ——. E. Pohl, Rhöndorf-on-the-Rhine, Germany. U.S. Pat. 1,103,375, July 14, 1914; date of appl., April 8, 1913.

A mixture of pure raw materials and those containing sintering ingredients, such as iron and clay, is worked into a mealy mass of uniform composition and burnt to a sintered condition.—F. Sodn.

Cement or hydraulic lime from sulphate of lime; Process of manufacturing ——. L. P. Basset, Montmorency, France. Eng. Pat. 23,538, Oct. 17, 1913. Under Int. Conv., Oct. 21, 1912. Addition to Eng. Pat. 12,027, May 21, 1912.

See Addition of Oct. 21, 1912, to Fr. Pat. 455,062; this J., 1913, 945.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Water with iron and with ferrous oxide; Reversible reactions of ——. G. Chaudron. Comptes rend., 1914, **159**, 237—239.

The action of steam on iron, between 300° and 1000° C., involves two series of equilibria, the solid phases being mixtures of iron and ferrous oxide and of ferrous oxide and magnetic oxide respectively. Tables showing the equilibrium pressure ratios of water vapour to hydrogen, are given for each series.—F. Sodn.

Iron-zinc alloys. F. Taboury. Comptes rend., 1914, **159**, 241—243. (See also Wologdine, this J., 1907, 97.)

Crystalline deposits from galvanising baths, separating somewhat above 422° C., were in all cases constituted of solid solutions containing 7·3% Fe (see von Vegesack, this J., 1907, 153). There was no evidence that these reacted with zinc at a lower temperature, even when slowly cooled, to form mixed crystals containing 0·7% Fe (*loc. cit.*).—F. Sodn.

Iridium; Determination of —— in platinum-iridium alloys. C. O. Bannister and E. A. Du Vergier. Analyst, 1914, **39**, 340—346.

The following methods were used for the analysis of two platinum-iridium alloys containing respectively 20 and 25% Ir:—

Silver method. 0·25 grm. of alloy and 1·5 of pure silver were cupelled (finally at a high temperature) with 10 grms. of assay lead, the button rolled into cornet form as usual, and "parted" with boiling concentrated sulphuric acid (2 successive portions of 40 c.c.); the residue was digested first with 10 and then with 5 c.c. of dilute *aqua regia* (HCl 4, HNO_3 1, H_2O 10, parts by vol.) to dissolve the platinum, then washed with water, dilute ammonia (to remove AgCl) and water in succession, ignited at a high temperature, and weighed as iridium.

Lead method. 0·5 grm. of alloy was heated for 1 hr. (in a wind furnace) with 5 grms. of assay lead in a carbon crucible contained in a covered clay crucible packed with charcoal, and allowed to cool slowly. The lead button was digested with two successive portions of 50 c.c. of dilute nitric acid (1 : 10), the insoluble residue treated with dilute *aqua regia*, and the process concluded as in the preceding method. In both methods platinum was determined (in the *aqua regia* solution) by precipitation with pure zinc and subsequent ignition of the metal in hydrogen; but it is customary to take this constituent by difference. The results obtained were as follow:—

Approximate composition of alloy.		By silver method.	By lead method.
	%	%	%
Iridium	20	20·20 20·40	20·60 20·40
Platinum	80	79·76 79·52	79·30 79·60
Iridium	25	25·20 25·24	25·32 25·28
Platinum	75	74·68 74·56	74·52 74·60

—W. E. F. P.

[*Silver.*] *Cyaniding a furnace product (speiss).* H. A. Megraw. Eng. and Min. J., 1914, **98**, 147—149.

The speiss produced at Deloro, Ontario, by smelting high-grade silver ore from the Cobalt district, contains As 25, Co 20—25, Ni 12—15, Fe 15—20, S 5—10, Cu 0·5—2%, and Ag 1400 oz. per ton. After being crushed to 40-mesh size and roasted to remove sulphur and arsenic (of which latter 6—7% remains in the product) the material is subjected to a chloridising roast, to convert silver into chloride, and then agitated for 6 hrs. with a 1% solution of sodium cyanide to which caustic soda is added to facilitate subsequent precipitation of the silver from the decanted liquid by means of aluminium dust (process of Hamilton and Kirkpatrick). The consumptions of aluminium and soda are respectively 8·9 and 29·8 lb. per 1000 oz. of silver recovered, that of cyanide being 11 lb. per ton of speiss treated. The silver precipitate is melted with small quantities of borax and soda, the fineness of the bullion produced being over 999. The residue from the cyanide process is treated for the recovery of cobalt and nickel oxides.—W. E. F. P.

Iodine and silver; Gases retained by ——. P. A. Guye and F. E. E. Germann. Comptes rend., 1914, **159**, 225—227.

The gases expelled from metallic silver, during its conversion into silver iodide (see Guichard, this J., 1911, 1018), contained oxygen (80%) and carbon monoxide, 0·17 c.c. of gas being obtained from 1 grm. of metal. Silver purified by melting in a current of hydrogen yielded no oxygen, but about the same volume of carbon monoxide, when treated by the iodine method. The iodine employed was purified by sublimation *in vacuo*, which furnished 10 cb. mm. of gas per grm.—F. Sodn.

Empressite, a new silver-tellurium mineral from Colorado. W. M. Bradley. Amer. J. Sci., 1914, **38**, 163—165.

A mineral discovered in the Empress-Josephine mine, Kerber Creek, associated with galena and native tellurium, had metallic lustre, greyish-black streak, conchoidal fracture, hardness 3—3·5, sp. gr. 7·51, and the composition AgTe.—O. R.

Copper; Precipitation of —— from solution. F. Laist and F. F. Frick. Min. and Eng. World, 1914, **41**, 152—157.

The solution obtained from an 80-ton leaching plant, and containing Cu, 1·91, $Fe_2O_3+Al_2O_3$, 3·88, NaCl, 8·3%, Ag, 0·634 oz. per ton, was not suitable for electrolytic treatment, on account of the high proportion of chlorine; and precipitation with scrap or spongy iron involved the waste of one-fourth of the leaching solution at each operation in order to avoid the accumulation of iron sulphate. Experiments were therefore made with hydrogen sulphide, generated from matte and also from alcium sulphate, and with sulphur dioxide from roasting urnace gases. The hydrogen sulphide process could be orked with a high efficiency, provided that the generator ad an agitating device, and the absorber was properly esigned. The acid used for generating the gas is recovered, he leaching solution is not fouled, a high-grade copper ulphide is produced which can be readily smelted, and he copper matte used in generating the hydrogen sulphide enriched by the removal of iron and sulphur. The est conditions for precipitation with sulphur dioxide ere saturation of the cold solution by a gas, containing at ast 10% SO_2, at a pressure of 15 lb. per sq. in., heating boiling under 20 lb. pressure and then cooling to 0—70 F. (15·5°—21° C.). About 90% of the copper ould be precipitated. The equation given is:— $CuCl_2+SO_2+2H_2O=Cu_2Cl_2+H_2SO_4+2HCl$, but a rther quantity of acid is regenerated by the reduction f ferric salts and by a catalytic action of the cuprous hloride. The cuprous chloride can be reduced by means f iron sponge, by coke and limestone, or electrolytically. he reaction with iron is $Cu_2Cl_2+Fe=2Cu+FeCl_2$, only alf as much iron being required as for direct precipitation. process was worked out for preparing spongy iron, r precipitating the copper. The iron was made by ducing with coke a calcine assaying SiO_2, 4·3; FeO, 72·2; 4·2; Cu, 6·2; Fe, 56·2%, obtained by roasting a ncentrate rich in iron sulphide. A rotary kiln was sed for the reducing process, with an oil burner at one d, a conduit leading to a stack at the other, and a charg- g and discharging door at the centre enclosed by an air- ght casing to prevent oxidation of the reduced iron. he charge of 1400 lb. of calcine was first introduced d heated to 1300° F. (700° C.). About 600 lb. of coal as then introduced in small lots, and the oil flame was opped until the hydrocarbons were burned off. The arge was then heated to 1700° F. (930° C.), when duction was complete, and the product was discharged d quenched. The reduction is effected by mixing ongy iron to a paste with the cuprous chloride solution. xperiments made by smelting briquettes composed of oist cuprous chloride 100, limestone 75, coke 10 and ment 5 parts, indicated that with a suitable installation % of the copper could be recovered as metal and in e slag, and that 75% of the remaining volatile copper uld be recovered by milk of lime. Electrolytic reduction as also tried with promising results.—A. T. L.

opper.] *Electrolytic refining; Ampère efficiency in* ——. K. S. Guiterman. Eng. and Min. J., 1914, **98**, 338—341.

ESTS were made under conditions approximating to ose of actual practice, the temperature, circulation, idity and copper content of the electrolyte, and the rrent density, being practically constant throughout. he electrolyte was a solution of pure copper sulphate, ntaining free sulphuric acid, to which glue and salt n quantities equivalent to 12—16 lb. per day per 170,000 . ft. of electrolyte), arsenic (up to 1·8%), iron (up to 1%), d hydrogen peroxide (sufficient to oxidise 2/3 of the iron) ere added in succession; anodes of pure, and also of ster copper were used. The average current efficiency as 95% with the pure materials; and varied between and 97% in all other experiments. Ferric iron was und to be quickly reduced to the ferrous condition during ectrolysis.—W. E. F. P.

pper; *Tensile properties of* —— *at high temperatures.* G. D. Bengough and D. Hanson. [Advance proof of paper taken as read at the Statutory Meeting of Inst. of Metals, London, Sept. 10, 1914.] (See also this J., 1912, 134.)

ARS of B.S., electrolytic, and "arsenical" copper (As 13%) were heated in oxidising, neutral, and reducing mospheres respectively. An oxidising atmosphere at gh temperatures produced high ductility. In a neutral mosphere, unannealed rolled copper had a greater nsile strength and was less ductile than the annealed etal at all temperatures up to 1000° C. In annealed pper, the fracture passed through the crystals below out 700°, and between the crystals above 750° C. The istence of a range of low ductility at 250°—450° C. was confirmed. Small quantities of oxygen or arsenic lowered the tensile strength at high temperatures. The tensile strength in hydrogen above 720° C. was about ½ ton per sq. in. lower than in an oxidising or neutral atmosphere.
—W. R. S.

Copper; Specific heat of —— *in the interval* 0—50 C. D. R. Harper. J. Franklin Inst., 1914, **178**, 234—236.

A LONG copper wire (50 metres) suspended *in vacuo* and forming part of an electric-circuit was heated by the current 4′—5° C. in each experiment, and the rise of temperature found by using the wire itself as a resistance-thermometer. The specific heat was found to be 0·0917+0·000048 (t — 25) calories$_{20}$ per grm.-degree.
—W. R. S.

Brass; Note on the annealing of ——. F. Johnson. [Advance proof of paper taken as read at the Statutory Meeting of Inst. of Metals, London, Sept. 10, 1914.]

ADMIRALTY brass (Cu 70, Zn 29, Sn 1%) should be annealed at 760° C. with subsequent quenching, to transform the eutectoid into the homogeneous β-phase. The structural change takes place rapidly at 760° C., but is very incomplete even after prolonged heating at lower temperatures.
—W. R. S.

Copper-zinc alloys; Behaviour of —— *when heated in a vacuum.* W. E. Thorneycroft and T. Turner. [Advance proof of paper taken as read at Statutory Meeting of Inst. of Metals, London, Sept. 10, 1914.]

THIN turnings of Cu-Zn alloys containing Cu 75·12, 51·33, 43·80, 34·20, 20·10, and 10·25% respectively were heated *in vacuo* (see Nair and Turner, this J., 1913, 914) at different temperatures for 30 mins., and the residues analysed. The variation of the rate of volatilisation with rising temperature could be represented by a line which was straight throughout the greater part of its length for the alloy (Cu 75·12%) consisting entirely of the α-solid solution, but for the other alloys the curves showed considerable deviations from a straight line. The alloy with Zn 89·75% was somewhat more volatile than pure zinc. The zinc could be completely volatilised from alloys with more than 40% Cu, but with less than 40% Cu, part of the copper was volatilised with the zinc. A greater amount of heat was required to separate zinc from alloys rich in copper than was necessary to volatilise the liberated zinc. (See also this J., 1912, 134, 391.)—A. S.

Corrosion; Contributions to the history of ——. *Pt. III., Coke, condenser tubes and corrosion.* A. Philip. [Advance proof of paper taken as read at the Statutory Meeting of Inst. of Metals, London, Sept. 10, 1914.] (See also this J., 1912, 134; 1913, 292.)

THE conclus on of Bengough and Jones (this J., 1913, 913) —that the corrosion of condenser tubes by sea water is not affected by contact with particles of coke—and the evidence upon which this is based, are criticised, and abundant experimental proof given to the contrary, as regards tubes composed of Admiralty alloy (Cu 70, Zn 29, Sn 1%).—W. E. F. P.

Phosphor-bronze; Determination of phosphorus in ——. E. W. Hagmaier. Met. and Chem. Eng., 1914, **12**, 524—525.

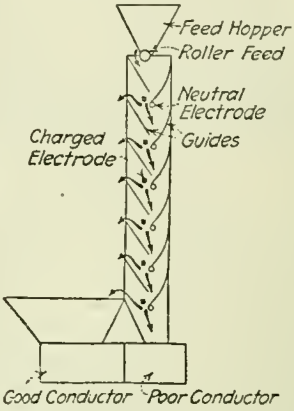
A MODIFICATION of the method previously described for the determination of phosphorus in vanadium-steel (this J., 1913, 145). 1 grm. of bronze is dissolved in 10 c.c. of strong hydrochloric and 5 of nitric acid; treated with 150 c.c. of hot water, and 10 c.c. of a solution containing 1 grm. of cerium chloride in 25 c.c. of hydrochloric acid and 200 of water, then with dilute ammonia (1 : 2) from a burette, with stirring, till a greenish-blue tint appears. 4 c.c. of acetic acid are added, and the mixture is boiled for 5—10 mins. After settling, the clear liquid is siphoned off, the precipitate washed by decantation with 100 c.c. of hot water 6—8 times, and dissolved by warming with

15 c.c. of nitric and 3 c.c. of hydrochloric acid. After cooling, 5 c.c. of ammonia (1 : 1) are added, and the phosphoric acid precipitated as usual with ammonium molybdate.—W. R. S.

Tungsten ; Analytical examination of [commercial] ——. H. Arnold. Z. anorg. Chem., 1914, **88**, 74—87.

THE metal, when in fine powder, is dissolved in a mixture of ammonia and hydrogen peroxide (or an oxidising salt, such as ammonium persulphate). Coarser crystalline powder is oxidised by igniting and moistening with nitric acid, the oxidation product being extracted with caustic soda solution containing hydrogen peroxide, and any residue again ignited. Larger pieces are dissolved electrolytically in concentrated ammonia (200 c.c., to which 1—2 grms. of ammonium persulphate are added) contained in a platinum dish which acts as cathode, the metal being the anode ; a current of 1—2 amps. at 2·5—3·5 volts is employed, and ammonia added as required to make up for loss by evaporation, any detached pieces of metal remaining being removed and weighed, or dissolved separately. Tungsten, in any state of division, may also be rapidly converted into soluble form by adding it, a very little at a time, to alkali nitrite heated nearly to fusion, in a large covered platinum crucible ; the mixture melts owing to the vigour of the reaction. The alkaline solution, containing, *e.g.*, 25 grms. WO_3, is treated with 35 c.c. of 50% tartaric acid, to convert the tungstic acid into a soluble complex salt, the mixture diluted to about 700 c.c., and sufficient hydrochloric acid added to introduce about 4% of free acid. Hydrogen sulphide is passed for many hours into the hot solution, which is then allowed to cool in a current of the gas, and the cooled liquid is kept in an atmosphere of hydrogen sulphide for 12 hours. The mixture is filtered (after warming, if gelatinised), the precipitate washed with boiled water, and dissolved in bromine-hydrochloric acid. Cu, Pb, and Bi are then separated from As, Sn, Sb, and Mo in ammoniacal tartrate solution by Finkener's method with hydrogen sulphide water, the precipitated sulphides being treated with nitric acid, Pb separated as sulphate, and Bi and Cu by ammonia. As, Sb, and Mo are precipitated with hydrogen sulphide from boiling oxalic acid solution (see Schürmann and Scharfenberg, this J., 1908, 860), and Sn determined in the filtrate by precipitation with hydrogen sulphide in acetic acid solution. The sulphides of As etc., are dissolved in warm ammonium sulphide containing sodium hydroxide, the sulpho-salts destroyed by cautious addition of hydrogen peroxide to the hot solution, and As precipitated by hydrogen sulphide, in presence of an excess of strong hydrochloric acid. Sb and Mo are again precipitated as sulphides, these are dissolved in sodium sulphide, and Sb is precipitated electrolytically (*loc. cit.*), whilst Mo is precipitated as sulphide, by acidifying the solution, and weighed as MoO_3. All the precipitates in the hydrogen sulphide group are examined for silica which is liable to be carried down. Only Mo and As offer special difficulty ; the latter is detected by Gutzeit's test and is best determined in a separate portion. Mo is shown either by the brown colour produced by ammonium sulphide in ammoniacal solution or the carmine-red colour given by thiocyanates in presence of reducing agents. If Mo be present, the filtrates from the various hydrogen sulphide precipitations must be tested by again saturating with the gas and heating in a pressure flask. The hot (alkaline) solution containing tungsten is allowed to flow slowly, in a thin stream, into strong boiling hydrochloric acid, so as to precipitate tungstic acid in granular form, and, after removing the supernatant liquid, the residue is treated with hot water containing hydrochloric acid. The united filtrates are evaporated to dryness on the water-bath, and the evaporation residue, containing possibly Al, Fe, Ni, Co, Mn, Zn, Ca, and Mg, together with about 1 grm. WO_3 (of 25 grms. taken) and large quantities of alkali or ammonium salts, is ignited in a covered platinum dish ; before all the liberated carbon is burnt away, the contained tungsten, now present as sodium tungstate, is extracted with water, and the other metals, remaining as oxides or carbonates, are then separated by known processes. In the presence of Al, the extraction of tungstate is best carried out with hot water, in a current of carbon dioxide, to decompose any alkali aluminate. Ammonium tungstate, as usually prepared, was found invariably to have the formula $(NH_4)_4W_5O_{17},2H_2O$, instead of that generally accepted.—F. SODN.

Ore separation ; Electrostatic ——. I. C. Clark. Eng. and Min. J., 1914, **98**, 264—267.



THE separator (fig.) employed in the Huff electrostatic process consists of an iron framework (earthed to prevent shocks to operators) containing two vertical series of electrodes—charged and neutral, respectively—between which, by means of a system of guides, a continuous stream of dry, sized ore is caused to fall from a hoppe above, the best conditions as to rate of flow and spacing of electrodes being ascertained by preliminary tests. The charged electrodes ar maintained at a poten tial of 20,000 volts an insulated from the iro framework, the neutra ones being in electrica contact with the latte By the action of the elec trostatic field upon th ore particles, the goo conductors among the latter become immediately charge with electricity of the same polarity as that of the elec trodes, and are repelled to the left side of the apparat as indicated ; while the poor conductors fall throug the machine by gravity before any appreciable repulsio occurs. The two products thus obtained are re-treate in separate "finishing" machines of the san kind, the "middlings" produced being conducted the dryer with the untreated ore. The electrical equi ment consists of a generator for producing an alternati current of high potential but low ampèrage ; a rectifier f changing the negative alternating-current waves in positive, pulsating waves ; and a resistance-box for reg lating the speed of the generator. The process h been successfully employed for the separation of mi from graphite flake ; slate from coal ; and metallifero minerals from various gangues.—W. E. F. P.

Molten metals ; Surface tension of ——. S. W. Smit [Advance proof of paper taken as read at the Statuto Meeting of Inst. of Metals, London, Sept. 10, 1914.]

THE capillary depression produced by plunging carb tubes (approximate diameter 1 mm.) into the molt metal was measured after solidification, and also lowering an insulated wire inside the tube until its low end made electrical contact with the molten metal. T depressions were constant at the same temperature a varied inversely as the radius of the tube. The variati for the same metal at different temperatures were sm in comparison with the depression itself. The depressi are periodic functions of the atomic weights of the met the surface tension decreasing rapidly as the ato weight increases. The capillary constants (product height of depression and radius of tube), in sq. m given are :

Metal.	Range of temp. (°C.).	Capillary constant.	Metal.	Range of temp. (°C.).	Capilla constan
Hg	15°–17°	6·72	Sn	750°–800°	14·5
Bi	700°–760°	7·53	Ag	1100°	18·5
Pb	770°–780°	8·12	Zn	590°	24·5
Sb	840°–850°	8·65	Cu	1150°	29·4
Au	1120°	11·29	Al	700°–820°	45·0

—W. R. S

letal spraying [coating]. R. K. Morcom. [Advance proof of paper taken as read at Statutory Meeting of Inst. of Metals, London, Sept. 10, 1914.]

DETAILED description is given, with diagrams, of the pistol" perfected by Schoop and Morf for coating bjects with metal by spraying, and based upon Morf's ng. Pat. 28,001 of 1912 (this J., 1912, 792). A wire of e required metal is fed into a suitable flame, where it is elted; it passes into an air-blast which breaks it up into ne particles and projects these with high velocity upon e object to be coated. The spray is cool enough to used upon inflammable objects and even explosives. ir at 80 lb. per sq. in. is employed at the rate of 45 50 cb. ft. per minute. A spray of alloy may be proced by using stranded wires. The method is useful for aking fine castings and for reproducing process ocks.—O. E. M.

letallurgical] Furnace gases ; Cooling —— before filtration. L. D. Anderson. Bull. Amer. Inst. Min. Eng., July, 1914. Eng. and Min. J., 1914, **98**, 354.

OOLING should effect the maximum coalescence of the rticles of "fume" without condensing the moisture. he gases are usually passed through flues constructed sheet steel about ⅛ in. thick, the rate of heat transssion through this material, under smelting conditions, ing about 0·02—0·04 B.T.U. per min. per sq. ft. of oling surface per 1° F. difference between the interior d exterior temperatures; the mean temperature fference (*θm*) is found from the expression

$$\theta m = (t_1 - t_2) \div \log.\frac{t_x - t_2}{t_x - t_1}$$

here t_1 and t_2 are respectively the initial and final temratures of the interior gases, and t_x the temperature of e external air. Within certain limits the cooling is oportional to the square root of the velocity of the ses; to avoid heavy deposition of heat-insulating dust the flues, it is hence advisable to maintain a high locity. In cooling by water sprays the saturation int of the gases should not be too closely approached or mpness, and destruction, of the filter-bags will result. —W. E. F. P.

ineral production of Western Australia in 1913. Board of Trade J., Sept. 10, 1914.

E quantity and value of the minerals produced in estern Australia during the years 1912 and 1913, is en by the Department of Mines of that State for the ar 1913, as follows:—

—		1912.		1913.	
		Quantity.	Value.	Quantity.	Value.
			£		£
al*	tons	295,079	135,857	313,818	153,614
pper ore† ..	,,	9.536	58,688	4,339	136,622
pper, ingot, atte, &c.†	,,	28	1,136	82	5,891
ld‡	fine ozs.	1,282,658	5,448,385	1,314,043	5,581,701
ver† ...	,,	165,371	19,725	188,020	23,420
ad ore†	tons	1,868	22,270	3,169	59,002
ntic ore* ..	,,	7,626	2.543	10,216	3,658
o and ingot†	,,	651	79,738	484	72,142
ram†	,,	—	—	1	86
c, spelter, &c.†	,,	14	217	—	—
olinite	,,	—	—	1	112
enumerated†	,,	—	8	—	17
Total values .. £		—	5,768,567	—	6,036,265

* Raised. † Exported. ‡ Exported and minted locally. ‖ Reported.

loys and metals ; The Widmanstätten structure in various ——. N. T. Belaiew. [Advance proof of paper taken as read at the Statutory Meeting of Inst. of Metals, London, Sept. 10, 1914.]

E Widmanstätten structure is not peculiar to iron and n alloys, but may occur in any metal or alloy which crystallises in the regular system and in which the solid solution is subject to recrystallisation after solidification. —W. E. F. P.

Nickel oxide ; Emissivity of —— in the range 600°—1300° *C.* G. K. Burgess and P. D. Foote. J. Franklin Inst., 1914, **178**, 233—234.

DETERMINATIONS of the monochromatic and total emissivity were made by the microscopic melt and spectrophotometer comparison methods. The monochromatic emissivity increased linearly with increasing wave length and decreased linearly with increasing temperature from 700° to 1300° C. The total emissivity increased with the temperature, being 0·54 at 600°, 0·68 at 800°, 0·76 at 1000°, 0·85 at 1200°, and 0·87 at 1300° C.: the relation is not linear.—W. R. S.

PATENTS.

Iron ; Deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 12,683, May 31, 1913.

To prevent exfoliation and brittleness of the deposit, the electrolyte (*e.g.*, a solution of ferrous sulphate) is vigorously agitated with spongy iron during electrolysis.—W. E. F. P.

Iron and iron alloys ; Hot working ——. R. B. Carnahan, jun., Middletown, Ohio, U.S.A. Eng. Pat. 28,593, Dec. 11, 1913. Addition to Eng. Pat. 28,571, Jan. 16, 1913.

THE process described in U.S. Pat. 1,090,115 (this J., 1914, 424) is extended to include the treatment of iron and iron alloys which, though not pure, are substantially free from carbon, manganese, and oxygen.—T. F. B.

Iron ; Process of casting —— in permanent moulds. E. A. Custer, Assignor to Custer Sandless Casting Co., Philadelphia, Pa. U.S. Pat. 1,104,037, July 21, 1914; date of appl., Oct. 22, 1910.

THE metal is caused to set as it is poured, and the casting is removed from the mould before chilling; the temperature of the mould (which has a relatively large mass, and superficial area) is kept below 600° F. (316° C.).—W. E. F.P.

Iron alloy. J. R. Speer, Trappe, Md. U.S. Pat. 1,105,341, July 28, 1914; date of appl., Feb. 24, 1914.

THE alloy contains Si 0·1—3, Cr 0·5—1·5, Ni 0·25—1, S 0·05—0·2, P 0·12—1·5, Mn 0·45—1, and C 1—4%, the quantity of chromium being in excess of that of nickel. —W. R. S.

[Iron-nickel] Balance spring having elasticity increasing with a rise in temperature. C. E. Guillaume, Sèvres, France, Assignor to Soc. des Fabriques de Spiraux Réunies, La Chaux-de-Fonds, Switzerland. U.S. Pats. 1,106,206 and 1,106,207, Aug. 4, 1914; date of appl., Feb. 20, 1912.

AN iron alloy containing Ni 27—31, Cr 0·2—4, V 0·2—4, and small quantities of C and Si, with or without Mn 1—4%; the constituents other than iron and nickel amount together to between 3·5 and 10%.—W. E. F. P.

Iron or steel structures ; Method of preventing corrosion on ships' bottoms and other ——. A. C. A. Holzapfel, London. Eng. Pat. 24,570, Oct. 29, 1913.

THE metal is thinly coated with a mixture of a highly volatile spirit or hydrocarbon and slaked or unslaked lime, which, when dry, is immediately replaced by a coating of paint or composition.—W. E. F. P.

Steel or iron sheets ; Method of oxidising ——. J. E. Carnahan, Canton, Ohio. U.S. Pat. 1,105,251, July 28, 1914; date of appl., June 9, 1913.

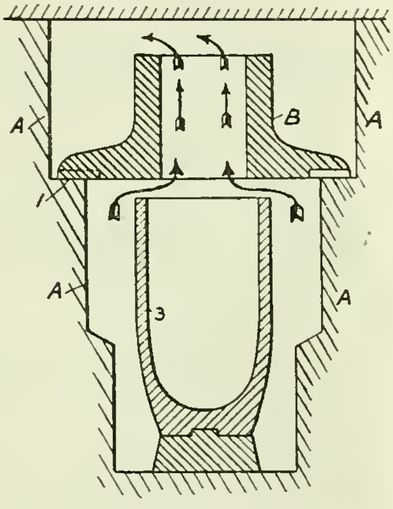
THE sheets are first "blued" by an oxidising process, then heated to dark redness and cooled in an annealing box in the presence of steam.—W. R. S.

Furnaces ; Gas heated [crucible] ——. J. King, J. R. Burnett, and The Richmond Gas Stove and Meter Co., Ltd., Warrington. Eng. Pat. 16,871, July 23, 1913.

In gas-heated crucible furnaces the heated products of combustion pass from the combustion chamber or chambers round the upper part of the crucible or pot and thence through a chamber below the crucible support to the exit flue. One or more inclined flues or passages are provided through which any metal or other material which may be spilled from the crucible is withdrawn.—W. H. C.

Furnace for melting metals. T. Ratcliff, Birmingham, and W. Ratcliff, Solihull, Warwick. Eng. Pat. 22,657, Oct. 8, 1913.

A crucible-furnace (fig.) in which a flanged tube or funnel, B, is disposed above the crucible, 3, within the heating chamber, A. The crucible is charged through the tube, the latter serving for preheating the metal and deflecting the flame upon the top of the crucible.
—W. E. F. P.



Roasting furnaces [for pyrites and other ores] ; Feeding devices for ——. H. H. Stout, New York. Eng. Pat. 3581, Feb. 11, 1914. Under Int. Conv., March 7, 1913.

In a furnace of the superposed-chamber type having feeding devices for automatically delivering ore to the drying hearth (roof) and the top chamber in succession, the effective area of the table upon which the ore is discharged from the hopper of the primary feeder is adjustable. The hopper of the secondary feeder, which surrounds and rotates with, the central shaft of the furnace, has a delivery spout from which the dried ore is discharged at an adjustable height above the floor of the top chamber.
—W. E. F. P.

Roasting furnaces ; Rabble shafts for ——. E. J. Fowler, San Francisco. Eng. Pat. 7471, March 24, 1914. Under Int. Conv., March 24, 1913.

In a rabble shaft (for roasting furnaces of the superposed-chamber type), the cylindrical wall which separates the axial from the annular passage is composed of telescopic sections ; or the outer wall is composed of abutting sections.—W. E. F. P.

Furnace ; Metallurgical ——. J. E. Greenawalt, Denver, Colo. U.S. Pat. 1,103,196, July 14, 1914 ; date of appl., Oct. 10, 1912.

The furnace consists of a hollow, movable, upper section having openings at the top and sides for the admission of air and gas respectively, and a fixed, lower section having a perforated support for the charge at the top and forming, when the upper section is placed upon it, a sealed chamber with which a suction apparatus is connected.—W. E. F. P.

Furnace ; Electric ——. H. F. D. Schwahn, Belleville, Ill. U.S. Pat. 1,105,538, July 28, 1914 ; date of appl., Sept. 26, 1912.

The smelting and refining furnace is divided, by a horizontal false bottom, into a lower chamber or well, and an upper chamber. A resister of carbonaceous material, in contact with carbon electrodes, is placed between refractory "checkers" and rests upon the false bottom. Means are provided for maintaining the material of the resister, for charging the furnace with raw material and reducing gases, and for the withdrawal of the resulting product and spent gases. The resister is not in direct contact with the unfused charge, but permits the passage of the gases and the fused non-volatile and volatile metals into the well. The latter is provided with a heating arrangement, and has a series of condensers attached to it.—B. N.

Furnace-process ; Electric —— *and electric furnace.* C. Hering, Philadelphia, Pa. U.S. Pat. 1,105,656, Aug. 4, 1914 ; date of appl., July 15, 1911.

A mass of molten metal is treated in an electric furnace by passing an electric current through a portion of the mass, disposed between masses of conducting fluid, the whole comprising a circulatory system. The current is also passed through the metal in a channel or tube, forming a conductor, disposed at an angle with the longitudina extent of the fluid metal, whereby the metal is automaticall circulated by the force exerted by the current in th conductor.—B. N.

Metals ; Precipitation of ——*from solutions of their salts an apparatus therefor.* G. Jacquier, Johannesburg, Transvaal. Eng. Pat. 17,790, Aug. 2, 1913.

Metals are precipitated from solutions of their salts b aluminium, with the aid of artificial ultra-violet radiation either alone or in combination with similar radiations fro the sun. For this purpose, mercury vapour electric lamp may be used, with containers of quartz or other materia permeable to ultra-violet rays, the lamps being suspende between the sheets of aluminium from a common supportin means.—B. N.

Ores ; Method of and means for separating metalliferou materials or metals from their —— *or other matter carryi same.* J. D. Wolf, London. Eng. Pat. 18,351, Aug. 1 1913.

A shaking table, the top of which consists of an endle belt of " woven hard duck " prepared by soaking in linse oil. The surface of the belt is dressed periodically wit a mineral oil in such quantity that no appreciable amou is retained by the surface.—W. E. F. P.

Ore ; Separation of ——. E. Primosigh, Also-Szalan Hungary. Eng. Pat. 18,944, Aug. 20, 1913.

A mixture of the ore with water, oil and acid, is introduc continuously into a closed mixing apparatus from whi air is excluded, and the materials are intimately mix by a rapid circular movement produced by a centrifug pump, the latter at the same time producing a pressu which is used for transferring the mixture through conduit to the separating bath. The pump is located this conduit, the socket of the pump through which t material is introduced being led through a water tank, a provided with one or more openings below the water lev The conduit on the delivery side of the pump is fitted wi one or more gas channels, so that compressed air or g may be supplied continuously to the mixture, thus assisti in the mixing. The end of the delivery conduit is provid with a spraying nozzle opening below the level of t liquid in the separating bath, thus producing a thorou mixing of the material by a sudden modification in t locity of the flow from the end of the delivery conduit, low the level of the contents of the separating bath. —B. N.

es ; Process of dressing —— by means of gas. K. Takeda, Tokyo, Japan. Eng. Pat. 20,158, Sept. 6, 1913. Addition to Eng. Pat. 7272, Mar. 27, 1913. (See Fr. Pat. 455,430 of 1913 : this J., 1913, 949).

E ore is moistened with water before admixture with l and alkali carbonate.—W. E. F. P.

pper ; Art of extracting ——. G. B. Chittenden, Chilito, Ariz. U.S. Pat. 1,104,410, July 21, 1914 ; date of appl., May 21, 1914.

PPER ore is leached with acid, the solution is treated th an excess of lime water, and the precipitate is subcted to a moderate heat.—W. E. F. P.

senic or antimony ; Extraction of —— from ores. F. G. Price, Assignor to H. A. Lewis, Oruro, Bolivia. U.S. Pat. 1,104,810, July 28, 1914 ; date of appl., March 8, 1912.

E ore is fused with sulphur and an alkali sulphide, and e product leached.—W. R. S.

es ; Treatment of ——. C. Robinson, Mount Vernon, N.Y., Assignor to Metallurgical Engineering and Process Corporation, New York. U.S. Pat. 1,105,102, July 28, 1914 ; date of appl., Nov. 29, 1910.

E ore is treated with a solvent which dissolves part of e metallic values ; the solution is then run off, and the e mass broken up by directing upon it a stream of the me, or another solvent, so as to expose fresh surfaces. —W. R. S.

ctroplating and the like ; Apparatus for ——. A. Murphy, Quincy, Mass. U.S. Pat. 1,105,292, July 28, 1914 ; date of appl., Oct. 22, 1913.

CYLINDRICAL inner perforated vessel is located within outer vessel, open at the top, and the latter may be tated by suitable means. Guiding pieces are attached one of the vessels and grooved strips to the other, that they may be connected and revolved together, d so that the inner vessel during removal is guided rough the open top of the outer vessel. A cathode d anode, each connected with a conducting ring, are aced respectively within the inner and outer vessels, d the cathode may be removed without disturbing e inner vessel.—B. N.

es ; Reduction of —— by means of peat. P. Anderson, Arvika, and E. E. son Odelstierna, Stocksund, Sweden. U.S. Pat. 1,105,870, Aug. 4, 1914 ; date of appl., April 18, 1912.

MIXTURE of the ore with powdered peat is heated in sed receptacles, reduction being effected without sion.—W. E. F. P.

loy. P. R. Parsons, London, and O. Silberrad, Buckhurst Hill. U.S. Pat. 1,106,055, Aug. 4, 1914 ; date of appl., March 25, 1910.

AIM is made for a high-speed ship's propeller in which least the surface exposed to erosive action consists of a -Zn alloy, of β structure, containing Cu 49—58%. —W. E. F. P.

ss ; Method of pickling ——. R. R. Parish, Assignor to Chase Rolling Mill Co., Waterbury, Conn. U.S. Pat. 1,106,107, Aug. 4, 1914 ; date of appl., Jan. 12, 1914.

SOLUTION of sulphuric acid "reinforced by a perid" is employed for removing blotches from the surface annealed brass.—W. E. F. P.

t-iron ; Process of treating ——. J. E. Johnson, jun., New York. U.S. Pat. 1,106,817, Aug. 11, 1914 ; date of appl., Aug. 13, 1913.

E Fr. Pat. 464,208 of 1913 ; this J., 1914, 488.—T. F. B.

Iron ; Treatment of ——. A. V. Dismore. Fr. Pat. 468,612, Feb. 18, 1914. Under Int. Conv., Feb. 19, 1913.

SEE Eng. Pat. 4292 of 1913 ; this J., 1911, 697.—T. F. B.

Aluminium ; Process for producing a coating on —— which is proof against the action of sea water and acids or alkalis. Z. D'Amico, Genoa, Italy. Eng. Pat. 28,410, Dec. 9, 1913. Under Int. Conv., Dec. 9, 1912. Addition to Eng. Pat. 22,684, Sept. 30, 1910.

SEE Ger. Pat. 273,292 of 1912 ; this J., 1914, 700.—T.F.B.

Alkali metals ; Electrolytic manufacture of ——. E. A. Ashcroft, London. U.S. Pat. 1,106,436, Aug. 11, 1914 ; date of appl., May 23, 1914.

SEE Eng. Pat. 10,980 of 1914 ; this J., 1914, 794.—T. F. B.

Sodium ; Process and apparatus for the [electrolytic] manufacture of ——. E. Marguet. Fr. Pat. 467,991, April 9, 1913.

SEE Eng. Pat. 11,278 of 1913 ; this J., 1914, 359.—T. F. B.

Open-hearth furnaces ; Regenerative ——. T. B. Rogerson. Fr. Pat. 468,451, Feb. 14, 1914. Under Int. Conv., May 8, 1913.

SEE Eng. Pat. 10,853 of 1913 ; this J., 1913, 1116.—T.F.B.

PATENT CASE.

Mineral substances ; Separation of —— by the selective action of oil. A. S. Elmore, London. Eng. Pat. 6519 of 1901 ; this J., 1902, 349. Reports of Patent Cases, Vol. XXXI. Illus. Off. Jnl. (Patents) Suppl., May 6, 1914. By permission.

THIS was an appeal to the Judicial Committee of the Privy Council from a decision of the Supreme Court of New South Wales, dismissing an action for infringement of the corresponding N.S.W. patent brought by the Ore Concentration Co. (1905), Ltd., against the Sulphide Corporation, Ltd. In a similar action in respect of the above Eng. Pat., the House of Lords had already decided that the patent had not been infringed.

The first of the five claims in the specification was as follows : In processes for separating metals by the selective action of oil, the addition of a small quantity of acid to the oil or water employed in the process, or to both, substantially as and for the purpose set forth. The appellants contended that the expression "the selective action of oil" was referable only to conditions in which the oil had a choice between mineral and gangue, and that those conditions existed only in a freely-flowing pulp. The respondents contended that the expression was referable only to conditions in which the oil was capable of carrying the particles in the process of separation, whether by buoyancy or in the form of oil globules. They also stated that they used, not a large quantity of thick oil, as the appellants did, but a small quantity of thin oil and that their process depended on surface tension. The Judicial Committee held that, as to the construction of the specification, the respondents' contention was well founded and that the invention claimed was the enhancement of the action of oil, as a selective agent, by the addition of a small quantity of acid to the oil or water in any process of separation in which the oil was adequate in quantity and of sufficient tenacity to entrap or coat mineral particles in a watery pulp, and to hold or carry them until separation was effected ; and that there was no limitation to the two forms of apparatus described in the specification ; that the invention was novel and useful ; but that the respondents used a process essentially distinct from that claimed and that there was no infringement. The small quantity of oil introduced in the respondents' process did not necessarily perform any other function than to give permanency in the froth and extremely minute emulsion. There might be oil in excess, and some of the particles might get oiled, but this was unessential. That process could be accounted for without assuming selection of the metallic particles by oil.

XI.—ELECTRO-CHEMISTRY.

Stability and oxidation-potential of hypochlorites. Contribution to catalysis, and a hypochlorite-carbon cell. Hofmann and Ritter. *See* VII.

Patents.

Cell; Galvanic ——. P. Burger, Berlin. Eng. Pat. 15,463, July 4, 1913. Under Int. Conv., July 6, 1912.

The carbon electrode is surrounded by "brownstone," mixed with chemically pure carbon, obtained in the form of soot from acetylene gas, in place of graphite.—B. N.

Containers or diaphragms for voltaic cells; Porous ——. J. G. Lucas, London. Eng. Pat. 24,569, Oct. 29, 1913.

The vessel, in the form of a basket adapted to hold the granular or pulverised particles of the depolariser, is constructed by plaiting Japanese rush in horizontal circular coils, strengthened by vertical lacing of the same material. —B. N.

Accumulators; Electric ——. A. Dinin, Paris. Eng. Pat. 14,119, June 11, 1914.

The negative electrodes of accumulators may be kept in a dry charged condition in the open air, by dehydrating the electrodes out of contact with the air. This may be effected by drying in a vacuum, or by treating the charged electrode with a volatile substance, such as alcohol.—B. N.

Battery plates: Apparatus for, and process of treating ——. G. H. Rabenalt, Buffalo, N.Y., Assignor to Gould Storage Battery Co., New York. U.S. Pats. (A) 1,104,272, and (B) 1,104,273, July 21, 1914; date of appl., Feb. 6, 1913.

(A.) One face of a containing vessel is provided with an acid-proof porous die, the latter having a roughened face so that when applied to a pasted battery plate the active area is increased, and the upper part of the container is connected with a vessel supplying a reagent under pressure, so that when this is passed through the pores of the die the paste is hardened. Both sides of a pasted battery plate may be thus similarly and simultaneously treated. (B.) Sulphuric acid may be used as the reagent so as to form a sulphate on the surface of the paste, thus hardening the latter before the die is removed.—B. N.

Electrodes; Storage battery ——. H. C. Hubbell, Newark, N.J. U.S. Pat. 1,104,898, July 28, 1914; date of appl., Nov. 18, 1912.

Precipitated active material, without drying, is kneaded into a slime with water, and the slime mixed with suitable conducting elements, dried to a thick dough, formed into cakes, dried, and strongly compressed edgewise. —B. N.

Cell; Electrolytic ——. J. B. Burdett, Assignor to Davis-Bournonville Co., Chicago, Ill. U.S. Pat. 1,104,754, July 21, 1914; date of appl., Nov. 6, 1912.

The cell is provided with a cover having integral walls arranged spirally upon its under surface, thus forming a closed chamber with an open space between the spiral convolutions. Electrode plates, similarly formed into spirals, are suspended in the chamber and the open space. A porous curtain, applied against the spiral wall of the chamber and depending therefrom in spiral formation, is interposed between the electrode plates. The curtain is secured against the spiral wall by a clamping ring, the latter being provided with an "off-set lower edge" engaging over the lower edge of the wall, in order to bring the surface of the curtain into alignment with the inner surface of the wall. Gas-delivery connections communicate with the chamber and the exterior space.—B. N.

Cell; Electrolytic ——. D. B. Ayerst, Wilmington, Del. U.S. Pat. 1,105,015, July 28, 1914; date of appl., Feb. 24, 1913.

The cell, for the electrolysis of saline solutions, comprises a body constituting an anode chamber, with diaphragms closing the sides; cathodes are disposed outside the diaphragms and anodes within the chamber confronting the diaphragms. A salt receptacle within the body is immersed in the electrolyte, and valved, perforated pipes are located respectively between the anodes, and between each anode and its confronting diaphragm for delivering air into the electrolyte.—B. N.

Resistance; Artificial [electrical] ——. G. J. Gage, Hillyard, Wash., Assignor to Gage Electric Co., Spokane, Wash. U.S. Pat. 1,105,070, July 28, 1914; date of appl., March 31, 1913.

One part by weight of finely divided graphite and sever of carborundum are bound together by an alkali silicat into a coherent and compact form, which is moulded b pressure and heat; the latter liberates silica which act as the effective binding agent. The resistance is provided on one or more sides, with a heat-insulating coating, which is united integrally with it.—B. N.

Furnace; Rotary electric ——. A. S. Bemis, Assignor t National Carbon Co., Cleveland, Ohio. U.S. Pat 1,105,175, July 28, 1914; date of appl., Jan. 22, 1912.

Granular material is fed through a hollow electrode o to a lower electrode, which is rotated about a vertical axis and a current is passed through the peak of the pile which is formed in the hollow electrode. The current is transmitted from the material to the rotating electrode, and a the same time the charge is moved substantially at righ angles to its perpendicular axis and to the general directio of the current flow.—B. N.

Electric furnace [for manufacture of stable boron nitride Comp. Franç. pour l'Exploitation des Procédés Thomson Houston. First Addition, dated Feb. 2, 1914, to F Pat. 456,488, April 10, 1913. Under Int. Conv., Feb. 1913.

See Eng. Pat. 12,377 of 1913; this J., 1914, 255.—T. F.

Electrolytic processes and apparatus. C. White. Fr. Pa 468,669, Jan. 7, 1914. Under Int. Conv., Jan. 2 1913.

See Eng. Pat. 1935 of 1913; this J., 1914, 206.—T. F.

Electrolytic preparation of hydrosulphites. Ger. Pat 276,058 and 276,059. *See* VII.

Treatment of seed grain. U.S. Pat. 1,106,039. *See* XIX

XII.—FATS; OILS; WAXES.

Fats; Natural —— from the standpoint of the phase-ru II. The ternary system: tripalmitin, stearic and palmi acids. R. Kremann and H. Klein. Monats. Chem 1913, **34**, 1291—1311.

In the binary systems composed of tripalmitin wi stearic acid and with palmitic acid, no compounds or so solutions are formed but only simple eutectics containi respectively somewhat more than 60% and about 50 of tripalmitin and melting at 58° and at 54° C. The otl binary system, composed of stearic and palmitic aci has been studied by de Visser (this J., 1898, 853) and Carlinfanti and Levi-Malvano (this J., 1909, 131 according to the latter authors the two acids form addition-compound, $C_{18}H_{36}O_2,C_{16}H_{32}O_2$, and this for a continuous series of solid solutions with stearic a and three different series of solid solutions with palmi acid. In studying the ternary system series of mixtu were prepared in which two of the components w in a constant ratio and the proportion of the third vari. The results are given in tables and curves, including triangular diagram. The eutectic line in the triangu diagram passes through a minimum at 49° C. but ma of the mixtures solidify at considerably lower temperat owing to undercooling.—A. S.

ats : *Natural —— from the standpoint of the phase-rule III. The ternary system : tristearin, stearic and palmitic acids.* R. Kremann and R. Kropsch. Monats. Chem., 1914, **35**, 561—580. (See also this J., 1912, 1040).

Ir the three binary systems mixtures of stearic nd palmitic acids have been studied by de 'isser (this J., 1898, 853) and by Levi-Malvano (this J., 909, 1318). In mixtures of tristearin and stearic acid ne solidifying point falls from that of stearic acid (67·5° C.) o an eutectic point (about 54° C., 90% of tristearin) and hen rises to the solidifying point of tristearin (56° C.). he system tristearin-palmitic acid is more complicated. he curve rises steeply from the solidifying point of tri- earin, passes through a flat maximum at about 7% of almitic acid, shows an ill-defined eutectic point (63° C.) t about 16%, a second very flat maximum, another itectic point (55° C.) at about 50% of palmitic acid nd then rises to the solidifying point of palmitic acid. 'wo compounds containing respectively 4 mols. and 1 mol. f tristearin to 1 mol. of palmitic acid, are probably formed, nd the eutectic point of mixtures of the former and tri- earin practically coincides with the solidifying point of istearin. An eutectic arrest was never observed with ixtures containing from 50 to 100% of palmitic acid and is possible that solid solutions are formed in this portion f the system. In studying the ternary system, series of ixtures were examined in which the relative proportions f two of the components were kept constant and that of ne third varied. The results are given in a series of bles and curves, including a triangular curve-diagram. n all the ternary mixtures complete solidification occurred ithin the temperature range 51°—54° C. The results iow that in hardened fats, *i.e.*, fats free from oleic acid nd olein, the highest melting-points will be obtained with ixtures of tristearin and palmitic acid, especially when ne content of the latter is small : addition of increasing uantities of stearic acid causes a tolerably rapid fall of ne primary solidifying point.—A. S.

ats ; *Catalytic hydrogenation of ——.* E. Bontoux. Les Matières Grasses, 1914, **7**, 4194—4198.

YDROGEN for hydrogenating fats must be free from lorine, sulphur, arsenic and phosphorus, and as ee as possible from oxygen and oxides of carbon. lectrolysis of alkaline distilled water by various methods used in some of the larger works (Siemens-Schuckert, teliers Oerlikon) to obtain very pure hydrogen which ntains as impurity only 0·2% oxygen. The electric ower consumed is 6 kilowatt-hours per cb.m. of hydrogen. n other works the hydrogen is prepared from water-gas producer-gas. The methods of Linde-Frank-Caro nd of the Soc. de l'Air Liquide are based on the fractional stillation of the liquefied components of water-gas, the ydrogen thus obtained being of 97 to 98% purity, and it is rought to 99 to 99·5% by being passed over soda-lime 180° C. In Lane's method steam is decomposed by d-hot iron, and the resulting iron oxide is reduced by the ements of water-gas. The Soc. Lyonnaise du Gaz use asted pyrites, and the Griesheim Elektron Co. employ a ixture of lime and iron to decompose the gas. These ethods yield a gas of 97·5 to 98·5% purity. In countries ith a petroleum supply the method of Rincker-Wolter n which the hydrocarbons of oil-gas are decomposed at high temperature into carbon and hydrogen) is used. n installation for the production of electrolytic hydrogen sts about 110,000 francs (about £4,400) for 45 cb.m. 590 cb. ft.) per hour, and about 230,000 fr. (about £9100) r 100 cb.m. (3530 cb. ft.). With electric power at 3 ntimes (0·3d.) per kilowatt-hour the gas will cost about 3 centimes per cb.m. (about 6s. 3½d. per 1000 cb. ft.), cluding labour. An installation for water-gas costs ther more than 200,000 francs (about £7900) for 50 cb.m. d 300,000 francs (about £11,900) per 100 cb.m. per hour, it the gas will cost only 10 to 15 centimes per cb.m. s. 3d.—3s. 4½d. per 1000 cb. ft.). A complete plant for drogenating less than 15 metric tons a day costs from 0,000 to 400,000 francs (about £13,900—£15,900), and e cost of hardening 100 kilos. of fat ranges from 3 to 8 ancs (1s. 2½d.—3s. 2½d. per cwt.) according to the process, e nature of the initial oil, and whether the hydrogenated t is intended for technical or edible purposes.—C. A. M.

Oxycholesterol and its digitonin compound. J. Lifschutz and T. Grethe. Ber., 1914, **47**, 1453—1459.

OXYCHOLESTEROL, $C_{27}H_{46}O_2$ or $C_{28}H_{44}O_2$, occurs in animal fats in association with cholesterol and may be prepared by oxidising cholesterol with benzoyl peroxide and purifying the product by treatment with methyl alcohol. It is a light yellow amorphous substance which resembles colophony and becomes electrified when rubbed. It softens at 100° C. and is completely fluid at 107°—113° C. It is soluble in all ordinary solvents and forms a colloidal solution in water. It gives all the ordinary reactions of cholesterol, but may be distinguished therefrom, by treating its solution in glacial acetic acid with a few drops of concentrated sulphuric acid. The red or bluish-violet colour thus produced is changed to bright green on adding ferric chloride solution, and on then adding one or two drops of chromic acid the liquid becomes colourless. Cholesterol does not give this colour reaction. Oxycholesterol is precipitated by an alcoholic solution of digitonin, the digitonide crystallising in rhombic plates which melt at 215° to 218° C. It forms a colloidal solution in water, dissolves with difficulty in chloroform, and is almost insoluble in ether and hydrocarbons.—C. A. M.

Enzyme action ; Studies on ——. XXII. Lipase. IV. Correlation of synthetic and hydrolytic activity. H. E. Armstrong and H. W. Gosney. Roy. Soc. Proc., 1914, B **88**, 176—189.

IN a previous communication (this J., 1913, 917) it was concluded from experimental results that lipase was specially fitted to act on oily glycerides but not to act in aqueous solutions, and that probably interaction takes place at and between surfaces separated only by a thin film of water at most. Parallel series of experiments have now been made on the influence of water and glycerol on the synthesis of glycerides from the fatty acids of olive oil and glycerol and the hydrolysis of olive oil. Using proportions of fatty acids and glycerol necessary for the formation of a triglyceride, equilibrium was attained when about 40% of acid was combined, and similar results were obtained for the hydrolysis of olive oil in presence of the theoretical minimum quantity of water. By addition of water the equilibrium was displaced in the direction of greater hydrolysis and the rate of change was markedly retarded. Excess of glycerol also retarded the rate of change and displaced the equilibrium in the opposite direction ; for example, with equivalent proportions of fatty acids and glycerol 39·2% of acid was combined in 50 hours, whilst with 1 mol. excess of glycerol, 55·8% of acid was combined. The retardation of hydrolysis by water is ascribed to its direct action in preventing effective contact of the enzyme and oil, but its effect in the synthetic experiments, especially the diminution of the extent to which synthesis takes place, is probably due to withdrawal of glycerol from the system through its solution in the water : synthesis was not entirely prevented even by 30 mols. of water to 1 mol. of glycerol, but in absence of excess of water, excess of glycerol beyond 2 mols. had but little effect in increasing the proportion of fat synthesised. The enzyme may be rendered inert by "overdrying," becoming active again on addition of a very small quantity of water. Enzyme which has been used and then recovered by washing with light petroleum, is usually less active than it was originally, the hydrolytic activity—in presence of a relatively large excess of water—being more affected than the synthetic activity. In one experiment with the fatty acids of olive oil and excess of glycerol, the reaction product was isolated by adding alcohol, neutralising the unchanged acid with caustic soda, evaporating off the alcohol, and extracting the soap solution with ether. About 18 grms. of a pale yellow oil was obtained having the saponif. value 183·5 (saponif. value of original olive oil, 191·7) and acetyl value 78·6. This result and others also cited indicate that mono- and di-glycerides are formed.

Bournot's statement (this J., 1913, 758) that the lipase of *Chelidonium majus* seeds does not require treatment with acid to render it active is confirmed. According to Bournot *Chelidonium* lipase differs from *Ricinus* lipase in being most active in a neutral medium, but the authors point out that *Ricinus* lipase, when once liberated from its zymogen, is also sensitive to acid, exhibiting maximum activity when the acidity does not exceed that of oleic acid. The enzymes from the two sources gave similar results in the synthesis and hydrolysis of triolein, but, weight for weight, the *Chelidonium* lipase was more active than *Ricinus* lipase in effecting the synthesis and hydrolysis of isobutyl oleate.—A. S.

Glycerin in the United States. Oil, Paint and Drug Rept., Aug. 31, 1914. [T.R.]

THE destruction by fire on August 23rd of the large new glycerin refining plant of Wm. F. Jobbins, Inc, at Aurora, Ill., and the shutting off of foreign supplies of the crude product have combined to raise prices in all grades. Fully 1,000,000 lb. of dynamite glycerin were destroyed in the fire, and should the directors decide to rebuild, it will take a year to do so. As the United States produces less than half of the world's requirements of glycerin suitable for refining into the C.P. grade and as no crude glycerin is now obtainable from Europe, a noteworthy shortage of supplies is expected for the remainder of this year. There are only three U.S. refineries left, viz., those of the Du Pont Powder Company, which makes refined dynamite glycerin for its own consumption at Repauno, N.J.; Marx and Rawolle, with a plant in Brooklyn, and the Harshaw, Fuller and Goodwin Company, with a plant in Elyria, near Cleveland, Ohio.

Fats; Changes in the character of —— during cooking. Masters and Smith. *See* XIXA.

Benzoyl peroxide as an agent for displacing sulphur. Vanino and Schinner. *See* XX.

PATENTS.

Oils from solids; Process for extracting ——. C. Turner, Chicago, Ill. U.S. Pat. 1,104,456, July 21, 1914; date of appl., June 26, 1911.

THE solid material is washed with a volatile solvent as it passes through one or more inclined chambers; the liquid is drained off laterally into a separation tank, while the residue is discharged through a liquid seal into a chamber, where the remaining solvent is evaporated, escape of vapours through the receiving and discharging openings of the chamber being prevented by directing into them a vapour under pressure.—C. A. M.

Oils; Treatment of ——. B. Lach, Vienna. U.S. Pat. 1,104,906, July 28, 1914; date of appl., June 5, 1913.

OILS are purified by treating them with steam after the addition of a quantity of formaldehyde sufficient to precipitate any proteins present. The excess of formaldehyde is then removed by means of nascent hydrogen produced by adding an acid and a metal to the oil.—W. P. S.

Cottonseed oil; Process of bleaching ——. C. Baskerville. New York. U.S. Pat. 1,105,743, Aug. 4, 1914; date of appl., Jan. 24, 1913.

VEGETABLE oils, such as cottonseed oil, containing colloidal colouring matter, are agitated, below 100° C., with an inorganic absorbent having the properties of fuller's earth, the treatment being carried out in the presence of an electrolyte and under conditions suitable to the coagulation of the colouring matter.—W. P. S.

Oils; Process of refining vegetable and animal ——. C. Baskerville, New York. U.S. Pat. 1,105,744, Aug. 4, 1914; date of appl., Feb. 15, 1913.

OILS and fats containing free acids are agitated with a fibrous vegetable material impregnated with a quantity of alkali slightly in excess of that required to neutralise the acids, and are then filtered.—W. P. S

Sulphonated stearic products; Production and utilisation of ——. I. Levinstein, Manchester. Eng. Pat. 16,577, July 19, 1913.

PURE or commercial stearic acid is melted with a fat capable of sulphonation (*e.g.*, stearine, wool stearine, palm oil), the mixture sulphonated at, say, 35° to 45° C., the sulphonated product washed, and the mineral acid separated or neutralised. Concurrent sulphonation of the stearic acid is thus effected. Miscible or emulsifiable preparations are obtained by mixing the sulphonated products with oils, waxes or greases.—C. A. M.

Beeswax; Process of bleaching ——. G. F. Jehlicka Williamsville, Mass. U.S. Pat. 1,106,221, Aug. 4. 1914; date of appl., Oct. 15, 1912.

BEESWAX is melted by the direct action of steam, allowed to settle, and the clear wax transferred to a bath consisting of 21 oz. of iron-free sulphuric acid and 1 lb. of sodium peroxide dissolved in 12 galls. of water, this solution being rendered slightly alkaline by the addition of a small quantity of sodium silicate; the bath is heated to 160° F (71° C.) by the injection of steam, and the wax and solution are agitated by blowing in air. The bleached wax is transferred to a vessel containing slightly acidified cold water the latter is heated to boiling for a definite period, and the wax is drawn off, and re-melted.—W. P. S.

Oleic and fatty acids derived from train or fish oils; Proces for deodorising ——. W. H. Hofmann, Hamburg, Germany. U.S. Pat. 1,106,509, Aug. 11, 1914. Date o appl., Sept. 23, 1913.

SEE Fr. Pat. 462,763 of 1913; this J., 1914, 324.—T. F. B

Emulsion products and process for producing them. I Berend, Assignor to Dr. Kurt Albert Chem. Fabrik Amöneburg on Rhine, Germany. U.S. Pat. 1,107,02 Aug. 11, 1913. Date of appl., Feb. 26, 1912.

SEE Fr. Pat. 444,739 of 1912; this J., 1912, 1173.—T. F. B

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Resins, etc., used in embalming in Egypt and Carthag 2000—800 B.C. L. Reutter. Chem.-Zeit., 1914, 3 276.

IN a specimen examined by the author were found: masti resin of *Pinus halepensis*, storax, asphaltum, resin cedar, residues of conifers such as *Juniperus oxycedru* wine residues, sodium carbonate, sulphate and chlorid together with different stones and pearls.—J. B.

Recovery of volatile solvents used in the manufacture of plast materials [*artificial silk, etc.*]. Barthélemy. *See* V.

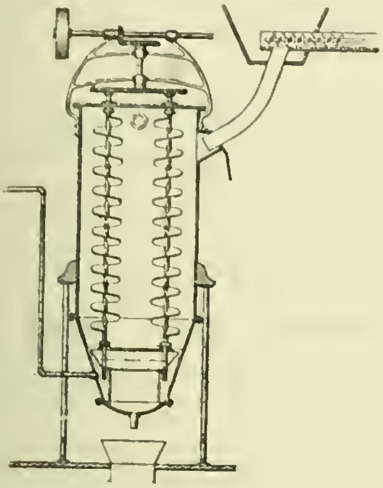
PATENTS.

Rosin from resinous wood; Method of extracting — F. E. Lichtenthaeler, Newton, Mass. U.S. Pa 1,104,912, July 28, 1914; date of appl., Mar. 17, 1913

RESINOUS wood is treated with steam at 250° C., t pressure in the vessel being reduced to about 2 lb. per sq. i (absolute), and the vaporous mixture of rosin and stea is led to a condenser.—W. P. S.

Turpentine-extractor. J. M. Hillard, Gulfport, Mis Assignor to M. W. Connor, Columbia, Miss. U.S. Pa 1,103,878, July 14, 1914; date of appl., Jan. 11, 191

THE extractor consists of a retort having, at the upp end, a vapour outlet, and at the lower end door for discharging the refuse, and, above t door, an arrangement of screens which serves a steam-chest from which two hollow vertical sha re supplied. The shafts are provided with steam-ischarge ports at intervals, and with spiral agitator lades, and are arranged to rotate in such a way that ne imparts an upward and the other a downward motion the material in the extractor. The heavier by-products e discharged through an outlet in the door.—E. W. L.



esinous condensation products. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 22,421, Oct. 4, 1913. Addition to Eng. Pat. 24,254, Oct. 23, 1912 (this J., 1914, 92).

ESINOUS products of the type described in the previous atent (*loc. cit.*) are obtained by heating a mixture in uimolecular proportions of glycerol and phthalic acid or nhydride, adding to the resulting compound 0·25 mol. roportion of phthalic anhydride and 0·5 mol. proportion oleic acid, and completing the reaction. The resinous mpound, which may be hardened by heating it to 0° C., is suitable for insulating purposes or for varnishes, d may be used for impregnating paper, wood, textile brics, etc.—C. A. M.

acking material; Acid-proof —— M. L. Chappell, Berkeley, Cal. U.S. Pat. 1,102,473, July 7, 1914; date of appl., Sept. 9, 1913.

HE packing material contains a condensation product of henol, formaldehyde, an unsaturated fatty acid such as eic acid and a condensing agent consisting of an alkali mmonium) salt of the acid. A lubricant may be added. —E. W. L.

omposition [resin] and process of manufacturing same. J. W. Aylsworth, Assignor to Condensite Co. of America, East Orange, N.J. U.S. Pat. 1,102,630, July 7, 1914; date of appl., May 14, 1909.

FORMALDEHYDE compound, having the formula $H_2O)_n$—where *n* is less than 4—is heated at a temperare not exceeding 350° F. (177° C.) with an anhydrous sible phenol resin, for a length of time sufficient to cause mplete hardening. The proportions of the two reacting dies are determined by ascertaining the amount of free enol in the phenol resin and calculating the amount of rmaldehyde compound necessary for complete combinan to form a hard infusible resin.—E. W. L.

astic composition [for sound records] and method of making ame. J. W. Aylsworth, Assignor to Condensite Co. of America, East Orange, N.J. U.S. Pat. 1,102,631, July 7, 1914; date of appl., Aug. 6, 1910.

HE composition is composed of a filling body, consisting a hard, infusible, final phenol-methylene condensation product (which may contain a plasticising agent), and a binder, consisting of a fusible phenol-methylene condensation product and a hardening agent, or of a fusible phenolic condensation product, hexamethylenetetramine and a plasticising agent. The mixture is heated under conditions such as will harden the mass, and, in the case of sound records, is cooled before removal from the mould. —E. W. L.

Enamel, lacquer, or varnish composition. J. W. Aylsworth, Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,102,632, July 7, 1914; date of appl., July 22, 1911.

THE enamel or varnish composition consists of an anhydrous fusible phenol resin, an anhydrous hardening agent containing methylene (*e.g.*, hexamethylenetetramine) and free phenol, and a fluid thinner, all dissolved in acetylene tetrachloride.—E. W. L.

Insulating composition. J. W. Aylsworth, Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,102,633, July 7, 1914; date of appl., Jan. 2, 1912.

AN insulating composition, which is slightly flexible when cold and has a congealing or setting point of 240°—320° F. (116°—160° C.) consists of Manila gum (100), phenylphthalimide (20—70) and castor oil (10—30 parts).—E. W. L.

Plastic phenolic condensation product and process for making same. J. W. Aylsworth, Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,102,634, July 7, 1914; date of appl., March 18, 1912.

AN anhydrous composition, infusible, and insoluble in alcohol or water, and plastic at high temperatures, is formed when a fusible phenol resin, a methylene-containing hardening agent, and benzoic anhydride are heated together. Any water evolved combines with the anhydride.—E. W. L.

Varnish and process of making same. M. F. Conghlin, Stoughton, Mass., Assignor to F. H. Kennard, Newton Center, Mass. U.S. Pat. 1,103,266, July 14, 1914; date of appl., Feb. 2, 1914.

A SOLUTION of kino resin in alcohol of more than 70% strength is mixed with a quantity of a solution of sulphite pitch in alcohol of less than 70% strength, sufficient to produce a solution in solvent of approximately 70% strength.—E. W. L.

Composition [for varnish] containing sulphite waste and shellac. M. F. Conghlin, Stoughton, Mass., Assignor to F. H. Konnard, Newton Center, Mass. U.S. Pat. 1,103,267, July 14, 1914; date of appl., Feb. 2, 1914.

THE composition consists of an ammoniacal solution of shellac together with the solid constituents of waste sulphite liquor.—E. W. L.

Paint; Process for preparing a weatherproof and rust-preventing ——. M. Brenoeisen. Fr. Pat. 468,598, Feb. 18, 1914. Under Int. Conv., Feb. 19, 1913.

SEE Eng. Pat. 4113 of 1914; this J., 1914, 652.—T. F. B.

Kauri and other like gums; Process and apparatus for the treatment of ——. F. V. Raymond, Mount Eden, New Zealand. Eng. Pats. 18,857, Aug. 19, 1913, and 12,766, 12,768, 12,769, and 12,770 of 1914, dates of appl., Aug. 19, 1913. Under Int. Conv., Sept. 5, Oct. 5 and 18, 1912, and Jan. 13 and June 11, 1913.

SEE Fr. Pat. 462,125 of 1913; this J., 1914, 208.—T. F. B.

Varnishes; Manufacture of ——. H. Rosenberg, Port Richmond, Staten Island, U.S.A. Eng. Pat. 20,401, Sept. 9, 1913. Under Int. Conv., Nov. 4, 1912.

SEE U.S. Pat. 1,062,419 of 1913; this J., 1913, 666.—T.F.B.

Elastic plastic masses; Manufacture of ——. T. S. Wennagel, Hamburg, Germany. U.S. Pat. 1,107,003, Aug. 11, 1914. Date of appl., June 3, 1912.

See Fr. Pat. 448,330 of 1912; this J., 1913, 438.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc solutions; Osmotic properties and physical constitution of ——. W. A. Caspari. Chem. Soc. Trans., 1914, **105**, 2139—2150. (See also this J., 1913, 1041.)

Determinations of the osmotic pressures of solutions of caoutchouc in benzene and in light petroleum (b. pt. 80°—120° C.), using ordinary white porous earthenware cells, the pores of which were blocked with cold-vulcanised caoutchouc, as semi-permeable diaphragms, showed that the osmotic rise increased more rapidly than the concentration. Solutions which had become less viscous by keeping or by boiling gave a much smaller osmotic pressure than freshly-prepared solutions of the same concentration. This is probably because a solution of caoutchouc consists of a sol- and a gel-phase. If the gel-phase is osmotically inactive the results obtained indicate that as the concentration increases, the sol-phase becomes more concentrated than the gel-phase, and as the viscosity of a given solution decreases the sol-phase diminishes. The gel-phase in contact with the diaphragm (depending on ratio of gel-volume to sol-volume in the liquid) may however exert simultaneously a pressure of the same character as that which causes caoutchouc, gelatin, etc., to swell when immersed in solvents.—T. C.

Patents.

Rubber; Method of and apparatus for coagulating ——. F. W. Manson, London. From T. W. Donaldson, Klang, Fed. Malay States. Eng. Pat. 22,302, Oct. 3, 1913.

Smoke from the combustion of carbonaceous material is passed through the latex in a closed vessel divided into two compartments communicating at the bottom. The smoke enters at the top of one compartment and leaves the other compartment through an outlet at the top, connected with a pump or fan.—C. A. M.

Rubber latex; Treatment [coagulation] of ——. W. G. ten Houte de Lange, jun., Amsterdam, Holland. Eng. Pat. 24,342, Oct. 27, 1913.

Latex enters, from a containing vessel, the top of a smoke chamber, and is delivered on to the surface of the uppermost of three superimposed rollers, through a perforated pipe. The middle roller rotates in the opposite direction to the other two, and, by means of baffle-plates, smoke from an outside generator is caused to pass, through a controlling slide-valve, upwards between and around the rollers in a direction opposite to that of their rotation. The latex is partially coagulated on the top roller; the uncoagulated portion flows downwards on to the middle roller where a further portion is coagulated; and on the third roller the remainder is coagulated. In this way a separation or grading as to quality is effected. Doors are provided for the removal of the sheet of rubber from the rollers; a vessel below the rollers for the reception of the serum; and a fan in the upper part of the chamber for the removal of smoke before opening the doors. —E. W. L.

Sponge-rubber; Method of making ——. J. Huebner, Chicago, Ill. U.S. Pat. 1,103,359, July 14, 1914; date of appl., Jan. 25, 1913.

Rubber is mixed successively, at different intervals, with resin oil, zinc oxide, turpentine, flowers of sulphur and ammonium carbonate; the mass is shaped in a mould, transferred to a vulcaniser, and steam admitted at intervals at successively higher temperatures, until a maximum of 35 lb. pressure is attained. This pressure is maintained until the mass is vulcanised.—E. W. L.

Pontianac; Process of treating ——. A. R. Ellison, Brookline, Mass. U.S. Pat. 1,104,744, July 21, 1914; date of appl., Oct. 13, 1909.

Pontianac is agitated with a mixture of naphtha, acetone oil (say, equal parts) and acetone (slightly more than one part), and the separated rubber washed with boiling water.—C. A. M.

Rubber substitute; Process for making a ——. C. Lamberty. Fr. Pat. 468,409, Feb. 13, 1914.

See Eng. Pat. 20,261 of 1912; this J., 1913, 760.—T. F. B.

Process of producing isoprene. U.S. Pat. 1,106,290. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Proteins [gelatin and fibrin]; Influence of certain non-electrolytes on the swelling of ——. M. H. Fischer and A. Sykes. Les Matières Grasses, 1914, **7**, 4202—4204.

Fibrin and gelatin swell more in acid solution than in distilled water, but the addition of any salt reduces the degree of swelling. With non-electrolytes the maximum dehydrating effect is attained only at high concentrations, but with electrolytes it is reached at relatively low concentrations and there is little increase in the action for each increase in the concentration. Sheets of gelatin of equal size and weight were immersed in water and in solutions of different non-electrolytes, and curves were plotted in which the times represented the abscissæ and the increases in weight the ordinates. Sucrose caused greater reduction in the swelling than lævulose or dextrose, whilst methyl, ethyl, and propyl alcohols, propylene-glycol and acetone had a dehydrating action similar to that caused by monosaccharides. In the case of fibrin the absolute degree of dehydration was less than with gelatin. At equal concentrations the effect of sugars, and especially sucrose, upon fibrin was greater than that of the alcohols.—C. A. M.

Patents.

Leather goods; Processes for washing or cleansing ——. Karplus und Herzberger, Berlin. Eng. Pat. 15,932, July 10, 1913. Under Int. Conv., July 11, 1912.

See Ger. Pat. 267,659 of 1912; this J., 1914, 365.—T. F. B.

Skins and hides; The degreasing of ——. S. L. J. Filhol, Lyons, France. Eng. Pat. 26,359, Nov. 17, 1913. Under Int. Conv., Nov. 18, 1912.

See Fr. Pat. 462,280 of 1912; this J., 1914, 326.—T. F. B

XVI.—SOILS; FERTILISERS.

Soils; Determination of the lime requirements of —— H. B. Hutchinson and K. MacLennan. Chem. News 1914, **110**, 61—62.

From 10 to 20 grms. of the soil are treated in a bottle wit 300 c.c. of approximately $N/50$ calcium bicarbonat solution, the air in the bottle is displaced by carbon dioxid and the mixture shaken for 3 hours. The solution is the filtered, and 150 c.c. of the filtrate are titrated with N/1 acid, using methyl orange as indicator. The differenc between this titration and the titre of the calciu bicarbonate solution is taken to represent the amoun of calcium carbonate absorbed by the soil. The calciu bicarbonate solution is prepared by suspending an exce of calcium carbonate in water, saturating with carbo dioxide, filtering, and diluting the filtrate with one-thir of its volume of water.—W. P. S.

Green manuring experiments, 1912–13. C. M. Hutchinson and S. Milligan. Agric. Research Inst., Pusa, India. Bull. No. 40. 1914.

Field trials and laboratory experiments were made with a green manure obtained from crops of *Crotalaria juncea* (sann hemp) in Pusa soil. The general result of the field trials was that no advantage accrued to the succeeding crop from the previous green manuring. In the laboratory experiments the optimum moisture content of the soil for nitrification was 18%, *i.e.*, with soil three-eighths saturated; under this condition 67·8% of the nitrogen of the manure was nitrified in 8 weeks. The optimum depth for burial varied with the age of the plant and also with the aeration and moisture of the soil, the more mature plant requiring to be buried nearer the surface. The biological activity of the soil was tested by the amount of carbon dioxide formed per day; the addition of the green manure increased the carbon dioxide about 10 times, and the addition of a fertiliser, such as superphosphate or bone meal, to the green manure, still further increased the evolution. Indications were obtained that the first stages of decay of the green manure were brought about mainly by fungi.—J. H. J.

Fertilisers for grapes; A test of commercial ——. U. P. Hedrick and F. E. Gladwin. New York Agric. Exp. Stat., Bull. **381**, March, 1914, 201—230.

The treatment consisted in annual applications of nitrogen in the form of sodium nitrate, dried blood and cottonseed meal, of phosphorus as acid phosphate (superphosphate), of potassium as potassium sulphate, and of lime. Nitrogenous fertilisers had a marked beneficial effect upon the yield and quality of the fruit, leaf and wood growth, whereas lime had no effect, and phosphorus and potassium so little that the use was not profitable To restore a failing vineyard, the steps required in the usual order of importance, are to secure a good drainage, control insects and fungi, improve the tillage and general care, apply such fertilisers as may be found lacking, nitrogen being probably most frequently the element needed.—B. N.

Calcium cyanamide [nitrolim]; Action of carbon dioxide on crude ——. C. Manuelli. Annali Chim. Appl., 1914, **1**, 493—494.

Some of the difficulties met with in the use of nitrolim as a fertiliser have been attributed to the presence of free lime, and it has been suggested that the latter might be converted into carbonate by substituting carbon dioxide for nitrogen in the furnace during the cooling of the nitrolim. In two experiments in which nitrolim was cooled from 800° to 480° C. in ½ hour and from 800° to 500° C. in one hour in a current of carbon dioxide, there were, however, losses of 12% and 29% respectively of the total nitrogen of the nitrolim.—A. S.

Patents.

Soil or rocks impervious; Process for making ——. A. Abraham, Liège, Belgium. Eng. Pat. 4805, Feb. 24, 1914. Under Int. Conv., Feb. 26, 1913. Addition to Eng. Pat. 10,478, May 2, 1912 (this J., 1912, 653).

Water or other inert liquid is introduced into the soil, etc. between the two reacting solutions, in order to prevent premature interaction.—C. A. M.

Fertilizers and method of preparing same. F. Hodson, Nottingham. Eng. Pat. 13,840, Nov. 20, 1913.

Lime obtained by burning limestone in a kiln is slaked with an excess of water, and the lime paste dried in a heated chamber with open top, into which steam at 20 lb. pressure is blown. The fine powder thus obtained may be applied direct or in admixture with other fertilisers. —E. W. L.

Manures. L. D. Wilson, Great Shelford, Cambs. Eng. Pats. 19,102, Aug. 22, 1913, and 2167, Jan. 27, 1914.

Manures are prepared in the "wet" or "dry" way from limestone and or one or more of the materials peat, plaster of Paris, oil-cake, wood, bone ashes, one or more salts of manganese, and sugar or molasses.—W. E. F. P.

Calcium cyanamide; Method of and apparatus for granulating ——. Eng. Pat. 15,713, July 8, 1913.

A paste of finely ground calcium cyanamide and water is fed through a hopper containing a stirring device on to the surface of a rotating, fluted cylinder, which is heated to about 95° C., preferably by means of steam. A scraper fitted with teeth, engaging with the grooves of the cylinders, removes the material in a form, in which it hardens in about half an hour, and the hopper is given a transverse movement relatively to the grooves in the cylinder, so as to spread the material evenly over its surface.—O. R.

Fertilizers; Apparatus for use in the production of ——. G. Herrmann, Braunschweig, Germany, and W. J. Fraser and Co., Romford, Essex. Eng. Pat. 17,594, July 31, 1913.

A closed, externally-heated, horizontal, cylindrical vessel adapted to rotate about a series of fixed helical blades by means of which the raw material (shoddy, waste leather, etc.), under treatment is first disintegrated and then discharged by rotation in successively opposite directions. The process is conducted under pressure, steam and acid being introduced axially into the receptacle.—W. E. F. P.

Manure; System for producing efficient fermentation of ——. G. Beccari, Florence, Italy. Eng. Pat. 2998, Feb. 5, 1914. Addition to Eng. Pat. 7496, April 2, 1912 (this J., 1912, 787).

Modifications and alterations in the process (*loc. cit.*) are described. The condensing tower is provided with horizontal tubes connected with chambers forming two sides of the tower and filled with water; the latter circulates through the tubes. Cold air may be circulated through the tubes instead of water. The ammoniacal liquid collecting on the surface of the tubes is led to a concentrating apparatus adjacent to the tower. Tubes, or thermo-siphons, are placed in the manure pit and serve to supply a current of hot air for heating surrounding objects (incubators, hot-houses, etc.) since the fermenting manure frequently attains a temperature exceeding 65° C. —W. P. S.

Fertiliser and process of making the same. G. H. Benjamin, New York. U.S. Pat. 1,105,607, Aug. 4, 1914; date of appl., May 23, 1912.

Lignocellulose is subjected to the action of a hydrolysing acid, and the resulting mixture of lignocellulose and calcium sulphate is divided into three parts. One portion is burnt so that an ash is obtained free from organic matter; a second part is carbonised to obtain amorphous carbon, ash and a calcium compound; the third portion is mixed with ammonia, nitrates and phosphates and the three portions are finally mixed together.—B. N.

Manure; Process for producing efficient fermentation of ——. G. Beccari. First Addition, dated Jan. 28, 1914, to Fr. Pat. 442,220, April 5, 1912.

See Eng. Pat. 2998 of 1914; preceding.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar production of Argentina in 1913. Board of Trade J., Sept. 10, 1914. [T R.]

The quantity of sugar-cane crushed in the Argentine in 1913 was 3,131,018 metric tons, as compared with 2,121,560 metric tons in 1912. The quantity of sugar manufactured was 276,140 metric tons in 1913, as compared with 147,249 metric tons in the previous year. The percentage of sugar to the cane crushed has risen from 6·9 in 1912 to 8·8 in 1913; in one factory in Tucuman the yield was 11 per cent., and in a factory in Jujuy it was 9%. This improved yield is attributed to better climatic conditions, better cultivation, and improved methods of manufacture. During the year 38 mills were in operation, whilst four were idle. Of the active mills 27 were in the province of Tucuman.

Reducing sugars; Behaviour of —— in the manufacture of cane sugar. H. Pellet. Intern. Sugar J., 1914, **16**, 359—362.

At every period of its growth, the sugar cane contains reducing sugars; in the mature plant the quantity is least at the base and greatest at the top of the stalk. The juice from the internodes, which is the softest part, contains more reducing sugars than that from the nodes; hence the glucose ratio of the juices from the second and third crushings is higher than that of the juice from the first crushing. The quantity of reducing sugars in the mixed juice is sometimes increased by the decomposition of the cane after cutting, and before passage through the mill, to an extent which is variable with the variety of cane, the temperature, and the time of keeping. The glucose ratio of the initial juice may be with good cane, 1·5—2·0; with ordinary cane, 3—5; with poor cane, 6—8; and with decomposed cane, 12%. Ordinary defecation, with or without sulphitation, does not appreciably modify the amount of reducing sugars; carbonatation, on the other hand, eliminates 15—40%. During the operations previous to evaporation the quantity of reducing sugars either increases or remains constant, and after concentration the syrup does not contain more reducing sugars than the thin-juice from which it originated, provided that the rapidity of the operation is sufficient; it cannot contain less (this J., 1914, 495). In the sugars exported and in all the molasses produced it is impossible to find less reducing sugars per 100 of cane than enters with the juice sent to the evaporators. The glucose ratio of the molasses varies very considerably, depending upon the quality of the cane and on the proportion between the reducing sugars and the non-sugars.—J. P. O.

Sucrose losses; Determination of the —— during evaporation and boiling. C. H. A. Zimmermann. Intern. Sugar J., 1914, **16**, 383.

During manufacture the amount of sulphates in solution always remains constant, and in order to indicate the sucrose lost by inversion it is recommended that the ratio of sucrose to soluble sulphated ash should be employed. The true sucrose content of the mill juice, syrup, and massecuite is determined by double polarisation; while the soluble sulphated ash is determined by ascertaining the total ash by sulphating in the usual manner, and deducting the lime, silica, iron and alumina obtained by precipitation with ammonium oxalate solution containing ammonia, this precipitate being treated with sulphuric acid and incinerated previous to weighing. In an example given the ratios were as follows: mill juice, 33·87; syrup, 33·55; and massecuite, 32·77, which figures denote that there was a total decrease in the ratio of 1·10, corresponding to a loss of 3·24% of the sucrose originally present in the mill juice.—J. P. O.

Double polarization method (of determining sucrose in cane products); Use of zinc dust in the ——. W. E. Cross. Intern. Sugar J., 1914, 16, 357—358.

For the decolorisation of the inverted solution in the double polarisation method of determining sucrose in cane products the use of zinc dust is recommended, the amount added being 0·2—0·5 grm., and the action continued for 2·5—20 minutes. This reducing agent may also be advantageously added previous to the inversion, especially in the analysis of cane molasses, much lighter coloured solutions being thus obtained.—J. P. O.

Bagasse and molasses; Utilisation of ——. N. Deerr. Report of the Committee on Manufacture of Sugar and Utilisation of By-products. Hawaiian Sugar Planters' Association. 1913. Intern. Sugar J., 1914, **16**, 378—382.

In Hawaii there may be a surplus of bagasse amounting to 9·5 per 100 of cane over the amount used for raising steam for the engines, juice-heaters, evaporators, and vacuum pans. It is suggested that this quantity might profitably be utilised as fuel for the distillation of spirit fermented from molasses (from 1 lb. of which it was found that 0·212 lb. of absolute alcohol could be obtained); for the concentration in the distillery of the spent wash to be subsequently employed as manure; for paper manufacture; and for pumping outside the factory, preferably using internal combustion engines.—J. P. O.

Starch and maltose; Action of cold concentrated hydrochloric acid on ——. Velocity of hydrolysis of starch and maltose by cold concentrated and fuming hydrochloric acid. A. J. Daish. Chem. Soc. Trans., 1914, **105**, 2053—2073.

When dextrose is dissolved in fuming hydrochloric acid its specific rotatory power rises within a few minutes to a high value dependent on the concentration of the acid ($[\alpha]_D$= about 115°, 95·5° and 63·61° for 1—2% solutions in acids of sp. gr. 1·210, 1·201 and 1·163 respectively; cp. Willstätter and Zechmeister, this J., 1913, 822) and remains nearly constant for several hours but eventually tends to rise still higher. The first rapid rise is probably due to the transformation of nearly the whole of the dextrose into the α-form, which in pure aqueous solutions has $[\alpha]_D = 110°$. The further slow rise may be accounted for by the formation of a di- or polysaccharide (isomaltose, see Friedrichs, this J., 1914, 328), and this is further indicated by a fall in the cupric-reducing power of the solutions, which becomes appreciable after only 1—2 hours and amounts to about 7% by the time the solutions begin to turn yellow (about 12 hours in the fuming acid). These evidences of synthesis may be observed in dextrose solutions of only 1—2% concentration, in ordinary concentrated acid (sp. gr. 1·103). Applying these facts to the interpretation of the action of hydrochloric acid on starch, the author concludes that a 1—2% solution of potato starch in fuming acid undergoes complete conversion into dextrose in 5—6 hours at the ordinary temperature. After this time the rotation of the products is practically identical with that of the calculated quantity of dextrose in acid of the same concentration, whilst the value found for the reducing power is about 7% low. The hydrolysis of maltose by fuming acid takes place no more rapidly than that of starch, so that the former process seems to be the determining factor in the rate of conversion of starch into dextrose, the earlier dextrin-stages being rapidly passed through as in hydrolysis by taka-diastase (see Davis and Daish, this J., 1914, 657). There appears to be no difference in the course of hydrolysis, as effected by acids and by enzymes, except in the relative velocity of the different stages (see Fernbach and Schoen, this J., 1912, 402). Ordinary concentrated hydrochloric acid converts starch completely into dextrose, but only about one-tenth as rapidly as the fuming acid. Acid of sp. gr. 1·083 dissolves starch fairly readily in the cold, but conversion into dextrose is extremely slow; cold acid of sp. gr. 1·049 has scarcely any solvent action.

By extrapolation of the velocity curve representing the hydrolysis of maltose by hydrochloric acid, it is calculated that the value of $[\alpha]_D^{20°}$ for maltose in fuming acid of sp. gr. 1·201, before any hydrolysis has occurred, is 157·4°, and in ordinary concentrated acid, 141·0°. Pure aqueous solutions of maltose which have undergone mutarotation probably contain a mixture of β-glucose-α-glucoside (βα-maltose), for which $[\alpha]_D = 114°$, with α-glucose-α-glucoside (αα-maltose), for which $[\alpha]_D$ probably exceeds 160°. In presence of strong hydrochloric acid the proportion of the latter is increased. Davis (this J., 1914, 800) has suggested that the unimolecular nature of the hydrolysis of maltose is masked owing to the simultaneous occurrence of three transformations, viz.: (1) βα-maltose→αα-maltose; (2) αα-maltose→α-glucose (2 mols.); (3) α-glucose→

equilibrium mixture of α- and β-glucose. In the nearly neutral solutions necessary for enzymic actions, transformations (1) and (3) proceed rather slowly and the unimolecular character of the main reaction (2) is masked. When hydrolysis is effected by fuming hydrochloric acid, however, reaction (1) is almost instantaneous, the specific rotatory power of the maltose rising to 157·4° ; and since the dextrose produced remains chiefly in the α-form (see above), reaction (3) is practically eliminated. Under these conditions the author found that the velocity-constant of hydrolysis varied only from 0·0103 to 0·0106. With ordinary concentrated acid, reaction (1) has more effect, since the equilibrium mixture of βα- and αα-maltose approaches more nearly to that obtaining in pure aqueous solutions, and accordingly the author found variations of 0·00170 to 0·00186 in the velocity-constant. In the case of starch the number of intermediate products of hydrolysis renders the conditions more complex ; working with soluble starch and fuming acid the author found velocity-constants ranging from 0·0052 to 0·0062 and, with ordinary concentrated acid, from 0·00111 to 0·00144.—J. H. L.

New constituents of the turnip and sugar beet plants and their biological detection. Kobert. *See* XIXa.

Patents.

Sugar ; Process of making superior ——. N. B. Bach, Modjoherto, Java. U.S. Pat. 1,104,095, July 21, 1914 ; date of appl., Aug. 4, 1913.

For making white sugar, the cane juice is clarified by liming and sulphiting, the resulting juice being neutral and the quantity of lime less than that required for complete liming. The juice is filtered, concentrated, and the thick juice limed, sulphited and filtered, the total quantity of lime both for thin and thick juices being less than the normal quantity required for liming.—J. F. B.

Sugar ; Device for removing —— *from centrifugal machines.* R. Lougher, Papaikou, Hawaii. U.S. Pat. 1,105,444, July 28, 1914 ; date of appl., May 28, 1913.

A rotary support adjustable vertically and placed between a pair of adjoining centrifugals, is fitted with a horizontal arm on which an adjustable carriage is mounted. A bar adjustable vertically is suspended from the carriage, and bears a rotary, dished disc cutter and a guard or shield behind and close to the concave surface of the cutter. —L. E.

Alfalfa ; Manufacture of syrup and other products from ——. M. C. Rich, Hot Springs, S.D. U.S. Pats. (a) 1,104,135 and (b) 1,104,136, July 21, 1914 ; date of appl., Nov. 28, 1911.

(b) Alfalfa, cut before it becomes fibrous and woody, is partially cured in the field, then subjected to artificial heat to prevent bleaching, and ground. (a) The product is boiled with water, the infusion strained and boiled with glucose and a "saccharine syrup."—J. F. B.

Starch or starch-containing materials ; Manufacture of ——. W. and S. L. Elborne, Peterborough, Northants, and A. V. Board, Liverpool. Eng. Pat. 16,997, July 24, 1913.

Starch, *e.g.*, cassava flour (280 lb.), is mixed with water (15 galls.) and passed through a ¼-inch sieve, spread on trays to a depth of about 2 ins., and placed in a steam-jacketed bakers' oven. The oven is heated to about 215° C. until practically all the starch granules are ruptured, the soluble starch being thus liberated. The temperature is then lowered to say 175° C. and the material partially dried for about an hour in a current of air, being raked at intervals of 10—15 mins. ; drying may be completed by prolonging this treatment or by transferring the material to a steam-heated floor on which it is turned over periodically. The pure soluble starch thus obtained is suitable for use in fermentation industries and for food products.—L. E.

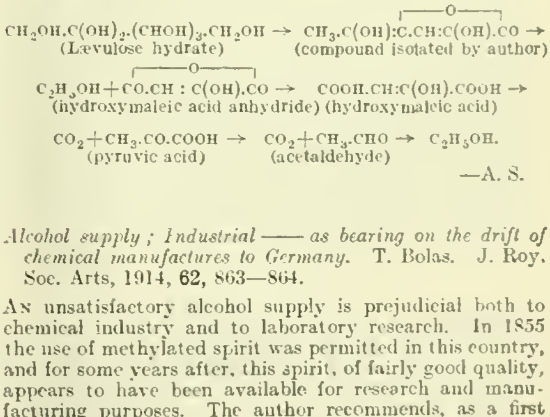
Betaine from molasses or other residues of beet sugar manufacture ; Process for extracting ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 468,366, Feb. 12, 1914. Under Int. Conv., May 7 and Oct. 16, 1913.

See Eng. Pats. 2813 and 2923 of 1914 ; this J., 1914, 658, 767.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Fermentation of some sugars by means of Aspergillus glaucus, and some notes on alcoholic fermentation. F. Tractta-Mosca. Annali Chim. Appl., 1914, 1, 477—492.

Aspergillus glaucus was isolated from soil which had been treated with stable manure by cultivation on nutrient solutions containing sucrose, dextrose, or lævulose. It slowly fermented solutions of these sugars with production of alcohol and carbon dioxide. After prolonged action the solutions of dextrose and lævulose became optically inactive ; the rotatory power of the sucrose solution diminished, then changed its sign, and the lævo-rotation first increased and then remained approximately constant. From the solutions, after fermentation, the author isolated a white crystalline substance of m. pt. 154° C. by extraction with ethyl acetate. This had the composition, $C_6H_6O_4$, and its properties indicated that it was a γ-lactone of the formula, $CH_3.C(OH):\overbrace{C\,CH:C(OH).CO}^{O}$. It was fermented by beer yeast with formation of alcohol and carbon dioxide and is regarded as an intermediate product of alcoholic fermentation, for which the following scheme is suggested :—



$$CH_2OH.C(OH)_2.(CHOH)_3.CH_2OH \rightarrow CH_3.C(OH):\overbrace{C.CH:C(OH).CO}^{O} \rightarrow$$

(Lævulose hydrate) (compound isolated by author)

$$C_2H_5OH + \overbrace{CO.CH:C(OH).CO}^{O} \rightarrow COOH.CH:C(OH).COOH \rightarrow$$

(hydroxymaleic acid anhydride) (hydroxymaleic acid)

$$CO_2 + CH_3.CO.COOH \rightarrow CO_2 + CH_3.CHO \rightarrow C_2H_5OH.$$

(pyruvic acid) (acetaldehyde)

—A. S.

Alcohol supply ; Industrial —— *as bearing on the drift of chemical manufactures to Germany.* T. Bolas. J. Roy. Soc. Arts, 1914, 62, 863—864.

An unsatisfactory alcohol supply is prejudicial both to chemical industry and to laboratory research. In 1855 the use of methylated spirit was permitted in this country, and for some years after, this spirit, of fairly good quality, appears to have been available for research and manufacturing purposes. The author recommends, as a first practical step, that the sale of methylated absolute alcohol in small quantities should at once be authorised by an Order in Council ; abuse could be prevented by licensing only one vendor in each large town and requiring the purchaser to give a written order or otherwise disclose his identity.—L. E.

[Note by Publication Committee.—Ordinary methylated spirit contains 0·4% of a light petroleum spirit and 10% of wood spirit. Industrial methylated spirit contains 5% of wood spirit and no petroleum spirit. Authority to receive and use such spirit is readily obtainable on application to the Commissioners of Customs and Excise and permission to use pure spirit specially denatured to suit particular industries is also granted when the ordinary or industrial methylated spirit is unsuitable.]

Methyl alcohol in spirituous liquors ; Detection of ——. R. Vivario. J. Pharm. Chim., 1914, 10, 145—147.

The alcoholic liquid is treated with anhydrous sodium carbonate and distilled. 30 grms. of the distillate (alcoholic strength of 80%) are then boiled in a reflux apparatus for 7 hrs. with 15 grms. of potassium hydroxide and 1 grm. of hydroxylamine hydrochloride. The liquid is freely diluted with water, made distinctly acid with sulphuric acid and distilled in a current of steam. When methyl alcohol or substances which yield it on boiling with alkali are present, hydrocyanic acid is found in the distillate. Furfural should be first removed by treatment with *m*-phenylenediamine hydrochloride or aniline phosphate. 5% of methyl alcohol in ethyl alcohol can be readily detected.—F. Shdn.

Action of cold concentrated hydrochloric acid on starch and maltose. Velocity of hydrolysis of starch and maltose by cold concentrated and fuming hydrochloric acid. Daish. *See* XVII.

Patents.

Malting drums ; Apparatus for producing and controlling moistened air in ——. L. Topf, Erfurt, Germany. U.S. Pat. 1,104,717, July 21, 1914 ; date of appl., Jan. 12, 1912.

Air is fed through the upper end of a pipe terminating near the bottom of a vertical air chamber ; water is sprayed from nozzles in the pipe to moisten and cool the descending air. The upper portion of the air chamber communicates with a horizontal chamber containing a spiral baffle and having a portion of its walls perforated, this perforated portion being surrounded by a casing. The surplus moisture passes through the perforations and then from the casing, through a pipe, back to the vertical chamber, while the moistened air passes into the drum.—J. F. B.

Metal vessels, beer casks, etc. ; Process and apparatus for treating the interior of ——. Wicküler-Kupper Brauerei Act.-Ges., Elberfeld, Germany. Eng. Pat. 591, Jan. 8, 1914. Under Int. Conv., Feb. 19, 1913.

Lacquer is applied over the internal coating of tin in the barrel and dried by exposing the cask for several weeks. The burning-in of the dried lacquer is effected by blowing hot compressed air through the bung-hole while the latter is inverted, the cask being closely surrounded by a casing in order to retain the heat outside it. The temperature of the compressed air must be sufficient to melt the layer of tin inside the barrel and cause it to combine with the lacquer, say 250° C., and a thermometer placed between the casing and the exterior of the cask should indicate about 120° C. Gases and loose particles of lacquer are driven out by the air through the inverted bung-hole.
—J. F. B.

Fermentation ; Process of alcoholic ——. R. de Fazi, Rome. Eng. Pat. 1335, Jan. 17, 1914.

The saccharine liquid is fermented with yeast previously acclimatised to ultra-violet rays, and is continuously exposed to ultra-violet rays during fermentation. A quantity of cellulose (*e.g.*, small pieces of filter paper), equal to 0·5—2% of the sugar, is added to the liquid, and, being carried up by the carbon dioxide, forms a protecting cover on the liquid.—L. E.

Ferment ; Process of making a ——. P. Altenfeld, New York. U.S. Pat. 1,105,601, Aug. 4, 1914 ; date of appl., Feb. 11, 1913.

Malt is mixed with gelatinised rye flour, and corn-(maize-) flakes and sufficient water are added to make a dough which is allowed to ferment at a low temperature for from 12 to 18 hours.—W. P. S.

Distillation. A. Woolner, jun., Peoria, Ill. U.S. Pat. 1,104,948, July 28, 1914 ; date of appl., Nov. 3, 1910.

Fermented mash is heated for a long time, with stirring, to develop the flavour, and then distilled. The slop is concentrated, the vapour therefrom, which is practically free from substances liable to injure the flavour of the mash, serving to effect the distillation. The vapour produced in distillation may be utilised to preheat the mash.—L. E.

Malt extract ; Process for removing the bitter taste from ——. E. Cantor. Fr. Pat. 468,937, Feb. 25, 1914. Under Int. Conv., March 6, 1913.

See Eng. Pat. 5025 of 1914 ; this J., 1914, 659.—T. F. B.

Distillery wash ; Method of treating ——. G. Meunier, Raab, Assignor to A. and E. Lederer, Vienna. U.S. Pat. 1,107,175, Aug. 11, 1914. Date of appl., May 17, 1911.

See Fr. Pat. 417,950 of 1910 ; this J., 1911, 44.—T. F. B.

Manufacture of starch or starch-containing materials. Eng. Pat. 16,997. *See* XVII.

Manufacture of food preparations or extracts [from yeast and blood]. Eng. Pat. 541. *See* XIXa.

XIXa.—FOODS.

Wheat ; Proximate analysis of ——. N. A. Barbieri. Comptes rend., 1914, **159**, 431—434.

Twenty kilos. of wheat (*Triticum turgidum*) were subjected to the successive action of various neutral solvents. The whole grains were washed with distilled water, macerated for 15 hours with chloroform water, then digested with water at 50°—60° C. until the grains were soft but not broken, and finally boiled with water for an hour and sifted to separate the husks and embryos from the meal. The solid fractions were treated with alcohol and the various washings and extracts worked up. From the aqueous liquids 2 grms. of a yellow colouring matter, "*b'éine*," were obtained by extraction with chloroform. This is regarded as a transformation product of chlorophyll. It is insoluble in water, but soluble in benzene, carbon bisulphide and petroleum ether ; it does not give the biuret or the acrolein reaction. By dialysis of the aqueous extracts potassium sulphate and monopotassium phosphate were obtained, but no chlorides nor any monocalcium phosphate. Extraction of the husks, embryos and meal with ether, yielded 225 grms. of oil, of which 211 grms. were insoluble in alcohol and acetone and free from phosphorus, sulphur and nitrogen, whilst 8 grms. (containing 0·221 grm. P) were soluble in alcohol and acetone and contained traces of "*b'éine*," palmitin, oleopalmitin and phosphates. The ash produced by incineration of the husks, embryos and meal consisted mainly of calcium sulphate and tricalcium phosphate, and was free from carbonates. From the fact that the whole of the phosphorus of an ether extract of wheat is in a form soluble in acetone, whereas lecithin is insoluble, it is concluded that the latter substance is not present in wheat.—J. H. L.

Wheat bran ; The organic phosphoric acid compound of ——. R. J. Anderson. J. Biol. Chem., 1914, **18**, 441—446. (See also this J., 1914, 371.)

The organic phosphorus compound present in wheat bran may be separated into two portions by treatment with barium hydroxide. The soluble portion yields a precipitate with lead acetate, and by repeated precipitation with this reagent, combined with intervening separation of the lead as sulphide from the compound, a solution is obtained which may be concentrated under reduced pressure to a thick colourless syrup. This immediately crystallises to a white solid mass when scratched with a glass rod. The substance may be re-crystallised from dilute alcohol, when large colourless crystals of inositol-monophosphoric acid, $C_6H_{13}PO_9$, are obtained. All the salts of this acid, with the exception of the lead salt, are soluble in cold water. The alkaline-earth salts are not precipitated by ammonia, the acid differing in this respect from other known organic phosphoric acids as well as from ordinary phosphoric acid. Inositol-monophosphoric acid has no sharp m. pt. ; when heated slowly it softens at 200° and decomposes at 201°—202° C. Heated rapidly, it softens at 188° and decomposes at 190° C.—W. P. S.

Phosphorus; Biochemical significance of ——. H. Kincaid. Brit. Assoc., Australia, 1914. Pharm. J., 1914, **93,** 350.

Australian soils are deficient in phosphorus, and native grasses, the wood of trees, and wheat have a lower phosphorus content than those grown in Europe. Acclimatised European grasses contain more phosphorus than do the native grasses but less than the same kind of grasses grown in Europe.—W. P. S.

Milk; The deposit obtained by centrifuging ——. H. S. H. Wardlaw. Brit. Assoc., Australia, 1914. Pharm. J., 1914, **93,** 350.

The white deposit obtained when milk is centrifuged varies somewhat in composition but consists approximately of mineral matters (chiefly calcium phosphate), 8; lactose, 19; caseinogen, 57; other proteins, etc., 16%. The first portion of the substance deposited consists of cellular material, the remainder of minute globules less than 0·001 mm. diameter. About 60% of the deposit is soluble in a volume of water equal to that of the milk from which it was obtained. The mineral content of the deposit at first increases and then decreases as the centrifuging is continued.—W. P. S.

Fats; Changes in the character of ——*, during the process of cooking.* H. Masters and H. L. Smith. Analyst, 1914, **39,** 347—350.

Butter-fat and cottonseed oil, when cooked with flour under normal conditions for making pastry, suffered slight changes similar in character to those which occur in the "blowing" of oils. Except when the pastry was very thin, or over-cooked, the ordinary analytical constants of the fat were not appreciably affected.—W. E. F. P.

Ossein; The nutritive value of —— *and its use as a food.* E. Maurin. Comptes rend., 1914, **159,** 450—452.

Ossein, the protein substance obtained from bones after the removal of mineral matters by treatment with hydrochloric acid, contains from 16 to 18% of nitrogen and about 4% of calcium phosphate and carbonate. It may be prepared in the form of a stable powder and forms a valuable food material.—W. P. S.

Bengal beans, a new fodder. H. S. Shrewsbury. Bull. Dept. Agric., Trinidad and Tobago, 1914, **13,** 194—195.

A sample of Bengal beans, *Stizolobium aterrimum*, contained: water, 12·0; fat, 3·5; proteins, 29·8; crude fibre, 6·2; carbohydrates, 44·3; ash, 4·2%. The beans from a closely related plant, *S. niveum*, possess toxic properties and cause vomiting and purging, but no evidence was found of injurious glucosides, saponins, alkaloids, vegetable ptomaines or toxalbumins in the Bengal beans. Feeding experiments with the beans did not produce any abnormal symptoms in animals.—W. P. S.

Turnip and sugar-beet plants, etc.; New constituents of the —— *and their biological detection.* E. R. Kobert. Z. Ver. deut. Zuckerind., 1914, 381—396.

The following method serves for the detection of certain toxic substances sometimes present in cattle fodder, *e.g.*, ricin (a constituent of castor seeds) and saponin:—Fresh venous blood from a rabbit or guinea-pig is stirred with a wooden rod for several minutes to separate the fibrin, and then strained through unsized gauze. The suspension of corpuscles thus obtained (or the pulpy mass which separates when the liquid is left to stand or centrifuged) is diluted 50—100-fold with isotonic (0·9%) salt solution, and 5 c.c. of the diluted suspension are placed in each of a series of 7 test-tubes. Five c.c. of the salt solution are then placed in the first and last tubes of the series, and increasing quantities of a solution (in 0·9% salt solution) of the toxic substance are placed in the intermediate tubes in succession, the contents of these tubes being made up to 10 c.c. with salt solution; each tube is gently shaken and left for half an hour. The contents of the first and last tubes then exhibit a uniform, opaque, red colour, and on filtration, yield an opaque red liquid without any deposit on the filter. The contents of the intermediate tubes may exhibit either agglutination or hæmolysis of the blood corpuscles. If agglutination occurs, the coagulated particles may be separated by filtration, a colourless filtrate being obtained. This agglutination is effected by a number of non-toxic plant substances known as phasins (occurring in beans, peas, lentils, vetch, earth-nuts, thorn apples, etc.) and by two strongly toxic substances, ricin and abrin (the latter occurring in wild liquorice). Hæmolysis is effected by numerous substances, and of those which occur in higher plants, the saponins are the most important. Whilst some saponins are toxic, others are found in various edible plants and must be regarded as valuable from the dietetic standpoint; thus the sugar beet and turnip each contain a neutral and an acid saponin, and the mangold-wurzel and spinach also contain saponins. It is not therefore justifiable to prohibit indiscriminately the use of saponins for imparting head-retaining power to aerated beverages.—L. E.

Patents.

Butter and the like; Apparatus for testing [determining water-content of] —— *by weighing.* P. Altmann, Berlin. Eng. Pat. 16,681, July 21, 1913. Under Int. Conv., July 20, 1912.

A definite weight of the butter is placed in a cup attached to one arm of a small scale; the cup and its contents are then heated until all the water has been removed, and the cup is replaced on the scale; a pointer attached to the other arm of the scale indicates, on a graduated quadrant, the loss of weight, *i.e.*, the percentage of water present. (Reference is directed to Eng. Pats. 4019 of 1877 and 11,452 of 1889.)—W. P. S.

Milk; Preservation of desiccated ——. T. Boberg, N. Testrup, and Techno-Chemical Laboratories Ltd., London. Eng. Pat. 17,077, July 25, 1913.

Milk powder, prepared by spraying partially concentrated milk into air heated to 120° C., is filled into tins, the residual air in the tins being expelled by means of a current of carbon dioxide. The tins are then sealed.—W. P. S.

Meat; Process of preserving ——. R. R. Cobb, Texarkana, Ark. Eng. Pat. 21,112, Sept. 18, 1913. Under Int. Conv., Sept. 20, 1912.

Strips of meat are immersed in a hot solution prepared by heating saturated sodium chloride solution to 200° F. (93° C.) and adding, for every 100 lb. of meat to be treated, 8 lb. of sodium chloride, 4 lb. of sugar, and 4 oz. each of potassium nitrate, ground black pepper, and borax. After the meat has been placed in the solution, the latter is boiled for 10 mins., the strips of meat being then transferred to a receptacle together with a quantity of the hot solution sufficient to cover them.—W. P. S.

Food preparations or extracts; Manufacture of —— *[from yeast and blood].* E. Krause, Steglitz, Germany. Eng. Pat. 541, Jan. 8, 1914. Under Int. Conv., Feb. 12, 1913.

A mixture of yeast, salt, and blood is submitted to peptic digestion, then boiled, filtered, and the filtrate concentrated to a suitable consistence.—W. P. S.

Lactic food products; Composition for producing ——. W. J. Mellersh-Jackson, London. From C. D. A. Hansen, Copenhagen. Eng. Pat. 1159, Jan. 15, 1914.

One part by weight of dried milk is mixed with 1 part of a compound prepared by incorporating 10 grms. of rennet powder and 57 grms. of calcium hypophosphite with 32 lb. of powdered sugar; solutions of flavouring substances and a binding material may be added before the addition of the sugar. A firm curd is produced within a few minutes when 3·5 oz. of this mixture is treated with 1 pint of water at 100° F. (38° C.). The proportion of rennet employed may be varied.—W. P. S.

Soy-milk product and process of making the same. J. Monahan and C. J. Pope, Oshkosh, Wis. U.S. Pat. 1,104,376, July 21, 1914; date of appl., July 28, 1913.

Soya beans are emulsified with the addition of sodium bicarbonate and coconut oil, the emulsion is separated from the solid portion, heated, filtered, the filtrate is mixed with malt extract and evaporated to dryness under reduced pressure.—W. P. S.

Flour; Dry-shortening ——. A. W. Estabrook and H. E. Weaver, Kansas City, Mo., Assignors to The Larabee Flour Mills Co., Hutchinson, Kans. U.S. Pat. 1,105,638, Aug. 4, 1914; date of appl., Aug. 4, 1913.

Flour is mixed with powdered stearic acid and gas-producing materials.—W. P. S.

Seed-grain; Treatment of ——. H. E. Fry, Dorchester, Assignor to C. E. De Wolf, London. U.S. Pat. 1,106,039, Aug. 4, 1914; date of appl., Oct. 10, 1913.

The grain is immersed in a solution containing nitric acid and a current of electricity is passed through the same. —W. P. S.

Manufacture of starch or starch-containing materials. Eng. Pat. 16,997. *See* XVII.

XIXb.—WATER PURIFICATION; SANITATION.

Water supplies; Purification of public ——. C. H. R. Fuller. Applied Science (Toronto), 1914, 9, 61—73.

Sedimentation.—Quiescent subsidence in a reservoir for a suitable time is largely used as a preliminary to subsequent treatment. At Cincinnati it was observed that in a reservoir of 160 million gallons capacity, a subsidence of 10 hrs. removed 48% of the suspended matter, a subsidence of one day 62%, two days 68%, 3 days 72%, and 4 days 76%. In some cases coagulants are added to the water entering the reservoir, in which case the reservoir is worked on the continuous flow system. The most widely used coagulent is aluminium sulphate, the quantity required depending on the amount and character of the suspended matter. In Saskatoon where the suspended matter varied from 130 to 400 parts per million, 0·28—1·52 grains of aluminium sulphate were added per gallon. Another coagulant is a mixture of ferrous sulphate and milk of lime, which gives good results when the alkalinity of the water is low.

Filtration.—The effluent from the sedimentation reservoir is filtered through sand, either by the slow or rapid system. At Toronto, a modern slow sand filtration plant has been erected recently, in which the rate of filtration is 6 million gallons per acre per day. The twelve filters are covered in, and are each 0·8 acre in area. The filtering material consists of a bottom layer of 7 in. of gravel, 1—2 ins. diameter, a second layer 2·5 ins. deep, of ⅜- to 1-inch gravel, and a top layer of 2·5 ins. of sand of ⅜-inch diameter. In mechanical or rapid sand filters, the rate of filtration is over 100 million gallons per acre per day, and the filters may be either open or closed. The water is always treated with a coagulant previously, and the deposit on the surface of the sand is removed by reversing the flow of water, the cleaning process taking a few minutes only. The reduction in the number of bacteria is 99%. The total cost of the rapid filter operation is about 10 dollars per million gallons.

Sterilisation.—The most general reagent used is bleaching powder in quantity sufficient to give 0·25—0·6 part of available chlorine per million. To remove the taste which is usually imparted to the water, either 1·2 lb. of sodium sulphite or 0·5 lb. of sodium thiosulphate is added for each pound of bleaching powder. Care must be taken not to add either of these until at least 10 mins. after the addition of the bleaching powder, to allow time for sterilisation. Another sterilising agent used in Europe is ultra-violet light. For this process the water must always be rendered clear by filtration and may then be passed at a rate of 130,000 gallons per day through the rays from a one h.p.-lamp. The best lamp is called the pistol lamp and is U-shaped, the two limbs being very close together and enveloped by a two-inch quartz tube. A current of 500 volts and 3 ampères is used. The lamp is situated in a channel and the water is passed through in such a way as to keep it under the influence of the light as long as possible. —J. H. J.

Nitrites [in water, etc.]; Fresenius' method for determining small quantities of ——, *and its sensitiveness compared with the m-phenylenediamine reaction.* E. A. Letts and F. W. Rea. Analyst, 1914, 39, 350—352. (See also this J., 1914, 570.)

In using the zinc-iodide-starch method of Fresenius [" Quant. Anal.," vol. ii., 7th ed. (English)], better results were obtained with 4 c.c. of the reagent and 2 c.c. of dilute sulphuric acid (1 : 5 by vol.) per 50 c.c. of water than by following the original instructions; and the blue colour was found to develop more rapidly in bright, than in dull, light. The results of comparative tests indicated that this method is 10—20 times as sensitive as the *m*-phenylenediamine process.—W. E. F. P.

Patents.

Filtering material for purifying and softening water; Process of preparing ——. Deutsche Filter Compagnie Ges. m. b. H. Fr. Pat. 467,687, Jan. 24, 1914. Under Int. Conv., Jan. 29, 1913.

Vitreous rocks are ground, levigated, and the lighter portion, which possesses base-exchanging properties, is extracted with hydrochloric acid, to remove soluble impurities, washed, and impregnated with sodium chloride solution, whereby the bases present are partly replaced by sodium. When it is desired to use the resulting material for the removal of iron and manganese from water, it may also be treated successively with a manganous salt and a permanganate.—W. P. S.

Sewage disposal. N. Testrup, London, T. Rigby and G. W. Andrew, Dumfries, and Wetcarbonising Ltd., London. Eng. Pat. 16,800, July 22, 1913.

Moderately dry sewage sludge is subjected to distillation in the presence of steam of gradually increasing temperature. In the first stage, ammonia is recovered from the sludge; in the second, the steam is superheated to 250°—300° C. in order to remove greases from the sludge; the residual sludge is then heated to about 800° C. to produce gas. The amount of air admitted to the still is regulated and the different zones in the still are separated by water-cooled valves. (See also Eng. Pat. 3247 of 1911; this J., 1912, 601.)—W. P. S.

Sewage or any other liquid; Process of and apparatus for purifying ——. L. Linden, Brussels. Eng. Pat. 1266, Jan. 16, 1914.

The sewage is introduced into a tank through a conical pipe reaching nearly to the bottom. Along the bottom of the tank, which inclines upwards towards the outlet end, are a number of wells or pockets separated by partitions provided with perforations. The second well is divided into two compartments by a partition extending from above the water-level nearly to the bottom. The suspended matters in the sewage settle in the wells and are withdrawn therefrom when necessary. Movable bands of fabric may be fitted over the perforated partitions and, when the sewage has been treated previously with lime, carbon dioxide is introduced into the sediment collecting in the first well so as to form calcium carbonate and thus produce a more compact bed of material through which the fresh sewage has to pass. Means are provided for cleansing and sterilising the bands of fabric.—W. P. S.

Liquids such as waste water; Apparatus for separating solid matter, more particularly fibrous matter, from ——. B. Hofer, Munich, Germany. Eng. Pat. 6793, March 17, 1914. Under Int. Conv., March 17, 1913.

THE effluent, such as that from a paper factory, is conducted through a pipe into a funnel-shaped vessel mounted within a tank having a conical bottom. The tank is illed previously with water. As the liquid rises slowly n the funnel, the fibrous material collects into lumps or layers which pass over the upper edge of the funnel and fall to the bottom of the tank; the clear liquid eaves the upper part of the tank and a screw-conveyor removes the fibrous material collecting at the bottom of the apparatus.—W. P. S.

Refuse destructor and other furnaces; Apparatus for charging ——. H. N. Leask, Liscard, Cheshire. Eng. Pat. 17,449, July 30, 1913.

A PACKING of flexible material, such as asbestos, wire-auze, or lead, is fitted round the door of the container rom which the refuse is discharged into the furnace, n order that dust shall not escape while the container s being filled with refuse.—W. P. S.

Clothing, furs, skins, etc.; Process for protecting —— against moths, beetles and insects, or for killing domestic and agricultural pests. Act.-Ges. für Anilin-Fabrikation. Berlin. Eng. Pat. 10,379, April 27, 1914. Under Int. Conv., Sept. 10, 1913.

BESIDES *p*-dichlorobenzene, specified in Eng. Pat. 19,688 of 1912 (this J., 1912, 1026), the other isomeric dichloro-enzenes may be used, also mono-, tri- and tetrachloro-enzenes or a mixture such as is obtained in the course of he manufacture of chlorobenzenes, also chloro-derivatives of a homologue of benzene.—I. F. B.

Clothes, furs, skins, and other articles; Process for protecting —— from attacks by moths or other insects. Act.-Ges. f. Anilinfabr. First Addition, dated Jan. 30, 1914, to Fr. Pat. 442,719, April 18, 1912. Under Int. Conv., Sept. 10, 1913.

EE Eng. Pat. 10,379 of 1914; preceding.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

xportation of cocaine and cinchona bark from the Netherlands. Board of Trade J., Sept. 10, 1914. [T.R.]

HE prohibition of the exportation of cocaine and of nchona bark and products made therefrom under the ecree of August 7 is temporarily repealed.

oca alkaloids. A. W. K. de Jong. Chem. and Drug., 1914, **85**, 280.

n view of serious attempts to manufacture coca alkaloids Java, two methods of extraction are suggested. (1) n excess of alkali is added to the coca leaves themlves or to an extract of the same made with dilute acid, hen the alkaloids can be extracted with chloroform amyl alcohol. (2) The leaves are extracted with a lute acid, as is done in Peru, excess of alkali added the extract, and the alkaloids extracted with loroform or amyl alcohol.—F. Shdn.

copolamine hydrobromide]. $C_{17}H_{21}NO_4,HBr.3H_2O$*: Criticism of the U.S.P. as to the naming of the compound ——, and the prescribed tests for the same.* A. G. Du Mez. Amer. J. Pharm., 1914, **86**, 339—349.

RACTICALLY all the scopolamine hydrobromide or the -called hyoscine hydrobromide used in the United ates is at present supplied by Germany. It is suggested that in the U.S. Pharmacopœia the former should be the official title, that the melting points of the chloroaurates of either *l*- or i-scopolamine should be omitted and that only *l*-scopolamine hydrobromide with a definite specific rotatory power should be recognised.—F. Shdn.

m-Nicotine. E. Maass and K. Zablinski. Ber., 1914, **47**, 1164—1173.

BENZOYL-*m*-NICOTINE crystallised from ether in fine colourless highly refractive needles, m.pt. 82° C. The base readily formed condensation products, such as phenyl-*m*-nicotinylurea, $C_{17}H_{19}N_3O$, which crystallised from alcohol and melted at 108° C., and phenyl-*m*-nicotinylthiourea, $C_{17}H_{19}N_3S$, m.pt. 137° C. after crystallisation from alcohol. Mononitroso-*m*-nicotine, $C_{10}H_{13}N_3O$, formed colourless silky needles, m.pt. 116° C. When the base was heated to 250°—260° C. with red phosphorus and hydriodic acid, dihydro-*m*-nicotine, $C_{10}H_{16}N_2$, and β-butylpyridine were produced and were separated by fractional distillation. The former boiled at 260°—262° C. and formed a stable colourless oil, fairly easily soluble in water. It yielded a platinum double salt melting at 197° C., and when reduced by means of alcohol and sodium yielded octohydro-*m*-nicotine, $C_{10}H_{22}N_2$, b.pt. 257°—260° C. β-Butylpyridine, $C_9H_{13}N$, a colourless oil insoluble in water, boiled at 205°—208° C. The hydrochloride melted at 126° C. and the platinum double salt at 187°—188° C. β-Butylpiperidine, $C_9H_{19}N$, was formed by reduction with sodium and alcohol. It was a colourless oil boiling at 196°—197° C. and gave a hydrochloride, m.pt. 102° C., and a picrate, m.pt. 124° C. —F. Shdn.

β-Gnoscopine; Synthesis of ——. Synthetical experiments in the group of the isoquinoline alkaloids. Part IV. E. Hope and R. Robinson. Chem. Soc. Trans., 1914, **105**, 2085—2104.

NITROMECONINE and cotarnine condense readily in boiling alcoholic solution to form nitro-β-gnoscopine, $C_{22}H_{22}O_9N_2$, which crystallises from trichloroethylene in canary-yellow prisms, m.pt. 191° C. It forms a hydrochloride, m.pt. 142°—143° C., which yields nitromeconine and cotarninium chloride when the aqueous solution is boiled. β-Gnoscopine, $C_{22}H_{23}O_7N$, can be obtained by eliminating the NO_2 group by successive conversion into $\cdot NH_2$, $\cdot NH\cdot NH_2$, $\cdot H$ or into $\cdot NH_2$, $\cdot I$, $\cdot H$. It is an optically inactive base, crystallising from methyl alcohol in colourless rectangular prisms, m.pt. 180° C., and isomeric but not identical with gnoscopine. It behaves as a lactone and can be readily converted into nornarceine and narceine. On oxidation, cotarnine and opianic acid are produced. The conclusion is drawn that the substance is a stereoisomeride of narcotine and gnoscopine. It is suggested that the name α-gnoscopine be reserved for the compound previously known as gnoscopine or *r*-narcotine, m.pt. 229° C. β-Gnoscopine is partially converted into α-gnoscopine by prolonged heating of the aqueous alcoholic solution to 100° C.—F. Shdn.

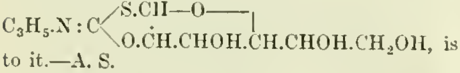
Papaveraldine methosulphate; Oxidation of ——. F. A. Mason and W. H. Perkin, jun. Chem. Soc. Trans., 1914, **105**, 2013—2024.

EQUAL weights of papaveraldine and methyl sulphate were intimately mixed, heated on the water-bath, and the resulting methosulphate crystallised from methyl alcohol. It had the composition, $C_{20}H_{18}O_5N.(CH_3)_2SO_4.CH_3OH$, and formed lemon yellow minute crystals readily soluble in water. Potassium hydroxide added to the aqueous solution produced an orange precipitate soluble in excess of the alkali. When the latter solution was boiled veratric acid and a derivative of 6.7-dimethoxy-N-methyl*iso*quinoline were produced. A solution of the methosulphate in dilute potassium hydroxide solution was readily oxidised by permanganate, the temperature being kept below 30° C.: after filtering veratric acid was precipitated from the solution by adding excess of hydrochloric acid, and three other substances were also isolated, viz., 3.4-dimethoxy-6-methylcarbamylphenylglyoxylic acid,

$C_{12}H_{13}O_6N$, m. pt. 107° C. after crystallising from water, *m*-hemipinmethylimide, $C_{11}H_{11}O_4N$, small needles, m. pt. 266°—267° C., also formed by the oxidation of tho preceding acid, and 6.7-dimethoxy-2-methyl*iso*carbostyril, isolated as a hydrochloride, $C_{12}H_{13}O_3N,HCl$, m. pt. 183°—185° C. Dimethoxy*iso*quinoline methosulphate, m. pt. 202°—203° C., when oxidised by permanganate in alkaline solution yielded the above glyoxylic acid, m. pt. 107° C.—F. SHDN.

Sinigrin ; Constitution of ——. *Mustard-oil glucosides.* W. Schneider and F. Wrede. Ber., 1914, **47**, 2225—2229.

BY the action of potassium methoxide on sinigrin in methyl alcohol solution, thioglucose, $C_6H_{11}O_5.SH$, was produced and was isolated in the form of its silver-compound. Thioglucose is also formed by the action of ammonia gas on a solution of sinigrin in methyl alcohol. Its formation shows that in sinigrin the sugar residue is attached directly to the sulphur atom as in Gadamer's formula, $C_3H_5.N:C(O.SO_2.OK)S.C_6H_{11}O_5$. From the product of the action of potassium methoxide on sinigrin there was also isolated another compound as fine colourless needles, m. pt. 192° C. (uncorr.). This compound, termed *merosinigrin*, is dextro-rotatory ($[\alpha]_D^{20°}=149{\cdot}2°$ in water), yields a triacetyl-derivative and is much more stable than sinigrin, and the formula :—



$$C_3H_5.N:C\begin{cases}S.\dot{C}H—O——\\O.\dot{C}H.CHOH.CH.CHOH.CH_2OH\end{cases}$$

is assigned to it.—A. S.

Ethyl galactoside-β ; Best conditions for the preparation of ——. E. Bourquelot and G. Mougne. J. Pharm. Chim., 1914, **10**, 157—163.

A MIXTURE of 100 grms. of galactose, 16 grms. of emulsin and 2 litres of 80% alcohol is kept at 38°—40° C. for about a month, when the optical rotation changes from +1° 16′ to +48′. The mixture is filtered, evaporated to dryness under reduced pressure and the residue dissolved in 1200 c.c. of distilled water. The solution is allowed to ferment at the ordinary temperature for 10 days after the addition of 15 grms. of dextrose and 30 grms. of washed and pressed bottom-fermentation yeast. The optical rotation changes from +5° 30′ to —30′. The whole is filtered, boiled with a little chalk and charcoal, again filtered and evaporated under reduced pressure. The residue is extracted with hot absolute alcohol and the ethyl galactoside-β purified by recrystallising from the same solvent, using animal charcoal. It forms fine colourless needles, m. pt. 161°—162° C. and with $[\alpha]_D = —7{\cdot}21°$.—F. SHDN.

Anemonin. Y. Asahina. Ber., 1914, **47**, 914—916.

THE fresh roots of the Japanese weed, *Ranunculus japonicus*, were distilled in a current of steam and the distillate extracted with ether, when about 0·12% of an oil was obtained. On standing the oil deposited crystals of anemonin, $C_{10}H_8O_4$, which were crystallised from alcohol and melted at 157°—158° C. Upon further heating the substance solidified at 180° C. and decomposed towards 300° C. Reduction by means of hydrogen in the presence of platinum black led to the formation of tetrahydroanemonin. After crystallising from hot water this formed tablet-shaped crystals which melted at 155° C. and remained liquid up to about 300° C., when decomposition took place.—F. SHDN.

Andrographis paniculata ; Constituents of ——. K. Bhaduri. Amer. J. Pharm., 1914, **86**, 349—354.

THE bitter *Andrographis paniculata* (Nees) is a common Indian plant. Extraction with light petroleum withdrew an essential oil and a small quantity of a crystalline substance, m. pt. 117° C. Chloroform removed chlorophyll and a minute amount of an amorphous white substance, m. pt. 221° C. The alcoholic extract was distilled with steam, when the aqueous portion of the residue deposited yellow crystals of a bitter substance. This had the composition, $C_{19}H_{28}O_5$, melted at 206°, and yielded an acetyl compound, m. pt. 95° C., and a dibromo-derivative. The hot aqueous extract of the solid residue left after steam distillation deposited a white amorphous substance with a very bitter taste, which is styled *kalmeghin*, $C_{19}H_{51}O_5$. It melted at 185° C. and after treatment with acid yielded *kalmeghic acid*, $C_{14}H_{23}O_2$.—F. SHDN.

Fenugreek seeds. Wunschendorff. J. Pharm. Chim., 1914, **10**, 152—157.

FRESH seeds taken from growing fenugreek plants have a sweetish taste and no disagreeable odour. On drying the odour and bitter taste rapidly develop, only to disappear again when the seeds are allowed to germinate. Seeds which have been boiled with alcohol remain inodorous and insipid on keeping, owing to the destruction of the diastatic agents.—F. SHDN.

Oil of Ocymum pilosum, Roxb. K. Bhaduri. J. Amer Chem. Soc., 1914, **36**, 1772—1773.

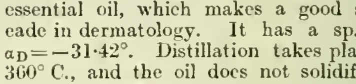
ALL parts of the plant contain oil, the green seeds bein richer than the leaves ; the dried seeds yield no oil o distillation. A jelly produced by soaking the seeds i water is used medicinally by the natives in India. small quantity of the oil was obtained in the laborator by steam distillation. It is a mobile yellow liquid havin an odour closely resembling that of lemongrass oil sp. gr. 0·8872 at 25·5° C., refractive index 1·4843 a 24·5° C., optical rotation at 24·5° C., —3·7° in a 100 mm tube. It distils mainly at 205°—230° C., and contain citral, citronellal, cineol, limonene, and a very sma quantity of thymol, but no methylchavicol. The per centage of aldehydes, as determined by shaking with solution of sodium sulphite and bicarbonate, was 75% by vol., of which 41% was citral and 34% citronellal.—A. S.

Cadier [Juniperus oxycedrus] ; Essential oil from t wood of ——. Huerre. J. Pharm. Chim., 1914, 1 164—165.

THE wood of *Juniperus oxycedrus* yields 3·0 to 1·6% essential oil, which makes a good substitute for oil cade in dermatology. It has a sp. gr. of 0·925, a $\alpha_D = —31{\cdot}42°$. Distillation takes place between 330° a 360° C., and the oil does not solidify at —15° C. It slightly soluble in water, dissolves readily in most orga solvents, and will take up considerable quantities menthol, salol, iodoform, sulphur, etc.—F. SHDN.

Phosphates of 2.3-distearin. R. R. Renshaw and R. Stevens. J. Amer. Chem. Soc., 1914, **36**, 1770—1772.

THE work of Grün and Kade (Ber., 1912, **45**, 3358) the preparation of the primary *o*-phosphate of 2.3-distea by the action of phosphoric anhydride on distearin confirmed. In attempting to simplify the process preparation the sodium salt of a pyrophosphate, probal



$$\begin{matrix}C_{17}H_{35}.CO.O.CH_2.CH.O.PO(ONa)\\ \qquad\qquad\qquad\quad | \\ \qquad\qquad\qquad\quad CH_2.O.PO(ONa)\end{matrix}\Big>O,$$

was obtained. A mixture of 2·5 grms. of distearin a 1·3 grms. of phosphorus pentoxide was heated for 1 h at 100° C., with constant stirring, the product was pow ered, and introduced, with stirring, into a satura solution of sodium bicarbonate. The brownish precipit was filtered off, washed with water, and freed from ste and distearin by extraction with acetone. One-fourth the residue was soluble in boiling benzene : the insolu portion was boiled with water (with liberation of ste acid) and its concentrated aqueous solution precipita with acetone. The combined soluble products w purified by dissolving in benzene, precipitating v acetone, and recrystallising from petroleum ether. pure sodium salt formed prismatic plates, m. pt. 16 168° C. (uncorr.). The silver, barium, and calcium s were also prepared. The authors found that the phosph of distearin tend to hydrolyse with formation of prod poorer in fatty acid, and not the reverse as stated by G and Kade (*loc. cit.*).—A. S.

'hromoform. K. H. Schmitz. Apoth.-Zeit., 1914, **29**, 465—466.

'HROMOFORM is an orange-red crystalline powder formed y the combination of dichromic acid and hexamethylene-·tramine, and has the composition $(C_6H_{12}N_4CH_2)_2Cr_2O_7$. t is only slightly soluble in alcohol and cold water, but ısily in hot water. Warming the aqueous solution or ·eatment with acids or alkalis causes the liberation of ırmaldehyde.—F. SHDN.

hloral and paraldehyde; Manufacture of ——. Chem. and Drug., 1914, **85**, 336.

CURRENT of chlorine is passed through 120 to 150 lb. of bsolute alcohol in a glass carboy for 12 to 14 days. The ·mperature rises to 60°—70° C. and the product finally equires a density of 41° B. (sp. gr. 1·397). The carboy is ırrounded by cold water which is gently heated as soon ı the chlorine ceases to be absorbed. The crude product heated with an equal weight of sulphuric acid in a aden vessel. When all the hydrochloric acid has passed I, the product is distilled, the chloral passing over etween 95° and 100° C. After redistillation this is mverted into chloral hydrate by adding 12·25% of ater. The product can be crystallised from chloroform. ldehyde is obtained from the first runnings in alcohol il's, the best yields coming from alcohol manufactured om potatoes or sugar-beet. Polymerisation to par-dehyde is effected by the addition of a few drops of ncentrated sulphuric acid, and purifying the crystalline ass that separates.—F. SHDN.

cetanilide; Determination of ——. A. Mirkin. Amer. J. Pharm., 1914, **86**, 354—355.

NE grm. of acetanilide is boiled with dilute sulphuric id (1 : 5) for 4 hrs., and carefully neutralised with sodium carbonate when cold. Hydrochloric acid is then added the proportion of 6 mols. to 1 mol. of aniline and the hole cooled to —10° C. Standard sodium nitrite solution run in, with constant shaking, till a drop of the mixture ken out after a few minutes' stirring turns starch-iodide iper blue.—F. SHDN.

enzoic acid; The catalytic decomposition of ——. P. Sabatier and A. Mailhe. Comptes rend., 1914, **159**, 217—220.

HE vapours of benzoic acid were not appreciably affected 550° C. by passing over cerium, zirconium, or barium xides, or the blue oxide of molybdenum or of tungsten, but ere decomposed readily by copper or cadmium, titanium, zinc oxides, and slowly by thorium or chromium oxides alumina (prepared at low temperature), yielding benzene ıd carbon dioxide. Lithium carbonate, calcium car-bnate, or manganous oxide also gave benzene and carbon oxide, but, in addition, benzophenone and a little ıthraquinone, whilst reduced nickel or nickel oxide fected dehydrogenation, with production of carbon and oundant evolution of carbon dioxide, hydrogen, and ethane. Reduced iron resembled both nickel and copper ı its action, giving carbon, hydrogen, gaseous hydro-ırbons, benzene, and diphenyl, and iron oxides (being duced) behaved like the metal, except that some henol (a trace only, with ferrous oxide) was formed. —F. SODN.

enzoyl peroxide as an agent for displacing sulphur. L. Vanino and A. Schinner. Ber., 1914, **47**, 699—703.

ENZOYL peroxide, which is used under the name of lucidol" as a bleaching agent for oils and fats, will ·move sulphur from sulphurised ketones and similar iocarbonyl compounds. When an alcoholic solution of iourea is treated with benzoyl peroxide practically the hole of the sulphur (up to 97·9%) is separated, but at igher temperatures part of the sulphur is dissolved by ıe alcohol. In the reaction cyanamide is formed as a rimary product and dicyandiamide as a secondary roduct of the decomposition. Diphenylthiourea can be esulphurised in the same way, but attempts to remove ıe sulphur from mustard oil were unsuccessful. In similar experiments with hydrogen peroxide no removal of sulphur from thiourea was effected at the ordinary temperature, but an addition compound, $CS(NH_2)_2,H_2O_2$, was obtained. This crystallised in transparent prisms (m. pt. 128°—130° C.), which were readily soluble in water, but were insoluble in alcohol, ether, acetone, chloroform and carbon bisulphide.—C. A. M.

Aminoguanidine and diaminoguanidine; Preparation of ——. G. Pellizzari and A. Gaiter. Gaz. chim. ital., 1914, **44**, II., 72—77.

BY the following simple method, a nearly theoretical yield of aminoguanidine, $NH:C(NH_2)NH.NH_2$, in the form of its bicarbonate, can be obtained from commercial calcium cyanamide and hydrazine sulphate. 100 grms. of calcium cyanamide of recent manufacture are ground with 250 c.c. of water and then, with agitation, 19 c.c. of sulphuric acid of 65·5° B. (sp. gr. 1·83), diluted with 200 c.c. of water, and 60 grms. of powdered hydrazine sulphate are added. The pasty mass is left for 1 hour with occasional agitation, filtered with the aid of the pump, and the residue washed with 250 c.c. of water. The solution, containing mainly free cyanamide and neutral hydrazine sulphate, is concentrated to 200 c.c. on the water-bath, any free acid present or developed being neutralised with calcium cyanamide. After filtering from small quantities of calcium sulphate, iron oxide, etc., the solution is heated for 7 hours on the water-bath, the volume being kept constant at 200 c.c. When the cyanamide is completely decomposed, as shown by a test with ammoniacal silver nitrate, the solution is cooled, a cold solution of 48 grms. of potassium bicarbonate in 200 c.c. of water is added, and the precipitated aminoguanidine bicarbonate is filtered off and washed. 54 grms. are obtained from 100 grms. of calcium cyanamide of recent manufacture. Other salts may be prepared from the bicarbonate by double decomposition.

Diaminoguanidine, $NH:C(NH.NH_2)_2$, is best obtained by the interaction of cyanogen bromide and hydrazine hydrate, the reaction being carried out under ether. A solution of 42·5 grms. of cyanogen bromide in 100 c.c. of ether is added gradually, with agitation, to 40 grms. of pure hydrazine hydrate below a layer of 100 c.c. of ether, the containing vessel being cooled with water. When the reaction is complete, the mixture is stirred until the smell of cyanogen bromide disappears, the ether is decanted off, and the residual crystalline magma is dissolved in 200 c.c. of hot alcohol, from which most of the diaminoguanidine hydrobromide separates on cooling, a further quantity being obtained by evaporating the mother liquor to dryness, dissolving the residue in a small quantity of hot alcohol, and cooling: about 52 grms. are obtained altogether. The hydrobromide crystallises in two different forms, viz., small opaque crystals, and long transparent needles which change into the other form; it melts at 262°—263° C. with decomposition.—A. S.

Triaminoguanidine. G. Pellizzari and A. Gaiter. Gaz. chim. ital., 1914, **44**, II., 78—85.

SALTS of triaminoguanidine, $NH_2N:C(NH.NH_2)_2$, are readily obtained by the interaction of salts of guanidine, amino- or diamino-guanidine with 3, 2, or 1 mol. of hydrazine hydrate respectively; salts of guanidine or aminoguanidine are preferably used. A concentrated aqueous solution of the reacting substances may be heated for 2—5 hours in an open vessel on the water-bath and the residue crystallised from water, or an alcoholic solution may be heated under a reflux condenser, when the triaminoguanidine salt separates in the solid condition as it is formed. The nitrate, hydrobromide, hydrochloride, and thiocyanate have been prepared.—A. S.

Acrolein; Preparation of ——. E. J. Witzemann. J. Amer. Chem. Soc., 1914, **36**, 1766—1770.

WOHL and Mylo's method (this J., 1912, 794) is used but with a much simpler apparatus. 100 grms. of dehydrated magnesium sulphate in pieces of ¼—½ in. size, and freed from dust and fine particles, are introduced into a 3-litre round-bottom Kavalier flask connected with a short condenser, which delivers through an adapter into the first receiver containing 100—125 grms. of common salt. The exit tube from the receiver is constricted at the lower end and has a hole in the side about 2·5 cm. above; it is connected with a second condenser which delivers into the receiver for the crude acrolein. 200 grms. of glycerol are introduced into the flask containing the magnesium sulphate and the flask is heated, gently at first, by a ring burner. The first receiver, in which most of the water is retained, is immersed in boiling water and that for the acrolein in ice-water. When acrolein begins to pass over into the second receiver, glycerol is slowly dropped into the generating flask as fast as that present is decomposed. With three sets of apparatus in operation simultaneously, 500 grms. of acrolein can be obtained in 5 hours. When a flask breaks during distillation the odour is mostly that of hot sugar tar and does not cause great inconvenience. An average yield of 43% of crude acrolein is obtained. This usually begins to polymerise at once, but if the small quantity of water always present be not removed, the polymerisation does not proceed far. The pure acrolein (b. pt. 52°—54° C.) obtained by redistillation polymerises quite rapidly; it should be dehydrated with calcium chloride and used immediately; calcium chloride which is alkaline in aqueous solution causes very rapid polymerisation. The generating flask can usually be quickly cleaned with warm water; small quantities of non-acid tar can be easily removed with chromic acid mixture.—A.S.

Vleminckx's solution [*Liquor calcis sulphuratae*]; *Preparation and analysis of* ——. J. L. Mayer. Amer. J. Pharm., 1914, **86**, 355—358.

A mixture of 165 grms. of freshly slaked lime and 250 grms. of sublimed sulphur is added slowly to 1750 c.c. of boiling water in a flask. The whole is boiled till the weight is reduced to 1000 grms., strained, allowed to settle in a stoppered bottle, and the clear brown liquid decanted and stored in bottles filled to the stopper. Solutions prepared in this way contained 29·1 to 29·6 grms. of total sulphur in 100 c.c., as determined by adding excess of sodium or potassium hydroxide, warming with hydrogen peroxide, acidifying with hydrochloric acid, and precipitating with barium chloride.—F. Shdn.

Syrup of iron iodide; Value of preservatives in ——. G. M. Beringer. Amer. J. Pharm., 1914, **86**, 358—359.

When syrup of iron iodide is made carefully and with the proper amount of sugar, no preservative is needed. Hypophosphorous acid as a preservative has a reducing action which is not possessed by organic acids such as citric and tartaric acids. It acts on the sugar in strong solutions and causes darkening, which could be obviated by substituting glycerin for a portion of the sugar.—F. Shdn.

Arsenical compounds combined with silver and antimony salts for the treatment of trypanosomatic diseases. J. Danysz. Comptes rend., 1914, **159**, 452—455.

The sulphate of arsenobenzene-silver bromide (product 882; see this J., 1914, 275) combines with a certain quantity of antimony, yielding the sulphate of dihydroxydiaminoarsenobenzene-silver-antimonyl bromide, $[C_{12}H_{12}O_2N_2As_2]_2AgBrSbO(H_2SO_4)_2$. This substance (product 102′) is about twice as efficient as arsenobenzene-silver bromide and is particularly active in the case of *T. gambiense.* Experiments on mice showed that the ratio of the maximum dose tolerated to the curative dose is as 80 : 1. The curative dose appears to be about 0·01 grm. per kilo. of body weight.—W. P. S.

Mercuric acetate and aniline; New compound of ——. L. Vecchiotti. Gaz. chim. ital., 1914, **44**, II., 34—38.

Pesci and others (Gaz. chim. ital., 1892, **22**, II., 608) by the interaction of mercuric acetate and aniline, obtained a compound which was shown later by Pesci (Gaz. chim. ital., 1899, **29**, I., 394) and by Dimroth (Ber., 1902, **35**, 2032; Z. anorg. Chem., **33**, 311) to have the constitution $C_6H_4(NH_2).HgC_2H_3O_2[NH_2 : HgC_2H_3O_2=1 : 4]$. The author has now obtained, by the interaction of 1 mol. of aniline and 2 mols. of mercuric acetate in aqueous solution, a white crystalline compound of the formul $C_6H_3(NH_2)(HgC_2H_3O_2)_2$ [1 : 2 : 4]. It is soluble in glaci acetic acid and in ammonia, with which it combine slightly soluble in boiling water, and insoluble in alcoho On treatment with caustic potash it yields the correspond ing mercuric hydroxide compound, $C_6H_3(NH_2)(HgOH)$, which is slightly soluble in boiling water and insoluble i alcohol. The constitution of the mercuric acetate con pound was proved by converting it into its acetyl-derivativ (compare Pesci, Chem.-Zeit., 1899, **23**, Nr. 7) and decon posing this with bromine, 1.2.4.-dibromoacetanilid m. pt. 146° C., being obtained.—A. S.

Iodine; Biochemistry of ——. *Distribution of iodine plant and animal tissues.* A. T. Cameron. J. Bio Chem., 1914, **18**, 335—380.

An exhaustive examination of numerous vegetable ar animal tissues showed that iodine is an invariable const tuent of all marine algæ, the quantity exceeding 0·001% distinct variation in the iodine-content is found in t same species growing under identical conditions. Diffe ence in iodine-content of the environment explains t difference in the quantities of iodine present in fresh-wat plants and vegetables and in marine algæ. Iodine present in appreciable quantity in certain tissues of marine species; in the higher species there is more differe tiation (and probably less total iodine in the wh organism) until, in the vertebrates, thyroid tissue alo is of consequence. Also in the case of mammalian tiss the thyroid gland alone is of importance in the stora of iodine; non-thyroid tissue contains less than 0·001 of iodine. Variations due to differences in diet observable in the case of the thyroid gland; the minim quantity present is about 0·01% whilst the maxim may reach 1·16%.—W. P. S.

Lanthanum and thorium salts; Bactericidal and antito. action of —— *on the cholera vibrio.* A. Frouin and Roudsky. Comptes rend., 1914, **159**, 410—413.

The sulphates of lanthanum and thorium had no injuri action on the human subject. Small amounts of the sa in solution destroyed the toxicity of cultures of chol bacilli and had a beneficial action in cases of experimen cholera produced in animals.—F. Shdn.

Iodine from marine algæ; Industrial extraction of —
Laurent. *See* VII.

Patents.

Alkali salts of diaminodihydroxyarsenobenzene in combinat with copper and silver; Manufacture of ——. O. Imr London. From Farbwerke vorm. Meister, Lucius, Brüning, Hoechst a/Main, Germany. Eng. Pat. 12 Jan. 16, 1914.

A solution of 3.3′-diamino-4.4′-dihydroxyarsenobenz is mixed with small quantities of silver or copper sa sodium hydroxide is added, and the compound forme separated by precipitation or by evaporating the soluti It is of great value for the treatment of sleeping sickn —W. P. S

Carbon tetrachloride package. W. L. Harrison, Branf Conn. U.S. Pat. 1.106,144, Aug. 4, 1914; date appl., Sept. 18, 1913.

Carbon tetrachloride is contained in a cylindrical ve into which compressed air is also introduced; the te chloride is separated from the air by a "follower," which packing containing glycerin is applied to protect tetrachloride from the action of the air.—T. F. B.

Isoprene; Process of producing ——. R. B. Earle L. P. Kyriakides, Assignors to Hood Rubber Boston. U.S. Pat. 1,106,290, Aug. 4, 1914; dat appl., Nov. 11, 1911.

The vapours of methylisopropylketone are passed ov a dehydrating catalyst, such as aluminium silicate, hea o 400°—600° C., under reduced pressure, and the isoprene ormed is separated from the other products.—T. F. B.

3.4-*Dihydroxyphenyl-α-aminopropionic acid ; Process for preparing* ——. F. Hoffmann-La Roche und Co. Ger. Pat. 275,443, Sept. 7, 1913.

HE seeds or hulls of *Vicia faba* are extracted for a short ime with aqueous sulphurous acid ; the extract contains he β-3.4-dihydroxyphenyl-α-aminopropionic acid, which an be isolated by conversion into its insoluble lead comound and decomposing this with sulphuric acid. The ee acid is sparingly soluble in cold water and more easily hot water ; it melts at 280° C. with decomposition and s rotatory power $[\alpha]_D$ —18·91. When it is heated arbon dioxide is eliminated and the corresponding dihyroxyphenylethylamine is produced.—T. F. B.

sters of 2-alkyl- or 2-arylquinolinecarboxylic acids or their derivatives ; Process for preparing ——. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 275,963, Oct. 9, 1912.

SOLUBLE salt of a 2-alkyl- or 2-arylquinolinecarboxylic cid or derivative thereof, whether substituted in the enzene or in the pyridine ring, is esterified by treating ith an alkyl halide in presence of water at a high temperare.—T. F. B.

examethylenetetramine di-iodide ; Process for preparing ——. M. Rix. Ger. Pat. 275,974, June 11, 1913.

N antiseptic compound of hexamethylenetetramine with dine is obtained by the action of an aqueous solution of e base on a solution of iodine in an organic solvent which immiscible with water, *e.g.*, benzene or carbon tetraloride. Antiseptic gauze may be prepared by impregating the fabric with hexamethylenetetramine solution d then immersing it in the iodine solution.—T. F. B.

cid chlorides of the oxyacids ; Process for the production of ——. L. Karczag, Charlottenburg, and E. Kopetschni, Mannheim, Germany. U.S. Pat. 1,106,455, Aug. 11, 1914 ; date of appl., Sept. 5, 1912.

E Fr. Pat. 450,227 of 1912 ; this J., 1913, 507.—T. F. B.

etaldehyde ; Process of preparing ——. E. Baum and M. Mugdan, Assignors to Consortium f. Elektrochem. Industrie G. m. b. H., Nuremberg, Germany. U.S. Pat. 1,107,019, Aug. 11, 1914 ; date of appl., July 25, 1913.

E Fr. Pat. 460,553 of 1913 ; this J., 1914, 42.—T. F. B.

hers of phenol homologues halogenated in the side chain ; Process for producing ——. Dr. Schmitz und Co. Fr. Pat. 468,363, Feb. 12, 1914. Under Int. Conv., April 10, 1913.

E Eng. Pat. 3053 of 1914 ; this J., 1914, 767.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

gment prints ; Transferring —— *to new supports.* K. Bleibtreu, Bonn, and Deutsche Photogravur Akt.-Ges., Siegburg, Germany. Eng. Pat. 9486, April 16, 1914. Under Int. Conv., April 16, 1913.

E distortion of pigment prints during transfer to metal other surfaces by the wet process, is avoided, according to the present patent, by bringing the dry pigment paper upon the dry support and subsequently moistening the paper ; the air between the paper and the support must be removed before or immediately after moistening, and the pigment paper must be prevented from changing its position on the support during moistening, *e.g.*, by covering the pigment paper with a layer of damp paper or fabric and placing over this an air-tight cover from which the air is then removed.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives ; Annual Report of the Chief Inspector (Major A. B. Denne) of —— *for the Union of South Africa for the year ending Dec.* 31, 1913. [U.G. 28—1914.] (See also this J., 1913, 1033.)

Accidents.—Six accidents occurred in manufacture, of which the chief were : A fire of empty nitrate bags ; an explosion in a packing house in which cartridging, since stopped, was also being carried on (see Special Report, this J., 1913, 627) ; a fire in a nitration house, due to the inadvertent supply of more glycerin than could be taken by the distributor, which, the stirrer having stopped, fired the supernatant nitroglycerin ; an explosion in a kneading house supposed to be due to the dropping of a box of gelatin, or to a blow on the edge of a kneading pan being charged (see Special Report, this J., 1913, 1171). In addition there were 61 accidents with explosives or other dangerous substances, including "outrages," but excluding mining accidents. *Importations.*—Gelatins, gelignites, dynamites, and tshisa sticks are made in S. Africa ; blasting and whaling powders, safety fuse, detonators and electric detonators, sporting powders and ammunition, and fireworks are imported. Statistics are as follows :—

	Blasting gelatin.	Gelignite.	Dynamite	Blasting powder.	Permitted explosives.	Total.	Detonators (number).
anufactured, cases	484,314	240,097	183,729	—	1,643	909,783	—
mported, cases ..	1,371	1,300	2,638	4,363	1,993	11,665	43,562,900
xported, cases ..	10,863	17,734	948	—	—	29,545	31,525

20,321 cases of 500 coils each of safety fuse were imported.
—O. E. M.

White phosphorus matches. Importation forbidden in Canada. Board of Trade J., Sept. 10, 1914. [T.R.]

UNDER the provisions of the "White Phosphorus Matches Act," the manufacture and importation of such matches are forbidden as from January 1, 1915, and their sale or use prohibited after January 1, 1916.

Patents.

Explosive powder ; Apparatus for forming —— *into spherical grains.* F. I. du Pont, Wilmington, Del. U.S. Pat. 1,106,138, Aug. 4, 1914 ; date of appl., Aug. 13, 1913.

THE explosive is supplied to a moving plate having holes, and is forced into the holes. A wheel revolves above the plate and is provided with fingers which enter the holes and force the plugs outwards into a heated receptacle in which they are dried and simultaneously subjected to a rolling motion to shape them into balls.—G. W. McD.

Explosives ; Manufacture of gelatin ——. A. E. Vergé, Vincennes, France. Eng. Pat. 17,205, July 26, 1913. Under Int. Conv., June 23, 1913.

LIQUID dinitrotoluene is prepared by the nitration of a mixture of *m*-mononitrotoluene (60 parts) and *o*-mononitrotoluene (40 parts). From 20 to 25 parts of this liquid dinitrotoluene is mixed with 60 parts of trinitrotoluene. A gelatinous base is made by the addition of

collodion cotton to the nitrotoluene mixture, and oxidising salts (chlorates, perchlorates and nitrates) are then added. Examples are: nitrotoluene mixture (17 parts), nitroglycerin (40), collodion cotton (5), and ammonium perchlorate (38 parts); nitrotoluene mixture (28 parts), collodion cotton (1·7), ammonium perchlorate (43·9) and sodium nitrate (26·4 parts); nitrotoluene mixture (29 parts), collodion (2) and potassium perchlorate (69 parts).
—G. W. McD.

Explosive compounds; Manufacturing ——. Explosive compound. W. C. Waddell, Assignor to Hoynes Safety Powder Co., Cleveland, Ohio. U.S. Pats. (A) 1,105,864 and (B) 1,105,865, Aug. 4, 1914; date of appl., June 27, 1913.

(A) Spherical explosive pellets are produced "by tumbling substantially dry nuclei of explosive material in the presence of dust-like explosive of the same nature, adding a small proportion of moistening liquid and continuing the tumbling, and successively adding more dust-like explosive followed by moistening fluid until said nuclei by accretion have formed substantially spherical units of the size desired." (B) A blasting explosive composed of "a shot-like aggregate of small, imperforate spherical units, each such unit being of uniform character and density throughout and the several units being substantially uniform in size."—G. W. McD.

Priming charge. W. H. Buell, Assignor to Winchester Repeating Arms Co., New Haven, Conn. U.S. Pat. 1,106,343, Aug. 4, 1914; date of appl., Oct. 21, 1913.

A mixture of lead hydrazoate and a nitrated carbohydrate, *e.g.*, nitrocellulose.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

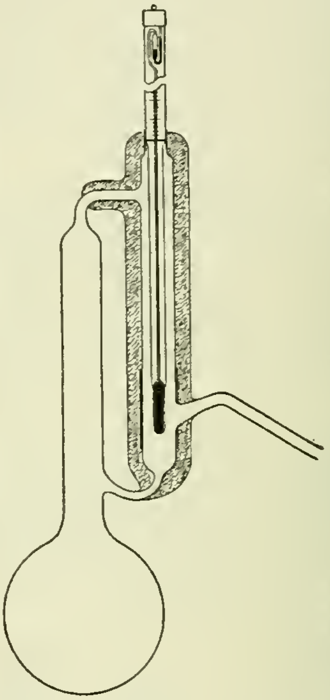
Zirconium; Separation of —— from iron and aluminium with the aid of the ammonium salt of nitrosophenyhydroxylamine ("cupferron"). W. M. Thornton, jun., and E. M. Hayden, jun. Amer. J. Sci., 1914, **38**, 137—141.

The method is similar to that previously described for the separation of titanium from iron, aluminium, and phosphoric acid (see this J., 1914, 615), the quantity of tartaric acid used being equal to 5 times the aggregate weight of the three oxides. "Cupferron" forms a very bulky and flocculent white precipitate with zirconium and the method gives accurate results, but is inadmissible in the presence of phosphoric acid.—O. R.

Nitric acid; Detection of —— with ferrous sulphate. I. Bellucci. Annali Chim. Appl., 1914, **1**, 549—558.

A large number of experiments were made under varied conditions and the best results were obtained by dissolving the substance in the smallest possible quantity of water, mixing the solution with excess of concentrated sulphuric acid, and adding to the hot solution, so as to form an upper layer, a solution of ferrous sulphate saturated in the cold: 1 part of nitric acid in 250,000 parts of sulphuric acid could be thus detected. For traces of nitric acid, *e.g.* when the zone reaction gave doubtful results, it was preferable to mix together the reacting substances. For such cases the concentrated solution of the substance was treated with a reagent prepared by dissolving 2·5 grms. of ferrous sulphate in 6—8 c.c. of water acidulated with sulphuric acid and adding the solution to 1 litre of 90% sulphuric acid. This reagent could be kept unaltered for a long time in a closed bottle, and was capable of detecting 1 part of nitric acid in 500,000 parts of sulphuric acid. It is useful for detecting small quantities of nitrous fumes or nitric oxide in gases.—A. S.

Still for the exact measurement of boiling point during fractional distillation; An advantageous ——. T. W. Richards and F. Barry. J. Amer. Chem. Soc., 1914, **36**, 1787—1791.



The still described (see fig.) has proved very efficient for fractional distillation and allows of the determinatior of the exact boiling points of the fractions. It consist of a flask with sid tube, parallel to th neck of the flask attached to it by tw connecting tubes, th lower one being ben so as to minimise th amount of dead spac capable of retainin the liquid being distilled. The side tub is constricted at th top where it receive and holds closely th shell of a Beckman thermometer near th zero mark; with hy groscopie liquids, th thermometer must b fitted in place wit a ground joint. . mirror of tinfoil t prevent radiation preferably boun around the side tub so as to surround th bulb of the therm meter, and the who of the side tube ar the upper connectin tube is encased in thick shell of asbesto In an experiment wi 500 c.c. of commerci toluene, after si distillations, with s fractions eac time, 130 c.c. of liquid distilling within an interv of 0·02° C. were obtained, and two more fra tionations of 65 c.c. of this liquid yielded 40 c.c. of tolue distilling within a range of less than 0·01° C. By imme ate immersion of the warm dry bulb of the standardis Beckmann thermometer into a steam bath, the differen between the boiling points of the toluene and of water w measured. A slightly modified form of the still for t with a small Anschütz thermometer is also described.
—A. S.

Nitrogen [in urine, etc.]; Colorimetric determination total ——. A. Gulick. J. Biol. Chem., 1914, **18**, 541 547.

A weighed quantity of the substance (or 1 to 2 c.c. urine), containing about 7 mgrms. of nitrogen, is treate in a flask of about 50 c.c. capacity, with 1 c.c. of sulphu acid, 1 grm. of potassium sulphate and 3 drops of saturated mercuric chloride solution, and the mixt is heated until oxidation is complete as in the ordina Kjeldahl method. The solution is then cooled, dilu to 100 c.c. with ammonia-free water, and the ammon content determined directly by Nessler's reagent. latter should be prepared by dissolving mercuric iodi 15, potassium iodide, 10, and sodium hydroxide, 40 grm in 500 c.c. of ammonia-free water.—W. P. S.

Carbon monoxide; Determination of ——. J. I. Grah and T. F. Winmill. Chem. Soc. Trans., 1914, **105**, 199 2003.

A modified form of the Haldane apparatus is used. measured gas sample is first treated with bromine potassium bromide solution, followed by potash;

es in volume gives the carbon dioxide, hydrogen sulhide, sulphur dioxide, and unsaturated hydrocarbons. ; is then passed backwards and forwards, by means of the otassium hydroxide solution confining it, through a tube filled completely with powdered iodine pentoxide reviously heated for 3—4 hours in a current of dry air at 0° C. Before and after this operation the U-tube stands cold water of known temperature; during the passage of e gas in water at 90°—100° C. The loss in volume gives e carbon monoxide. Mixtures rich in hydrogen and rbon monoxide require dilution with air to bring the ydrogen below 20% and the carbon monoxide below 8%: herwise hydrogen is oxidised. An accuracy of 0·02% possible.—O. E. M.

etermination of sulphur in spent oxide. Marsden. *See* IIa.

apid determination of sodium sulphide in a standing sulphide dye-bath. Len. *See* VI.

olumetric determinotion of sulphurous acid. Jamieson. *See* VII.

etermination of iridium in platinum-iridium alloys. Bannister and Du Vergier. *See* X.

etermination of phosphorus in phosphor-bronze. Hagmaier. *See* X.

nalytical examination of [*commercial*] *tungsten.* Arnold. *See* X.

etermination of the sucrose losses during evaporation and boiling. Zimmermann. *See* XVII.

etermination of sucrose in cane products] *Double polarisation method, using zinc dust.* W. G. Cross. *See* XVII.

ew constituents of the turnip and sugar beet plants and their biological detection. Kobert. *See* XIXa.

resenius' method of determining small quantities of nitrites, and its sensitiveness compared with the m-phenylenediamine reaction. Letts and Rea. *See* XIXb.

Determination of acetanilide. Mirkin. *See* XX.

Patents.

ensity of gases; Process and apparatus for measuring the ——. K. Bomhard and G. König. Fr. Pat. 468,784, Feb. 21, 1914. Under Int. Conv., Feb. 22, 1913.

ee Ger. Pat. 269,862 of 1913; this J., 1914, 336.—T. F. B.

il-baths and means for heating liquid therefor. Eng. Pats. 17,190 and 17,334. *See* IIb.

pparatus for testing [*determinining the water-content of*] *butter and the like.* Eng. Pat. 16,681. *See* XIXa.

XXIV.—MISCELLANEOUS ABSTRACTS.

mydalinase and amygdalase; Modification of —— due to ageing. G. Bertrand and A. Compton. Comptes rend., 1914, **159**, 434—436.

he amygdalase and amygdalinase of emulsin (see is J., 1911, 762) exert their maximum activity in solutions distinctly alkaline to phenolphthalein. Emulsin preparations stored for several years in the dark, undergo a gradual loss of activity and at the same time the optimum reaction is progressively displaced towards the neutral point and even beyond, although the reaction of the preparations themselves may not have changed. J. H. L.

Trade Report.

Contraband of War.

A Royal Proclamation, dated September 21st, 1914, adds the following to the list of articles to be treated as "conditional contraband":—Copper, unwrought. Lead, pig, sheet, or pipe. Glycerin. Ferrochrome. Hæmatite iron ore. Magnetic iron ore. Rubber. Hides and skins, raw or rough tanned (not including dressed leather).

Competition with Germany and Austria-Hungary. Further list of articles in connection with which applications have been received at the Board of Trade. September, 1914.

The following is extracted from a second list which has been issued by the Board of Trade to supplement the list issued in August (see this J., 1914, 896); those interested should communicate with the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C..

A.—*Articles which inquirers wish to buy.*—Acetates; acetic anhydride; acetone; alum blocks; aluminium silicofluoride; ammonium persulphate, silicofluoride, and sulphate; aniline oils; arsenic and its ores; bakelite; barium and its ores; barium carbonate, chlorate, peroxide, and sulphate; barytes; beryllium; benzene; bleach, liquid; bitumen for flash lamps; borax; cadmium; calamine; candles; carbonic acid gas; cerium nitrate; chemicals for brass engraving and for laboratories; chlorophyll; chrome alum; chromium and its ores; chromium oxide, pure; Chinese wood oil; clay; cocoa butter; copra; cryolite; diatomite; ethyl-acet-trichloranilide; felspar; filter paper; filters; fireworks; fluorspar; formic acid; fossil earth; galalith; glass, chemical and philosophical, blown; soda glass for Crookes' tubes; optical glass; glue for bookbinders; gum tragacanth; hydrochloric acid; hydrogen peroxide; kieselguhr; kainite; lactose; lampblack; lanoline; lead, pig and powdered; lead sulphate and hypophosphite, white lead; leather, artificial; limestone; lithopone; magnesium; manganese oxide; mannol; mannol ethyl ketone; matches, safety; methyl-ethyl-ketone; mineral jelly; mineral oils, white, and refined for foods; molybdenum; naphtha; oils for motors and for soap-making; oxalic acid and oxalates; petroleum, white toilet; photographic papers and chemicals; platinum ores; potassium bromide, chloride, metabisulphite, and persulphate; porcelain, chemical; potato flour; pyrogallic acid; quartz; resorcin; rubber, synthetic; salicylic acid; selenium; size (Sickel); slag, basic; sodium hyposulphate, peroxide, and salicylate; strammonium herb; superphosphates; tannin; tanning materials; tartaric acid and tartrates; thorium nitrate; tin oxide; tungsten and its ores; urea; vanadium ores; vanillin; vegetable extracts; washing blue; waterproofing paste and solution; wood distilling plant; wood tar; wood pulp; wool fat, purified; zinc blende and spelter; zinc sulphide and other compounds.

B.—*Articles which inquirers desire to sell.*—Acetates; albumin; alloys, special; aluminium; asbestos; baking powder; bottles; bronze powder; carbolic acid; carbonates; celluloid and celluloid articles; cellulose; charcoal; chlorides; coal and fuel; cresylic acid; explosives; filters; French chalk; galalith; gelatin; glycerin; malt extract; metal foil; mica; ores and minerals; oxides; plaster, wall and ceiling; plastic compositions; rubber; rubber goods; soap; starch; sugar; sulphates; sulphides; tannin; tar; tin; tungsten; waterproofing paste.

Competition with Germany and Austria-Hungary in neutral markets.

In pursuance of the Board of Trade Scheme for assisting British manufacturers and traders to secure trade in British Possessions and foreign countries (see this J., Sept. 15th. 1914, p. 896), bulletins have been issued on lubricating oils and greases; boot polishes; rubber tyres for motor cars and motor cycles; goldsmiths' and silversmiths' wares and electro-plate; fertilisers; perfumes and cosmetics; medicines and drugs.

Openings for British trade. Board of Trade J., Sept. 10, 1914.

Canada.

A firm in Montreal would take up agencies for dyes and chemicals suitable for factories making cotton goods, paper, and matches. (C.I.B. 24207.)

A firm of manufacturing chemists in Toronto wishes to represent manufacturers of pharmaceutical products not conflicting with its own goods, a catalogue of which may be seen at 73, Basinghall Street, E.C. (C.I.B. 24219.)

A hardware company in the province of Ontario requires sodium cyanide, 98—100% and 128—130%; quicksilver; sodium sulphide; glassware similar to "Jena"; porcelain ware and various assay and chemical apparatus such as is used in silver, gold, and nickel mines. (C.I.B. 24223.)

A Montreal company invites offers for tungsten lamps of 10, 15, 25, 40, 60, 100, 150 and 250 watts in 110 and 115 volts. Lamps should be made of continuous drawn wire tungsten with screw sockets suitable for the Canadian market. (C.I.B. 24224.)

A manufacturer's agent at Montreal wishes to secure agencies for chemicals and oils.

A Toronto company desires supplies of rubber articles.

Further information as to the above may be obtained at 73, Basinghall Street.

England.

The following home enquiries have been received at 73, Basinghall Street, whence further information may be obtained :—

A London company needs supplies of wood naphtha, acetic acid, acetone, methyl alcohol and formaldehyde and invites Canadian offers.

Others desire the addresses of Canadian graphite mines, and of Canadian manufacturers of bronze powders.

Holland.

A gold-mining company, with offices at the Hague and mines in Java, wants quotations for two tons of cheap commercial calcined borax, and for zinc discs.—Apply, 73, Basinghall Street, E.C.

Italy.

The British Chamber of Commerce at Milan has received enquiries from local firms, who want the following goods: tanned leathers, leather goods, hides and skins, glass tubes and gauges, wood pulp, oilskins, dyeing and bleaching materials, chemicals, iron and steel, and indigo.

Japan.

Stocks of dyes in Japan are sufficient for six months' requirements.

Sweden.

A firm of importers wishes to buy menthol, crystallised and double crystallised.—Address, Swedish Chamber of Commerce, 5, Lloyd's Avenue, E.C.

Canadian import duties on certain articles increased. Board of Trade J., Sept. 10, 1914.

A Customs Memorandum (No. 1811b) contains the text of a Canadian Act to amend the "Custom Tariff Act, 1907," which received assent on Aug. 20, 1914. It increases the rates of duty on various articles imported into Canada, among them being sugar, preserves, ale and stout, fruit juices, ethyl and methyl alcohol, perfumes, nitrous ether, sweet spirits of nitre, aromatic spirits of ammonia, medicated wines, malt extract, all medical, chemical, and pharmaceutical preparations compounded of more than one substance, patent and proprietary preparations, and paints, colours, lacquers and varnishes.

Books Received.

The Inventor's Handbook of Patent Law and Practice. By Francis E. Bradley, LL.D., M.A., etc., and F. H. Bowman, D.Sc. Ewart, Seymour & Co., Ltd., Windsor House, Kingsway, London, W.C. 1914. Price 5s.

Volume (8¾ ins. by 5¾ ins.), containing 173 pages of subject-matter, including an appendix, and followed by a list, I. to XIV., of Law Officers' Rules, and an alphabetical index of subjects. The matter is classified as follows:— I. Origin and history of Patent Law and Procedure. II. The patentee and the subject-matter of a patent. III. How to preserve the inventor's rights before the patent has been granted. IV. How to obtain a patent. V. Oppositio to grant of patent and the inventor's method of defence. VI. Revocation of a patent. VII. Register, rectificatio of register, licences, and assignments. VIII. Means o exploiting a patent so as to render it profitable. IX Amendment of specification. X. Foreign and colonia patents. XI. Legal proceedings. XII. Miscellaneou provisions. Appendix. Patents and Designs Acts, 190 and 1908. Patents Rules of 1908.

Science and the Miller. By J. S. Remington. Th Northern Publishing Co., Ltd., 17, Goree Piazzas, Liverpool. 1914. Price 4s. 6d. net.

Volume (7¼ by 5 ins.) containing 166 pages of subjec matter and 8 plates and including chapters on: the trainin of the flour-mill chemist; oils and lubrication; purchas of coals and oil fuel; moisture in wheat and flour; in provers and enrichment processes; breakfast, invali and infant foods; feeding stuffs and mill offals.

Annual Statement of the Trade of the Unite Kingdom with Foreign Countries and Britis Possessions, 1913 Volume II. [Cd. 7585.] Pric 4s. 1d.

This volume contains abstract and detailed tables imports from, and exports to, each country; abstra and detailed tables of imports and exports at each port tables showing the amount of Customs revenue receiv at each port or place; details of the transhipments und bond of certain articles; an account of the quantities articles liable to Customs duties remaining in bond, an details of the transhipments of free goods on through bil of lading.

Patent Office Library; Subject Lists; New Serie Patent Office, 25, Southampton Buildings, W.C. Pri 6d. each.

1. Works on enamelling, art metal-work, furnitu costume, etc. C.K. 15—C.O., 17.
2. Works on Sound and Light. G.G.—G.P.
3. Works on General Physics .S.—G.F.

Journal of the Society of Chemical Industry.

No. 19, Vol. XXXIII. OCTOBER 15, 1914. No. 19, Vol. XXXIII.

Official Notice.

APPOINTMENT OF NEW EDITOR.

The Council of the Society of Chemical Industry will shortly proceed to appoint an Editor of the Society's Journal in place of Mr. Watson Smith, who has resigned. The Editor will be required to devote his whole time to the duties of his office, and, subject to the Publication Committee, will be held responsible for the whole of the contents of the Journal, the necessary assistance being provided by the Society. Minimum Salary £500.

Applications for the appointment should be forwarded to the President at the office of the Society, Broadway Chambers, Westminster, S.W., before the 1st November, 1914.

Canadian Section.

Meeting held at Toronto on Friday, March 27th, 1914.

VISCOSE: A NEW CASING FOR SAUSAGES.

BY W. P. COHOE, E. C. FOX, AND A. J. ACTON.

Casings for sausage meats at present in use consist of the larger intestines of the ox, sheep, and hog, known in the trade as bungs; the gullet of the ox known as "Weasands," and the smaller and middle intestines of the ox. For small sausages the smaller intestines of the sheep and hog are used. They have been used for many generations. No exception can be taken to them providing proper precautions are taken to insure their purity.

In the large packing houses the conditions of purity are more closely watched than in small butcher shops and abattoirs, but a sanitary substitute is highly desirable.

An ideal casing should possess the following properties:

The raw material should be pure and uniform. The process of manufacture should not permit any possibility of contamination by disease germs. The finished product should be of uniform chemical composition. It should be mechanically suitable. It should have a pleasing physical appearance. It should not provide a surface upon which mould and other organisms can readily propagate. It should not contain substances injurious to the human organism. It should be, although in many cases not necessarily so, edible. If possible it should be digestible. It should be capable of being kept, stored and transported, under ordinary conditions, for an indefinite period of time, without deterioration.

So great has been the increase in the demand for sausage and Bologna, and so drastic of late has been the condemnation of natural casings by Government meat inspectors, that the cost of natural casings is very high and likely to remain so.

There is a certain sized casing for which there is a great demand. Artificial casings can be made in any quantity to this standard at a less cost than the natural casings.

In order to find a substitute for the present casings, a survey of the field of possible raw materials was made, and it was finally decided to try cellulose (hydrate) and to use the viscose reaction of Cross and Bevan.

Bleached sulphite wood pulp is used as the raw material. This is mercerised by the action of caustic soda solution, washed and treated by carbon disulphide.

On the addition of water swelling takes place, giving a thick viscous solution without a trace of fibrous structure. This material is then manufactured into tubes, and passed into a salt solution, which converts it into a yellow jelly. The by-products of the reaction are largely removed by washing in mixed solutions of sodium sulphides and bisulphites. Many of the salts may be removed by heat, either by the direct action of steam, or by passing the tube through a hot solution, either of salts, alcohol, glycerin, and many other substances.

The tube, which now consists of cellulose (hydrate) together with adhering sodium salts, is washed thoroughly in boiling water. The length of time necessary to accomplish this may be first determined by an ash determination. When the amount of ash falls to an amount equal to that in the original bleached sulphite pulp, freedom from impurities is assured. The tube is finally dried, conditioned, and rolled up ready for shipment.

Should colourless product be desired, the tube may be bleached after the hot wash. In this case it is led first through a hypochlorite solution, then washed in water, then led through thiosulphate solution, and finally washed in water.

At the present time containers of two sizes are being made, large sizes to replace beef bungs for the Beef Bologna trade and medium sizes in place of weasands for the Ham Bologna trade.

As soon as the necessary technical data can be obtained, it is proposed to prepare a small sized casing corresponding to the sheep or hog casings.

Bleached sulphite pulp is pure, abundant and uniform. The chemical treatment it undergoes ensures an aseptic condition. In cellulose (hydrate) we have a definite chemical compound, carrying with it slightly varying proportions of water. Inorganic impurities are limited to the small proportion of ash, 0·53% mainly consisting of alkalis and alkaline earths. The finished product contains less ash than the original wood pulp.

As the weight of a sausage casing of cellulose (hydrate) averages 1·04 to 1·12 per cent. of the meat, it may be seen that the ash present is insignificant. Still it is in the interests of careful manufacture to set a standard for this.

The experience in Canada with the use of the new product showed that its mechanical properties were satisfactory. Although the origin of the casing was known to the store managers, yet the man behind the counter, who had been handling sausages for years, did not recognise the change of material.

Cellulose (hydrate) casings are transparent and colourless in thin films when unbleached, and when bleached are colourless in all usual thickness. The surface is smooth and glossy, and does not easily afford a lodging place for mould or bacteria. Even supposing they do lodge there, such a surface does not furnish food for their growth. This is quite the opposite of the conditions characteristic of the casing hitherto in use. In the case of our product, we have something in the nature of a preservative coating or container. This is particularly true in the case of cooked sausages, where the casing dries rapidly.

Our product when finished contains: cellulose (hydrate), moisture, glycerin, and ash. The human organism is quite accustomed to cellulose in its varying forms in the ordinary diet. For instance, white cabbage contains 63·25% of cellulose. (Hoesslin; Z. Biol. 54, 395.)

For purposes of comparison it is interesting to note the proportions of fibre carried by various cereal products in common use.

Product.	Fibre.	Ash.	Authority.
Wheat flour (finest)	0·3	0·5	Konig
Wheat flour (American)	0·3	0·6	Johnson
Oat meat (American) ..	0·9	2·0	Johnson
Maize meal (American)	2·0	1·5	Johnson
Whole wheat flour	1·6	1·9	Richardson

There is a lack of uniformity between the results given by various authorities, due undoubtedly to the method used by the older investigators in determining "crude fibre." This error is very large. As much as 39% of the weight of sawdust can be hydrolysed by 1% hydrochloric acid under certain conditions. (See also Krauch and Becko, Landw., Vers. Stat., 27, 5; Cross and Bevan, this J., 1903, pp. 165 *et seq.*) Variations of method probably account for such results as are shown below.

Average composition of flour of cereals.

Cereal.	Cellulose.	Ash.
Old wheat	8·3	1·6
Barley	11·5	2·8
Oats	1·0	2·2
Rye	6·4	1·8
Maize	14·9	1·6
Rice	0·2	0·9

Taking the mean content of 1·8% of cellulose in American wheat, obtained by Richardson. after 407 analyses (Am. 6. 302) and remembering that the casing of a sausage is from 1·04 to 1·12% of its total weight, it will be seen that the eating of many of the prepared breakfast foods made from whole wheat, *e.g.* shredded wheat biscuit, involves a larger percentage of cellulose than does the eating of a sausage with cellulose (hydrate) casing.

Furthermore, it can be shown that cellulose (hydrate) is in a form more susceptible of chemical attack than is the hard covering of the cereal grains. To confirm this last point, bleached sulphite wood pulp and cellulose (hydrate) casing were treated side by side at 100° C. with first 0·50% hydrochloric acid, and secondly with 0·50% sodium hydroxide solution. The results were as follows :—

	Pulp.	Casing.
Dry weight	1·7678	1·6258
Weight after 5h. acid treatment ..	1·6468	1·3848
Weight after 4h. alkali treatment..	1·2278	0·8114
Percentage dissolved in acid	6·74	14·82
Percentage dissolved in alkali	23·80	35·27
Total percentage dissolved	30·54	50·09

Thus cellulose (hydrate) is more easily attacked than normal cellulose and cannot be looked upon as harmful. The ash content of our product, 0·53%, is so small that it may be neglected

Edibility is demanded only in the case of small sausages, the casings of which consist of intestines of the sheep or hog. The casings of sausages of the Bologna variety cannot be masticated in any reasonable length of time, and are simply coverings or food containers. The meat of the sausage also does not adhere to the casing when made of our product, as it does to the old ones. A Bologna casing made of cellulose (hydrate) can, however, be masticated. In such a case, a soft non-irritant mass is produced. In the case of the smaller sausages, the thickness of the casing is very small (0·004 to 0·006 in.).

The power of the human organism to digest cellulose is still a moot point among chemists. Much work has been done in the study of its value to the ox and the horse. It is only recently that exact information has been obtained with regard to man. For instance, Hammersten (Mandel's translation, pp. 291 and 297) states that certain kinds of cellulose are undoubtedly partly dissolved in the intestines and cites Hanneberg and Stohmann, Zeits. f. Biol. 21, 613; Kneirman. *ibid.* p. 67; Hofmeister, Arch. f. wiss. u. pract. Thier., 11; Weiske, Lat. f. Biol. 22, 373; Tappeiner, brd. 20, 24; and Mallovre, Pfflugers Arch., 49.

The most recent work on this subject, which has come to the writer's attention, is that of Lohrisch (Zeit. Ex. Path., 5, 478). The conclusion of this investigation is that in normal individuals 50% of cellulose is digested, and in chronically constipated cases 80%. The action is one of hydrolysis to sugar and starch. The suggestion of Lohrisch to substitute cellulose for sugar in the diet of diabetic patients is interesting. It would seem safe to conclude, therefore, that our product is at least in part digestible by the human system.

As our product consists practically of dried cellulose, its keeping properties are excellent. Under ordinary conditions of storage, it is not attacked by anything, but will keep indefinitely like paper or cotton cloth.

Yorkshire Section.

Meeting held at Bradford Midland Hotel, on Monday, May 11th, 1914.

MR. GEORGE WARD IN THE CHAIR.

ESTIMATION OF ALDOSES. (PART I.). THE ACTION OF NEUTRAL SODIUM HYPOIODITE.

BY N. BLAND AND L. L. LLOYD.

Since concordant results by polariscopic and copper methods for the estimation of sugars, dextrins, etc., in sizing mixures are difficult to obtain, an attempt was made to discover a method that would give some idea of the relative amounts of different sugars in mixtures. This work led to an examination of the oxidation of aldehydes by sodium hypoiodite.

The action of sodium hypoiodite upon formaldehyde was first tested. The reaction is quantitative according to the following equation :—

$$I_2+2NaOH=NaIO+NaI+H_2O$$
$$NaIO+HCHO=NaI+HCOOH$$
$$\text{or } HCHO+I_2+H_2O=2HI+HCOOH$$

The hypoiodite may be used for the estimation of formaldehyde as follows :—5 c.c. of commercial formaldehyde ar diluted to 1000 c.c. and 10 c.c. of this solution are adde to 50 c.c. $N/10$ iodine to which a slight excess of causti soda has been added. The reaction mixture is allowed t stand for about five minutes, acidified with dilute hydro chloric or sulphuric acid, and the liberated iodine titrate with $N/10$ thiosulphate. Each c.c. of iodine used repre sents 3% of formaldehyde. In one experiment a figur of 40·5% was obtained. The results are concordant an quite as accurate as the longer process in which the amoun of ammonia to form hexamethylenetetramine is foun by adding to a solution of the formaldehyde, ammoniu chloride, followed by a definite quantity of $2N$ causti soda, allowing to stand in a stoppered bottle for abou two hours and titrating with standard acid, using meth orange as indicator. The formaldehyde gave by th hexamethylenetetramine method 40·3 and 40·5%, compared with 40·5% by the hypoiodite method.

An attempt to value paraformaldehyde by this metho failed. The paraformaldehyde was in a finely divid condition, and gave very variable results. Acetaldehy gave, under similar conditions, low and variable result due possibly to the formation of iodoform.

The action of the hypoiodite upon solutions of suga was found to vary at first with the quantity of caust soda added, and the period of action of the hypoiodite.

A practically neutral hypoiodite solution was th made by adding 50 c.c. $N/10$ caustic soda to 50 c.c. $N/$ iodine. The sugar solutions were added to this solutio allowed to stand for about five minutes, acidified wi dilute acid and titrated with $N/10$ thiosulphate. many cases the reaction with the neutral hypoiodite w continued for from 30 mins. to 24 hours, the resu increasing gradually with increased period of acti The experiments were carried out with a 1% soluti of lactose. 25 c.c. of this was added to a mixture 50 c.c. of $N/10$ iodine and 50 c.c. of $N/10$ caustic so and in one case 25 c.c. of $N/10$ iodine and 25 c.c. of $N/$

caustic soda were employed. The following table shows the results :—

	1	2	3	4	5
Volume of $N/10$ iodine	25	50	50	50	50
Volume of $N/10$ NaOH	25	50	50	50	50
Time of action	30 m.	3 hrs.	7 hrs.	12 hrs.	24 hrs.
odine used	14·8	14·9	15·1	15·2	15·2

From the composition of a sugar can be calculated the amount of iodine that will be required to oxidise it into an acid, since neutral hypoiodite oxidises only the aldehyde group.

The following compounds have been dealt with: Dextrose, lævulose, sucrose, lactose, and maltose.

Dextrose contains one aldehyde group and should require one molecule of iodine or one molecule of hypoiodite to oxidise the aldehyde group. Working with pure dextrose (Kahlbaum) we found that the gram molecule of the sugar (180 g.) required 254 grams of iodine for oxidation.

In the whole of the experiments, the same strength of sugar solutions was used, namely—10 grams per litre; 25 c.c. of these solutions were added to 50 c.c. of $N/10$ iodine converted into neutral hypoiodite, allowed to stand for about five minutes, acidified, and titrated with $N/10$ thiosulphate.

In one experiment 25 c.c. of dextrose solution required 27·7 c.c. of iodine, representing 99·7% dextrose.

Laevulose and sucrose contain no aldehyde group and do not react with the neutral hypoiodite.

Sucrose on hydrolysis produces dextrose and lævulose, and one mol. should require one mol. of iodine as hypoiodite for oxidation. Two portions of 20 c.c. of pure sucrose (Kahlbaum) solution were heated with 10 c.c. of concentrated hydrochloric acid for ten minutes at 66°—68° C., cooled, neutralised, and treated with neutral hypoiodite. They required 11·8 c.c. and 11·85 c.c. $N/10$ iodine, equal, respectively, to 100·85% and 101·3% sucrose. Ordinary cane sugar gave 102·6%.

In all the experiments with cane sugar the figure after hydrolysis was higher than it should be; some samples of crude cane sugar, although without action before hydrolysis, gave as much as 104% after hydrolysis.

Lactose contains one aldehyde group and requires one molecule of iodine. The result in this case was 99·4%. Lactose on hydrolysis gives one molecule of dextrose and one molecule of galactose; after hydrolysis with 3% sulphuric acid a figure of 99·45% was obtained.

Maltose also contains one aldehyde group, and in this case the results obtained were 100·08 and 100·8%. After heating with 3% sulphuric acid for four hours in a bath of boiling water, maltose hydrolyses into two molecules of dextrose. A result of 99·9% was obtained.

The figures obtained directly by the hypoiodite method are given in the following table :—

	Dextrose.	Lævulose	Sucrose.	Lactose.	Maltose.
	%			%	%
Maximum	99·7	nil	nil	99·4	101·8
Minimum	96·4			99·1	99·9
Mean	98·8			99·3	100·2

and the figures obtained by the hypoiodite method after hydrolysis (inversion) are shown in the following table:—

	Sucrose (pure).	Sucrose (ch. pure).	Lactose.	Maltose.
	%	%	%	%
Maximum	101·3	103·4	99·4	99·9
Minimum	100·8	102·6	99·1	99·1
Mean	101·1	103·0	99·3	99·5

We hope to be able to apply the method to the examination of starch and dextrin products used for sizing purposes. Simple mixtures containing two of the above sugars have been analysed fairly easily, but dextrin presented difficulties which we are attempting to overcome, an account of which will appear later.

Discussion.

Mr. F. W. Richardson said that he had done a large amount of work on this subject some time ago, but his discoveries as to the errors arising from the application of processes given in the standard books were of such a remarkable character that the Society before which the paper was read did not care to publish them. With a mixture of maltose, dextrose, dextrin, and invert sugar the ordinary methods were quite inadequate for a correct analysis. The least objectionable results arose from the application of polarimetry before and after complete inversion, and also after elimination of the invert reading at 187° F. with the conjunction of alcoholic precipitation for the dextrin and with copper methods carefully applied.

Dr. L. L. Lloyd said that the results obtained by the polarimeter when working with very dilute solutions of sugars were too variable to be of any use. The copper number along with the hypoiodite (iodine) number was found to be fairly constant and would probably be of much use.

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Rotary kiln; Development of the —— and its application to various chemical and metallurgical processes. R. K. Meade. J. Ind. Eng. Chem., 1914, **6**, 754—760.

An account of the advantages of the rotary kiln and its use in the manufacture of cement; for nodulising ores, cinder, etc.; burning lime; roasting bauxite, chemicals, etc.; manufacture of bichromates; burning pyrites; manufacture of sulphides; production of phosphatic fertilisers from phosphate rock, and of potassium compounds from lspar.—A. S.

External corrosion of cast-iron pipe. Pugh. *See* X.

Patents.

[*Mixing liquids.*] *Apparatus for the introduction of one liquid into another under pressure.* R. C. Parsons, London. Eng. Pats. 16,751, July 21, and 29,329. Dec. 19, 1913.

To maintain the proportion between the two liquids as constant as possible when the flow varies considerably, a pair of vertical injecting cylinders is used having pistons of slightly higher specific gravity than the liquid and both connected with an adjustable, constant-flow feeding device, and so arranged that the upward stroke of one piston synchronises with the downward stroke of the other. All mechanical friction is reduced as much as possible. (See also this J., 1914, 515).—W. H. C.

Mixer for liquids. B. Goldman. Fr. Pat. 468,959, Feb. 26, 1914. Under Int. Conv., April 22, 1913.

To promote the mixing, the blades of the agitator are only partially immersed in the liquid. They are adjustable vertically on the shaft so as to be adaptable to various depths of liquid.—W. H. C.

Drying machines or hydro-extractors; Centrifugal ——. H. C. Longsdon, Keighley. Eng. Pat. 22,261, Oct. 3, 1913.

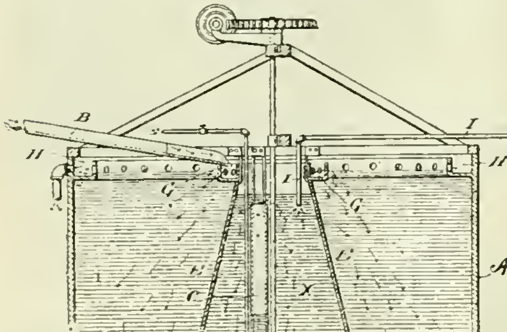
Locking devices flexibly connected together are provided for centrifugal machines with covers, so that the machine cannot be started until the cover is closed nor can the cover be opened until the machine is stopped. The drum can, however, be rotated by hand when the cover is open.—W. H. C.

Dryer; Mechanical —— with superposed parts. F. Fouché. Fr. Pat. 468,939, Feb. 25, 1914.

A number of drying chambers through which the material is carried on endless bands are arranged one above the other. The material passes down from band to band and the hot air or other drying medium is passed either upwards or downwards, or from the centre both up and down, or *vice-versa.* The tension and speed of each band can be adjusted independently and stirring devices and cleaning brushes may be provided. The hot air is obtained from a stove in which the hot gases pass through vertical passages grouped around a furnace and interposed between horizontal passages through which the air is passed.—W. H. C.

Thickening and agitating pulp; Process of and apparatus for ——. J. van N. Dorr, Denver, Colo., U.S.A. Eng. Pat. 22,411, Oct. 4, 1913.

The pulp flows from the shoot, B, and launder, G, into the tank, A. The clear liquid overflows through the launder, H, and the solid particles sink to the bottom where they are agitated by the rakes, J, and are elevated by the air-lift, C, and overflow into the agitating chamber, X, formed by the suspended conical partition, E. The heavier particles sink rapidly and are re-washed and re-elevated, and the lighter particles are discharged as a thickened mud through the pipe, I.—W. H. C.



Grinding mills. D. M. Clark, London. From Bradley Pulveriser Co., Boston, Mass., U.S.A. Eng. Pat. 6193, March 11, 1914.

To prevent leakage of lubricating oil from the universal coupling to the rotary shaft, a frusto-conical shield is provided, within the universal coupling, to retain the oil. —W. H. C

Furnaces for boiling or melting purposes. L. F. Tooth, London. Eng. Pat. 7636, March 26, 1914. Addition to Eng. Pat. 18,523, Aug. 12, 1912 (this J., 1913, 933).

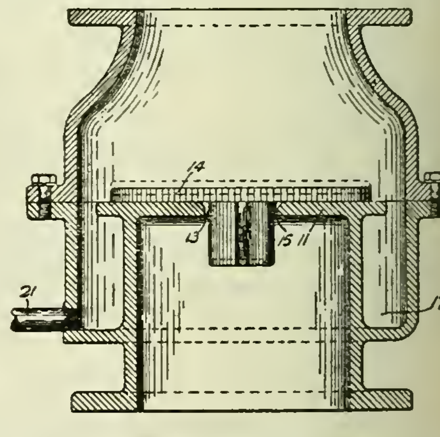
The furnace is built up of quadrant-shaped blocks and the annular flue is divided horizontally into an upper and a lower portion. The former communicates with the central heating chamber and the latter with the flue leading to the stack. The openings in the partition and those connecting respectively the heating chamber with the upper flue chamber and the lower flue chamber with the stack are arranged so as to cause the gases to traverse as long a path as possible.—W. H. C.

[*Kiln.*] *Art of treating vegetable and mineral matter by heat.* A. G. Waterhouse, Leonardo, and J. H. Van Mater, Atlantic Highlands, N.J. U.S. Pat. 1,105,729, Aug. 4, 1914; date of appl., Aug. 13, 1913.

A tunnel kiln for burning bricks or other products consist of an insulating conduit, held above its foundations by external, isolated supports, and having an under-passag throughout its length, formed between two hanging partitions, which extend downwards from the interior of the conduit into a water-seal. Two separate supports driven by external mechanism travel through the conduit in opposite directions and carry the material to be burnt which is heated on both sides whilst passing through the conduit.—O. R.

Gases; Extractor of liquids and solids from ——. J. T Wilkin, Assignor to The Connersville Blower Co. Connersville, Ind. U.S. Pat. 1,105,868, Aug. 4, 1914 date of appl., May 27, 1914.

The top, 11, of the central chamber of the apparatu (see fig.) has a circular aperture closed by a heavy, movabl plate, 14, from the under side of which a plug project into the opening. With sufficient pressure in the chamb the gas passes through the annular space, 13, 15, a thence, in a thin, radiating stream between the adjace horizontal surfaces of the place and its support, to t space above, the non-gaseous constituents accumulati in the annular channel, 17, and being discharged throu the pipe, 21.—W. E. F. P.

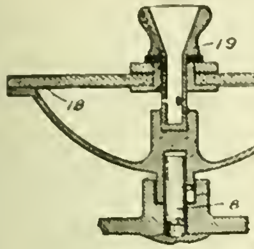


Evaporator. E. Zaremba and O. Mantius, Buffalo, N. Assignors to Zaremba Co. U.S. Pat. 1,106,532, Aug. 1914; date of appl., Aug. 22, 1912.

A vessel for the evaporation of acid or other corros liquids *in vacuo* consists of a steel or cast iron cylindri shell lined with refractory bricks or slabs which built in and domed or arched so that the lining can it withstand pressure from without. The heating medi is passed through a group of horizontal pipes of ac resisting material which extend from acid-resist tube-plates and protected steam-chests fixed on oppo sides of the lower part of the vessel.—W. H. C.

Extractor ; Centrifugal —— O. E Beach, Assignor to F. W. Braun, Los Angeles, Cal. U.S. Pat. 1,105,954, Aug. 4, 1914 ; date of appl., Aug 21, 1912.

THE material is fed into the cup-shaped vessel, 12, otating about the spindle, 8, through the hollow screw, 19, which serves to clamp a transparent cover, 17, on o the vessel. A layer of filtering material, 18, is interosed between the upper edgo of tho vessel and the over.—W. H. C.



lastic materials [Soap, clay, etc.] ; Treatment of ——. A. L. Mowry and F. A. Secord. Fr. Pat. 468,002, Feb. 3, 1914.

HE material is forced through a conduit by a hollow rew conveyor, and issues at the further end in a ctangular form. It is heated or cooled during its assage through the apparatus by circulating a heating r cooling medium through the screw conveyor.—W. H. C.

ilter-press. R. Christiansen. Fr. Pat. 468,565, Feb. 17, 1914.

HEATING agent is passed through a pipe disposed in a iral groove formed in the outer surface of the casing hich surrounds the press-plates.—W. H. C.

anks and reservoirs ; Process for lining ——. Comp. du Ciment-Verre. Fr. Pat. 469,064, May 10, 1913.

HE tanks are lined with enamelled metallic plates ined together by a solder which will resist the action f the liquid they are destined to contain.—W. H. C.

urnaces ; Regenerative gas ——. F. K. Siemens, London. Eng. Pat. 28,049, Dec. 5, 1913. Addition to Eng. Pat. 10,824, May 7, 1912.

EE Addition of Jan. 1, 1914, to Fr. Pat. 461,938 of 1913 ; is J., 1914, 850.—T. F. B.

rying apparatus. C. Grau, Niedernzwil, Switzerland. U.S. Pat. 1,107,294, Aug. 18, 1914 ; date of appl., Sept. 23, 1912.

EE Fr. Pat. 447,238 of 1912 ; this J., 1913, 275.—T. F. B.

ases ; Apparatus for purifying [waste] ——. A. Müller, Leipzig-Schleussig, and C. Bomhard, Berlin. U.S. Pat. 1,107,986, Aug. 18, 1914 ; date of appl., Dec. 2, 1909.

EE Eng. Pat. 17,380 of 1909 ; this J., 1910, 932.—T.F.B.

parating solid matter, more particularly cellular matter, from liquids ; Apparatus for ——. B. Hofer, Munich, Germany. U.S. Pat. 1,108,095, Aug. 18, 1914. Date of appl., April 22, 1914.

EE Eng Pat. 6793 of 1914 ; this J., 1914, 939.—T. F. B.

paration of materials ; Process for effecting the ——. R. Jaffé, Frankfort, Germany. U.S. Pat. 1,109,529, Sept. 1, 1914. Date of appl., March 16, 1912.

EE Ger. Pat. 255,531 of 1911 ; this J., 1913, 351.—T.F.B.

Vacuum ; Process for producing and maintaining a high ——. Sudfeldt und Co. Fr. Pat. 468,434, Feb. 13, 1914.

SEE U.S. Pat. 1,100,694 of 1914 ; this J., 1914, 781.—T.F.B.

IIA.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Vertical retorts ; Wilson's "continuous-intermittent" ——. J. Dickson. J. Gas Lighting, 1914, **127**, 615—621.

THE "continuous-intermittent" process consists in making gas continuously in vertical retorts which are partially discharged and filled up with fresh coal at short intervals. The process has been in use for a year at Johnstone, with an installation comprising three settings of 4, and one of 6 retorts, each capable of carbonising 3 tons of coal per 24 hours, and each setting having a separate gas-producer. The retorts were designed to suit the secondary coking coals of Scotland and are 23 ft. high, 3 ft. 4 in. by 10 in. at the top, tapering a distance of 11 ft. 6 in. to 4 ft. by 1 ft. 6 in. 7 cwt. of coke is withdrawn every 4 hrs. leaving 6 to 7 ft. at the top of the retort to be recharged. Compared with horizontal retorts used previously, there was a saving in labour cost during the year equivalent to 1·47d. per 1000 cb. ft. of gas, on an output of 9¾ million cub. ft. The yield increased from 9820 to 10,113 cb. ft. of gas, from 12·90 to 14·63 galls. of tar, and from 26·50 to 28·99 lb. of ammonium sulphate per ton, while coke fell from 9·90 to 8·78 cwt. per ton, these results being obtained with a cheaper coal than that previously used. During the last two months of the period reported on, the yield was 10,808 cb. ft. of gas, 15·69 galls. of tar and 29·48 lb. of sulphate per ton, with a consumption of 16·42 lb. of coke per 100 lb. of coal carbonised. The gas has calorific value 647 B. Th. U. gross and 583 B. Th. U. net, and the illuminating power is 17 c.p. Naphthalene stoppages have fallen from 195 to 23 during the periods May—July 1913 and 1914. The yield of gas per ton was greater by 400—500 cb. ft. when the charging period was increased to 4 hrs. 48 min., but the calorific value fell to 593 B. Th. U. gross and 534 B. Th. U. net, the candle-power to 15·6 and the fuel consumption increased to 18 lb. of coke per 100 lb. of coal. The composition of the gas was :—

Charging period	4 hrs. 48 min.	4 hrs.
	%	%
Carbon dioxide	3·05	3·10
Illuminants	3·30	5·00
Oxygen	0·45	0·50
Carbon monoxide	9·90	7·50
Methane	28·35	33·90
Hydrogen	49·80	43·25
Nitrogen	5·15	6·75

The retorts run 6 to 7 weeks without scurfing. At the first sign of sticking up, the retort is worked till empty, the carbon burnt off by admitting air at the bottom, any remaining carbon is removed with a light bar, the retort is filled with coke to within 7 ft. of the top, and charged with coal some time after. The whole process occupies 54—56 hrs.—A. T. L.

Transformer oils. W. Brauen. Chem. Rev. Fett. Ind., 1914, **21**, 138—139, 170—171.

ONLY mineral and rosin oils are now used in transformers ; most of those sold are neutral, and have high flash and ignition points, good insulation capacity and low viscosity. Since mineral and rosin oils are hygroscopic, electrical conductivity determinations should be applied to the oil previously dried or heated to 100° C. In use the mineral oils are oxidised, with formation of acids which attack the metals, especially the lead, of the transformer, to form compounds sparingly soluble in oil, leading to the production of solid yellow to black deposits in the transformers. The insolubility of the acids in petroleum spirit indicates the presence of hydroxy-acids. Their saponification value is about 187. The formation of acids increases with the temperature and time, and the presence of copper promotes the oxidation. Oils containing sulphur undergo pronounced decomposition in transformers. The solid deposits contain up to 30% of ash, and are partially soluble in hot mineral oil and soluble in benzene, from which they can be reprecipitated by petroleum spirit. All types of crude or slightly refined mineral oils yield these solid deposits, whereas highly-refined colourless or light yellow oils, which have been treated with concentrated sulphuric acid, are equally oxidised, but instead of yielding a deposit, form acid vapours, oil-soluble acids, and water. These products strongly attack the metals and insulating material. The acids have a pronounced oxidising action and liberate iodine from potassium iodide. As a practical test of the stability of an oil a current of air, oxygen or ozone is passed through the sample heated to the desired temperature in a glass vessel. The deposits of liquid acid products thus obtained are identical with those formed in a transformer. Mineral oils rich in hydrocarbons with open carbon chains are particularly liable to decomposition, whilst those rich in cyclic hydrocarbons are more stable. In practice oils containing aromatic hydrocarbons have proved the most suitable. Rosin oil (flash point 158° to 160° C.; ignition point, 170° to 180° C.) is preferable to mineral oils. The volatility is only slightly higher, whilst the insulation capacity is better than in the case of mineral oils. The oxidation products are soluble in the rosin oil and do not attack the metal or insulating material, whilst water is not formed in the decomposition. Owing to slight polymerisation rosin oil thickens more than mineral oil of equal viscosity, but since its viscosity decreases much more rapidly with rising temperature, it always remains sufficiently fluid to circulate in the transformer. To obviate the action of atmospheric oxygen upon mineral oils, transformers are made in which contact of the air with the hot oil is prevented, but these are only partially successful, since the air dissolved by the oil is able to produce the deposits and acid-formation, with the liberation of water. Rosin oil that has become viscous after many years' use can be made sufficiently fluid again by the addition of fresh oil. Mixtures of mineral and rosin oils should not be used, since they undergo decomposition in the same manner as mineral oils. (See also this J., 1910, 406; 1911, 696, 697; 1912, 62, 114.)—C. A. M.

Coke production in the United States in 1913. E. W. Parker. U.S. Geol. Survey. Mineral Resources, 1913, 455—520. [T.R.]

The production of coke in the United States in 1913 amounted to 46,299,530 short tons, valued at $128,922,273 compared with 43,989,599 tons in 1912, value $111,805,113. The amount of coal consumed in coke manufacture in 1913 was 69,239,190 tons. Of the 1913 production, 33,584,830 tons, value $80,284,421, was beehive or "oven" coke and 12,714,700 tons, value $48,637,852 was by-product or "retort" coke. Nearly 70% of the increase in the production in 1913 was due to retort coke. The total number of ovens and retorts in operation in the United States in 1913 increased from 102,230 to 102,650, but the number of beehive ovens decreased by 57. Th average production of oach retort oven was about 230 tons, and of each beehive oven 505 tons. A marke tendency to consolidation into larger units is shown, th number of coke establishments having decreased fror 578 in 1910 to 551 in 1913. The total value of the coke gas, tar, ammonia, and other products produced at by product recovery ovens during the last three years shown in the following table:—

Product.	1911.		1912.		1913.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gas (thousand cb. ft.)	33,274,801	$3,781,218	54,491,248	$4,650,517	64,553,941	$5,694,69
Tar (galls.)	69,410,599	1,638,314	94,306,583	2,310,900	115,145,025	2,830,15
Ammonia, sulphate or reduced to equivalent in sulphate (lb.)	72,920,056	1,943,761	95,275,545	3,649,144	173,342,349	5,324,44
Ammonia liquor (galls.)	4,660,596	548,824	5,502,403	735,120	4,102,448	537,41
Anhydrous ammonia (lb.)	23,180,118	1 847,929	*26,672,474	*2,387,562	*28,663,936	*2,135,65
Other by-products	—	273,915	—	610,552	—	403,57
Total value of by-products	—	10,033,961	—	14,343,795	—	16,925,94
Coke (short tons)	7,847,845	27,297,897	11,115,164	42,632,930	12,714,700	48,637,85
Grand total	—	37,331,858	—	56,976,725	—	65,563,79

* Mainly ammoniacal liquor sold on pound basis of NH_3.

The gas included in the table is the "surplus" n consumed in the coking process, which is either used manufacturing establishments operated in connecti with the coke-oven plant or sold. At the close of 19 there were 5211 retort ovens in operation, and 793 we building. The completed ovens consisted of 2100 Unite Otto ovens (including the Otto-Hoffmann and Schniewi types), 1443 Semet-Solvay, 281 Rothberg, 1,215 Koppe 150 Didier, and 22 Klönne ovens. At the close of 19 there were 5688 ovens working, and 504 ovens buildi The new construction added in 1913 consisted of Semet-Solvay ovens, 66 Koppers, and 150 Didier ove There were 200 United-Otto ovens abandoned. T ovens building included 334 Koppers ovens, 152 Sem Solvay ovens, and 18 Wilputte ovens.

California petroleums; The specific heat of——. H. Wales. J. Ind. Eng. Chem., 1914, **6**, 727—728.

The results given are:—

	Composition of oil.					Speci heat at 20°
	Water.	0°—150° C.	150°—300° C.	Above 300° C.	Asphaltum.	
1	0	—	—	—	—	0·39
2	0·33	—	—	—	—	0·41
3	0·52	—	—	—	—	0·43
4	7·0	5·7	23·14	32·1	31·7	0·50
5	1·3	0	37·4	30·0	30·9t	0·47
6	0	35·6	54·1	4·2	6·2	0·48
7	0	8·1	27·3	39·7	23·5	0·44
8	0	25·8	43·3	22·1	7·0	0·48
9	0	0	12·3	48·7	36·3	0·44
10	0	0	22·5	42·3	34·7	0·45
11	6·2	0	30·9	22·6	39·9	0·45
12	0	0	34·1	30·2	35·4	0·44

Note.—Nos. 1, 2 and 3 were oils yielding no distillate be 300° C.

—A. S

Hydrogenation of oils, and synthetic fatty acids [f petroleum]. Colletas. *See* XII.

Patents.

Lignite; Treatment [drying] of——. T. Rigby, Dumfr Scotland, and N. Testrup, London. Eng. Pat. 18, Aug. 20, 1913.

In a drying plant such as that described in Eng. P 24,748 of 1911 and 969 of 1912 (this J., 1913, 77, 353) temperature of the issuing gases is maintained between 75° and 150° C. by varying the feed of lignite in relation to the volume of hot gases. The drying duct and its auxiliaries are made strong enough to sustain an explosion, the force of which is dissipated through an outlet to the atmosphere.—O. E. M.

Peat or bog material; Treatment of —— for industrial purposes. A. Dickson, S. Geoghegan, and A. Smythe, Dublin. Eng. Pat. 18,932, Aug. 20, 1913.

Peat in a liquid state is fermented at 90° F. (32·2° C.) by the addition of yeast; the solid matter separates, and is further dried mechanically.—O. E. M.

Coke; Machine for quenching and discharging ——. Maschinenbau-Anstalt Humboldt. Fr. Pat. 467,891, Jan. 30, 1914.

A portable casing, mounted on a trolley, receives the coke from any chamber of the oven and carries it to a central discharging pit. The casing is of ∩-section, and is suspended from its upper end over a fixed base-plate. The coke is discharged from the ovens into this casing through a tubular member fitted with water sprayers. The trolley is brought to the central pit and by swinging the casing aside from its base-plate the coke is discharged down a fixed inclined plate, where a further quantity of water is supplied for quenching. The lower part of this plate is perforated for the escape of water and coke dust. At the bottom of the inclined plate, and forming a continuation thereof, is a series of discharging hoppers which can be adjusted vertically to regulate the passage of the coke to a conveyor and elevator.—A. T. L.

Retorts for continuous distillation of coal; Vertical ——. Comp. Gen. de Construction de Fours. Fr. Pat. 468,808, May 3, 1913.

Air-heating flues are arranged around the lower parts of the retorts, and dampers are provided so that the hot air can be directed at will either to the gas generator or to the regenerators and thence to the combustion chambers.—A. T. L.

Acetylene gas; Storing of dissolved ——. G. L. Wilkinson, Middle Town, Conn., U.S.A. Eng. Pat. 18,745, Aug. 18, 1913.

Silk waste is used for absorbing the solvent used to dissolve the acetylene.—W. H. C.

Ammonia from producer gas; Apparatus for absorbing ——. E. S. Mond, London. Eng. Pat. 17,779, Aug. 2, 1913.

The gas is passed through a long vessel, provided with two or more lutes for the removal of tar, and containing acid, which is sprayed up into the gas space by means of revolving dashers. The vessel consists of a steel framework, comprising vertical sections connected together by horizontal members, which support a lead shell resting on a lead floor, the vertical sides and the floor being burnt together and on to long lead straps, which are lapped over the angles of the frame. The roof is supported by longitudinal lead straps lapped over the longitudinal angles of the framework, and by curved metal straps covered with lead and bolted to the uppermost horizontal angle at the side of the framework. The dashers are supported by bearings built on a foundation, which is separate from the framework, the dasher shaft passing through a gland fixed in a vertical cast-iron plate, which may form part of the bearing and be covered with lead on the inside.—O. R.

Hydrocyanic acid in crude coal gas; Recovering as an ammonium salt the nitrogen of the ——. South Metropolitan Gas Co. and E. V. Evans, London. Eng. Pat. 29,047, Dec. 16, 1913.

The hydrocyanic acid is converted in the known manner into ammonium sulphocyanide (thiocyanate), and the latter is hydrolysed by an acid, preferably sulphuric acid, at about 50° C., and under conditions of concentration and proportions by mass suitable for obtaining a maximum yield of ammonia in the form of an ammonium salt. The quantity of sulphuric acid used may be equivalent to the ammonium sulphate to be produced by hydrolysis of the thiocyanate and the ammonia in the gas from which the thiocyanate has been made, and the acid liquor left after the hydrolysis is then supplied to the saturator in which the ammonia in the gas is converted into sulphate. The conditions of concentration, etc., leading to the maximum yield of ammonia in the hydrolysis are such that no appreciable precipitate is produced in the liquor and no appreciable quantity of volatile nitrogenous products escapes. They must be determined experimentally in particular cases, but with a 25—30% solution of ammonium thiocyanate, 1 vol. of this is heated at 80°—110° C. with 1·5 vol. of 70—80% sulphuric acid: 96—99% of the theoretical quantity of ammonia is recovered. The reaction is: $NH_4SCN + H_2O = COS + 2NH_3$.—A. S.

Coal gas and similar gases; Purification of —— with recovery of by-products. K. Burkheiser. Fr. Pat. 469,122, Feb. 28, 1914.

Hydrogen sulphide is absorbed by an alkaline emulsion of hydrated iron oxide and free sulphur. The mixture of iron sulphides and free sulphur formed, is treated with an alkali sulphide to extract the free sulphur, and the iron sulphides are oxidised so as to regenerate an emulsion of hydrated oxide and free sulphur. The alkali necessary for the absorption may be provided by the ammonia present in the crude gas, the temperature of the washing liquor being regulated so as to leave the requisite quantity of ammonia in the gas. The cyanogen in the crude gas is also absorbed, soluble thiocyanates being formed. The solution from the extraction with alkali sulphide is heated to 90—100° C. to precipitate free sulphur, the thiocyanates remaining in solution. The hydrogen sulphide and ammonia set free by heating the solution are returned to the purifier. The free sulphur is burned and the sulphur dioxide used for absorbing ammonia from the coal gas.—A. T. L.

Combustion of combustible mixtures. C. D. McCourt, Streatham Common, and Bonecourt Surface Combustion, Ltd., London. Eng. Pat. 18,542 of 1913; date of appl., Jan. 15, 1914.

The flues are packed with bricks or shaped pieces of refractory material set at an angle with one another so as to form a tortuous passage which decreases in cross-section in proportion to the reduction in temperature of the burning or burnt products of combustion passing through it.—W. H. C.

Hydrocarbons [of coal distillation gases]; Conversion of aliphatic —— into alcohols. J. de Lattre. Fr. Pat. 468,244, Feb. 9, 1914.

Coal distillation gases, especially those produced during the early stages in coke ovens, are freed from hydrogen sulphide, tar, and aromatic hydrocarbons, and then passed through concentrated sulphuric acid, preferably in presence of vanadium or uranium oxide; the ethyl hydrogen sulphate produced is converted into ethyl alcohol by means of water. The residual gas, containing methane and its homologues, is mixed with an equal volume of chlorine and subjected to the action of ultra-violet rays; the chlorohydrocarbons thus formed are converted into the corresponding alcohols by treatment with an alkali or alkaline-earth.—T. F. B.

Gasolene or naphtha; Machine for refining used ——. G. E. Olsen, Laconia, N.H. U.S. Pat. 1,106,887, Aug. 11, 1914; date of appl., April 14, 1913.

The naphtha is displaced upwards by water into a small dome at the top of a tank fitted with agitating gear, and passes off through a pipe having a transparent portion for inspection of the liquid.—O. E. M.

[Light petroleum] spirit, petroleums, and benzols; Process and apparatus for the continuous rectification of ——. E. Barbet et Fils et Cie. Fr. Pat. 468,068, April 12, 1913.

The process comprises two operations in each of which a triple or other multiple effect is used in conjunction with a rectifying column; with triple effects, crude petroleum can be separated into 11 distinct fractions. In the case of petroleum, the lighter spirit is separated in the first operation and the illuminating and heavy oils in the second. The process differs from that of ordinary triple effect evaporation in that the same (atmospheric) pressure is maintained in each section of the first series, and the same, lowest possible pressure is each section of the second series. Further, in each series, the liquid and vapour pass from section to section in opposite directions, *i.e.*, the first section for the liquid is the last section for the vapour and inversely.—L. E.

Boiler or still for liquid hydrocarbons (petroleum); Electrically-heated ——. T. Delort. Fr. Pat. 469,054, Feb. 8, 1913.

Two stills are described. In the first the oil flows downwards in a zig-zag path between a series of inclined plates, heated electrically by internal resistances. The vapours pass from the still-head downwards through a condenser, and the whole is immersed in oil in an outer vessel also provided with still-head and condenser. The second form of still comprises a vessel, with walls encased in non-heat-conducting material, containing a number of horizontal plates forming the electrical resistances.—A. T. L.

Dust [in mines, etc.]; Composition for agglutinating ——. H. Belger, Cullercoates. U.S. Pat. 1,107,880, Aug. 18, 1914. Date of appl., April 8, 1913.

See Eng. Pat. 6343 of 1913; this J., 1913, 690.—T. F. B.

Coal gas; Apparatus for the manufacture of ——. R. C. Congdon, Atlanta, Ga., U.S.A. Eng. Pat. 9587, April 17, 1914. Under Int. Conv., April 29, 1913.

See U.S. Pat. 1,090,813 of 1914; this J., 1914, 471.—T.F.B.

Gas-producer; Suction ——. M. F. Derrick, Montreal, Canada. U.S. Pat. 1,107,917, Aug. 18, 1914. Date of appl., June 12, 1913.

See Eng. Pat. 14,153 of 1912; this J., 1913, 860.—T.F.B.

Ammonia and sulphur compounds from gas; Process of extracting ——. J. W. Cobb, Leeds. U.S. Pat. 1,108,705, Aug. 25, 1914. Date of appl., May 31, 1913.

See Eng. Pat. 13,141 of 1912; this J., 1913, 971.—T.F.B.

Motor-spirit. R. de Fazi, Rome. U.S. Pat. 1,108,351, Aug. 25, 1914. Date of appl., Oct. 31, 1912.

See Eng. Pat. 25,177 of 1911; this J., 1913, 187.—T.F.B.

Process of and means of obtaining phenols from tar oils, applicable also for other purposes [e.g. refining petroleum]. Eng. Pat. 20,077. *See* III.

Complete extraction of industrial chemical products contained in crude ammoniacal liquor. Fr. Pat. 468,535. *See* VII.

Apparatus for determining the percentage of carbon dioxide in flue gases. Eng. Pat. 21,542. *See* XXIII.

Patent Case.

Peat and the like; Treatment of (extracting water from) ——. J. E. Jameson and O. H. Valpy, London, and E. A. Buckle, Manchester. Eng. Pat. 10,370 of 1912 (this J., 1913, 590). Repts. of Patent Cases Vol. XXXI. Ill. Off. J. Patents. Sept. 9th, 1914, 361. By permission.

This was a petition in Chancery for revocation of Jameson's patent, which claimed a process for the extraction of water from peat, by passing an electric current through peat pulp, heated to a temperature of at least 100° C., under a pressure such that no steam is produced. It was proved that the water in peat is partly free and partly combined in the form of "hydrocellulose," and that the combined water could not be got rid of by pressure. Prior to the patent it had been suggested that the water could be removed by the use of a comparatively high temperature and pressure. The patentees said that the result could be attained by the use of an electric current (the voltage of which might vary within wide limits) at a lower temperature. The petitioner contended that the only result obtained by the use of the current was due to its heating effect.

The Court held that the specification described a process in which the electric current was used to effect the decomposition of the "hydrocellulose" without recourse for that purpose to heat, while the earlier process depended on the effect of heat alone. The process had been in operation on a practical scale for some time, with the result that a pressed cake had been produced suitable either for fuel or for consumption in a gas producer for the production of ammonium sulphate. The process was useful and the directions given were sufficient. A certificate of validity was given and the petition was dismissed with costs.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Ligneous materials; Treatment [dry distillation] of peat, sawdust, nutshells, and other ——. R. F. Strong, London. Eng. Pats. 15,980 of 1914, and 18,984 of 1913; dates of appl., Aug. 21, 1913.

For the production of alcohol, acetic acid, acetone, motor spirit, etc., raw peat is masticated in a retort connected with a condenser. The partly carbonised peat falls by stages to the bottom of a second retort fitted with shelves and slowly rotating rakes, and connected with a condenser. The condensed tarry liquid, with or without separation of acetic acid and other products, is "cracked" in a coil heated by the red hot carbonised peat in a third chamber: the liquid products are condensed, and the gases are scrubbed and used for firing the retorts. The apparatus is suitably modified for dealing with nutshells, sawdust, etc.—O. E. M.

Wood alcohol; Refining ——. L. F. Hawley, Assignor to A. D. Little, Inc., Boston, Mass. U.S. Pat. 1,106,707, Aug. 11, 1914; date of appl., April 13, 1914.

By repeated treatment with an aqueous solution of alkali an acetone layer substantially free from methyl alcohol, and a methyl alcohol layer containing small quantities of acetone, are obtained. The acetone layer is purified by dissolving out the alcohol with aqueous alkali.—O. E. M.

Furnaces for heating gases. C. M. T. Olsson, Nygard, Sweden. Eng. Pat. 11,774, May 20, 1913.

Heat is transferred from the hot to the cold gases, ascending in separate superimposed chambers fitted with baffles of chequer-brickwork, by a falling stream of sand, which passes successively through the chambers.—O. E. M.

Incandescence body for electric lamps. W. G. Hughes, Pittsburgh, Pa. U.S. Pat. 1,106,384, Aug. 11, 1914; date of appl., Dec. 16, 1912.

A filament of pure, drawn, annealed, metallic uranium is produced from a mixture of uranium chloride, metallic sodium and potassium chloride.—B. N.

Glow-lamp; Electric ——. W. Nernst, Göttingen, Germany, Assignor to Nernst Lamp Co. U.S. Pats. (A) 1,106,960 and (B) 1,106,961, Aug. 11, 1914; dates of appl., Sept. 10, 1908 and April 24, 1913.

(A) The glower for lamps of the Nernst type, non-conductive at atmospheric temperatures but conductive at high temperatures, is composed of an intimate mixture of yttria and a relatively small proportion of tungstic acid, formed into the desired shape and thoroughly baked. (B) The homogeneous conductor is composed of intimately mixed oxides of calcium and tungsten.—B. N.

Filaments and mantles used in incandescent gas-lighting; Process for impregnating the ——. G. Bagrachow, Paris. U.S. Pat. 1,108,116, Aug. 25, 1914. Date of appl., July 13, 1911.

See Eng. Pat. 18,084 of 1910; this J., 1911, 530.—T. F. B.

III.—TAR AND TAR PRODUCTS.

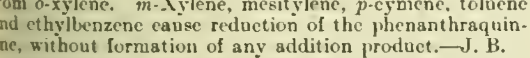
Autoxidations [of xylene and benzaldehyde]. IV. Communication on chemical action of light. H. Suida. Ber., 1914, **47**, 467—472.

It was shown previously (Monats. Chem., 1912, **33**, 1268) that xylene mixed with an aromatic nitro-hydrocarbon contained more active oxygen after exposure to light and oxygen than pure xylene so treated. In further experiments involving exposure to sunlight for six months, and the working up of the products of the oxidation, it was found that the presence of the nitro-compound reduced the total yield of oxidation product, but that considerable quantities of toluic aldehyde were present. Thus, in presence of the nitro-hydrocarbon the less stable products of oxidation, aldehydes and peroxides, remained, whilst the pure chemical reaction—the decomposition of these primary products to the next higher and more stable stage of oxidation—was delayed. It was possible by cooling in carbon dioxide and ether to bring almost to a standstill the decomposition of the benzoyl-hydroperoxide formed from benzaldehyde by the action of ultra-violet light, but the product of the primary autoxidation process could not be isolated, as it decomposed into benzoic acid within a few minutes of removing from the cooling mixture.

—G. F. M.

Phenanthraquinone; Action of the benzene hydrocarbons on —— *in sunlight.* A. Benrath and A. v. Meyer. J. prakt. Chem., 1914, **89**, 258—270.

Phenanthraquinone when exposed to light with *o*- or *p*-xylene, ψ-cumene, or quinaldine, forms addition products, probably ethers of phenanthrenequinol, *e.g.*,

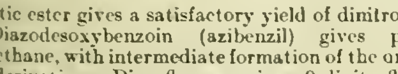


$$\begin{array}{ll}C_6H_4.C.O.CH_2.C_6H_4.CH_3 \\ | \qquad \| \\ C_6H_4.C.OH\end{array} \quad \text{or} \quad \begin{array}{ll}C_6H_4.CH.O.CH_2.C_6H_4.CH_3 \\ | \qquad \quad | \\ C_6H_4.C:O\end{array}$$

from o-xylene. *m*-Xylene, mesitylene, *p*-cymene, toluene and ethylbenzene cause reduction of the phenanthraquinone, without formation of any addition product.—J. B.

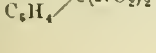
Diazo-compounds and tetrazenes, The action of nitrogen peroxide on aliphatic ——. H. Wieland and C. Reisenegger. Annalen, 1913, **401**, 244—251.

The action of nitrogen peroxide on aliphatic diazo-compounds is analogous to that of bromine—nitrogen is split off and a dinitro-compound formed—



$$R{\cdot}CH\left<\begin{matrix}N\\ \|\\ N\end{matrix}\right. + 2NO_2 = R{\cdot}CH\left<\begin{matrix}NO_2\\ \\ NO_2\end{matrix}\right. + N_2$$

Diazoacetic ester gives a satisfactory yield of dinitro-acetic ester. Diazodesoxybenzoin (azibenzil) gives phenyldinitromethane, with intermediate formation of the unstable benzoyl-derivative. Diazofluorene gives 9-dinitrofluorene



$$\left.\begin{matrix}C_6H_4\\ \dot{C}_6H_4\end{matrix}\right>C(NO_2)_2$$

The tetra-aryltetrazenes behave differently, for, whereas with bromine they give bromo-amines, instead of giving the corresponding diarylnitramines with nitrogen peroxide a smooth nitration of two symmetrically disposed benzene rings takes place and no nitrogen is split off. A dark green addition product is first formed, to which the constitution: $C_6H_5:(NO_2):N(NO_2)(C_6H_5).N_2.N(NO_2)(C_6H_5):C_6H_5:(NO_2)$, is ascribed. This loses 2 mols. HNO_2 to give dinitrotetraphenyltetrazene,

$$(NO_2)C_6H_4.N(C_6H_5).N_2.N(C_6H_5).C_6H_4(NO_2).$$

The reaction is carried out by adding a benzene solution of nitrogen peroxide to the diazo-compound. Nitric acid acts catalytically to decompose the diazo-compound.

—J. B.

β-Anthraquinone-aldehyde. A. Eckert. Monatsh. Chem., 1914, **35**, 289.

β-Anthraquinone-aldehyde was converted into β-anthraquinoylacrylic acid by the usual method with a view to carrying it through the steps of Baeyer's Indigo synthesis. The action of nitric acid, however, on the acid was to give not nitro-anthraquinoylacrylic acid, but 1-nitroanthraquinone-aldehyde, the same product as that obtained by direct nitration of β-anthraquinone-aldehyde.

—J. B.

Patents.

Tar and like substances; Apparatus for melting or boiling ——. R. P. Brousson, London. Eng. Pat. 2058, Jan. 26, 1914.

A cauldron or tank for boiling tar, flux oil from petroleum, etc., is provided with a perforated tray supported by means of brackets at some distance from the walls of the vessel. The material to be heated is poured between the tray and the walls of the vessel. This construction of apparatus is especially suitable for use in treating materials such as asphaltic bitumen, and ensures rapid dispersion of froth.—T. F. B.

Phenols from tar oils; Process of and means for obtaining —— *applicable also for other purposes.* A. Pepper, Tunstall, Staffs. Eng. Pat. 20,077, Sept. 5, 1913.

Tar oils and caustic soda solution are heated in separate tanks and then brought together into a vessel in which they fall on a series of circular baffle-plates, below each of which is a partition with a central opening, so that the mixture has to take a circuitous path before it reaches the separating tank. This tank is provided with one or more vertical curtain-plates, and from it the oil and aqueous solution are run off to stock tanks, or the oil is again treated with caustic soda in a similar manner. This process may also be used for washing and refining petroleum, benzol, and other oils.—T. F. B.

Aromatic hydroxy derivatives; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 469,040, Feb. 10, 1914. Under Int. Conv., May 26, 1913.

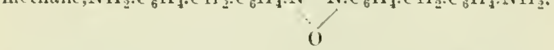
The formation of oxidation products, which always occurs when aromatic sulphonic acids are fused with alkali hydroxides, can be avoided if the two substances are heated together in aqueous solutions at high temperatures (*e.g.*, 300° C.). *Example.*—A mixture of 46 parts of the sodium salt of naphthalene-β-sulphonic acid and 50 parts of caustic soda lye of 40° B. (sp. gr. 1·385) is heated in a closed vessel for 10 to 20 hours at 300°—330° C. The cooled mass is acidified and the β-naphthol is filtered, washed, and dried. A good yield of the phenol, only very slightly coloured, is obtained.—T. F. B.

Process and apparatus for the continuous rectification of essences [light petroleum], petroleums, and benzols. Fr. Pat. 468,068. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

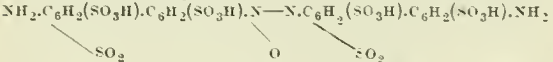
Azoxy-compounds ; Certain —— and the action of dinitrophenylpyridine chloride on sulphonated substances. F. Reitzenstein and R. Fitzgerald. J. prakt. Chem., 1914, **89**, 271—289.

The product obtained by oxidising diaminodiphenylmethane in alkaline solution (this J., 1910, 1098) is an azoxy-compound, viz., *p*-*p*′-diamino-*p*-azoxydiphenylmethane,



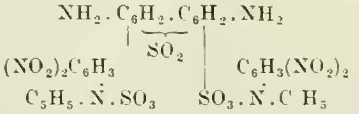
$$\mathrm{NH_2.C_6H_4.CH_2.C_6H_4.}\underset{\mathrm{O}}{\underbrace{\mathrm{N{-}N}}}\mathrm{.C_6H_4.CH_2.C_6H_4.NH_2}.$$

and a similar compound,



$$\mathrm{NH_2.}\underbrace{\mathrm{C_6H_2(SO_3H).C_6H_2(SO_3H)}}_{\mathrm{SO_2}}\mathrm{.}\underset{\mathrm{O}}{\underbrace{\mathrm{N{-}N}}}\mathrm{.}\underbrace{\mathrm{C_6H_2(SO_3H).C_6H_2(SO_3H)}}_{\mathrm{SO_2}}\mathrm{.NH_2}$$

results from the oxidation of benzidinesulphonedisulphonic acid. In the latter case the oxidation product is always the same, whatever be the oxidising agent used, in contrast with the behaviour of diaminostilbenedisulphonic acid which gives different products with different reagents (*loc. cit.*). The compound from diaminodiphenylmethane dyes wool red and gives a red azo-compound when diazotised and combined with β-naphthol. The compound from benzidinesulphonedisulphonic acid is a yellow substance and dyes wool an intense red. It is peculiar in that it does not give the ordinary reaction of an amino-compound with dinitrophenylpyridinium chloride according to Zincke's method, *i.e.*, $2R.NH_2+C_5H_5N(Cl)C_6H_3(NO_2)_2 \rightarrow R.NH(HCl)—.C_5H_5NR + C_6H_3(NO_2)_2.NH_2$, but simply gives a sulphonate of the reagent, no dinitraniline being produced. The parent substance, benzidine-sulphone-disulphonic acid, behaves similarly, giving :—

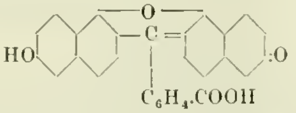


$$\begin{array}{ccc} & \mathrm{NH_2.\,C_6H_2.\,C_6H_2.\,NH_2} & \\ & \underbrace{\qquad}_{\mathrm{SO_2}} & \\ \mathrm{(NO_2)_2C_6H_3} & & \mathrm{C_6H_3(NO_2)_2} \\ \mathrm{C_5H_5\,.\,\dot{N}\,.\,SO_3} & & \mathrm{SO_3\,.\,\dot{N}\,.\,C\;H_5} \end{array}$$

Diaminostilbenedisulphonic acid and benzidine-*m*-disulphonic acid, also the azoxy-compounds derived from them, all give this peculiar reaction. All these sulphonic acid salts of dinitrophenylpyridinium are coloured and dye wool. The amino-groups condense in the usual way with dimethylaminobenzaldehyde. 2-Naphthylamine-6-sulphonic acid gives an azine with alkaline oxidising agents.—J. B.

6.6′-*Dihydroxynaphthofluoran. Action of phthalic anhydride on* 1.6-*dihydroxynaphthalene.* O. Fischer and E. König. Ber., 1914, **47**, 1076—1084.

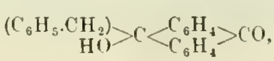
By melting 1.6-dihydroxynaphthalene with phthalic anhydride a red substance is formed which gives a blue-green alkali-compound and a red oxonium salt with hydrochloric acid. With diazonium salts it forms bis-azo-compounds which are insoluble in alkali and are thus analogous to the azo-compounds of β-naphthol, whence it follows that the substance is probably 6.6′-dihydroxynaphthofluorane :—



The lactone form of the compound is unstable and exists only in solution or in combination with ether or acetone of crystallisation.—J. B.

Anthraquinone ; Benzyl derivatives of ——. M. Tschilikin. Ber., 1914, **47**, 1055—1058.

By treating anthraquinone with dimethylphenylbenzylammonium chloride ("Leucotrope") in the presence of caustic soda and sodium hydrosulphite, benzyloxanthrone,

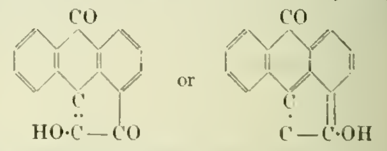


$$\begin{smallmatrix}\mathrm{(C_6H_5.CH_2)}\\ \mathrm{HO}\end{smallmatrix}{>}\mathrm{C}{<}\begin{smallmatrix}\mathrm{C_6H_4}\\ \mathrm{C_6H_4}\end{smallmatrix}{>}\mathrm{CO},$$

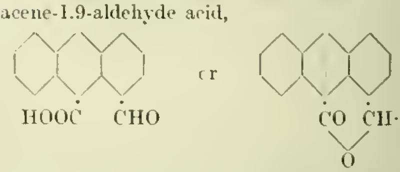
is formed—analogous to the formation of the benzyl ether of indigo in the "Leucotrope" discharge process, the reaction being a general one. On heating with sulphuric acid benzyloxanthrone loses water and gives the compound, $\mathrm{C_6H_5.CH : C}{<}\begin{smallmatrix}\mathrm{C_6H_4}\\ \mathrm{C_6H_4}\end{smallmatrix}{>}\mathrm{CO}$, m. pt. 117° C.—J. B.

Aceanthrenequinone ; The behaviour of —— with dilute alkali. C. Liebermann and M. Kardos. Ber., 1914, **47**, 1203—1210.

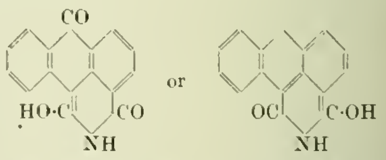
By boiling aceanthrenquinone with 10% caustic soda both hydrolysis and oxidation take place and the following products have been isolated : aceanthrenhydroxydione,



anthracene-1.9-aldehyde acid,



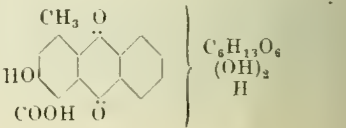
anthraquinone-1-carboxylic acid and anthracene-1.9-dicarboxylic acid-anhydride. Aceanthrenhydroxydione gives a phenylhydrazone and an oxime, the latter condensing when heated with strong sulphuric to anthronhydroxypyridone,



By submitting this substance to the caustic potash melt and oxidising the resulting leuco-compound, Iso-aceanthrene Green is obtained, a dyestuff dyeing cotton from the vat a violet shade changing to a dull green in the air.
—J. B.

Carminic acid. O. Dimroth. Annalen, 1913, **399**, 1—35.
(See also this J., 1914, 544)

Carminic acid, the dyestuff of cochineal, has been previously oxidised by the author (this J., 1909, 595) to carmazarin (8-methyl-2.3.6-trihydroxynaphthalene-5-carboxylic acid). Using hydrogen peroxide and caustic potash in the presence of a catalyst, an intermediate oxidation product has now been obtained which is shown to be 8-methyl-2.6-dihydroxy-1.4-naphthoquinone-3.5-dicarboxylic acid. On treatment with bromine this substance yields β-bromo-carmine, which therefore must be 8-methyl-2.6-dihydroxy-3.5.7-tribromo-1.4-naphthoquinone. The constitution of this new oxidation product indicates that carminic acid is a derivative of anthraquinone. The coccinine whic results from the fusion of carminic acid with causti potash has also been investigated and shown to be a derivative of anthranol. It oxidises in alkaline solutio in air to coccinone, a mordant dyestuff, which gives o further oxidation the known cochenillic acid (1-methyl-3 hydroxybenzene-4.5.6-tricarboxylic acid). On distillin carminic acid with zinc dust anthracene, α-methylanthra cene and possibly higher homologues are formed. Th constitution :

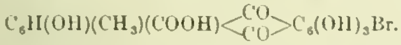
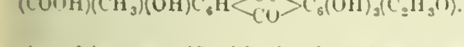


in which $C_4H_{13}O_4$ is probably an aliphatic residue, is suggested for carminic acid.—J. B.

Dihydroxy-1.4-naphthoquinones ; The 2.6 and 2.7- ——. O. Dimroth and B. Kerkovius. Annalen, 1913, **399,** 36—43.

The compounds mentioned in the title were prepared by Thiele's method by treating the known 6- and 7-hydroxy-β-naphthoquinones with acetic anhydride and sulphuric acid, saponifying the resulting tetracetyl-1.2.4.6- and -1.2.4.7-tetrahydroxynaphthalenes and then oxidising to the quinones (see Annalen, 1900, **311,** 341). The 2.6-isomeride gives the same colour reactions as the methyldihydroxynaphthoquinonedicarboxylic acid derived from carminic acid (see preceding abstract) and on bromination it gives a tribromo-derivative closely similar to β-bromocarmine. The 2.7-isomeride, on the other hand, gives different colour reactions from the oxidation product of carminic acid and its bromination product is quite different from β-bromocarmine. The identification of the oxidation product of carminic acid as 8-methyl-2.6-dihydroxy-1.4-naphthoquinone-3.5-dicarboxylic acid is thus confirmed.—J. B.

Kermes ; The dyestuff of ——. O. Dimroth and W. Scheurer. Annalen, 1913, **399,** I, 43—61

The dyestuff of kermes yields the same decomposition products as carminic acid, and like the latter gives α-bromocarmine when brominated in boiling 50% acetic acid. In anhydrous acetic acid however, the reaction does not go so far and there is obtained a new dyestuff, monobromococcin,  $C_6H(OH)(CH_3)(COOH)<{\substack{CO\\CO}}>C_6(OH)_3Br$. The side chain, C_2H_3O, of kermes acid is replaced in this bromination. As the original substance has no aldehyde properties, this side chain must be an acetyl group, whence it follows that kermes acid has the constitution  $(COOH)(CH_3)(OH)C_6H<{\substack{CO\\CO}}>C_6(OH)_3(C_2H_3O)$. Distillation of kermes acid with zinc dust gives α-methylanthracene. Kermes also contains a second dyestuff called flavokermes acid, which has different dyeing properties from the main constituent. Kermes wax consists of the ceryl ester of cerotinic acid.—J. B.

German dyestuffs and medicines ; Embargo on exports of ——. Oil, Paint. and Drug Rep., Sept. 14, 1914. [T.R.]

There is a general expectation that the German embargo on certain exports from that country *viâ* Rotterdam will soon be raised, and Mr. H. A. Metz, of New York, is said to have received advices that it had been raised on dyestuffs and most medicines (see however this J., 1914, 915). It is reported that German dyestuffs are very scarce in the United States. "Developed black," normally 24 c. per lb., was unobtainable under $2.00 per lb. in 20,000 lb. lots. "Oxidised black" had advanced from 8·5 c. to 50 c., carbolic crystals from 7.5 c. to 65 c., and tartaric acid from 29 c. to 85 c. In the case of potash salts used by lead glass manufacturers, not 60 days' supply remained in the country. Potassium chloride has advanced from $35 to $185 per ton. The State Dept. so far cannot indicate when foreign shipments will begin.

Patents.

Monoazo dyestuff ; Process for making a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 468,218, Feb. 5, 1914. Under Int Conv., Sept. 1 and 2, 1913.

A dyestuff which gives red shades on wool very fast to light, is obtained by combining the diazo derivative of 4-acetaminoaniline-2-sulphonic acid with 2-amino-8-naphthol-6-sulphonic acid, or by acetylating the dyestuff obtained, for example, by alkaline reduction of the compound of *p*-nitraniline-*o*-sulphonic acid with γ-aminonaphtholsulphonic acid.—T. F. B.

Phthaleins of the naphthalene series ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 275,897, April 16, 1913.

1.6-Dihydroxynaphthalene is combined with phthalic anhydride or its substitution products, with or without addition of a condensing agent, *e.g.*, by heating on an oil-bath at 180°—200° C. The products are deep red substances, soluble in alkali, which dye deep bluish-green shades.—T. F. B.

Sulphide dyestuffs ; Process for preparing ——. R. Vidal Fr. Pat. 468,526, April 25, 1913.

Black or blue sulphide dyestuffs are obtained by heating *p*-aminophenol, *p*-phenylenediamine, *op*-diaminophenol, hydroxyazobenzene, benzene-azo-cresols, or polyamino- or aminohydroxydiphenylamines with sulphur in presence of phenol, cresol, or α- or β-naphthol. The dyestuffs from hydroxyazobenzene or hydroxyazotoluene are black : the rest are blue. The following example is given : A mixture of *p*-aminophenol (50 kilos.), sulphur (30 kilos.), and commercial cresol (100 kilos.) is boiled under a reflux condenser for 12 hours ; on treating the product with benzene the dyestuff separates as a powder. In cases where it is not desirable or possible to boil the mixture, *e.g.*, with the naphthols, it is heated to 200°—220° C.
—T. F. B.

Azo dyestuffs ; Process for preparing ——. L. Cassella und Co. Ger. Pat. 275,896, July 1, 1913.

A diazo or tetrazo compound is combined with triaminocarbazolemonosulphonic acid (see Ger. Pat. 275,975 ; this J., 1914, 854) ; when the product is diazotised and developed on the fibre or combined with a diazotised nitraniline, yellowish-brown to black shades, fast to washing and light, are produced.—T. F. B.

Vat dyestuffs ; Manufacture of ——. E. Wray, Assignor to Kalle und Co. Akt.-Ges., Biebrich on Rhine, Germany. U.S. Pats. 1,108,056 and 1,108,057, Aug. 18, 1914 ; dates of appl., Oct. 29, 1913.

See Ger. Pat. 269,123 of 1912 and Fr. Pat. 463,772 of 1913 ; this J., 1914, 247, 416.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Solidonia [bast fibre]. R. Werner. Färber-Zeit., 1914, **25,** 284.

Solidonia is a bast fibre which furnishes a yarn of good tensile strength and high lustre. It is generally used mixed with wool or cotton. The fibre can be bleached and dyed just like cotton. Low temperatures are recommended for dyeing—not above 80°—90° C.—as the material becomes brittle at the boiling point. Drying at low temperatures is also necessary. The same dyestuffs are employed as for cotton.—J. B.

Patents.

Fabrics for outer covers for pneumatic tyres and envelopes for balloons ; Manufacture of ——. L. Liais, Paris. Eng. Pat. 22,065, Sept. 30, 1913. Under Int. Conv., Oct. 9, 1912.

The weft threads, preferably on cops unwinding from the inside (cocoon pirns), are impregnated with a rubber solution and woven while still wet, the material being afterwards vulcanised.—J. B.

Fur ; Art of carroting ——. P. C. Donner, Summit, N.J. U.S. Pat. 1,106,371, Aug. 11, 1914 ; date of appl., March 17, 1914.

The cut fur is blown into a receptacle at the top and a "carroting" solution is sprayed on to the moving fur.
—J. B.

Silk fibres; Process for strengthening —— and increasing their elasticity. E. Vowe. Fr. Pat. 467,987, Feb. 3, 1914.

Raw silk is treated in a bath of water to which is added a saponified drying oil, *e.g.*, linseed oil, and an "alkali," preferably Marseilles soap, and then dried in the air.—A. S.

Purification, decolorisation and disinfection of flax by means of sulphurous acid. A. Leconte. Fr. Pat. 468,312, Feb. 11, 1914.

The flax is treated with an aqueous solution of sulphurous acid and then washed repeatedly, the water being removed in a hydraulic press after each washing.—J. B.

Filaments, films and masses from cellulose acetate; Process of preparing ——. H. S. Mork, Assignor to Chemical Products Co., Boston, Mass. U.S. Pat. 1,107,222, Aug. 11, 1914; date of appl., March 27, 1914.

The cellulose acetate is dissolved in a solvent composed largely of acetylene tetrachloride and is coagulated by a mixture of acetylene tetrachloride with petroleum hydrocarbons the average boiling point of which is higher than that of the acetylene tetrachloride.—J. B.

Plastic material enclosed between two films of cellulose; New products composed of a —— and process of manufacture of same. J. E. Brandenberger. First Addition, dated Jan. 22, 1914, to Fr. Pat. 458,638, May 31, 1913 (this J., 1913, 1063).

One of the films of cellulose may be replaced by any material in web form, *e.g.*, metal foil, paper or fabric. One or more materials having continuous or discontinuous surfaces may be introduced between the two cellulose films at the same time as the plastic material and embedded in the same.—J. F. B.

Plastic material [from soy beans] capable of replacing celluloid, suitable for finishing, spinning and weaving; Transparent, flexible, non-inflammable ——. P. J. Contant and J. B. F. Perrot. First Addition, dated Jan. 5, 1914, to Fr. Pat. 461,007, Aug. 1, 1913 (this J., 1914, 20).

One hundred kilos. of soy beans are steeped in soft water for 18—24 hours, crushed and treated with sufficient water to give 500 litres of "milk." After filtration, the liquor is made slightly alkaline with ammonia, or preferably magnesia mixture, allowed to settle for 6 hours, decanted off and precipitated by acetic or nitric acid. The precipitate is washed, heated with a little water to 80°—100° C., filtered off, dried and powdered. The product is treated with a 10% solution of sodium phenoxide in the proportion of 1 grm. of phenoxide to 20 grms. of dry material. This solution is treated with 2% of alum on the dry weight and the precipitate collected and dried. The product is dissolved, milled, and compressed.—J. F. B.

Carbohydrates of the type $(C_6H_{10}O_5)_n$ and their derivatives; Manufacture of ethers of —— [for celluloid substitutes, artificial threads, etc.]. L. Lilienfeld. Fr. Pat. 468,162, Feb. 7, 1914. Under Int. Conv., Feb. 14, 1913.

Carbohydrates, other than cellulose, of the type $(C_6H_{10}O_5)_n$, or their derivatives, *e.g.* starch, dextrins, and the like, are treated with esters and alkalis in presence of suitable solvents or diluents, etherification being accelerated by catalytic, condensing or dehydrating agents. Or the carbohydrate, in alkaline solution, is partially etherified to produce ethers soluble in water, the product, previously isolated if desired, then being further etherified to form insoluble ethers. The products, alone or mixed with other agglutinants, plastic materials, etc., are employed for making celluloid and substitutes therefor, artificial thread, varnish, dressings for fabrics, printing compositions, glue, etc.—L. E.

Cellulose; Process for obtaining lustrous threads of a basis of ——. J. Joliot. Fr. Pat. 468,380, April 22, 1913.

Threads composed of natural cellulose fibres, *e.g.* hanks of cotton yarn, are converted into alkali-cellulose under tension as in the ordinary mercerising process; they are then subjected to the regulated action of cuprammonium solution or of carbon bisulphide without proceeding to the extent of dissolving the threads. The treated threads are stretched by tension to an extent depending on the degree of brilliancy desired and in this state are re-converted into cellulose and purified.—J. F. B.

Cellulosic substances; Conversion of —— into plastic or gelatinous masses or colloidal solutions. P. von Weimarn. Ger. Pat. 275,882, April 27, 1912.

Cellulosic substances are converted first into a gelatinous or plastic condition and finally into colloidal solutions, by heating them under suitable conditions with solutions of neutral salts, other than zinc salts, potassium and ammonium thiocyanate, potassium iodide, and potassium-mercuric or barium-mercuric iodide. When sodium iodide, calcium bromide or iodide, or barium, calcium, strontium, or sodium thiocyanate is used, the reactions can be carried out at atmospheric pressure. Sodium or potassium chloride and sodium sulphate involve the use of higher pressures. When "concentrated" sodium chloride solution is used, solution of the cellulose commences at about 170° C. at 8 atmos. The same solvent action is observed with nitrates, acetates, and many other salts.—T. F. B.

Paper machine; Arrangement for regulating the weight of pulp in the stuff-box of the ——. E. W. Rüdiger. Fr. Pat. 468,682, Jan. 31, 1914.

The stuff flowing from the chest into the stuff-box of the paper machine is regulated automatically, independently of the amount of stuff in the chest, by means of a lever or spring balance which can be set to admit any desired weight of pulp and which controls the buckets, valves or other devices by which the stuff is transferred from the chest. Various arrangements for carrying out this principle are described.—J. F. B.

Artificial silk and other similar articles of cellulose; Process for preparing —— from solutions of viscose. F. Petit, Lyons, France. Eng. Pat. 24,376, Oct. 27, 1913.

See Fr. Pat. 461,900 of 1912 and Addition thereto; this J., 1914, 196, 858.—T. F. B.

Nitrocellulose and similar substances; Making compounds of ——. D. Bachrach, Baltimore. Reissue No. 13,793, Sept. 1, 1914, of U.S. Pat. 794,581, July 11, 1905. Date of appl., Aug. 25, 1910.

See this J., 1905, 901.—T. F. B.

Cellulose acetate soluble in ethyl acetate; Process of making a ——. F. Collischonn, Frankfort, and F. Ruppert, Mainz-Mombach, Assignors to Verein f. Chem. Industrie in Mainz. Mainz, Germany. U.S. Pat. 1,109,512, Sept. 1, 1914. Date of appl., Feb. 18, 1913.

See Fr. Pat. 455,117 of 1913; this J., 1913, 865.—T. F. B.

Production of glucose and alcohol from sawdust and other cellulosic materials. Fr. Pat. 468,188. *See* XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Wool and indigo; A chemical compound obtained from ——. M. Fort and L. L. Lloyd. J. Soc. Dyers and Col., 1914, **30**, 297—298.

Indigo-dyed wool was extracted with boiling acetic acid and the extract diluted with water. A precipitate was formed containing wool substance and Indigo in fixed proportions. Similar results were obtained with other solvents and methods of isolation, and it is concluded that a definite wool-Indigo lake is formed on the fibre when wool is dyed with Indigo, which explains the superior fastness of Indigo dyed on wool to Indigo dyed on cotton. —J. B.

Bleaching of cotton cloth; Chemistry of ——. J. C. Hebden. J. Ind. Eng. Chem., 1914, **6**, 714—720.

Samples of cotton taken from goods being regularly bleached by the caustic soda boiling process were examined at different stages. The results given are :—

Percentages of original substances removed at the end of each operation.

	Steep.	First boil.	Second boil.	Chemick.	Sour.
	%	%	%	%	%
Ash	70·5	87·3	95·4	93·0	95·0
Proteins (N × 6·25)	—	91·5	91·7	92·2	92·7
Fats and waxes (ether extract)	5·5	20·4	64·0	67·8	69·6
Phosphoric acid	60·0	100·0	—	—	—

The samples were also submitted to wetting-out and steaming tests, and it is concluded that the yellowing produced by steaming is due to the proteins rather than to fats and waxes. It is suggested that the bleaching process be controlled by ultimate analyses of the cotton, checked by determinations of ash, and of ether and alcohol extracts. (See also Cross, this J., 1908, 260.)—A. S.

Patents.

Cotton; Process for imparting the character of wool to ——. Heberlein et Cie. Fr. Pat. 468,821, Feb. 23, 1914. Under Int. Conv., Dec. 5, 1913, and Feb. 13, 1914.

The cotton is mercerised, then treated with sulphuric acid of 49°—51° B. (sp. gr. 1·515—1·546), and finally washed. The acid may be printed to produce designs. Instead of sulphuric acid, phosphoric acid of 55°—57° B. (sp. gr. 1·615—1·652), hydrochloric acid of sp. gr. 1·19, nitric acid of 43°—46° B. (sp. gr. 1·424—1·468), zinc chloride solution of 66° B. (sp. gr. 1·842) at 60°—70° C., or an ammoniacal copper solution may be used.—J. B.

Bleaching or scouring fibrous materials; Apparatus for ——. J. Macadam, Chester, Pa., Assignor to the Eddystone Manufacturing Co., Eddystone, Pa. U.S. Pat. 1,107,160, Aug. 11, 1914.

The material is passed through the tank containing the liquor between two parallel endless belts which pass up and down the tank over guides and rollers placed at the top and bottom. The belts consist of rollers held in driving chains. The tank is enclosed and the endless belts enter and leave through waterseals.—J. B.

Bleaching of vegetable fibres; Process for facilitating the ——. E. T. J. Watremez. Fr. Pat. 467,887, Jan. 30, 1914. Under Int. Conv., Feb. 7, 1913.

Fibres difficult to bleach by the usual processes are treated first with an alkaline bath containing the salt of a metal the oxide of which is soluble in excess of alkali (preferably sodium aluminate) and then with an acid, after which the material is "chemicked" and the process, if necessary, repeated.—J. B.

Bleaching animal fibres by separate treatments with hydrogen peroxide and ammonia. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 275,879, May 27, 1911. Addition to Ger. Pat. 270,703.

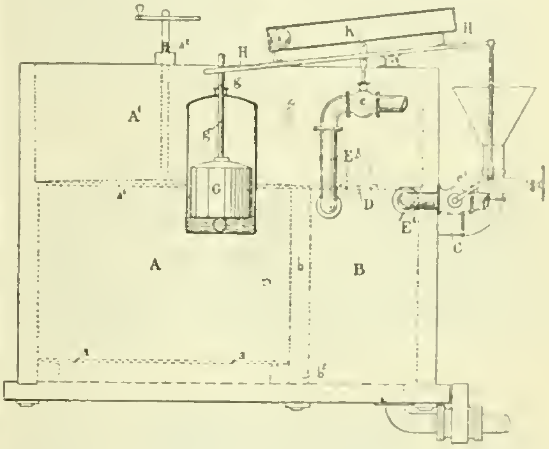
Wool, silk, feathers, and other animal substances may be bleached by the process described in the principal patent (see Eng. Pat. 6896 of 1913; this J., 1913, 1007) for treating vegetable fibres. When delicate materials are to be bleached, stronger solutions may be employed and the treatments correspondingly shortened.—T. F. B.

Bleaching or dyeing liquors; [Apparatus for] treating textile materials with ——. O. and E. H. Sumner, St. Margarets-on-Thames. Eng. Pat. 18,817, Aug. 19, 1913.

The material and the dyeing or bleaching liquor are enclosed in two compartments and submitted to varying air pressure from a pump which causes the liquor alternately to rise and fall within the compartments. The air pressure is automatically controlled within the compartments by floats, which act through external levers on a reversing valve.—J. B.

Dyeing; Apparatus for ——. S. J. Applegate, Kendal, Westmoreland. Eng. Pat. 15,595, Dec. 23, 1913.

The dyeing machine is divided into a dyeing compartment, A, and a dye reservoir, B, separated by a partition, *b*, the latter being provided with openings, b^2, for the passage of liquor. The compartment, A, has a perforated false bottom, *a*, and is closed by a perforated cover, a^1, held in position by a screw, a^2. The reservoir, B, is fitted, in the cover, with a mixing valve, D, opening downwards, and held normally in a closed position by a spring. The two compartments are filled with dye liquor, to the level of the cover, through the pipe, C, and steam is then admitted through the pipe, E, the valve, *e*, being opened, and the exit pipe, E^1, closed by the valve, e^1. The liquor is driven into A and acting upon the float, G, the connecting rod, *g*, is raised until the end of the lever, H, is above the horizontal position, when the lever is tipped over by the ball, *k*, in the tube, K, thus closing the valve, *e*, and opening the valve, e^1. The liquor, accumulated in A^1, returns through the perforated cover, a^1, and through the goods to be dyed, but part returns through the valve, D, thus ensuring thorough mixing of the liquor.—B. N.



Dyeing apparatus. J. Schmitz, Philadelphia, Pa., Assignor to Uniform Dyeing Machine Co. U.S. Pat. 1,105,845, Aug. 4, 1914; date of appl., May 31, 1913.

The dye vat is divided into two compartments in one of which the material is packed in horizontal, superimposed, perforated trays. At the bottom of this compartment is a branched circulating pipe which is in connection with the other, relatively smaller, compartment and with the source of supply of dye-liquor.—J. B.

Dyeing-machine; Beam ——. F. M. Morton, Phoenix, Ala., Assignor to W. H. Dismuke and H. L. Woodruff, Columbia, Ga. U.S. Pat. 1,107,095, Aug. 11, 1914; date of appl., Sept. 24, 1912.

The beam consists of a series of slats fixed in the beam-heads and an intermediate series of movable slats connected with reciprocating mechanism for moving them inwards or outwards beyond or within the circumference of the fixed slats.—J. B.

Dyeing and finishing animal fibres and tissues; Process for ——. R. Vidal. Fr. Pat. 468,525, April 25, 1913.

Hair is dyed on the skin by treating it first with bichromate and afterwards with a sodium sulphide solution of a sulphide dyestuff or of the chromogen described in Fr. Pat. 391,465 (condensation product of *p*-phenylenediamine and 2 mols. of phenol; this J., 1908, 1150).—J. B.

Designed effects on cotton; Production of ——. Heberlein et Cie. Fr. Pat. 468,642, Feb. 19, 1914. Under Int. Conv., Nov. 20, 1913.

Mercerised cotton is printed with sulphuric acid of more than 50·5° B. (sp. gr. 1·538) and then washed, or the cotton may be printed with a reserve and treated with the sulphuric acid.—J. B.

Reserving the silk in half-silk goods in dyeing with sulphide blacks; Process for ——. Farbwerk Mühlheim vorm. A. Leonhardt und Co., Ger. Pat. 275,886, Nov. 19, 1913.

A natural or artificial resin, which is soluble in alkali, is added to the dye-bath, in quantities of, say, 20 grms. per litre.—T. F. B.

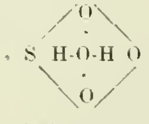
Metallic coatings upon cloth; Process for applying ——. J. Worsley, Blackpool, and C. Greenwood, Clifton Junction, Lancs. Eng. Pat. 17,871, Aug. 5, 1913.

A fabric suitable for optical projection screens is made by coating cloth (preferably coarse-grained American leather cloth) with a mixture of carriage varnish and boiled linseed oil and dusting it with a metallic powder.—J. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid; Sulphonic acids and —— *as hydrolytic agents: a discussion of the constitution of sulphuric and other polybasic acids and of the nature of acids. Studies of the processes operative in solutions. XXXI.* H. E. Armstrong and F. P. Worley. Proc. Roy. Soc., 1914, A **90**, 73—100.

The view is advanced that sulphuric acid is a monobasic acid, on the ground of its general behaviour, and particularly of the nearly equal hydrolytic activities of acid ethereal sulphates and the sulphonic radical in sulphonic acids, on the one hand, and of sulphuric acid, on the other. To it is assigned the formula:



The nearly equal velocity-constants obtained for the hydrolysis of sucrose in presence of different sulphonic acids show that the hydrolytic activity of the sulphonic radical is scarcely affected by the alterations in the hydrocarbon radical to which it is attached. The metabenzenedisulphonic acid is somewhat more active than the para, and much more active than the ortho acid. Benzene mono-, di-(meta), and tri-(1.3.5.-)sulphonic acids give equal activities in equivalent concentrations. Acidity is stated to be a function not of the hydrogen ion alone, but of the acid molecule as a whole, involving the co-operation of water. Two compounds are formed,

$$HX<^{H}_{OH} \text{ and } H_2O<^{H}_{X},$$

in proportions depending on the concentration: the discrepancy between the hydrolytic and electrolytic methods of contrasting acids may be explained on this basis.—O. E. M.

Sulphonic acids; The influence of sulphonates on the hydrolytic activity of ——: *a contribution to the discussion on the influence of neutral salts. Studies of the processes operative in solutions. XXXII.* H. E. Armstrong and F. P. Worley. Proc. Roy. Soc., 1914, A **90**, 101—111.

The increase caused by potassium toluene-*p*-sulphonate in the velocity-coefficient of hydrolysis of sucrose in presence of toluene-*p*-sulphonic acid is found to diminish with successive additions of the salt, and to fall to about a third of its value when the concentration is halved. The increase is greater the smaller the proportion of acid present. The addition of 1 equivalent of K, Ca, Sr, Ba, Zn, or Cd salts of toluene-*p*-sulphonic acid to solutions containing 1 molecular proportion of acid to 100 of water and 0·5 of sugar gives velocity-coefficients varying from 235 for the Ba-salt to 245 for the Zn-salt: the acid gives 217. The mechanism of hydrolysis is discussed in the light of the authors' association hypothesis.—O. E. M.

Borates; Electrolysis of fused ——. A. Zschille-Hartmann. Dissert., München, Techn. Hochschule, 1913, 1—61. Silikat-Zeits., 1914, **2**, 34—35.

By the electrolysis of fused borax, boron is produced near the cathode, but not at the anode as Moissan asserted. With high current-strengths veins of sodium are found in the separated boron (see Hampe, Chem.-Zeit., 1888, **12**, 841). The boron in the fused product was determined by oxidising it to boric acid and distilling this over as boric acid methyl ester. The constant fluctuation of the current strength is the chief difficulty in the electrolysis of borax. Iron and carbon anodes do not make effective contact with the fused borax and the best results were given by anodes made from a mixture of 80% of carbon powder and 20% of dehydrated powdered borax, made into a stiff paste with sugar, and moulded in an iron tube. Boron, nearly free from carbon, was obtained from pure borax with alternating current heating and a current density of from 0·45 to 0·8 ampère per sq. cm. It dissolved in water unless traces of an electrolyte were present. The air-dried product consisted of: B about 61%, and H_2O 14·3% with small quantities of C, Fe, and SiO_2, leaving a balance of O 14·4% possibly Weintraub's suboxide, B_6O (this J., 1910, 23).—W. C. H.

Silicic acid gels produced by the decomposition of silicates; Contribution to the knowledge of ——. M. Thiele. Dissert., Leipzig, 1913, 1—39. Silikat-Zeits., 1914, **2**, 33—34.

Silicic acids were obtained by decomposing fragments of natural heulandite and scolecite crystals with concentrated hydrochloric acid at 19° C. for several weeks, the gels being washed, dried and tested for purity. Gelatinous silicic acid separates in a few hours from scolecite and natrolite, and becomes mealy on drying, whereas the acid from heulandite and desmin is powdery and becomes granular on drying. With gels from the former minerals especially, distinct angular points often do not occur in the dehydration curves. The higher the temperature and the stronger the dehydrating agents employed, the larger are the amounts of water removed from the gels, which indicate that they are adsorption compounds of SiO_2 and H_2O. As Graham showed, the water of gels can be almost completely replaced by alcohol, acetic acid, glycerin and other substances, including chloroform and carbon tetrachloride, which not being miscible with water do not attract atmospheric moisture during the dehydration in air. Experiments with these liquids showed that there is a relation between their specific gravities and the amounts of liquid combined with the gel, though these are not in molecular ratios. The possibility of substituting other liquids for water in a gel without altering its properties indicates that the water of the hydrogel is not water of hydration. Silicic acid gels derived from simple artificial silicates such as those of lead and lithium had a water content of 26%, irrespective of their origin.—W. H. C.

Radium constants on the International Standard. E. Rutherford. Phil. Mag., 1914, **28**, 320—327.

Various radioactive magnitudes, determined in terms of the "Rutherford-Boltwood" standard, have been recalculated in terms of the International Standard. The revised values are :—(1) Amount of radium in equilibrium with 1 grm. of uranium, $3{\cdot}23 \times 10^{-7}$ grm. (2) Production of helium per grm. of radium per year, 164 cb. mm. (3) Total heating effect of 1 grm. of radium and its products in equilibrium with it, 134·7 cals. per hr. (4) Volume of emanation from 1 grm. of radium in equilibrium, 0·63 cb. mm. (5) Number of α particles expelled per sec. per grm. of radium itself, $3{\cdot}57 \times 10^{10}$; number per sec from 1 grm. of radium in equilibrium, $14{\cdot}3 \times 10^{10}$. (6) Total charge carried by the α particles per sec. from 1 grm. of radium itself and from each of its products in equilibrium with it, 33·2 e.s. units ; $1{\cdot}11 \times 10^{-9}$ e.m. units. (7) Total current due to the α rays from 1 curie of emanation (*a*) by itself, $2{\cdot}89 \times 10^{6}$ e.s. units, (*b*) with its α ray products, $9{\cdot}94 \times 10^{6}$ e.s. units. (8) Total charge carried by the β particles emitted per sec. by radium B or radium C in equilibrium with 1 grm. of radium, 18·3 e.s. units. (9) Calculated half value period of transformation of radium, 1690 years.—F. Sodn.

Nitrogen ; An oxidisable variety of ——. T. M. Lowry. Phil. Mag., 1914, **28**, 412—416.

Air which had been submitted successively to a silent and sparking discharge, as in Leetham's process for the preparation of bleaching gases for flour, etc. (this J., 1905, 341), was compared spectroscopically with that which had been passed through a silent discharge or spark-gap apparatus only. No visible absorption was observed except with the gas obtained by using both forms of discharge, with which the flutings characteristic of nitrogen peroxide could be clearly recognised. The proportion of peroxide (about 1/4000 by volume) was but little affected by passing the air through the ozoniser and spark-gaps in the reverse order, or by passing air partly through an ozoniser and partly through spark-gaps, and mixing the gases when no longer under the influence of the discharge. The spark discharge appears to lead to the production of an oxidisable variety of nitrogen (see also this J., 1912, 383) which, however, reverts in a few seconds to a form no longer oxidisable (either by oxygen or ozone), and it is suggested that the most important feature in the technical fixation of nitrogen may be the generation of this modified nitrogen, under conditions which provide a supply of atomic or ozonised oxygen to effect oxidation before reversion to the ordinary inactive form can take place. Strutt's chemically active nitrogen (this J., 1911, 683 ; 1912, 70) is not oxidisable by ozone under the conditions of his experiments. The paper is illustrated by photographs of spectra.—F. Sodn.

U.S. bauxite and aluminium in 1913. W. C. Phalen. U.S. Geol. Survey, Sept., 1914. [T.R.]

The production of bauxite in the United States in 1913 was 210,241 long tons, valued at \$997,698, an increase of 31·5% in quantity over that of 1912 and of 29·8% in value. Arkansas led, and the production of Tennessee showed an increase. The falling off in Alabama was considerable. During the year the demand for aluminium has shown a steady growth, and although the statistics of production are not complete, it is known that 72,379,000 lb. were consumed in 1913 in the United States.

Heavy chemicals. Board of Trade Bulletin.

A Bulletin (No. 67) on heavy chemicals has been issued by the Board of Trade ; it covers the following products :—Aluminous sulphates (including alums) : arsenic and its oxides and compounds : bleaching materials : coal products, not dyes ; copper sulphate ; potassium and sodium cyanides ; soda compounds ; sulphuric acid.

Inquiries should be addressed to the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, London, E.C.

Patents.

Acetic acid ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a Main, Germany. Eng. Pat. 10,377, April 27, 1914. Under Int. Conv., April 26, 1913.

Acetaldehyde, mixed with about 1% of its weight of a catalyst, especially ceric oxide, is treated with oxygen under a pressure of about 2 atmospheres, or with air at a somewhat higher pressure, for 5 hours, cooling being resorted to after the temperature rises spontaneously to 50°—60° C. ; 95% of the theoretical amount of glacial acetic acid is thereby produced.—O. R.

Acetic acid ; Process of producing ——. E. H. French, Dayton, and J. R. Withrow, Columbus, Ohio. U.S. Pat. 1,104,978, July 28, 1914 ; date of appl., July 9, 1909.

Crude acetic acid is subjected to electrolysis in conjunction with a salt to remove pyroligneous substances and foreign volatile acids ; the electrolysis is regulated so that no material decomposition of acetic acid takes place.—O. R.

Nitrogen ; Process for fixing —— *by means of ferro-aluminium.* Soc. Générale des Nitrures, Paris. Eng. Pat. 27,971. Dec. 4, 1913. Under Int. Conv., Nov. 19, 1913. Addition to Eng. Pat. 27,030, June 7, 1913 (this J., 1914, 549).

In carrying out the process described in the principal patent, it may suffice to start the reaction at one or more points, and allow the reaction to be propagated throughout the whole mass by the heat so evolved. The ferro-aluminium may be used in the form of powder, agglomerates, or packets wrapped in paper, and may contain a small percentage of activating agents, especially aluminium fluoride or carbide.—O. R.

Magnesium perborate ; Manufacture of ——. Henkel und Co., Düsseldorf, Germany. Eng. Pat. 3388, Feb. 9, 1914. Under Int. Conv., Feb. 19, 1913.

One molecular proportion of crystallised magnesium sulphate and two mol. proportions of sodium perborate ($NaBO_3,4H_2O$) are melted together at 65°—70° C., kept at that temperature for some time with stirring, cooled, and the solidified mass pulverised.—O. R.

Sulphur dioxide ; Apparatus for making ——. J. G. Jones, Carthage, N.Y. U.S. Pat. 1,097,177, May 19, 1914 ; date of appl., Sept. 25, 1911.

A rotary kiln for burning pyrites, mounted at a slight inclination, is provided near its exit with a sulphur-burner, to furnish heat for starting the decomposition of the ore, the vaporised sulphur passing through a central tubular duct between which and the inner circumference of the kiln are radial partitions ; the partitions and duct terminate in a small chamber, which forms part of the burning zone. Between this chamber and the inlet of the kiln is a second series of radial partitions. A screw conveyor at the inlet end feeds the ore forward into the kiln. At the exit of the kiln is a discharge hood having a closed end with peep holes, and a door, which automatically opens and shuts as the kiln rotates, thereby discharging the spent pyrites.—O. R.

Salt ; Process of making ——. C. L. Weil, Assignor to Diamond Crystal Salt Co., St. Clair, Mich. U.S. Pat. 1,105,387, July 28, 1914 ; date of appl., May 31, 1911.

Brine is superheated in stages, and is passed from below upwards through pressure-releasing devices at different levels, the vapours escaping when the pressure is released, serving to heat the brine in the earlier stages of the process. The mother liquors mixed with fresh brine are thus heated to 260° F. (126·6° C.) and then cooled to 245° F. (118° C.), the impurities deposited at each of these temperatures are removed, and the brine is admitted to the evaporating pans at 226° F. (108° C.) and at atmospheric pressure, to deposit salt in granular form.—O. R.

(a) *Titanic oxide concentrate and method for producing the same.* (b and c) *Methods for concentrating titanic oxide from substances containing it and iron oxide.* (d and e) *Methods of obtaining titanic oxide.* A. J. Rossi and L. E. Barton, Niagara Falls, N.Y., Assignors to The Titanium Alloy Manufacturing Co., New York. U.S. Pats. 1,106,406—1,106,410, Aug. 11, 1914 ; dates of appl., (a, b and c) Nov. 29, 1912, (d and e) Feb. 6, 1913.

(a) Ore containing TiO_2 and iron oxide is smelted with caustic alkali (*e.g.*, sodium hydroxide), in presence of a reducing agent, the melt—containing alkali titanate and metallic iron—is lixiviated with hot water, and the undissolved residue treated with sulphuric acid to dissolve the titanium compounds, which are then precipitated (preferably by boiling the solution with nitric acid) and calcined. (B) After smelting as above, in the presence of a reducing agent (carbon, for example), withdrawing iron from the melt, and lixiviating with water, the insoluble portion is treated with an iron-solvent acid, such as sulphuric acid, so diluted as to dissolve the compounds present other than titanic oxide. (C) The ore is melted with caustic alkali, the melt lixiviated with hot water, and the undissolved portion treated with acid, diluted so as to dissolve iron rather than titanium compounds, the residue being ignited. (D) The ore is fused with alkali sulphide (*e.g.*, sodium sulphide) and the melt treated as in C, the residue insoluble in water being boiled with the dilute acid. (E) Carbon and an alkali sulphate are substituted for the alkali sulphide in D.—F. Sodn.

Barium hydrate [hydroxide]; Process of making ——. S. B. Newberry and H. N. Barrett, Baybridge, Ohio. U.S. Pat. 1,106,578, Aug. 11, 1914; date of appl., April 19, 1912.

Barium sulphate is mixed with an infusible insoluble material and the finely divided mixture (90% of which should be capable of passing through a 100-mesh screen) heated, in an agitated condition, to not below 2700° F. (1482° C.), or until substantially all the sulphate is converted into oxide. Barium hydroxide is obtained from the calcined product by treatment with water.—F. Sodn.

Argon and rare atmospheric gases; Method of obtaining ——. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co., Providence, R.I. U.S. Pat. 1,106,921, Aug. 11, 1914; date of appl., Dec. 15, 1913.

Atmospheric nitrogen, substantially free from oxygen, is passed at from 500°—1150° C. through a heated mass presenting an extended surface of catalytic material intimately associated with carbon and free alkali metal (or other element capable of acting as the base of a stable cyanogen compound), with which the nitrogen combines. —F. Sodn.

Potassium compounds from silicious minerals; Process of extracting ——. T. B. Stillman, Hoboken, N.J. U.S. Pat. 1,106,984, Aug. 11, 1914; date of appl., March 29, 1913.

The finely divided mineral is fused with potassium carbonate, to convert the silica into potassium silicate, the ground product treated with cold water to dissolve the potassium aluminate and potassium oxide, and ammonia and an ammonium salt added to the solution to precipitate the aluminium as hydrated oxide, which is separated from the liquor. The solution is then treated with carbon dioxide to convert potassium hydroxide into carbonate, and evaporated. The residue insoluble in cold water is also treated for the recovery of potassium. —F. Sodn.

Nitrogen and carbonic acid; Process for obtaining ——. Nitrogen Ges. m. b. H. Fr. Pat. 468,349, Feb. 12, 1914.

In the preparation of nitrogen and carbon dioxide by passing air or gaseous products of combustion over a heated mixture of copper and copper oxide, this mixture is incorporated with aluminium hydroxide, silicic acid, or calcium oxide, to allow of the reaction being carried out at a much lower temperature and thus prevent sintering. —F. Sodn.

Ammoniacal liquor; Process for the complete extraction of industrial chemical products contained in crude ——. L. C. Bonneau and V. E. Hasenfratz. Fr. Pat. 468,535, April 26, 1913.

The liquor is distilled and sulphur extracted from the residue by a volatile solvent (preferably trichloroethylene, in the apparatus described in Fr. Pat. 457,905 of 1913; this J., 1913, 999), the residue is first exhausted with water to which the ammoniacal distillate from the first operation is added, the resulting solution of ammonium salts being distilled with lime, and then treated with lime and water, whereby Prussian blue is converted into soluble calcium ferrocyanide: potassium chloride is added to the ferrocyanide solution to precipitate the double ferrocyanide of calcium and potassium, and this is converted by sodium carbonate into potassium sodium ferrocyanide which is treated with a ferric salt to obtain pure Prussian blue. —F. Sodn.

Calcium cyanamide; Processes and furnace installation for the manufacture of ——. J. H. Lidholm and Dettifoss Power Co., Ltd. Fr. Pats. (A) 469,045 and (B) 469,046, Feb. 12, 1914. Under Int. Conv., Feb. 18, 1913.

(A) Nitrogen, under pressure, is brought into contact with heated calcium carbide, to which is added an inert heat-absorbing substance, such as sand, to prevent fusion or sintering of the material. (B) Finely divided calcium carbide and nitrogen are brought together at a temperature at which reaction is instantaneous, sintering of the material being avoided by preventing the grains from coming together until sufficiently cooled. In the apparatus described the powdered carbide falls through a sieve into a chamber heated electrically by resistance, and the product is suddenly chilled below its dissociation temperature by passing into a zone surrounded by a cooling device.—F. Sodn.

Iodine; Apparatus for the sublimation of ——. L. Le Gloahec. Fr. Pat. 469,118, Feb. 28, 1914.

The iodine is heated in a vessel having a double bottom into which steam is admitted tangentially.—F. Sodn.

Calcium cyanamide; Process of producing ——. Dettifos Power Co., Ltd., and J. H. Lidholm, London. Eng Pat. 3547, Feb. 11, 1914. Under Int. Conv., Feb. 18 1913.

See Fr. Pat. 469,046 of 1914; preceding.—T. F. B.

[Zinc] Sulphate liquors; Process for the electrolysis an treatment of ——. E. J. Hunt, Oldbury, and W. T Gidden, Warley, Assignors to Chance and Hunt, Ltd. Oldbury. U.S. Pat. 1,107,309, Aug. 18, 1914. Date o appl., March 21, 1914.

See Eng. Pat. 11,634 of 1913; this J., 1914, 692.—T. F. B

Hydrogen peroxide; Manufacture of ——. H. Henk and W. Weber, Assignors to Henkel und Co., Dusseldor Germany. U.S. Pat. 1,108,752, Aug. 25, 1914, Dat of appl., June 16, 1913.

See Eng. Pat. 8890 of 1913; this J., 1913, 791.—T. F. B

Perborates; Process for making ——. Henkel und C Fr. Pat. 468,293, Feb. 10, 1914. Under Int. Conv Feb. 19, 1913.

See Eng. Pat. 3388 of 1914; preceding.—T. F. B.

Hydrogen; Generation of —— *by means of iron.* Messerschmitt, Stolberg, Germany. U.S. Pat. 1,109,44 Sept. 1, 1914. Date of appl., June 26, 1912.

See Eng. Pat. 12,117 of 1912; this J., 1912, 1079.—T. F.

Hydrogen; Manufacture of ——. A. Messerschmit Stolberg, Germany. U.S. Pat. 1,109,448, Sept. 1, 1914 date of appl., March 14, 1913.

See Fr. Pat. 461,480 of 1913; this J., 1914, 201.—T. F.

Recovering as an ammonium salt the nitrogen of the hydr cyanic acid in crude coal gas. Eng. Pat. 29,047. *See* II

Patent Case.

Compounds containing unstable oxygen (hydrogen peroxide, etc.): Process for increasing the keeping qualities of ——. L. Sarason, Berlin. Eng. Pat. 23,676 of 1908 (this J., 1910, 152). Sarason v. Frenay. Repts. of Patent Cases, Vol. XXXI., 111. Official J. Patents., June 17, 1914, 252, and Aug. 12, 1914, 330. By permission.

This was an action for infringement. The patentee claimed the use of alkali pyrophosphate for increasing the keeping qualities of hydrogen peroxide, and inserted in his contracts a condition that all licensees should purchase from him all the pyrophosphates which they used in their hydrogen peroxide baths. The defendant contended that this condition was null and void and relied on the Patents and Designs Act, Section 38 (4).

The court held that pyrophosphate was not protected by the patent and that the condition inserted in the contract was unlawful. The decision was in favour of the defendant on both points.

VIII.—GLASS; CERAMICS.

Refractory clays: Effect of graphite on ——. F. Schreiber. Brick and Clay Record 1913. Silikat-Zeits., 1914, 2, 60.

A brick from a coke-oven which had cracked owing to the formation therein of free carbon contained :—

	Outer layer, clay. 45 mm. thick.	Middle dark layer. 22 mm. thick.	Inner, un-attacked layer. 12 mm. thick.
SiO_2	83·77	80·00	83·35
Al_2O_3	12·69	11·08	12·73
Fe_2O_3	1·16	0·67	1·15
CaO	0·24	0·23	0·23
MgO	0·42	0·29	0·32
K_2O	1·56	1·58	2·01
C	0·26	6·15	0·21
	100·10	100·00	100·00

Silica bricks may be destroyed in a similar manner. —W. C. H.

Clays: The rational analysis of ——. J. Burian and J. Juránek. Chemické listy 1912, [1—5.]. Silikat-Zeits., 1914, 2, 12—13.

Experiments were made on the effect of concentration and of the time of digestion at the boiling point with sulphuric acid on the decomposition of the clay substance; the effect of sulphuric acid at different concentrations on felspars and mica; the effect of lyes on felspars; the effect of hydrochloric acid on the clay substance and felspars; and the oxidation of organic substances in clays by chromic acid. The following improved process was devised: 3 grms. of clay, dried at 120° C. are heated in a covered porcelain dish for 6 to 8 hours with 25 c.c. of concentrated sulphuric acid, till white fumes appear. When cool, the liquid is diluted with hot water and decanted three times, the decanted liquid being collected in a 2 litre cylinder. The residue is boiled for 5 mins. with 25 c.c. of a mixture of equal parts of 5% NaOH and 5% Na_2CO_3 solution, then diluted with water, the residue washed twice by decantation, and boiled for 5 mins. with 10 c.c. of concentrated hydrochloric acid. The treatments with alkali and acid are repeated, the decanted liquid being united with that collected previously, and the residue then washed on a filter with dilute hydrochloric acid. The combined decanted liquids are allowed to stand 12 hours, the clear portion siphoned off, and the residue twice boiled for 5 mins. with alkali and acid, and brought on to the same filter. After igniting and weighing, the residue is decomposed with hydrofluoric and sulphuric acids, and the quantity of felspar in it calculated from the alumina. Any considerable quantity of organic matter can be removed by gradually heating the clay in the presence of dilute sulphuric acid (1 : 2) and adding chromium trioxide. The oxidation is completed in 5 mins., and after the clay has settled the green liquid is decanted, the residue washed with hot water, and the rational analysis carried out as above.—W. C. H.

Stoneware bodies; The casting of ——. H. Stein. Keram. Rundschau, 1913, 501. Silikat-Zeits., 1914, 2, 41—42.

To obtain a good casting body, 1 litre of the slip should weigh 1809—1813 grms., and difficulties arise when these limits are departed from even to a small extent. If the slip is only a little lighter, the piece splits in the mould; if heavier, the slip does not pour easily, and sound pieces taken from the mould split as soon as drying begins. This applies equally to stoneware bodies with a very large or very small content of non-plastic materials. An increase or decrease of the alkali added does not alter the behaviour of the mass on casting.—W. C. H.

Stoneware; Casting-flaws in ——. C. Tostmann. Keram. Rundschau, 1913, 535. Silikat-Zeits., 1914, 2, 19—20.

Casting-flaws appear as dark-coloured patches which do not take the glaze. They may be avoided by smearing the parts of the mould which are struck by the casting slip and by smoothing the surface of the white hard sherd. It should be possible to prevent their formation by pouring the slip on to a brass plate hung in the mould, but generally the slip is directed on to a place where the flaws are not objectionable. The flaws are probably caused by the splashing of the casting slip; the non-plastic material is thrown off, but the plastic clay adheres to the mould and forms a thin skin at the casting inlet.—W. C. H.

Stoneware; Casting-flaws in ——. H. Stein and C. Tostmann. Keram. Rundschau, 1914, 11. Silikat-Zeits., 1914, 2, 42.

According to Stein flaws may occur even when the stream of slip is carried to the bottom of the moulds through a funnel in such a way that splashing is prevented (see preceding abstract). The prevention of flaws in many bodies by the addition of water-glass is attributed by Tostmann to the separation of gelatinous silicic acid, which envelopes the non-plastic components, and prevents their being thrown back on striking the mould.—W. C. H.

Patents.

Alumina; Method of bonding fused crystalline ——. *Refractory article and method of manufacturing the same.* T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pats. (A) 1,107,011 and (B) 1,107,012, Aug. 11, 1914; dates of appl., March 11 and Nov. 13, 1913.

(A). The alumina is mixed with a glycerin solution of boric acid or other acid, the radical of which is capable of combining with alumina, then moulded and heated to 1300° C. or higher. (B). Crystalline alumina is mixed with aluminium hydroxide, with or without addition of glyceroboric acid, then formed into the desired shape, and heated to a temperature (at least 1200° C.) sufficient to set the amorphous alumina.—A. S.

Furnaces for melting or smelting glass, metal, and ores: Liquid fuel ——. R., G., and K. H. Siegwart, Lucerne, Switzerland. Eng. Pat. 19,670, Aug. 30, 1913. Under Int. Conv., Feb. 17, 1913.

See Fr. Pat. 462,684 of 1913; this J., 1914, 342.—T. F. B.

Quartz bodies; Method of producing hollow ——. A. Voelker, Beuel, Germany. U.S. Pat. 1,107,386, Aug. 18, 1914. Date of appl., Aug. 13, 1909.

See Eng. Pat. 18,713 of 1909; this J., 1910, 89.—T. F. B.

Quartz: Method of producing transparent ——. A. Voelker, Beuel, Germany. U.S. Pat. 1,107,387, Aug. 18, 1914. Date of appl., Feb. 18, 1911.

See Fr. Pat. 421,526 of 1910; this J., 1911, 424.—T. F. B.

Brick kilns. W. Drayton, Shawnee, Ohio, U.S.A. Eng. Pat. 21,289, Sept. 20, 1913.

See U.S. Pat. 1,075,904 of 1913; this J., 1913, 1055.—T. F. B.

Enamel; Process of producing an opaquing agent for white ——. I. Kreidl, Vienna. Reissue No. 13,791, Aug. 25, 1914, of U.S. Pat. 1,024,405, April 23, 1912. Date of appl., Oct. 29, 1912.

See Fr. Pat. 429,665 of 1911; this J., 1911, 1213.—T. F. B.

[Kiln.] Art of treating vegetable and mineral matter by heat. U.S. Pat. 1,105,729. *See* I.

Treatment of plastic materials [clay, soap, etc.]. Fr. Pat. 468,002. *See* I.

IX.—BUILDING MATERIALS.

[Portland cement.] Synthetic celite and large crystals of tricalcium silicate. E. D. Campbell. J. Ind. Eng. Chem., 1914, **6**, 706—710.

Finely-ground mixtures of washed kaolin, pure alumina, and pure calcium carbonate in proportions corresponding to the composition of celites recovered from cement clinker (this J., 1914, 25) were fused in a large platinum crucible, the furnace being heated to over 1150° C. during one night, and for 2—3 hours at 1585°—1590° C. on the following morning, then the temperature lowered to about 1415° C. during 4—6 hours, the burner removed, and the furnace closed and allowed to cool slowly: in some cases the furnace was closed and allowed to cool slowly from the highest temperature attained. The hard vitreous products contained well-defined crystals; they possessed hydraulic properties and in some cases test-pats gave perfect boiling tests. To isolate the crystals, pieces of the product were heated to 1590° C. in a magnesia dish supported on discs of magnesia: the fusible solvent (celite) was absorbed by the magnesia. The crystals (alite) thus obtained, some of which were nearly 7 mm. long, consisted mainly of $3CaO_2,SiO_2$ and analysis of the magnesia discs showed that the absorbed celite was mainly $5CaO,3Al_2O_3$ (see Shepherd and others, this J., 1911, 543). The view put forward previously (this J., 1914, 25) as to the constitution of celite is thus confirmed, and the aluminate is shown to be $5CaO,3Al_2O_3$. Based on the results, the general formula $x(3CaO,SiO_2)+y(5CaO,3Al_2O_3)$ is suggested for Portland cement. This formula, which requires a quantity of CaO equal to $2{\cdot}8SiO_2+0{\cdot}9Al_2O_3$, conforms more closely than those of Le Chatelier and Newberry (this J., 1897, 887) with the results obtained in the best practice.—A. S.

Portland cement, iron-Portland cement and blast-furnace slag; The hydration of ——. F. Blumenthal. Dissert., Jena, 1912, 1—46. Silikat-Zeits., 1914, **2**, 43—44.

Compounds formed by hydration in Portland cement can be identified by colour reactions. A solution of Anthrapurpurin in lime water gives a superficial red colour with lime and its compounds, when alumina is not present, and also colours alumina brownish-red. Alumina and its compounds, when freshly produced by hydrolysis, are coloured blue by Patent Blue, whilst ignited alumina, clay or alumina in acid solution are not coloured. Free silicic acid can be detected by a neutral solution and combined silicic acid by an acetic acid solution of Methylene Blue. The quantitative composition of the hydration products was adduced by comparison with artificially prepared melts. Experiments with calcium ferrites and ferrous silicates showed that the chief hydration products in Portland and iron-Portland cement are small hexagonal plates of tricalcium aluminate, fine needles of monocalcium silicate, a gelatinous mass of monocalcium silicate and large hexagonal crystals of calcium hydroxide. Iron shares in the hydration, forming ferrous silicates and tricalcium ferrite. The effect of water is not merely to hydrate compounds already present, but to produce new compounds from the individual components which occur in the uncombined condition in the clinker. Crystals of calcium silicate and tricalcium aluminate are first formed by hydration, and afterwards, a gelatinous mass of calcium silicate separates. The setting of cement is chiefly influenced by crystallisation processes. The actual hardening process occurs when these are complete and results in the binding together of the individual crystals and undecomposed grains of clinker and the filling of the pore spaces. Crystal and gel formation in cements is only possible when an excess of lime is present.—W. C. H.

Concrete: Tar painting of ——. B. N. Abbott. Eng. Record; through J. Gas Lighting, 1914, **127**, 663.

Asphaltum will not firmly adhere directly to concrete, but if the concrete surface be first painted with coal tar, the asphaltum will adhere so firmly that it cannot be broken away without bringing pieces of concrete with it. The coal tar should be heated in small quantities, just to the boiling-point, and then applied immediately.

Patents.

Slag; Treatment of —— *for the manufacture of bricks.* W. E. Evans, London. From E. R. Sutcliffe, Brussels. Eng. Pats. 18,806, and 7027, Aug. 19, 1913 and March 19, 1914.

The molten slag is granulated by running it into a thick mixture of lime and water, to which ground slag may be added. The mixture is afterwards conveyed to a sump or reservoir for the separation of the heavier particles of slag, the lighter particles passing away with the liquid mixture. The slag, being coated with lime, is in a suitable condition, after drying, for compression into bricks.—B. N

Water and weather proofing agent for porous stone and th like. H. von der Heide, Unna-Königsborn, Germany Eng. Pat. 10,491, April 28, 1914.

A mixture of an ammoniacal or alkaline solution of th hydroxides of Zn, Cu, Pb, Sn, Cr or Al, with a soa solution.—O. R.

Cement structure; Coloured —— *and process of makin same.* H. A. Gardner, Washington, D.C. U.S. Pa 1,106,298, Aug. 4, 1914; date of appl., Oct. 30, 1913.

A pigment, an aqueous solution of a resin soap, and calcareous cement are mixed and allowed to harden.—O. I

Cement or hydraulic lime; Process and apparatus f manufacture of ——. L. P. Basset. Fr. Pat. 466,51 March 4, 1913.

Plaster is decomposed by heating with clay and carbo so that the calcium sulphide formed reacts further wi the sulphate to form sulphur or sulphur dioxide, accordi to the equations: $3CaSO_4+CaS=4CaO+4SO_2$ a $SO_2+2CO=2CO_2+S$. Excess of calcium sulphide then destroyed by oxidation, if desired by an air blast. furnace for the process comprises two zones, with a reduci and oxidising atmosphere respectively, the former bei obtained by means of carbon monoxide or by injecti powdered carbon with the air.—H. H. S.

Lime; Process for obtaining a substance which increases hydraulic properties of ——. Alpine Maschinenfabriksg m. b. H. vorm. Holzhauer'sche Maschinenfabrik G m. b. H. and F. Meyer. Fr. Pat. 466,859, Dec. 27, 19 Under Int. Conv., Feb. 8, 1913.

A mixture of clay and limestone, dolomite, marl or the li containing 25—50% $CaCO_3$, together with a flux, *e.g.*, of calcium chloride, is heated to 800° C. The product w finely ground has only weak hydraulic properties but markedly increases the hydraulic properties of lime. A mixture of 25 parts of it with 75 parts each of lime and sand is recommended.—A. S.

Cement; Process for the manufacture of white ——. A. Helbronner. Fr. Pat. 468,527, April 25, 1913.

A white cement is produced from ferruginous raw materials by adding calcium chloride to them and then passing steam over the mass, raised to a high temperature. The process is facilitated by adding carbon or some other reactive substance to the raw materials, and in this case hydrochloric acid may be collected as a by-product. By heating alkali-felspars in the presence of carbon and calcium chloride, and passing steam over the mass, raised to a high temperature, calcium silico-aluminates of the same type as cement, and sodium and potassium compounds, which can be advantageously extracted, are produced. —W. C. H.

Concrete and mortar; Manufacture of impermeable and elastic —— requiring no expansion joints. R. Houben. Fr. Pat. 466,878, Dec. 31, 1913. Under Int. Conv., Nov. 19, 1913.

An elastic and noiseless concrete consists of 125 parts of cement, 200 of sand, 400 of small stones and 60 of an elastic material composed of: wood shavings or cotton waste 100, cork 100, oil 25, and bitumen 5 parts.—H. H. S.

Cement and materials similar to mortar; Process for the manufacture of ——. A. Anker. Fr. Pat. 469,149, March 2, 1914.

Before the final grinding the burnt clinker is brought into contact with steam, or with air charged with aqueous vapour, in order to slake the free lime, and to break the clinker into fragments. After the treatment with steam, the slaked lime can be separated by bolting before the final grinding.—W. C. H.

Retarder for plaster. Process of making a retarder for plaster and the like from lime wastage. C. H. Campbell, Chicago, Ill., Assignor to American Glue Co., Boston, Mass. U.S. Pats. (A) 1,106,777 and (B) 1,106,778, Aug. 11, 1914; dates of appl., May 12 and Oct. 18, 1910.

(A). The retarder is composed of lime wastage from the liming of hides, practically free from inert, insoluble animal matter and substances having objectionable odours, but containing a soluble albuminate, *e.g.*, "dissolved hair" (see U.S. Pat. 1,106,779; page 975). (B). The retarder is prepared by digesting lime wastage from the liming of hides with a suitable alkaline solution until the insoluble animal matter has been converted into soluble substances, and drying the resulting product.—A. S.

Mortar for construction or other works; Manufacture of an isolating material or ——. R. Varret and J. Ostrowski. Fr. Pat. 466,867, March 15, 1913.

A mixture, in variable proportions, of sodium palmitate, silica and sodium borate, is added to mortar or one of its components before or during gauging.—H. H. S.

Artificial stone and the like; Manufacture of —— from peat. W. Weiler. Fr. Pat. 467,337, Jan. 15, 1914. Under Int. Conv., Jan. 16, 1913.

The peat is gathered during the autumn and winter and stacked in the open air so that the water present therein becomes frozen. Ultimately it is dried, reduced to pulp, and compressed into blocks, with or without the addition of cement or other binding agent.—A. S.

Fireproof and heat-resisting material; Preparation of a ——. L. Esselborn. Fr. Pat. 467,393, Jan. 17, 1914.

A porous refractory material such as pumice stone is impregnated with milk of lime, and the particles are then enveloped in a protecting material such as a mixture of clay, sand, cement and trass.—H. H. S.

Heat-insulating materials and process for the manufacture of the same. Armstrong Cork Co. Fr. Pat. 468,938, Feb. 25, 1914.

A mixture of 60 to 80% of calcium fluoride and 12 to 25% of slaked lime with sufficient water to make a liquid paste is poured into moulds. The latter are shaken to facilitate the escape of air bubbles and to render the mass homogeneous and then dried and hardened without pressure. The moulds are coated inside with a mixture of water and magnesia to facilitate the removal of the blocks. —W. H. C.

Wood; Impregnation of coloured or soft —— at a high temperature without destroying the wood. L. Petersen-Hviid. Fr. Pat. 466,768, Dec. 30, 1913. Under Int. Conv., Dec. 30, 1912.

The acid compounds formed in wood at high temperatures are neutralised by ammonia, which is partly introduced into the wood before heating, and partly into the receiver continuously during heating. Ammonium salts thus formed in the wood are expelled by heat into the receiver, where they are decomposed by the introduction at intervals of soda lye or other non-volatile alkali, the process being thus regenerative.—H. H. S.

Woods; Process of hardening and preserving —— with a view to increasing their resistance and life. Comp. Française d'Injection pour la Conservation des Bois et des Tissus. Fr. Pat. 467,926, Jan. 24, 1914.

A hardening and preservative material, such as naphthalene, which is solid at ordinary temperatures is melted and the wood immediately impregnated with it. The process is specially applicable to paving blocks, sleepers, etc. By solidifying in the wood, the naphthalene equalises and increases the resistance and renders the wood uniformly hard.—W. C. H.

Wood; Process for impregnating —— and an apparatus for carrying out the process. Hulsberg und Co., m. b. H. Fr. Pat. 468,351, Feb. 12, 1914. Under Int. Conv., Oct. 24, 1913.

In order that wood may absorb an impregnating liquid better, it is perforated by means of needles. The needles are guided between plates provided with grooves, and are forced into or withdrawn from the wood by punches which are likewise guided between the plates. The lower ends of the punches are slotted in such a manner that they will hold and retain the needles during both the upward and downward movements.—W. C. H.

Cement or hydraulic lime; Process and apparatus for the manufacture of ——, *with the simultaneous production of sulphurous anhydride or of sulphur.* L. P. Basset, Montmorency, France. Eng. Pat. 17,873, Aug. 5, 1913. Under Int. Conv., March 4, 1913.

See Fr. Pat. 466,518 of 1913; preceding.—T. F. B.

Concrete; Manufacture of ——. R. Houben, Brussels. Eng. Pat. 4349, Feb. 19, 1914. Under Int. Conv., Nov. 19, 1913.

See Fr. Pat. 466,878 of 1914; preceding.—T. F. B.

Volcanic and other fusible rock; Manufacture of industrial objects from ——. F. Ribbe, Mauriac, France. U.S. Pat. 1,108,007, Aug. 18, 1914. Date of appl., July 13, 1911.

See Fr. Pat. 418,624 of 1910; this J., 1911, 88.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast-iron pipe; External corrosion of ——. M. R. Pugh. Proc. Amer. Soc. Civil Eng., 1914, 40, 1641—1691.

Examples are given from France, England and the United States of the great durability of cast-iron piping and also of piping which deteriorated rapidly in 7—20 years, when laid in saline soils or in sea-water. The causes conducing to and inhibiting corrosion are discussed, and details of typical cases of corrosion are given with photographs and analyses. The remedies recommended are: increasing the natural resistance of the skin of the cast-iron, surrounding the piping with lime or cement, laying the piping in open trench or above ground, and galvanising the pipes. —J. H. J.

Iron and steel; Determination of carbon in —— by direct combustion in oxygen. J. R. Cain and H. E. Cleaves. J. Wash. Acad. Sci., 1914, **4**, 393—397. (See also this J., 1914, 696.)

To oxidise carbides of chromium, titanium or tungsten, in determining carbon by direct combustion, the tube should be heated at 1500° C. for 30 mins. after the metal has ceased to burn; slightly higher results are obtained in some cases than by the usual method.—W. R. S.

Steel; Titanium nitride in ——. G. F. Comstock. Met. and Chem. Eng., 1914, **12**, 577—580.

VARIOUS titanium compounds were incorporated with iron and steel in the presence or absence of alumina. The minute, hard, pink, non-metallic spots or inclusions, visible (under a magnification of at least 200 diameters) in rail steel which has been treated with ferro-carbon-titanium, appear to consist mainly, if not entirely, of titanium nitride; alumina is not necessary for their formation. —W. F. F. P.

Copper; The effects of repeated re-melting on ——. F. O. Clements. Amer. Inst. of Metals, Chicago, Sept. 7—11, 1914. [Advance proof.]

100 lb. of copper was melted and cast 4 times in succession under foundry conditions, and after the fourth casting, 16 lb. of the metal was melted with 2 oz. of boron suboxide and again cast. Samples from each casting were tested in a modified form of the Upton and Lewis machine, in which alternate bends were produced in a test-piece 1 in. wide and of a given thickness, and a graphic record made of the number of bends required, and the resistance offered, before fracture. The results obtained, together with those given by a sample of boronised copper melted and cast *in vacuo*, were :—

	Temperature of melting or casting ° C.		Average number of alternate bends.	Resistance offered to bend.	Percentage diminution in resistance, in 10-in. lengths measured on the machine diagram.
	Melting.	Casting.			
					%
Original metal	—	—	1515	100 (assumed)	2·7
After 1st heat	—	1120	850	97	5·5
After 2nd heat	—	1120	845	96	4·9
After 3rd heat	1165	—	762	96	8·5
After 4th heat	—	1115	334	96	22·6
After treatment with boron suboxide	1260	1149	2007	103	2·7
Boronised copper melted and cast *in vacuo*	—	—	3044	117·5	0·74

—W. E. F. P.

Silver and base metal in precious metal bullion; Determination of ——. F. P. Dewey. J. Ind. Eng. Chem., 1914, **6**, 650—658, 728—736.

THE results of a large number of bullion assays, some from the regular working of the Mint service of the U.S. Treasury, and some from special experiments, are tabulated and discussed. There are no effective means of controlling the two chief sources of error in the determination of base metals by cupellation, viz., absorption of gold and silver by the cupel and retention of base metal by the precious metals, and proof corrections may be fallacious, as the proofs are subject to the same uncontrollable errors. Recently a method for the direct determination of silver by fusing the bullion with cadmium in presence of potassium cyanide, dissolving the button in nitric acid, and titrating with ammonium thiocyanate (compare Whitehead, this J., 1892, 458), has been extensively tried in the U.S. Mint service, and, on the whole, the results compared favourably with those obtained by cupellation.—A. S.

[Copper.] Arsine (AsH_3) formation in electrolytic refining. F. R. Pyne. Eng. and Min. J., 1914, **98**, 432.

IN the electrolytic refining of copper, undesirable concentration of arsenious acid in the electrolyte is prevented by periodically electrolysing a portion of the latter with insoluble (lead) anodes and returning the purified solution to the bulk. Arsenious acid is reduced by nascent hydrogen, and, in the absence of sufficient copper in solution to form an insoluble arsenide, the AsH_3 produced is evolved. —W. E. F. P.

Copper; The crystalline structure of ——. W. L. Bragg. Phil. Mag., 1914, **28**, 355—360.

A NATURAL crystal of copper was examined by means of the X-ray spectrometer (Proc. Roy. Soc., 1913, **A88**, 428; 1914, **A89**, 468). The copper atoms are arranged on a face-centred cubic "lattice," the crystal structure being the simplest of any yet analysed.—F. SODDY.

Brass; Use of producer gas for melting yellow ——. E. B. Guenther. Amer. Inst. Metals, Sept. 7—11, 1914. [Advance proof.]

FOUR producer-gas furnaces with separate preheaters were tested against four ordinary coke furnaces. The chief advantages found with producer-gas furnaces were: cleanliness, easy control and evenness of temperature, with consequent saving in repairs to furnace linings and in crucibles, less loss by oxidation, and greater ease in recovering spilt metal. Detailed calculations showed a considerable saving in cost.—O. E. M.

Brass-melting furnaces; Tests of natural-gas fired ——. F. L. Wolf and R. B. Burr. Amer. Inst. Metals, Sept. 7—11, 1914. [Advance proof.]

THREE types of non-tilting crucible furnace were tested under factory conditions. The first, with chamber burner and air preheater, was efficient with high pressures an continual repair of the burner, but its radiation losse and injurious gas leakage were high. The second, wit air-preheater and rising body to give access to the crucibl was efficient with 2 lb. pressure of air, but this was offse by the cost of repairs, mechanical defects, and difficult of manipulation. The third, a converted pit furnac when large enough to take a thick lining, and equipp with preheating coils, and a simple tube burner, whic allowed the use of low pressures of gas and air, was a efficient as the more complicated types, cost little fc maintenance and was convenient to work.—O. E. M.

Brass furnaces; Melting losses in electric ——. H. W. Gillett and J. M. Lohr. Amer. Inst. of Metals, Sept. 7—11, 1914. [Advance proof.]

Various kinds of closed electric furnaces, in which local overheating is avoided, such as the resister and crucible type, gave very low metal losses and a decided advantage over furnaces fired with fuel. Electric arc furnaces showed greater losses, due apparently to the high temperature of the arc producing local overheating. To prevent oxidation a reducing atmosphere should be maintained, and with resistance furnaces this may be secured by dropping oil into the furnace. Tilting furnaces gave greater metal losses, due to greater exposure of the metal and volatilisation of the zinc during pouring.—B. N.

Pyrometers for molten brass and bronze. H. W. Gillett. Amer. Inst. of Metals, Sept. 7—11, 1914. [Advance proof.]

A preliminary report of an investigation, by the U.S. Bureau of Mines, to discover or devise a pyrometer suitable for general use in brass foundries. On account of zinc fume, pyrometers of the ordinary radiation and optical types were generally unsatisfactory, or at best of very limited application. By employing a closed-end tube with the former type, the time lag was too high owing to the size of tube required. Satisfactory results for large-scale laboratory work were obtained with the optical type when a sighting tube was used, but the practical utility of this type under general foundry conditions is doubtful. All forms of thermo-couples in which the elements (base metals) were wholly or partly in contact with the molten charge were unsatisfactory, mainly on account of rapid corrosion. A form of protected platinum platinum-rhodium couple was devised in which the wires were insulated at the lower part by Marquardt mass (a porcelain-like material containing SiO_2 35—30 and Al_2O_3 60—65%), and at the upper part by fireclay, tubing, and placed in a sectional nickel tube, 4 ft. long, closed at the lower end by a small molybdenum cap or tip and filled with anhydrous, powdered alumina after the couple was in position. The lower 10 in. of the nickel tube was protected by a loosely-fitting sleeve of "silfrax" (a dense, metal-like form of carborundum) having at the bottom an opening through which the molybdenum tip projected for ⅝ in. This instrument proved very efficient up to 1330° C. under foundry conditions, the time lag being small and apparently decreasing with increasing temperature.—W. E. F. P.

Lead smelting; Use of the bag-house in ——. L. D. Anderson. Min. and Eng. World, 1914, **41**, 239—242.

At the Midvale (Utah) smelter, all the gases from the 6 blast-furnaces, roasting-furnaces, and converters for blast-roasting are filtered in a bag-house. By cutting off the blast and applying a slight suction, the dust is detached and drops through hoppers into wagons. The roaster dust containing 9—16% As is briquetted with fine ore and smelted. The dust from the blast-furnace, which contains 35—45% As, is used for the manufacture of white arsenic; it is very inflammable, especially when containing more than 45% As. When an efficient bag-house is used, most of the loss of lead in lead smelting can be traced directly to the slag.—W. R. S.

Lead matte converting at Tooele (Utah). O. M. Kuchs. Amer. Inst. Min. Eng., Aug. 1914. Eng. and Min. J., 1914, **98**, 379—380.

Lead-copper matte is "converted" in basic-lined vessels without addition of silicious fluxes, the blowing being continued until the lead is practically eliminated. The lead fume is recovered in a bag-house, and contains sufficient zinc oxide to prevent injury to the bags by acid gases; the residual copper product and the highly ferruginous "slag" are treated in ordinary "copper" converters. The percentage compositions of the matte, slag and fume are:—

	Pb.	Cu.	Ag. (oz. per ton.)	SiO_2.	Fe.	S.	Zn
Matte	15·0	9·05	20·3	—	37·0	23·0	5·4
Slag	1·4	—	—	1·7	59·1	1·8	4·0
Fume	64·2	0·37	5·7	0·2	0·4	6·0	10·4

—W. E. F. P.

Tin-wolfram (tungsten) bismuth ores; Treatment of ——. L. Hills. Min. and Eng. Review, July 16, 1914. Eng. and Min. J., 1914, **98**, 486.

Magnetic separation of a concentrate containing Sn 40%, WO_3 22, and Bi 6%, yielded a magnetite concentrate, and a pyrite concentrate, both together containing less than 1% of the three valuable metals; a product assaying WO_3 70%, Sn 0·7%; and a residue: Sn 56·3%, Bi 8%, and WO_3 0·7%.

Die-casting practice; Modern ——. C. Pack. Amer. Inst. Metals, Chicago, Sept. 7—11, 1914. [Advance proof.] (See also this J., 1914, 203.)

The alloys used contain Zn 70—90%, with Sn, Cu, Al, Sb and Pb; Sn 60% (or over), with Pb, Sb, Cu and Zn; and Pb 60% (or over), with Sn and Sb. Aluminium alloys may also be used. A typical zinc alloy contains Zn 84·5, Sn 9·0, Cu 4·5, and Al 2·0%, and has a tensile strength of over 18,000 lb. per sq. in. The castings are extensively used in the motor car industry and may be protected from corrosion by water and by impurities in gasoline, by plating with copper or nickel. The machines used in casting are of two types. In the air machines the metal is usually forced upwards from the closed melting pot into the die by opening a compressed-air valve. Plunger machines are more generally used, in which a horizontal cylinder is immersed in the molten metal and is connected through a nozzle with the die. The metal is forced into the die by a plunger in the cylinder, operated by a lever, and a cutting device is forced through the gate of the die by a second lever. 230 castings can be made per hour, and they are accurate within 0·005 in., or for castings not exceeding 1 in. either way, within 0·0005 in.—A. T. L.

Zinc in alloys; Determination of ——. G. E. F. Lundell and N. K. Bee. Amer. Inst. Metals, Sept. 7—11, 1914. [Advance proof.]

The solution of the alloy, freed from Hg′, Cu, Bi, Cd, As‴, Mn, K_2SO_4, $NH_4C_2H_3O_2$, NH_4CNS, H_2S, oxides of N, and any large quantity of Ni, and containing not more than 10% of acid, is precipitated with a solution containing 39 grms. of KCNS and 27 grms. of $HgCl_2$ per litre. The precipitate, $ZnHg(CNS)_4,H_2O$, is collected on a Gooch filter, dried at 100°—108° C., and weighed, or is dissolved in very dilute nitric acid containing iron alum, and determined volumetrically by Volhard's method. The results agreed with those obtained by the pyrosulphate method.—O. E. M.

Mercury ores; New wet process for the treatment of low-grade ——. G. Carrara. Rend. R. Istit. Lombardo Sci. e Let., 1914, **47**, 117. Annali Chim. Appl., 1914, **2**, 52.

The pulverised ore is concentrated to ⅕—¼ of its weight by levigation, and treated with a solution of sodium hypochlorite obtained by electrolysis of sodium chloride. Mercuric sulphide is oxidised to sulphate and this is converted into chloride by the excess of sodium chloride present. Mercury is precipitated from the solution with sodium sulphide, and after removal of the precipitate, the liquid, which should be free from any excess of sodium sulphide, is electrolysed to obtain sodium hypochlorite for use again.—A. S.

Cobalt; Some recent applications of metallic ——. de C. Browne. Amer. Inst. of Metals, Chicago, Sept. 7—11, 1914. [Advance proof.]

The percentage elongation and reduction of area of manganese bronze and the alloy, Cu 88, Sn 10, Zn 2%, were greatly increased by the addition of 0·5% Co; the tensile strength and elastic limit were considerably reduced in the former, but not seriously affected in the latter case. The tensile strength of "low brass" (Cu 80, Zn 20%) was increased 15 and 20% by the addition of 0·25 and 0·5% Co, respectively. The cobalt was added in the form of an alloy containing Co 10 and Cu 90%. —W. E. F. P.

Eutectics; Growth of metallic ——. F. E. E. Lamplough and J. T. Scott. Roy. Soc. Proc., 1914, A **90**, 600—604.

The formation, around the primary crystals of an alloy, of a halo or envelope of the second constituent, separating the primary crystals from the banded eutectic, has been attributed to undercooling at the first moment of solidification of the eutectic, whilst Desch has suggested that the phenomenon may be due to segregation of the eutectic around the primary crystals during solidification. Temperature-time curves of alloys cooling under different conditions were taken, and the solid alloys were examined micrographically. In some cases considerable undercooling existed without the formation of halos and in others marked halos were accompanied by only slight undercooling. The formation of the halo was not affected when undercooling at the moment of eutectic formation was prevented by inoculation or by shaking. In the case of Cd-Sn alloys the halo was observed only when the primary crystals had become enveloped by the growing eutectic. It was found possible to divide the greater number of eutectics into two classes. Halos were observed only in the case of eutectics of the first class, characterised by spherical radiating growth. Examples are Sn-Pb, Sn-Cd, Zn-Cd, Ag-Cu, Zn-Al and Cu-Cu_3P eutectics. Eutectics of the second class had well-defined crystal contours, showing in section a herring-bone structure. Examples are Bi-Pb, Bi-Sn, Ag_3Sb-Sb, Au-$AuSb_2$, Mg_2Pb-Mg, Mg_2Sn-Mg, ZnSb-Sb, $NaCd_6$-Cd, and $NaSn_2$-Sn eutectics. Some eutectics, *e.g.* Bi-Cd, Cu_2Sb-Sb, and SnAu-Sn, belonged to a third type, of irregular form: in these one constituent crystallised as laminæ and the eutectic growth originated at one of the primaries.—A. S.

Patents.

Iron; Local hardening of —— and malleable iron castings. Vickers Ltd., Sheffield, and C. L. Sumpter, Grindleford Bridge, Derbyshire. Eng. Pat. 18,643, Aug. 16, 1913.

The part of the casting to be treated, is either protected from decarburisation by a coating of "paint," etc., during annealing, or is re-carburised and then heated by means of an intensely hot flame (*e.g.*, oxy-acetylene) while the casting is just covered with water by immersion or otherwise.—W. E. F. P.

[*Iron and steel.*] *Case-hardening process.* A. W. Machlet, Elizabeth, N.J. U.S. Pat. 1,106,573, Aug. 11, 1914; date of appl., Dec. 19. 1911.

The articles are placed in a heat-retaining oven and heated to carburising temperature by the direct action of flames. The flames are then extinguished and a suitable gas introduced into the oven to effect carburisation while the metal is slowly cooling. These operations may be repeated. —A. S.

[*Open-hearth steel*] *Furnace-wall construction.* N. E. Maccallum, Phoenixville, Pa. U.S. Pat. 1,106,725, Aug. 11, 1914; date of appl., May 13, 1913.

The walls of the combustion chamber of an open-hearth steel furnace are composed of a number of iron containers filled with basic material or a mixture of basic and neutral materials.—W. H. C.

[*Iron and steel.*] *Soldering; Process of mixed —— and products obtained thereby.* E. L. Chameroy fils. Fr. Pat. 468,454, Feb. 14, 1914.

Steel, malleable cast iron, or the like is soldered to cast iron by keeping the surfaces in contact at such a temperature that the surface layer of the cast iron yields a portion of its carbon to the surface layer of the other metal, forming an intermediate layer which acts as a solder. The piece of steel or the like may be heated and immersed in the molten cast-iron, or the two metals, in contact, may be heated by an oxy-hydrogen or oxy-acetylene flame. The process is suitable for the production of pistons, tyres, valves, etc., with a core of steel or malleable cast iron and an outer layer of cast iron, of cast-iron cog wheels with steel teeth, paddle-wheels with steel blades, and the like. —A. S.

Tool steel; Manufacture of extra rapid ——. E. Jaboulay. Fr. Pat. 468,796, Feb. 16, 1914.

From 15 to 30% Cr is added to steel, which may also be alloyed with small quantities of other metals (W, Mo, V). Tool steel made in this way and containing, for example: Fe 60·0, Cr 21·0, W 8·5, Mo 8·5, V 0·5, C 1·5%, may be used at nearly double the speed attainable with the special steels hitherto known.—A. S.

Iron alloys; Process of manufacturing ——. G. M. Colvocoresses, New York. U.S. Pats. (a) 1,106,785 and (b) 1,106,786, Aug. 11, 1914; dates of appl., June 12 and 19, 1913.

(a) A sulphide ore containing Ni 0·5—12, Cu 0·2—10, and Fe 25—60%, is crushed, roasted, and smelted with a flux so as to remove the non-metallic elements as silicates and produce a pig of Fe, Ni, Cu and C, which is refined to obtain a steel alloy. (b) A blast- or reverberatory furnace slag containing Fe 20—50, Ni 0·2—2, and Cu 0·1—2%, is smelted with fuel and flux, and the resulting pig is refined at a sufficiently high temperature to obtain a steel alloy containing Cu 0·2—2, Ni 0·4—4, and C up to 1%.—A. S.

Tin ores and slags containing tin; Treatment of ——. Billiton Maatschappij, The Hague, Holland. Eng. Pat. 18,422, Aug. 13, 1913. Under Int. Conv., Sept. 16, 1912.

A mixture of the material with iron pyrites is smelted to produce Sn-Fe matte, the slag obtained being re-smelted with pyrites as often as necessary. The matte is sintered with sodium sulphate and carbon to convert the tin into sulpho-stannate which is subsequently extracted with water.—W. E. F. P.

[*Metallic*] *Coatings or deposits; Process of and apparatu for applying —— to surfaces.* R. K. Morcom, London Eng. Pats. (a) 18,840 and (b) 18,841, Aug. 19, 1913.

(a) A rod of the metal to be deposited is subjected to th action of a powerful blast while heated below its meltin or oxidising point, and the resulting spray projected upo the required surface, which may be preheated or not. Th rod may be fed into a blowpipe flame, or form on electrode of an electric arc against which the blast i directed; and sprays of two or more separate metals ma be caused to impinge simultaneously upon the surface to b covered. (b) For spraying molten metal, etc., upon th interior surfaces of hollow bodies a flexible blowpipe employed, to the nozzle of which a deflecting surface spreader—convex towards the blast—is attached b means of wires. (See also this J., 1914, 925.)—W. E. F.

Ore concentration. G. A. Chapman, Miami, Ariz., U.S. Eng. Pat. 18,937, Aug. 20, 1913. Under Int. Conv May 8, 1913.

In an agitation-froth process, the partly crushed ore ground (*e.g.*, in a Hardinge mill) with water containi "a modifying agent" (cresol), the pulp mixed with frothing agent (turpentine), agitated, and separated usual; the maximum amounts of modifying agent ar frothing agent employed are respectively 0·1 and 0·4 of the weight of ore.—W. E. F. P.

Ore concentrator. J. Weatherby, New Cumberland, P U.S.A. Eng. Pat. 19,302, Aug. 26, 1913. Under I Conv., Jan. 4, 1913.

A shaking-table has riffles of magnetic material dispos within a magnetic field, so that, by contact with the rif edges, slightly paramagnetic ore particles are carried across the channels by the water and thus separated. —W. E. F. P.

Ores; Concentration of ——. Minerals Separation, Ltd. Fr. Pat. 468,136, Feb. 6, 1914.

The process is intended particularly for the treatment of very finely divided ores containing galena and blende, *e.g.*, the slimes produced in crushing Broken Hill ores. The pulp, mixed with a small quantity of a frothing agent, such as eucalyptus oil, is passed into a separator, into which air or other gas is delivered at the bottom. The mixture is vigorously agitated, *e.g.*, by means of a centrifugal pump, in the lower part of the separator, and a relatively tranquil zone is maintained near the top. The first portions of the froth removed from the surface carry most of the galena and the subsequent portions most of the blende. A series of separators is preferably used, in which the different fractions are treated successively. Modifications of the process are also described in which the pulp is treated by agitation and aeration, without acid, but with addition of 0·003% of eucalyptus oil; or the pulp is mixed with a small quantity of oil, without acid, and treated first with a limited quantity of air to float certain constituents and then with a further quantity of oil and a larger volume of air, and also, if necessary, with acid; or the pulp is mixed with an acid, and certain constituents removed by flotation without the use of a frothing agent, the residue being treated by agitation and aeration in presence of a frothing agent to effect selective flotation of other constituents.—A. S.

Ores; Process and apparatus for concentrating —— *by flotation.* J. M. Ormaza. Fr. Pat. 468,395, Feb. 13, 1914.

The ore is crushed in a ball-mill to about 1 mm. size, passed through an inclined, rotary drying chamber, and then to a hopper whence it is delivered between a pair of adjustable rollers on to an inclined table, to which a vibratory motion is imparted. From the table the material flows uniformly into a second hopper from which it falls between another pair of adjustable rollers on to a mass of water carrying an upper stratum of oil and moving at right angles to the path of the ore. A regulated blast of air is directed across the surface of the water at the place where it receives the ore. The particles which float overflow with the water into an adjacent tank, whilst the remainder of the ore sinks, and is discharged as pulp on to a Wilfley table, the inclination of which can be varied. The different sections of the plant are arranged so that the movement of the ore is effected as far as possible by gravity; and it is possible to treat 24 tons of ore per day of 10 hours with an expenditure of 15 horse-power.—A. S.

Tungsten and the like metals; Manufacture of drawn wires from ——. C. Gladitz, London. Eng. Pat. 20,122, Sept. 5, 1913.

The cross-section is reduced by cold drawing by a considerable amount in relatively few stages so as to produce an amorphous structure, and the wire is then heated in an inert atmosphere to effect recrystallisation of the metal. —W. E. F. P.

Cuprous chloride; Process of reducing ——. F. Laist, Anaconda, Mont. U.S. Pat. 1,104,907, July 28, 1914; dato of appl., April 30, 1914.

Cuprous chloride precipitated from chloride leaching solutions is fused with carbonacous matter and an alkaline-earth carbonate, to form copper, and an alkaline-earth chloride, which can be used in subsequent leaching operation.—O. R.

Copper: Process for extracting fractions rich in —— *from cupriferous ores and gangues.* "Azurit" Vegyi Ipar Részvenytársaság. Fr. Pat. 468,839, Feb. 23, 1914. Under Int. Conv., Feb. 27, 1913.

Low-grade copper ores are roasted, if necessary, then finely ground, and treated with a solution of aluminium sulphate or alum, which has a selective action on the copper oxide or basic carbonate present, copper sulphate and aluminium hydroxide being formed. On standing, insoluble basic double compounds of aluminium and copper are formed, and these are converted into aluminium and copper sulphates by treatment with sulphuric acid. The ore may be treated in a filtering chamber with aluminium sulphate, and after this has drained off, the residue treated with sulphuric acid. The two filtrates are mixed and again poured on the residue, which is afterwards treated with a further quantity of sulphuric acid, and these operations repeated until the copper is completely extracted. Ores in which the gangue is composed of felspar or the like, yielding aluminium sulphate on roasting, may be treated with water instead of with a solution of aluminium sulphate. From the final solution containing aluminium and copper sulphates, part of the copper sulphate is recovered by crystallisation, and the mother-liquor, containing the double salt, $CuSO_4,7H_2O+Al_2(SO_4)_3,7H_2O$, is used again in the process.—A. S.

Zinc ores; Process and apparatus for the treatment of ——. J. J. Boguski and Soc. Minière et Industrielle Saturn. First Addition, dated Feb. 6, 1914, to Fr. Pat. 441,098, March 8, 1912 (this J., 1912, 823).

When the ammoniacal zinc solution obtained as described in the chief patent (*loc. cit.*) is heated under diminished pressure to recover the ammonia, the basic zinc carbonate precipitated tends to form a hard mass on the bottom of the receptacle. According to the present patent the ammoniacal zinc solution is added to a large quantity of boiling water or weak ammoniacal liquor and superheated steam is passed through the mixture, whereby the zinc is separated as a coarsely crystalline precipitate consisting mainly of hydroxide.—A. S.

Metal [*zinc*] *vapours; Process for the recovery of* ——. Helfenstein-Elektro-Ofen-Ges. m. b. H. Fr. Pat. 468,445, Feb. 14, 1914. Under Int. Conv., Feb. 18, 1913.

In smelting zinc ores in an electric furnace, the gases and vapours evolved before the distillation of the zinc commences are drawn off separately through the upper portion of the charge, oxidation of the zinc vapour evolved later being thus reduced to a minimum and the zinc largely condensed in the liquid form. Any zinc vapour drawn off with the gases is condensed in the cooler, upper portion of the charge and carried down therewith into the reduction chamber.—A. S.

Vanadium; Extraction of —— *from ores.* H. Boericke, Vanadium, Colo. U.S. Pats. (A) 1,105,244 and (B) 1,105,245, July 28, 1914; dates of appl., Mar. 27, 1912, and Jan. 20, 1914.

The vanadium is converted into sodium vanadate by heating the ore with sodium chloride and (A) a metallic sulphate, such as iron sulphate, or (B) sulphur, or a non-metallic compound of sulphur.—W. R. S.

Alloy of vanadium and precious metals. Vanadium-gold alloy. F. von Oefele, Assignor to H. Schweitzer, New York. U.S. Pats. (A) 1,107,180 and (B) 1,107,181, Aug. 11, 1914; dates of appl., Oct. 11, 1911 and Oct. 22, 1912.

An alloy of (A) gold-vanadium with other metals, (B) vanadium and gold.—A. S.

Lead; Apparatus for refining and desilverising ——. W. Thum, Hammond, Ind. U.S. Pat. 1,106,480, Aug. 11, 1914; date of appl., Dec. 9, 1910.

A melting "kettle" is connected with a series of crystallising "kettles," into which the molten metal is passed successively, being forced from one "kettle" to another by means of a fluid under pressure. At the bottom of the melting "kettle," on opposite sides, are two spouts and the portion of the "setting" over the spouts is composed of removable blocks of refractory material, retained in position by sheet steel sections on their outer sides; the steel sections slide in passages connected with the fixed main portion of the setting to allow of removal of the blocks.—A. S.

Soldering alloy. G. D. Long and E. W. Rapp, Granite City, Ill. U.S. Pat. 1,107,082, Aug. 11, 1914; date of appl., May 15, 1914.

An alloy of Al 400, Zn 400, Sn 700, Bi 8, Cu 8, Sb 28, and Hg not over 2 parts.—A. S.

Aluminium alloy. W. A. McAdams. Fr. Pat. 468,853, Feb. 24, 1914.

See U.S. Pat. 1,104,369 of 1914; this J., 1914, 869. Silver is used in relatively small quantities (up to 20%), and small proportions of copper, zinc, or titanium may also be added.—T. F. B.

Ores; Process of treating ——. N. C. Christensen, jun., and T. P. Holt; Christensen assignor to G. H. Dern, Salt Lake City, Utah. U.S. Pat. 1,107,240, Aug. 11, 1914; date of appl., Aug. 3, 1911.

The finely-divided ore is intimately mixed with 2—6% of finely-divided fuel, and, if desired, also with suitable chemicals, the fuel is ignited and the mixture is roasted by the heat developed by the combustion of the fuel with an air-blast, which is regulated so that the temperature attained is insufficient to fuse or sinter the ore. The useful metals are extracted from the residue by leaching with a solvent.—A. S.

Furnace for the heat treatment of metals. A. Grebel. Fr. Pat. 468,234, April 19, 1913.

The furnace is heated by means of producer gas enriched with the vapour of heavy hydrocarbons, an open vessel in which a constant level of petroleum or coal tar oil is maintained, being disposed in the conduit leading from the gas producer to the burners. The openings through which the heating gas and the preheated air from the recuperator enter the working chamber, and those through which the waste gases leave, are so arranged and regulated that a more intense combustion is attained near the door or doors of the working chamber, in order to compensate for cooling and influx of cold air.—A. S.

Furnace; Semi-continuous —— fired with coke or coal, for reheating, annealing, cementation, or tempering. J. Conor. Fr. Pat. 468,621, April 28, 1913.

Suitable connections are provided so that when the door of the working chamber is opened, a damper in the flue leading from the fire-box to the chimney is automatically closed, thus preventing influx of cold air into the working chamber. In like manner when the door of the fire-box is opened, a damper automatically closes communication between the fire-box and the working chamber and another closes the air-supply pipe.—A. S.

Furnace for roasting ores. A. Zavelberg. Fr. Pat. 468,685, Feb. 3, 1914.

The ore is moved over each of the superposed hearths by rabble-arms carried on supports which travel on a circular track either around the outside of a cylindrical furnace or around the inner periphery of an annular furnace. The openings through which the arms project into the furnace are closed by means of a sand seal fixed to the furnace and plates carried by the arms. The arches above the roasting hearths are provided with angle-irons which bear on rollers or the like carried by the supports for the rabble-arms.—A. S.

Roasting furnace; Mechanical ——. J. Claude. Fr. Pat. 468,968, May 7, 1913.

The furnace comprises a number of superposed cylindrical chambers for the charge, and a central vertical rotating shaft carrying radial rabble-arms. Special features claimed are the method of mounting the vertical shaft in its bearings and of fixing the arms to the shaft, the shape of the teeth carried by the arms, and the arrangement of passages within the shaft and arms for cooling air which is afterwards admitted to the combustion chambers or to the furnace chambers.—A. T. L.

Plated ware; Process of obtaining adherent deposits of precious metals on alloys usually regarded as unsuitable for the manufacture of ——. Maison Murat. Fr. Pat. 468,801, May 2, 1913.

The alloy is coated electrolytically with Cu, Ni, Co, Ag, or the like, and then plated with Au, Ag, or other precious metal foil by the known process of heating and strongly compressing. By this method alloys containing relatively high proportions of Zn or Al, which cannot be plated directly by the hot method, may be used.—A. S.

Iron; Process of treating cast ——. J. E. Johnson, jun., New York. Eng. Pat. 24,297, Oct. 27, 1913. Under Int. Conv., Aug. 13, 1913.

See Fr. Pat. 464,208 of 1913; this J., 1914, 488.—T. F. B.

Solder; Impts. in and process of making soft ——. J. T. Dwyer, St. Louis, U.S.A. Eng. Pat. 118, Jan. 2, 1914. Under Int. Conv., Jan. 2, 1913.

See U.S. Pat. 1,059,982 of 1913; this J., 1913, 608.—T.F.B.

Roasting-furnace. A. Zavelberg, Hohenlohehütte, Germany. U.S. Pat. 1,107,006, Aug. 11, 1914. Date of appl., May 14, 1914.

See Fr. Pat. 468,685 of 1914; preceding.—T. F. B.

Copper; Process for welding ——. H. Suzuki, Shibaku, Japan. U.S. Pat. 1,107,865, Aug. 18, 1914. Date of appl., Aug. 2, 1913.

See Fr. Pat. 461,688 of 1913; this J., 1914, 205.—T. F. B.

Zinc-blende and other metalliferous constituents; Separation of —— from ore concentrates and slimes by flotation or granulation. E. J. Horwood, Broken Hill, N.S.W. U.S. Pat. 1,108,440, Aug. 25, 1914. Date of appl., Dec. 4, 1913.

See Eng. Pat. 28,604 of 1913; this J., 1914, 793.—T. F. B.

Annealing or cementing various articles; Method and apparatus for ——. G. Richter, Assignor to Stettiner Chamotte-Fabrik A.-G. vorm. Didier, Stettin, Germany. U.S. Pat. 1,109,362, Sept. 1, 1914. Date of appl., May 29, 1913.

See Ger. Pat. 265,761 of 1913; this J., 1913, 1161.—T.F.B.

Furnace for treating molten metals; Single or multiphase electric [induction] ——. P. Lescure. Fr. Pat. 468,139, Feb. 6, 1914. Under Int. Conv., Feb. 7, 1913.

See Eng. Pat. 3291 of 1914; this J., 1914, 794.—B. N.

Process of and apparatus for thickening and agitating pulp. Eng. Pat. 22,411. *See* I.

Titanic oxide concentrate and method for producing the same. Method for concentrating titanic oxide from substances containing it and iron oxide. Method of obtaining titanic oxide. U.S. Pats. 1,106,406—1,106,410. *See* VII.

Treatment of slag for the manufacture of bricks. Eng. Pats. 18,806 and 7027. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Aluminium cathode; Disintegration of the ——. L. L. Campbell. Phil. Mag., 1914. **28**, 347—354.

The aluminium cathode, hitherto supposed to disintegrate, to an appreciable extent, only in the monatomic gases, was found to "splutter" violently in presence of the halogens and some other gases or in the vapour of mercury or cadmium. Disintegration seemed to take place best when the pressure in the tube was at the ordinary X-ray stage and the cathode dark-space had reached the walls of the tube next the cathode, the rate of disintegration increasing, in general, with the molecular weight of the discharge gas.—F. Sodn.

Electrolysis of fused borates. Zschille-Hartmann. *See* VII.

Patents

Ozone; Apparatus for producing ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 21,779, Sept. 26, 1913.

The units of the ozoniser are connected with a source of direct current through an inductive device (transformer), in the primary circuit of which is an electro-magnetic current interruptor. The electro-magnet is provided with a number of coils, each having a different number of turns, and by including one or other of these coils in the circuit, the reactance and hence the rate of ozone production may be varied. In order to keep constant the "ampere turns" of the electro-magnet, and thus minimise the noise produced by a change in the number of "turns," means are provided for including either all or only a part of the coils of the primary of the transformer in the circuit.—A. S.

Electrode for furnaces. C. Hering, Philadelphia, Pa. U.S. Pat. 1,106,381, Aug. 11, 1914; date of appl., Dec. 12, 1912.

The electrode is composed of a shell or cage of conducting material, diminishing in periphery and increasing in thickness from its outer towards its inner end, and arranged so that the conducting paths converge and unite. The current flows to or from a mass of conducting fluid in the furnace through the electrode, passing through the union of the conducting paths.—B. N.

Furnace; Electric [induction] ——. G. H. Benjamin, New York. U.S. Pat. 1,106,486, Aug. 11, 1914; date of appl., Dec. 19, 1913.

The furnace comprises a closed metallic core, a fixed primary, and a movable secondary, in the form of an annular crucible with a body of metal therein. The crucible is provided with ribs in the bottom projecting upwards, together with means for rotating the secondary relative to the core and primary. Material is introduced into the crucible through a sectional cover, and means are provided for exhausting gases from the crucible.—B. N.

Electrolytic apparatus. I. H. Levin. Fr. Pat. 467,945, Jan. 31, 1914. Under Int. Conv., May 9, 1913.

Each element comprises an anode and a cathode, with an interposed diaphragm, built up in the form of a filter-press. Means are provided for regulating the hydrostatic pressure on the two faces of the diaphragm, and for maintaining an equal pressure from one end of the apparatus to the other. A reservoir, consisting of two separate chambers with independent non-communicating conduits, is employed to supply electrolyte from the chambers to the neighbourhood of the anode and cathode respectively. The chambers are surmounted by bells, and the disengaged gases are brought to these by means of conduits communicating with the opposite faces of the diaphragms, means being also provided for equalising the pressures of gas and liquid in the reservoir chambers.—B. N.

Ultra-violet rays; Industrial production of —— by means of [electric] sparks. J. de Kowalski-Wierusz. Fr. Pat. 468,215, Feb. 5, 1914. Under Int. Conv., April 15, 1913.

Electrodes of nickel, tungsten, or their alloys, either alone or in combination with rare earths, are employed, so that the sparks are greatly weakened, and by an appropriate choice of electric constants, employing a wave length of less than 3000 m., a great amplitude of current intensity is obtained. The ultra-violet rays, produced by the sparks, may be used for sterilising liquids, and the yield is increased by using different materials for the two electrodes and plunging them into the liquid to be treated. For the production of chemical reactions, where the gases formed by the sparks would be objectionable, a screen, such as quartz, may be interposed between the sparks and the material under treatment.—B. N.

Electro-chemical treatment of liquids [e.g. water]; Process and apparatus for the ——. C. P. Landreth. Fr. Pats. (a) 468,242, Feb. 9, 1914, and (b) 468,277, Feb. 10, 1914. Under Int. Conv., Feb. 21, 1913.

(a) A portion of the liquid to be treated [*e.g. water*] is diverted under pressure into a treating chamber, wherein it is mixed with excess of a soluble salt, and subjected to the action of an electric current, the anode being constructed of a metal, such as aluminium, which is attacked with the formation of hydroxide. The treated liquid is then mixed with the mass of untreated liquid, and the aluminium hydroxide serves as a precipitant for removing impurities. The electrodes are arranged in groups, so that one group may be removed independently of the others, and instead of a direct current, both direct and alternating currents may be used simultaneously. Rotating elements, working between the electrodes, are employed for agitating the liquid and giving it a movement independent of that of its flow, thus clearing the electrodes of deposits. (b) A positive metallic electrode, for example of iron, is employed, and a soluble hydroxide is added to the liquid under treatment, thus producing under the influence of the electric current an increase of hydroxyl ions, any organic material in the liquid being thus oxidised. The process may also be employed for the treatment of liquids containing soluble encrusting salts, or colloidal impurity, or both, by adding to the liquid, after the passage of the current through it, a reagent producing insoluble salts or a coagulant for the removal of the colloid. The apparatus comprises an electrolytic vessel containing positive and negative electrodes immersed in the portion of the electrolyte to be treated, the treated portion being afterwards mixed with the untreated mass of the liquid. The current may be interrupted after a time, and the whole of the electrodes may be connected, exterior to the electrolyte, with an electro-positive mass within the electrolyte which is normally out of the circuit, so that both positive and negative electrodes then become electro-negative with respect to the mass.—B. N.

Accumulator electrodes; Process for producing highly porous ——. Gebr. Stanislaw und Georgij Gaszynski, Apoznanski und Co. Ger. Pat. 275,881, Dec. 3, 1910.

The plates to which the paste has been applied are dried at high temperatures in closed receptacles which are not affected by acids. The rapid evolution of gas makes the paste porous, and the pressure generated hardens the mass.—T. F. B.

Oxygen compounds of nickel; Process for manufacturing a mass of higher —— for use in the positive electrodes of alkaline accumulators. Svenska Ackumulator Aktiebolaget Jungner, Stockholm. Eng. Pat. 1062, Jan. 14, 1914. Under Int. Conv., Jan. 16, 1913.

See Fr. Pat. 467,311 of 1914; this J., 1914, 871.—T. F. B.

Electro-optical cell. C. Stille, Zehlendorf-West, Germany. U.S. Pat. 1,108,638, Aug. 25, 1914. Date of appl., April 22, 1913.

See Eng. Pat. 9060 of 1913; this J., 1913, 873.—T. F. B.

Electric arc furnaces; Stabilising means for ——. C. E. Guye, Geneva, Switzerland, Assignor to Southern Power Co., Charlotte, N.C. U.S. Pat. 1,109,350, Sept. 1, 1914. Date of appl., Jan. 8, 1912.

See Fr. Pat. 438,783 of 1912; this J., 1912, 649.—T. F. B.

Process of producing acetic acid. U.S. Pat. 1,104,978. *See* VII.

XII.—FATS ; OILS ; WAXES.

Oil-producing plants and fats. Voigt. Jahresber. Inst. angew. Bot. in Hamburg. Chem. Rev. Fett-Ind., 1914, **21**, 117—119.

For many years large quantities of the kernels of mowrah or illipé nuts (from *Illipe latifolia*) have been imported into Hamburg, and recently the fat from them has been used for edible purposes. All attempts to use the residual oil-cake as a feeding stuff have been unsuccessful owing to the large proportion of a saponin with pronounced hæmolytic action. More recently the kernels of *I. longifolia* and *I. malabarica* and of *Shorea stenoptera* have also been imported under the name of "Illipé nuts." Other imported oil seeds include habock beans probably from *Bassia Mottleyana* (Dutch Indies), candle nuts (British India and Java), kemiri nuts (Java), lumbang nuts (Philippines), hot-caylai (Cochin-China), and lama nuts (Samoa). Experiments have been made as to the suitability for food of the fats of the nuts of various species of *Canarium*, including *C. commune*, *C. polyphyllum* (New Guinea), *C. luzonicum* and *C. ovatum*, of pili nuts (Manila), and of *Herea* seeds (Malay). Of African seeds there have been occasional imports of manketti nuts, and the fruit of *Balanites Maughami* (Portuguese W. Africa), the utilisation of which appears unprofitable owing to the small proportion of oil and the difficulty of extracting it. American products included cohune nuts and the seeds of *Virola bicuhyba*, also the seeds of *Carapa guayensis*, and "andiroba paste" prepared therefrom in Brazil. *Manketti-oil-cake* contained : water 8·1, ash 2·5, proteins 5·8, fat 1·8, carbohydrates 48·1, and crude fibre 33·7%.—C. A. M.

Cohune nuts from British Honduras ; [Fats and oil-cake from ——]. Bull. Imp. Inst., 1914, **12**, 237—242.

Three samples of the outer fibrous layer of the fruit of the cohune palm (*Attalea cohune*) yielded 9·3 to 20·6% of a dark green fat, the colour of which could be largely removed by animal charcoal. Five samples of the kernels contained 65·4 to 71·6% of a white crystalline fat resembling coconut oil in appearance and odour. These fats had the following characters :—

	Fat from fruit.		Fat from kernels.				
	1	2	1	2	3	4	5
Specific gravity at 100°/15·5° C. ..	0·848	0·855	0·870	0·871	0·871	0·868	0·870
Acid value	162·0	121·3	3·5	13·1	1·2	20·4	12·3
Saponification value	197·4	203·1	255·0	256·5	256·5	252·4	252·4
Iodine value	75·1	65·4	13·6	13·7	11·4	13·7	11·0
Hehner value	97·0	—	—	—	—	87·7	—
Reichert-Meissl value.............	1·65	—	6·8	8·3	8·2	7·1	—
Solid. pt. of fatty acids	31·0° C.	—	19·8° C.	21·0° C.	20·2° C.	19·7° C.	—
Unsaponifiable matter, %	0·95	—	0·24	0·28	0·23	0·28	—
Polenske value	—	—	—	15·4	—	12·5	—

The residual meal from the extracted kernels was free from alkaloids and cyanogenetic glucosides, and had the following composition recalculated on a basis of 10% of fat :—Moisture, 9·2 ; crude proteins, 21·7 ; fat, 10·0 ; starch, etc., 38·8 ; fibre, 15·6 ; and ash, 4·7%. Nutrient ratio, 1 : 2·9 ; food units (starch+2·5 times the sum of fat and proteins), 118. The amount of proteins was higher and that of the the fibre lower than in the case of palm-kernel meal (see also this J., 1913, 797).—C. A. M.

Cacao butter ; New adulterant of ——. C. Grimme. Chem. Rev. Fett-Ind., 1914, **21**, 47—49, 74—75.

The new adulterant of cacao butter has not been identified and cannot be detected by determining the ordinary chemical characters of the fat. The physical properties of the adulterated fat and of the fatty acids obtained from it are, however, distinctly different from those of pure cacao butter. Adulterated samples yield brownish-yellow fatty acids having a coarse granular crystalline structure, the surface being irregular and lumpy, whereas fatty acids from pure cacao butter are of a light yellow colour and always solidify in fine crystals. The best evidence of the presence of the adulterant is obtained by determining the critical temperature of solution in glacial acetic acid (5 c.c. of molten fat and 5 c.c. of acetic acid), which is 76°—80° C. for pure cacao butter, whereas an adulterated sample gave 35° C. By allowing a solution of 10 grms. of the fat in 30 c.c. of a mixture of 3 parts of dry ether and 1 part of absolute alcohol to stand for half an hour at 10° C., an oily product was obtained which, on recrystallisation from the same solvent, melted at 39·7°—40° C. Under similar conditions pure cacao butter gave directly white crystals which melted at 46°—52° C. and after recrystallisation at 56°—57·4° C.—J. A.

Oils ; Hydrogenation of ——, and synthetic fatty acids [from petroleum]. M. Colletas. Les Matières Grasses, 1914, **7**, 4151—4153.

At the Vereinigte Chem. Werke at Charlottenburg, hydrogenation is effected at 100° C. under a pressure of 2 to 3 atmos. by means of 0·00002 part of palladium chloride in the presence of an alkali. The loss of catalytic agent is from 5 to 7% of the weight taken, which corresponds to an expense of 1·60 francs per 100 kilos. of fat (about 7¾d. per cwt.).

The synthetic production of fatty acids from liquid hydrocarbons by the process of Zelinsky is commercially applicable, but the cost of the product is still too high. The crude petroleum is chlorinated and dissolved in anhydrous ether, and the solution treated with magnesium and a catalytic agent (iodine, methyl iodide, aluminium salts, hydrochloric acid), and subsequently, when cold, with a current of carbon dioxide. The fatty acids, etc., are then liberated from the magnesium salts by treatment with dilute acid.—C. A. M.

Liquid from solid fatty acids ; The Fachini-Dorta method of [approximately] separating ——. A. de Waele. Analyst, 1914, **39**, 389—391.

Separation of the liquid and solid fatty acids by treating the potassium soaps with acetone (this J., 1912, 397) is more rapid and complete than lead-ether methods, whilst the liquid fatty acids undergo less oxidation in the process The following modification is recommended :—Abou 10 grms. of the dry fatty acids are dissolved in 90 c.c of anhydrous acetone at 25° C., 10 c.c. of $N/1$ potassiu hydroxide solution run in with constant stirring, and th flask corked and immersed in ice-water for 3 to 4 hour Its contents are then filtered through a Buchner funne and the residue washed with anhydrous acetone at 0° until colourless, and then pressed to remove the solven The flask is rinsed with dilute potassium hydroxide sol tion, the washings added to the solid cake, the soa dissolved in water, and the solid fatty acids liberate transferred to a weighed beaker, and dried at 100° until constant in weight. The liquid fatty acids a separated from the acetone solution by adding an equ volume of water, and 30 to 50 c.c. of ether, acidifyin with hydrochloric acid, and washing and evaporatin the ethereal layer. The following amounts of solid fatt acids were thus obtained :—Linseed oil (Calcutta seed 9·1% with iodine value, 16·4 ; (Baltic seed), 6·6%, iodi value, 20 ; Soya bean oil, 13·8%, iodine value, 12·

Para rubber seed oil, 16·3%, iodine value, 10·7; China wood oil (varied considerably) 54·1%; crude menhaden oil, 23·5%, iodine value, 20·2. The solid stereo-isomeride of elæomargaric acid from polymerised China wood oil formed a potassium soap which was practically insoluble in 90% acetone, but had an iodine value of 157. Both this method and the lead-ether method are therefore inapplicable to polymerised oils. No diminution of solid fatty acids takes place during oxidation of drying oils until solid, unless a lead drier (which precipitates part of the solid fatty acids as lead soap) is present. In the case of oxidised oils the sample is saponified, and the fatty acids liberated by treatment with petroleum spirit and hydrochloric acid. The precipitated "oxidised acids" are re-dissolved and re-precipitated to remove any unoxidised fatty acids mechanically precipitated, the united petroleum spirit solutions evaporated to dryness, and a weighed quantity of the residue treated with acetone etc., as described.—C. A. M.

Oils; Insoluble bromide value of ——. J. A. L. Sutcliffe. Analyst, 1914, **39**, 388—389.

In reply to the criticisms of Gemmell (this J., 1914, 756) the author lays stress upon the point that the factor (0·63 I.V.—78) does not vary if the conditions described in his note (this J., 1914, 147) are exactly followed. A temperature of 11° C. will prevent the formation of substitution compounds. Before filtration the contents of the flask should be cooled below 5° C., the red ethereal solution decanted, and the bromides washed with chilled ether. When dried they should be white and crumble readily. Certain sorts of bromine yield dark horn-like bromides, and should be rejected. The accuracy in duplicate determinations is usually within 1%.—C. A. M.

New copra drying process. Oil, Paint, and Drug Rep., Sept. 14, 1914. [T.R.]

An American engineer at Manila has devised a small copra drying machine of a capacity of from 800 to 1000 coconuts at one filling. The nuts are set on wire trays and heated air at 270° F. is forced through and over them. It is claimed that the value of the dried product is greater than that done by the old process.

PATENTS.

Presses for oleaginous seeds and analogous material; Means for preventing shaking and jarring in —— during the discharge of the oil-cakes. Harburger Eisen und Bronzewerke Akt.-Ges. Fr. Pat. 468,153, Feb. 7, 1914.

SUDDEN jarring of the parts of the press raised with the oil-cake is prevented by directing the pressure (by means of an outside device) against buffers at the sides, so that after the discharge of the oil-cake the pressure is retained and no sudden movement of these parts can take place. —C. A. M.

Fats and oils; Process of treating ——. [*Catalytic oxidation.*] Gebr. Strobentz Fabriks-Act.-Ges. für Chem. Farben, Produkte, Lacke und Firnisse and L. von Kreybig. Fr. Pat. 468,352, Feb. 12, 1914. Under Int. Conv., Feb. 17, 1913.

To effect rapid decolorisation and oxidation, oils, etc., are mixed with oxides of metals of the iron group (especially cobalt oxides), and a current of air is drawn through the mixture at about 120° to 130° C.—C. A. M.

Oils; Process of hydrogenating ——. G. Calvert. Fr. Pat. 468,426, Feb. 9, 1914. Under Int. Conv., Aug. 12, 1913.

THE hydrogen and hot oil are mixed under pressure in a closed vessel by means of an agitator or circulating pump, worked by an electric motor which is contained in a communicating chamber. The passage between the two chambers may be surrounded by a cooling jacket.—C.A.M.

Treatment of plastic materials [*soap, clay, etc.*]. Fr. Pat. 468,002. *See* I.

Producing a varnish with the aid of semi-drying oils, such as fish oil, for use in the manufacture of oil-cloth and linoleum. Fr. Pat. 468,003. *See* XIII.

Manufacture of emulsions [*for margarine*]. Eng. Pat. 19,344. *See* XIXA.

Process for submitting liquids to the action of ultra-violet rays. Fr. Pat. 468,216. *See* XIXB.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Oil paint vapours; Toxicity of ——. C. A. Klein. Chem. World, 1914, **3**, 252—254.

THE toxic action of the vapours from drying paints was attributed by Armstrong and Klein to the volatile thinning constituent (this J., 1913, 320) and by Gardner (this J., 1914, 266, 363) to the presence of carbon monoxide in the vapours. It is now pointed out that Gardner's conclusions are fallacious, since the formation of the carbon monoxide must be ascribed to the interaction of the formic acid in the vapours and the fuming sulphuric acid through which the vapours were passed to absorb organic compounds. Quantitative determinations of the carbon monoxide by Gardner's method might indicate the rate of drying of a paint, but have no value as an index of the toxicity.—C. A. M.

Resin acids; Stability of —— at slightly elevated temperatures. A correction. C. H. Herty and H. L. Cox. J. Ind. Eng. Chem., 1914, **6**, 782.

FURTHER experiments have shown that the resin acids of *Pinus heterophylla* (Cuban or slash pine) yield no carbon dioxide when heated at 140° C. in a current of dry nitrogen for 1 hour, if they be perfectly dry and protected from oxygen during preparation. (Compare this J., 1909, 318.) —A. S.

Transformer oils. Brauen. *See* IIA.

PATENTS.

White lead; Process of producing ——. E. Euston, St. Louis, Mo. U.S. Pats (A) 1,106,793 and (B) 1,106,794, Aug. 11, 1914; date of appl., Sept. 10, 1913.

(A) ACID and neutral and (B) alkaline and neutral solutions of basic lead acetate are separately treated with carbon dioxide and the respective precipitates mixed. In both cases the pigments contain 11·0 to 14·5% CO_2.—C. A. M.

Pigment and process of manufacture. J. Gevers. Fr. Pat. 468,697, Feb. 10, 1914.

A SUBSTITUTE for white lead is composed of zinc sulphide, 35; barium sulphate, 20; and alumina, 5 parts; and is used with a medium consisting of linseed or olive oil, 35; driers, 2½; and turpentine, 2½ parts.—E. W. L.

Varnish; Process for producing a —— with the aid of semi-drying oils, such as fish-oil, for use, more particularly, in the manufacture of oil-cloth and linoleum. E Girzik. Fr. Pat. 468,003, Feb. 3, 1914. Under Int. Conv., April 8, 1913.

FISH oil, or other semi-drying oil, is freed from fatty acids by neutralising with caustic alkali or lime, and separating the salts from the oil. Any excess of alkali is carefully neutralised by means of acid, and the neutral purified oil is polymerised by heating, with or without the addition of a drier.—E. W. L.

Varnish; Manufacture of ——. G. Cuneo. Fr. Pat. 469,144, March 2, 1914. Under Int. Conv., March 3, 1913.

A VARNISH for covering the bottoms of ships is obtained by grinding with a liquid varnish a mixture of organic or inorganic fluorine compounds with the ordinary mineral pigments. It may contain, for example, varnish (a mixture of resin and benzene), 50; fluorine compounds, 25; and oxide of zinc, iron, etc., 25%.—E. W. L.

Plastic material. A. Chanard, St. Claude, France. Eng. Pat. 14,125, June 18, 1913. Under Int. Conv., July 6, 1912.

A MIXTURE of a resin (*e.g.*, 1000 parts of sandarac) with naphthol (1000 parts) is melted, and incorporated with a mixture of albuminoid material (casein) with, say, 20% of hydrated sodium carbonate, and the homogeneous product is moulded and treated with a hardening agent (50% formaldehyde solution). Resins such as Canada balsam may be used to obtain a transparent product, and inert loading materials, especially antimony oxide and metastannic acid, may be introduced.—C. A. M.

Plastic masses; Process for the manufacture of —— more particularly for insulating purposes. A. Regal. Fr. Pat. 468,241, Feb. 9, 1914. Under Int. Conv., March 7, 1913.

A PLASTIC mass suitable for insulating purposes, is prepared by heating a mixture of phenol 2, formaldehyde 1, sodium carbonate 0·2, and soluble glass 0·5 to 1 part on a water-bath until homogeneous, then heating the product in hot water and allowing to settle in cold water. The mass can be moulded at 40° C., and a layer 1·3 mm. thick will withstand a pressure of 12,000 volts. Sodium aluminate or zincate or aluminium acetate may be employed instead of soluble glass, each of these salts acting as a condensing agent, and being at the same time decomposed into acid and base, whereby mineral matter is precipitated throughout the mass.—E. W. L.

Diphenols and triphenols and their derivatives; Process for obtaining solid products by condensation of ——. A. Labbé. Fr. Pat. 468,879, May 5, 1913.

CATECHOL, resorcinol, quinol, pyrogallol, etc., are treated with a cold 40% solution of formaldehyde in presence of an acid: the mass soon becomes gelatinous, and after some hours is converted into a homogeneous, elastic substance. Hard products may be obtained by diluting the formaldehyde solution with half its volume of water. They are insoluble in water and organic solvents, unattacked by acids and alkalis, and are non-inflammable. The addition of acetone or glycerin to the formaldehyde results in the production of transparent masses. The physical properties of the products may be further modified by incorporating carbohydrates or cellulose.—T. F. B.

Paint for protecting iron, wood, and the like from sea growths; Manufacture of ——. M. Rappard, Den Helder, Holland. U.S. Pat. 1,108,395, Aug. 25, 1914. Date of appl., Oct. 7, 1912.

SEE Eng. Pat. 22,802 of 1911; this J., 1912, 347.—T. F. B.

Varnish-kiln. C. A. Cutler, Buffalo, N.Y. U.S. Pat. 1,105,623, Aug. 4, 1914. Date of appl., May. 28, 1912.

SEE Eng. Pat. 22,985 of 1913; this J., 1914, 408.—T. F. B.

Condensation products and process of treating the same. Resinous condensation products. M. J. Callahan, Pittsfield, Mass., Assignor to General Electric Co., New York. U.S. Pats. 1,108,329 and 1,108,330, Aug. 25, 1914. Dates of appl., May 11, 1912, and Feb. 8, 1913.

SEE Eng. Pats. 3271 and 22,358 of 1913; this J., 1914, 322.—T. F. B.

Resinous composition. M. J. Callahan, Pittsfield, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,108,331, Aug. 25, 1914. Date of appl., Feb. 8, 1913.

SEE Eng. Pat. 8417 of 1913; this J., 1914, 364.—T. F. B.

Resinous composition and process of making the same. M. J. Callahan, Pittsfield, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,108,332, Aug. 25, 1914. Date of appl., July 9, 1913.

SEE Eng. Pat. 3566 of 1913; this J., 1914, 322.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENTS.

Rubber; Process and apparatus for the extraction of —— [from the leaves of plants]. A. Caubel, C. Peigniet-Amaury, P. Quilici and H. Pannard. Fr. Pat. 468,245, Feb. 9, 1914.

THE fallen leaves of rubber plants are dried, coarsely crushed, and extracted with a mixture of 2 parts of carbon bisulphide and 1 part of benzene, to which is added 5% each of chloroform and sulphur chloride. The extraction apparatus consists of an upper vessel containing a removable bucket with perforated bottom, and communicating with a lower vessel by means of a large valve or cock. The lower vessel is provided with an internal heating coil, and the upper portions of the two vessels are connected to opposite ends of a condensing worm. The solvent is left in contact with the leaves in the upper vessel for 6—8 hours, and is then run off into the lower vessel, where it is heated by means of the steam-coil, the vapours condensing in the upper vessel and continuing the process of extraction. After 3 hours the bucket of leaves is removed and a fresh one inserted in its place. The solvent is then distilled from the lower vessel through the condensing worm into the upper vessel, and the process of extraction repeated The rubber is removed from the lower vessel.—E. W. L.

Rubbered fabrics and similar articles: Preservation of ——. W. E. Muntz. Fr. Pat. 468,493, Feb. 16, 1914. Under Int. Conv., Feb. 26, 1913.

To protect the fabric of rubber-coated materials from the action of sulphurous and sulphuric acids produced by oxidation of the sulphur in the rubber, the fabric is impregnated before being coated with rubber, with a substance which will combine with the acids to form innocuous compounds. For instance, cotton cloth is treated with a 3% solution of barium hydroxide, under reduced pressure, for 15 min., allowed to drain for 3 mins., and then immersed in a 3% solution of ammonium carbonate for 5 mins., after which it is dried at the ordinary temperature.—E. W. L.

Waterproofed [rubber-coated] materials; Manufacture o ——. M. Frankel und Runge. Fr. Pat. 468,755, Feb 20, 1914. Under Int. Conv., Aug. 14, 1913.

FABRICS may be impregnated or proofed with reclaime rubber by making use of the emulsion obtained when th first product of certain methods of reclaiming (see Alexander, this J., 1910, 1025) is steam-distilled in order t remove the solvent. The proofed sheet thus obtaine does not require to be vulcanised. —E. W. L.

Manufacture of fabrics for outer covers for pneumati tyres and envelopes for balloons. Eng. Pat. 22,06 *See* V.

XV.—LEATHER; BONE; HORN; GLUE.

Glue from hides; Manufacture of ——. V. Cambo Les Matières Grasses, 1914, 7, 4153—4155.

THE parings of ox-hides from the tan yards are mixed wit tendons, ears, and other refuse and sold under the name *carnasses*, to be used in the manufacture of a strong gl of reddish colour, whilst the similar parts of calves a heifers yield a glue of very superior quality. The fragmen from the skins, etc., of sheep and goats, which are l frequently met with in commerce, yield a more yellow glue, the value of which is often reduced by the presence of too much fat. In general, the glue derived from the hides of young animals is superior to that from old animals, the yield is larger and the product contains much less fat. The quantity of glue calculated on the dry material ranges from 40 to 60%. A glue of inferior quality is obtained from the shavings of the skins, which are contaminated with fat, hair, etc., and are sold under the name of *poussures*. The skins of rabbits, hares, cats, rats, and other small mammals, and the cuttings from glove manufacture yield a glue held in high esteem by plasterers (*Colle Tottin*). The fluid fish glues are largely prepared from the skins of the haddock. The plant required for the manufacture of glue from skins is much simpler than in the case of bone glue. The skins are soaked for 72 hours in lime water, and are then transferred to a perforated rotating drum of iron or wood through the axis of which a current of water is passed. After washing for 1 hour the skins are soaked in lime water (1° B., sp. gr. 1·007) for a week, washed in the drum, and again soaked for 3 to 5 weeks. They are next washed until the washings are quite clear, soaked for 12 hours in an acid bath (preferably 1% phosphoric acid free from iron) to remove the last traces of lime, then transferred to a sulphurous acid bath (1° B., sp. gr. 1·007) for 10 to 15 hours, and thoroughly washed. They are then ready for the extraction of the glue in a hot water tank.—C. A. M.

Patents.

Tanning skins; Compounds for —— and process of making them. L. Pollak, Aussig, Austria-Hungary, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,107,107, Aug. 11, 1914; date of appl., June 26, 1914.

Condensation products containing sulphur are obtained by the interaction of a monohydroxy phenol (*e.g.*, 5 parts of phenol), sulphuric acid (5 parts of 98% acid) and a carbohydrate (1 part of glucose). They give deep colorations with ferric ammonium sulphate, precipitate glue from its solutions, are precipitated by ammonium acetate and alum, and even in a solution of "normal acidity" and of 20° B. (sp. gr. 1·162) will tan skins without destroying them.—C. A. M.

Hair; Process of "converting" ——. C. H. Campbell, Chicago, Ill., Assignor to American Glue Co., Boston, Mass. U.S. Pat. 1,106,779, Aug. 11, 1914; date of appl., May 12, 1910.

The hair is digested at a gentle heat for a long time in a dilute alkaline solution, which is active only when heated. When the hair is almost all "converted," the source of heat is withdrawn, and the remainder "converted" by aid of the heat remaining in the liquor. The "converted" hair is dried in thin films by the application of "high heat" for a short time. (See also U.S. Pats. 1,106,777 and 1,106,778; page 965.)—A. S.

Tanning liquors; Apparatus for preparing ——. J. Forster, Warrington. U.S. Pat. 1,107,925, Aug. 18, 1914. Date of appl., April 29, 1911.

See Eng. Pat. 6795 of 1911; this J., 1912, 82.—T. F. B.

Retarder for plaster. Making a retarder for plaster and the like from lime wastage. U.S. Pats. 1,106,777 and 1,106,778. *See* IX.

XVI.—SOILS; FERTILISERS.

Plant growth and nutrition; Some accessory factors in ——. W. B. Bottomley. Roy. Soc. Proc., 1914, **88** B, 237—247.

The substance or substances which confer on "bacterised peat" (see this J., 1913, 878, 919, 920; 1914, 366) its stimulative action on plant growth, are soluble in alcohol and in water. If an alcoholic extract of bacterised peat be evaporated to dryness *in vacuo* and the residue treated with water, the aqueous solution even after being boiled for 5 mins. exhibits very strong stimulative action, whereas similar extracts made from the original raw peat are inactive. The humic acids of peat are converted into soluble humates by the bacterial treatment, but the stimulative activity does not appear to be due to these, for extracts made from raw peat previously saturated with a 1% solution of sodium carbonate and dried, are inactive. Like the vitamines of Funk, which exert a similar stimulating effect on animal growth, the active substances of bacterised peat are precipitated (without loss of activity) by phosphotungstic acid and by silver nitrate and baryta. From an extract of 7 kilos. of bacterised peat, only 12 grms. of phosphotungstic acid precipitate (freed from reagents) were obtained, and from this by further precipitation with silver nitrate and baryta only 0·2452 grm. (freed from reagents); but an aqueous solution of the latter, at a concentration of 0·35 part per million, added at intervals of a week to wheat seedlings grown in sand moistened with Detmer's complete food solution increased the gross weight of the plants obtained after 7 weeks by 50% and their dry weight by 17·7%. The effect of the solution of the "silver fraction" on water cultures (Detmer's solution) of wheat seedlings was still more marked. Although all the plants were well aerated and the solutions were changed twice a week, the control plants weighed less at the end of 50 days than at starting, whereas the weight of those treated with the active solution had increased by more than 50%. In similar experiments with young seedlings from which the seeds had been removed, the difference between the treated and untreated plants was even greater, probably because during germination it is one of the functions of the seed to produce substances, similar to those formed in peat by the action of certain soil bacteria, which enable the young plant to utilise the food materials present. The formation of such substances during the bacterial decomposition of organic matter in the soil, *i.e.*, during the formation of humus, explains the beneficial effect of farmyard and other organic manures on crops.—J. H. L.

Aldehydes in garden and field soils; Occurrence of ——. O. Schreiner and J. J. Skinner. J. Franklin Inst., 1914, **178**, 329—343. (See also this J., 1913, 546.)

The aldehydes were extracted by treating about 14 lb. of soil with 8 litres of 3% caustic soda solution for 6—8 hrs., acidifying the alkaline extract, filtering off the humus precipitate, shaking the acid filtrate with ether, and treating the ether extract with concentrated sodium bisulphite solution. The bisulphite solution was then acidified, the sulphur dioxide expelled with air, the solution extracted with ether, the extract evaporated and the resinous or oily residue purified by dissolving in water and extracting again with ether. Of 14 garden and greenhouse soils which had become unfertile, and 60 field soils, half of which were unproductive, from various parts of the United States, 5 of the garden soils and 12 of the field soils, yielded aldehydes. The aldehydes when added to distilled water and nutrient solutions in which wheat seedlings were grown, proved distinctly harmful, causing a diminished growth both in the stems and roots of the plants.—J. H. J.

Sulphur; Influence of —— on soil acidity. H. C. Lint. J. Ind. Eng. Chem., 1914, **6**, 747—748.

Laboratory tests were made in which a quantity of sulphur equivalent to 1000 lb. per acre-foot was added to the soil, the moisture content of which was kept at about 20% during the experiment. The acidity increased continuously up to the end of the eighth week, after which there was little change. The excess acidity over that found in similar tests with soil to which no sulphur was added, corresponded with the quantity which would be formed by oxidation of the sulphur. Oxidation of the sulphur was more rapid with a sandy loam than with a heavy clay loam soil and was also favoured by keeping the soil moist.—A. S.

Nitric and nitrous acids ; Influence of weather conditions upon the amounts of —— in the rainfall near Melbourne, Australia. V. G. Anderson. Brit. Assoc. (Sect. B.), Australia. 1914. Chem. News, 1914, **110,** 127.

The concentration of nitric acid in the rainfall was greatest in summer and least in winter, whilst that of nitrous acid was greatest in winter and least in summer. The ratio of nitric to nitrous nitrogen was highest in summer and lowest in winter. The relation between this ratio and the temperature indicated that the acids are produced from atmospheric nitrogen peroxide : in hot weather the nitrous acid is rapidly converted into nitric acid. The concentration of total oxidised nitrogen (nitric plus nitrous) varied inversely as the rainfall ; the product of the concentration and the rainfall, and the total weight (per unit area) of oxidised nitrogen precipitated with rain falling during 24 hours, were constant ; so that the amount of oxidised nitrogen per acre carried by rain falling on any day is a function of the type of weather, and, within certain limits, is independent of the amount of rainfall. The amount of oxidised nitrogen thus deposited for nine distinct types of weather ranged from 1·5 to 35·0 lb. per 1000 acres.—A. S.

Patents.

Calcium acid phosphate ; Process of making ——. E. W. Reed, Savannah, Ga. U.S. Pat. 1,105,304, July 28, 1914 ; date of appl., July 19, 1913.

Sulphuric acid is sprayed into a current of air carrying finely powdered phosphatic material in suspension.—O.R.

Phosphates ; Preparation of assimilable ——. E. Ciselet, C. Deguide, and P. Becquevort. Fr. Pat. 468,042, Feb. 4, 1914. Under Int. Conv., Feb. 28, 1913.

A mixture of calcium phosphate (*e.g.* 100 kilos. of calcareous phosphate containing 40% $Ca_3(PO_4)_2$) with a concentrated solution of calcium chloride (*e.g.* 40 kilos. in 50% solution) is dried, heated to about 1000° C. (which causes the phosphate to dissolve in the fused chloride), crushed, and washed with water. The phosphate is thus obtained as an amorphous powder, calcium chloride being recovered.—F. Sodn.

Phosphates ; Process for the preparation of assimilable ——. E. Ciselet and C. Deguide, Brussels. Eng. Pat. 3074. Feb. 5, 1914. Under Int. Conv., Feb. 28, 1913.

See Fr. Pat. 468,042 of 1914 ; preceding.—T. F. B.

Fertiliser and process of manufacturing the same. T. Knösel, Neustadt, Germany. U.S. Pat. 1,108,189, Aug. 25, 1914. Date of appl., Dec. 13, 1910.

See Fr. Pat. 423,562 of 1910 ; this J., 1911, 638.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Beet seed ; New German standards for the trade in ——. W. Edler. Fühling's Landwirtsch. Zeit., 1914, **63,** 268—277 ; Monthly Bulletin of Agricultural Intelligence, 1914, **5,** 852—857.

A number of interested bodies have drawn up a new set of standards, embodying modifications that have been proposed from time to time, and including instructions for sampling and the calculation of the deduction to be made in the case of seeds not coming up to standard, but yet saleable. *Standards for beet seed.* (1) The seed must be delivered in good condition, fit for use, and, except for the screening necessary in cleaning, not graded according to the size of the clusters. It must belong to the variety specified. (2) It should contain at least 85% of dry substance, but is saleable with 83%, in which case the excess of moisture must be allowed for (see Clause 5 below.) (3) The purity should be at least 96%, and clusters passing through a 2 mm. (0·08 in.) sieve must be considered as impurities. Seed of 94·5% purity is saleable, but the value must then be calculated by the formula given under (5), for the purpose. (4) In the germination test, 1 kilo. (2·2 lb.) must give a minimum of seedlings, as follows : (a) large cluster, 60,000 ; (b) medium cluster, 65,000 ; and (c) small cluster, 70,000 ; of which number 70% must appear within 14 days. One hundred clusters must give in 14 days a minimum of seedlings, as follows : (a) large cluster, 80 ; (b) medium cluster, 75 ; and (c) small cluster, 70. Large cluster seed contains not more than 40 clusters per grm. ; medium, 41—50, and small 51 or more. (5) The reduced prices for seed which is saleable but does not come up to the specification of clauses (2) or (3), is calculated according to the following formula :

$$\frac{\text{price agreed upon} \times \text{value of seed delivered}}{\text{guaranteed value}} ;$$

while if both (2) and (3) require reduction, the price is obtained by the formula :

$$\frac{\text{price agreed upon} \times \text{actual dry matter} \times \text{actual purity}}{85 \times 96}.$$

(6) In the absence of any other agreement, samples must be taken within three days of the delivery of the seed by a sworn sampler, according to the following directions : *Sampling beet seed.* If the lot numbers more than 100 sacks, a sample must be taken from at least every twentieth sack ; if there are between 20 and 100 every tenth ; while for less than 20 every other sack must be sampled. At the request of one of the parties concerned, all the sacks to be sampled may be turned out ; or if this be not practicable, the fact must be noted in the report. The average sample made up from the small portions is thoroughly mixed, then divided into separate samples according to the number of analyses required. The samples for the determination of moisture and purity are to be enclosed in clean and dry air-tight vessels of glass or tin, openings being sealed with wax, rubber cement, etc. ; ground-glass stoppers should be greased. The seed must b tightly pressed into the vessel, and each sample should weigh about 200 grms. The samples (about 200 grms. for the germination test are to be preserved in cloth bags and not in air-tight vessels. The sampler must despatc the samples within 24 hours, one set being sent to th purchaser, one to the vendor, and a third retained.—J.P.O

[Sugar] Cane ; Disinfection of —— before planting. A. H Rosenfeld and T. C. Barber. Intern. Sugar J., 1914 **16,** 410—412.

Experiments at the Tucumán Experiment Statio showed that a preliminary treatment of plant and ratoo canes with Bordeaux mixture is not profitable, the sligh increase in the crop being insufficient to compensate th extra expense.—J. P. O.

Sugar-cane juice ; Potash content of ——. C. S. Taylo Agric. J. India, 1914, **9,** 236—246.

From the beginning of December 1913 until the middl of February 1914, fortnightly determinations of th potash content of the juice of Khari cane grown o various plots were made. The perchlorate method o estimation was used, sulphates being first removed wit barium chloride. The mean sugar content of 38 sample of juice was 13·79 and the mean potash content 0·191% There was very little correlation between potash conten and sugar content. Similar determinations were made wit juice from different varieties of cane grown under simila conditions. Here there was some evidence that a hig potash content was accompanied by a low sugar conten The mean potash content of the 38 different varieti examined was 0·174, varying from 0·060 to 0·272% an average sugar 17 to 18%.—L. J. de W.

Raw sugars ; Valuation of ——. F. G. Wiechman Sugar, 1914, **16,** No. 8, 27—31.

Seyffarth's proposed method (Z. Ver. deut. Zuckerind 1894, 399) of valuing raw beet sugars by means of t so-called "normal organic non-sugar" (total non-sug minus ash) has been examined by the author to t its applicability to raw cane sugars. The value 2·97, which was shown to be valid for beet sugars, does not hold good for cane products, but definite constants may be established for the different classes, as centrifugals (1·53—1·72), muscovados (1·60—2·34), mats (1·42—1·57), and molasses sugars (1·75—2·11). Having ascertained the class constant, the "organic non-sugar" may be calculated by the formula: $\frac{100-\text{polarisation.}}{\text{class constant}}$ In calculating the rendement of a raw sugar any formula taking into account the ash alone must be inadequate, since the organic non-sugar also has a melassigenic function, and the general use of a yield formula taking into consideration both factors is advocated. —J. P. O.

Filtration ; Cause of difficult —— in the filter-presses [when working the carbonatation process in the beet sugar factory]. H. Wesely. Oesterr.-Ungar. Zeits. Zuckerind., 1914, **43**, 66—68.

Difficult working of the filter-presses in the beet sugar factory is stated to be caused by the presence in the scums of minute gas bubbles, which impart a sandy feel, hitherto generally believed to be caused by fine grit originating from the lime used for defecation. These gas bubbles obstruct the pores of the cloths, and render easy filtration impossible, notwithstanding the application of high pressure. To avoid their presence in the scums, the use during carbonatation of the stirring appliances formerly generally employed is advocated.—J. P. O.

Gum ; Determination of the —— in [cane] molasses. L. G. L. Steuerwald and T. van der Linden. Archief Suikerind. Nederl.-Indië, 1914, **22**, 1033—1071 ; Intern. Sugar J., 1914, **16**, 430—431.

Approximate results only are obtainable by precipitation with strong alcohol, as pectins and certain organic acid compounds are also precipitated. More reliable and concordant results are obtained by the following process: 50 grms. of the sample are dissolved in 100 c.c. of water, and 20 c.c. of the solution are treated with a mixture of 150 c.c. of 95% alcohol and 30 c.c. of 6*N* hydrochloric acid. The resulting precipitate is collected on a tared paper, washed with 95% alcohol until neutral, and treated first with warm water, and afterwards with 10% hydrochloric acid, again washed with warm water till neutral, dried at 105° C., weighed, and incinerated, the weight of ash being deducted to give the net weight of true gum. The total gummy substances are higher in defecation than in carbonatation molasses.—J. P. O.

Yield of alcohol from cane molasses of different sources. Owen. *See* XVII.

Patents.

Sugar ; Process for refining ——. J. G. Kremers, Milwaukee, Wis. U.S. Pat. 1,107,172, Aug. 11, 1914 ; date of appl., July 30, 1913.

Impure sugar solutions are defecated with lime, and treated first with carbon dioxide until neutral to phenolphthalein, and then with sulphur dioxide until slightly acid to litmus.—W. P. S.

Levulose ; Process for transforming —— into mannitol by hydrogenation. T. Lupieri and H. Mayer. Fr. Pat. 468,920, May 6, 1913.

Levulose is hydrogenated (*a*) by electrolysing a solution of the sugar in dilute sulphuric acid or alkali between inert electrodes, (*b*) with hydrogen at a pressure of at least 3 atmospheres in presence of finely divided metals or metallic oxides, at not above 70° C., (*c*) with nascent hydrogen produced by the action of rhodium black or other finely divided allied metals on formic acid, or (*d*) continuously, by the action of sodium amalgam produced electrolytically. —L. E.

Manufacture of ethers of carbohydrates of the type $(C_6H_{10}O_5)_n$ and their derivatives. Fr. Pat. 468,162. *See* V.

Production of glucose and alcohol from sawdust and other cellulosic material. Fr. Pat. 468,188. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Beer worts ; Influence of temperature on saccharometer readings in ——. G. Rossi. Annali Chim. Appl., 1914, **2**, 27—35.

From the results of the author's experiments with different types of saccharometers, together with results of other investigators, the following table has been constructed, from which the true value at the normal temperature of 17·5° C. can be calculated from saccharometer readings at other temperatures, with sufficient accuracy for practical purposes in the case of beer worts of average gravity:—

Temp.	Correction.		Temp.	Correction.		Temp.	Correction.	
	By weight.	By vol.		By weight.	By vol.		By weight.	By vol.
° C.			° C.			° C.		
12	—0·26	—0·28	25	+0·45	+0·50	38	+1·51	+1·65
13	0·22	0·24	26	0·52	0·58	39	1·60	1·75
14	0·18	0·19	27	0·59	0·66	40	1·69	1·85
15	0·13	0·14	28	0·66	0·74	41	1·79	1·95
16	0·08	0·09	29	0·74	0·82	42	1·89	2·06
17	0·03	0·03	30	0·82	0·91	43	1·99	2·17
18	+0·03	+0·03	31	0·90	1·00	44	2·09	2·28
19	0·09	0·09	32	0·98	1·09	45	2·19	2·39
20	0·15	0·16	33	1·06	1·18	46	2·29	2·50
21	0·21	0·22	34	1·15	1·27	47	2·39	2·61
22	0·27	0·29	35	1·24	1·36	48	2·49	2·72
23	0·33	0·36	36	1·33	1·45	49	2·59	2·83
24	0·39	0·43	37	1·42	1·55	50	2·70	2·95

[See also "Bates' Saccharometer Tables" used by H.M. Customs and Excise.]—A. S.

Enzyme action ; Constancy of the optimum temperature of —— under varying concentrations of substrate and of enzyme. A. Compton. Roy. Soc. Proc., 1914, **87**B, 245—254 ; **88**B, 258—262.

In the hydrolysis of salicin by emulsin (Merck's preparation) and of maltose by the maltase of *Aspergillus oryzae* (takadiastase), variation of the concentrations of substrate and enzyme were found to have no effect on the temperature of maximum activity of the respective enzymes. —J. H. L.

Molasses; Yield of alcohol from [cane] —— from different sources. W. L. Owen. Sugar. 1914, **16,** 31—32.

THE figures given show the yield of alcohol from molasses from different sources, and the profits from its distillation estimated on the basis of denatured spirit of 180 proof selling at 37 cents per gallon, and molasses costing 5 cents per gallon :—

Source of molasses.	Brix.	Sucrose.	Glucose.	Total sugars as glucose.	Theoretical yield in proof spirit.	Maximum yield in proof spirit.	Fair yield of alcohol 80%.	Value of alcohol. cents.	Value of molasses when converted into alcohol per gall.	Profit, including cost of molasses. cents.
Cuba	85·98	36·45	16·84	55·11	1·03	0·975	0·82	16·89	9·3	4·3
Louisiana ..	85·84	30·35	27·36	59·22	1·10	1·04	0·88	18·0	10·5	5·5
Mexico	83·27	30·05	21·82	53·32	0·98	0·928	0·78	15·9	8·4	3·4
Hawaii	93·5	35·20	12·57	49·47	0·96	0·91	0·76	15·5	8·0	3·5
Porto Rico	85·5	35·8	18·3	55·89	1·04	0·98	0·83	17·0	9·5	4·5

—J. P. O.

Methyl alcohol; Detection of ——. A. Rinck. Z. Unters. Nahr. Genussm., 1914, **28,** 98—99.

THE solution under examination is slowly distilled in a flask through the cork of which is passed a silica tube bent at an angle of 60°, a copper spiral being placed in the tube just below the bend. The distillate is collected in a small flask immersed in ice-water, and the first 1 c.c. is tested for formaldehyde with 5 c.c. of sulphuric acid containing morphine. The test will detect 0·05 grm. of methyl alcohol.—C. A. M.

Preparation of α-methyl- and α-ethyl-glucosides. Aubry. *See* XX.

PATENTS.

Mash filters. J. Schaefer, Frankfort-on-Maine, Germany. Eng. Pat. 17,028, July 24, 1913. Under Int. Conv., Aug. 10, 1912.

A FIXED head, with inlet and outlet valves controlling the inflow and outflow passages formed by the holes in the filter-plates, is placed centrally between two series of filter-frames extending in opposite directions. The filter frames are pressed together by any suitable means and are so constructed that free access is provided on one side of each filter-cake for the sparge water to the whole surface of the cake, and a space is provided on the other side of each cake for the spargings to flow away from the whole surface of the cake. Each series of filter-frames is connected with a common canal for admission of the sparge water to each cake and to another common canal for withdrawal of the spargings from each cake, the rate of flow of water and spargings in each canal at each cake being substantially the same. The sparge water enters, and the spargings leave, at the same end of the series of frames; hence the maximum flow and minimum pressure are maintained at one end of the series of frames, and the minimum flow and maximum pressure at the other end, and the inflow and outflow pressures on the sides of each cake are substantially the same.—L. E.

Yeast; Means for handling, skimming and pressing ——. W. Scott, Birmingham. Eng. Pats. 21,925, Sept. 29, 1913, and 7729, March 27, 1914.

THE yeast is transferred from the fermentation vat to a closed vessel from which it is forced by gas pressure into a filter-press; the filtrate is returned to the fermentation vat. The pipes for conveying the yeast to the filter-press and the filtrate therefrom to the fermentation vat may be cooled by water-jackets.—W. P. S.

Brewery; Vat for the —— or for other purposes. O. Wehrle. Fr. Pat. 468,746, Feb. 20, 1914.

THE vat is divided by a number of arched partitions into superposed independent compartments. Successive compartments are joined together by iron rings to which the arched partitions and the edges of the compartments are soldered; or, the connecting rings may be provided with projecting rims which engage with, or are bolted to corresponding rims at the edges of the compartments.

—L. E.

(A) *Wines and* (B) *spirits, marcs, brandies, etc.; Process for artificially ageing —— by radioactivity.* H. Farjas. Fr. Pats. (A) 468,700 and (B) 468,701, April 30, 1913.

A MIXTURE of radioactive material, freed from any injurious constituent, and a plastic substance such as cement, is moulded into a suitable shape, dried, and immersed in the liquid to be treated, whereby ageing is effected much more rapidly than by storage.—L. E.

Distilling apparatus; Continuous ——. A. L. Obrador Manila, Philippine Islands. U.S. Pat. 1,106,832 Aug. 11, 1914; date of appl., Aug. 31, 1911. Renewe April 29, 1914.

A SERIES of boilers is connected with a main fractionatin column and with an auxiliary column. The vapours fron the boilers pass up the auxiliary column and thence to th main column, and the " mash " is fed through the auxiliar column into the first of the series of boilers.—W. H. C.

Rectification; Process for the continuous treatment of th tail products of ——. P. Marin. Fr. Pat. 467,83 April 7, 1913.

THE tail products are admitted to a rectifying colum fitted with at least 34 plates so that the ethyl and am alcohols may be completely separated in a single operatio The amyl alcohol accumulates between the 7th and 12t plates, and when it separates in drops, the liquid is wit drawn from this part of the column. The volume amyl alcohol subsequently decanted from the liqui should amount to about 25% of the total volume of liqui withdrawn.—L. E.

Glucose and ethyl alcohol from sawdust and other cellulos materials; Production of ——. A. de Posnansk Fr. Pat. 468,188, April 17, 1913.

THE process is essentially the same as that described Fr. Pat. 464,502 of 1913 (this J., 1914, 497). After bei treated with ammonia and washed, the material thoroughly mixed with the saccharifying agent (sulphur acid) before it is introduced into the autoclave saccharification. The saccharified product is fr from sulphuric acid, preferably by barium carbona and purified by one of the methods previously describ or by freezing it and then separating it from the snow th formed.—L. E.

Liquids [wines, spirits, etc.]; Treatment of —— for improving the quality. C. Henry, Coye, France. Eng. Pat. 19,346, Aug. 26, 1913. Under Int. Conv., Aug. 27, 1912.

See Fr. Pat. 459,141 of 1912; this J., 1913, 1167.—T. F. B.

Wines, liqueurs, and other vegetable extracts; Process of clarifying, ageing, and refining ——. E. Monti, Turin, Italy. U.S. Pat. 1,108,777, Aug. 25, 1914. Date of appl., Sept. 29, 1905.

See Fr Pat. 358,287 of 1905; this J., 1906, 230.—T. F. B.

Alcohol; Process of manufacturing ——. F. Thatcher, El Paso, Texas, and L. M. Stiles, Hachita, New Mexico, U.S.A. Eng. Pat. 6775, March 17, 1914.

See U.S. Pat. 1,096,965 of 1914; this J., 1914, 659.—T.F.B.

XIXa.—FOODS.

Gluten; Variations of ——. Marchadier and Goujon. J. Pharm. Chim., 1914, **10**, 191—202.

Addition of foreign flours (rye, barley, etc.) to wheat flour diminishes the quantity of gluten obtainable from the latter on kneading with water (see Balland, this J., 1899, 389), and if the proportion of foreign flour is sufficiently high (*e.g.*, 40% of rye) no gluten is obtained. The cause of this appears to be physical, for inorganic substances such as talc, magnesia or silica, in the form of powder, behave like foreign flours in this respect. Variations in the gluten-content of wheat flour itself, or of the wheat grain, are on the other hand probably due to deviations from the optimum proportion (3 : 1) between the gliadin and glutenin which together constitute gluten (cp. Baker and Hulton, this J., 1908, 373) and which are interconvertible, the former being a deoxidised, hydrated derivative of the latter. Such deviations may occur during the germination of wheat grains, or during the milling process if this is too vigorous and the particles become overheated. The proportion between gliadin and glutenin may also be affected by the weather conditions during the growth of wheat, and by the conditions of storage of flour. It is known that if the acidity of flour exceeds a certain small value (0·05%) the separation of gluten is to some extent inhibited, and the authors suggest that the higher gluten-content of wheat grown on virgin soil (America) as compared with that from highly manured soils, may be due to a slightly higher acidity of the grain in the latter case, arising from the large quantities of superphosphate manures employed.—J. H. L.

Casein [in milk]; The ferric alum determination of ——. H. V Arny and H. H. Schaefer. J. Ind. Eng. Chem., 1914, **6**, 748—751.

Five c.c. of milk are mixed with 5 c.c. of standardised ferric alum solution (48·2224 grms. $FeNH_4(SO_4)_2, 12H_2O$ per litre), and after 1 hour, the mixture is filtered with the aid of suction, and the precipitate washed free from soluble iron compounds. The excess of iron in the filtrate and washings is determined by digesting with 3 c.c. of 31% hydrochloric acid and 2 grms. of potassium iodide for 30 mins. at 40° C., and titrating the liberated iodine with $N/50$ thiosulphate. For rapid work the excess of iron may be determined by direct titration with $N/10$ alkali, using phenolphthalein as indicator. 1 c.c. of the ferric alum solution is equivalent to 0·05934 grm. of casein.—A. S.

New adulterant of cacao butter. Grimme. *See* XII.

Cohune nuts from British Honduras. See XII.

Detection and determination of saccharin in complex mixtures. Condelli. *See* XX.

Patents.

Cacao, coffee, and like seeds; Continuous pulping, washing, developing, drying, and polishing of —— and machinery or apparatus therefor. G. Watt, Lockerbie, Scotland. Eng. Pat. 15,703, July 8, 1913.

The seeds are subjected to the action of water, steam, and agitating devices until the outer pulpy coating is softened and rendered detachable; they are then washed, subjected to the action of hot water and air, with or without the addition of chemical agents, dried, and polished. The different vessels may be combined in one machine, the various parts being removable.—W. P. S.

Cacao and like seeds; Treatment or method of preparing —— and machinery or apparatus therefor. G. Watt, Lockerbie, Scotland. Eng. Pat. 13,011 of 1914; date of appl., July 8, 1913.

Cacao beans are subjected to the action of hot or cold water while contained in a perforated rotating vessel, provided with an agitator and mounted in a chamber. Chemical agents, such as potassium permanganate, vinegar, etc., are added to the water which is continuously supplied to the chamber, and air is blown into the liquid. Sterilisation may subsequently be effected by cutting off the supply of water and admitting steam until the beans are heated to 120° F. (49° C.).—W. P. S.

Tea, coffee, and the like; Means and apparatus for the production of dry extracts of ——. M. I. Bray, Sealby, A. C. T. F. Waugh, Bradford, and H. Ingle, Scarborough. Eng. Pat. 18,873, Aug. 20, 1913.

The extracts are evaporated in a chamber having a large, level, steam-heated base divided into a number of compartments supplied separately with steam so that the heat applied to different portions of the base may be varied or regulated. An anti-splash is arranged in the upper part of the chamber, which is connected with a device for exhausting the air and vapours, and the cover is fitted with observation windows.—W. P. S.

Emulsions; Manufacture of —— [for margarine]. E. V. Schou, Copenhagen. Eng. Pat. 19,344, Aug. 26, 1913.

Fat is emulsified with a liquid, such as skimmed milk, in which a gelatinous or ropy fermentation has been induced by *e.g.* inoculation with lactic acid bacteria, or with a culture of micro-organisms producing aromatic compounds and lactic acid.—C. A. M.

Foodstuffs; Process for preserving liquid ——. Ges. f. Sterilisation m. b. H. Ger. Pat. 275,871, March 1, 1913.

A small quantity of bromine or iodine in alcoholic solutions containing at least 2% of ethyl alcohol, is used as preservative. For example, 10 kilos. of egg yolks are treated with 10 grms. of iodine dissolved in 200 grms. of absolute alcohol and 200 grms. of water.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

London waters; Chemical and bacteriological examination of the ——. A. C. Houston. Metr. Water Board. Eighth Annual Report, April, 1914. (See also this J., 1913, 921.)

This report covers the year ended 31st March, 1914. The most notable event was the recurrence of the algal trouble in the Staines reservoirs, due this year to the growth of *Tabellaria*, which rendered the water almost unfilterable. The remedy used was to treat the water with copper sulphate and dilute it largely with raw river water.

In addition to the usual oxygen absorption test for 3 hrs. at 80° C., 4-hour tests were also made over a considerable period; they gave results 5% higher. In the case of unsatisfactory waters there is a striking parallelism between the results of a 5 mins. oxygen absorption test and the usual 3-hours test. Taking 0·1 as the basis for objecting to the quality of a water on the 3-hours test, the corresponding figure for the 5-mins. test is 0·038. The bacterial count on bile-salt agar, previously confined to the raw river water, was extended to the filtered waters. The number of bacteria found averaged less than one per c.c. The result of the test is most reliable in winter; occasionally in summer, higher results are obtained, but the colonies are not of typical appearance, and there may be a growth in the water of bacteria which are not necessarily of intestinal origin. In averaging the number of bacteria in the raw river water, all the results have been included, but at times of high flood, counts of 25,000 have been obtained, and it is considered that if these high counts were excluded, a more accurate average figure would be obtained. Further, as there is no reason why the intakes should not be closed at these times of high flood, the exclusive average figure would more truly reflect the quality of the water abstracted. Full tables with details of the chemical and bacteriological results for the raw and filtered waters throughout the year are given. It is considered that the means now adopted for the purification of the supply are such as to render the water reasonably, if not absolutely, safe for drinking purposes.—J. H. J.

River water and sewage; Search for pathogenic microbes in ——. A. C. Houston. Metr. Water Board. Tenth Research Report, June, 1914. (See also this J., 1912, 355, and 1913, 764.)

A known number of typhoid bacilli was added to samples of sewage, and by suitable means a proportion of them was again isolated. It was calculated that it would be possible to isolate one typhoid bacillus from 0·00066 c.c. of sewage, and as none was isolated from control samples of the sewage used, the conclusion is that they were absent from that amount of such sewage. The average number of other bacteria in 0·00066 c.c. of the sewage was 704, whilst the volume of raw river water containing 704 bacteria was 17 c.c. As the filtered water is about 1000 times purer than the raw water, it follows that 17,000 c.c. of the filtered water would not contain a single typhoid bacillus. For isolating the *B. typhosus* from water, a "malachite green" solid medium was superior to ox-gall and "brilliant green" liquid media. In a series of experiments upon the vitality of the *B. typhosus* in water stored at different temperatures, it was found that the bacilli and also *B. coli* lived much longer near the freezing point than at 20° C. No constant difference between the fermentation characteristics of streptococci of human origin and those from animal dung could be detected, but the number of lactose-fermenting streptococci in animal dung was very small. In examining stored water for survival of *B. coli* and other organisms, it has been objected that the diminution in the number of bacilli might be due to clumping and to adherence to the sides of the vessel, but no increase in numbers was observed after shaking the samples with lead shot or sand. Devitalisation is considered to be the chief factor in producing the changes observed under storage. In some laboratory experiments on the excess lime method of sterilisation, *B. coli* died in 7 days in tap water containing 4 parts of CaO per 100,000, whereas in the water, boiled or unboiled, without lime it survived for 25 days. Excess of free lime was necessary: in tests using just sufficient to neutralise the carbonic acid acidity, the *B. coli* was still alive after 13 days.—J. H. J.

Sewage; Clarification of —— *by fine screens.* K. Allen. Proc. Amer. Soc. Civil Eng., 1914, 40, 1839—1910.

The dividing line between coarse and fine screens is taken as being an opening of $\frac{5}{8}$ in. or 15 mm. Only screens which are cleaned above the surface of the sewage are considered, and of these there are five types. The *band screen* consists of an endless flexible band, either of wire mesh or links, which passes over upper and lower rollers. In the screen at Hamburg the links are 0·6 in. apart and are made of an aluminium alloy. The screen is inclined and revolves at the rate of 1—2 in. per sec. At the top, there is a comb or rake to pass between the links to remove the screenings. Before passing through the screen, the sewage flows through a grit chamber. The screenings removed contain H_2O 83—93%, and N 0·1—3·7% when dried At Carshalton, Surrey, a band consisting of perforated steel strips with holes of $\frac{3}{8}$ in. diam. is used. It will remove about 2·5 cub. yds. of solids per million gallons of sewage. The *wing screen* consists of an axle on which flat vanes are set radially. At Frankfort the axle has five vanes consisting of steel bars 0·4 in. apart. The screen revolves in the sewage channel which has a depression under the screen. As a vane rises out of the sewage, a rubber scraper is forced along it from the axle outwards, and the screenings are dropped on to a horizontal steel plate which transfers them to a belt conveyor. The cost is 9d. per cubic yard of screenings. At Bradford similar screens are in operation, the bars being about 0·5 in. apart. When a pair of vanes reaches the horizontal, the screen stops and a rake is introduced and withdrawn mechanically. In the *shovel-vane screen* the vanes are semi-circular and fixed between two circular plates which form the sides of the screen. The axle is hollow and partly open, and contains a belt conveyor. When a vane is in the upright position, the solids drop off on to the belt. The vanes are cleaned by a brush on the end of an arm swinging from a centre near the middle of the adjacent vane. At Strassburg where the vanes are formed of V-shaped wires, 0·1 in. apart, the suspended matter in the sewage was reduced from 211 parts per 100,000 to 78·5 parts at a cost of 3d. per cubic yard of screenings. The *drum screen* consists of a truncated cone of perforated plates or wire mesh, which rotates on a horizontal axis. There are radial plates which raise the screenings and drop them into a central hopper delivering into buckets. At Trier, Germany, the perforations in the plates are 0·1 in. diameter and 0·04 in. apart. The cost of working is 8s. 9d. per million gallons. The *Riensch-Wurl screen* consists of an annular disc surmounted by a truncated cone, both of which are perforated with slots 0·04—0·2 in. in width. The disc is mounted on an inclined shaft and is partly submerged. When raised out of the sewage, the solids are removed by brushes revolving on arms from another shaft. At Dresden where the slots are 0·08 in. wide, the solids removed averaged 1 cubic yard per million gallons and contained 84% H_2O. Fine screening of sewage is suitable in cases where there is a large body of water capable of receiving the screened sewage without further treatment. The efficiency is comparable with that of plain sedimentation tanks, 30—50% of the suspended solids being removed. The screenings contain less water and are more convenient to handle than tank sludge.—J. H. J.

External corrosion of cast-iron pipe. Pugh. *See* X.

Patents.

Pumps [*Water*]; *Process of protecting* —— *from ozone* C. Knips, Charlottenburg, Germany, Assignor to Siemen und Halske, Akt.-Ges., Berlin. U.S. Pat. 1,103,211, July 14, 1914; date of appl., July 18, 1911.

To prevent corrosion of the inner metal parts of the pump, special lubricants are employed, and a small quantity o water is supplied to the pump simultaneously with th ozonised air. This water and the ozonised air are force together through the water to be sterilised.—W. H. C.

Water; Process for clarifying and sterilising ——. C Massatsch, Assignor to Permutit-Akt.-Ges., Berlin U.S. Pat. 1,107,199, Aug. 11, 1914; date of appl., Feb. 6 1914.

The water is treated with such quantities of a perman ganate and a manganous salt as to produce a clear brow solution of colloidal manganese oxides, and is then filtere through sand.—W. P. S.

Water and other liquids or the like; Filtering of —— D. Dunbar, Glasgow. Eng. Pat. 19,142, Aug. 23, 1913

Parallel screens of wire-cloth are arranged in a chambe and two feed tanks fitted with baffle-plates are provide for supplying the water to the chamber. When th screens become clogged, they are cleansed by means ater charged with air under pressure, delivered through spraying device which is lowered between them; this praying device can be raised, lowered, or removed from ne set of screens to another as required.—W. P. S.

ater; Process of removing carbonates from ——. K. Schrempp. Fr. Pat. 468,047, Feb. 4, 1914.

ISSOLVED calcium and magnesium carbonates may be recipitated from water by heating the latter to near, or bove, its boiling point under pressure, and then, as uickly as possible, subjecting it to a low pressure. —W. P. S.

ltra-violet rays; Process for submitting liquids to the action of ——. J. de Kowalski-Wierusz. Fr. Pat. 468,216, Feb. 5, 1914. Under Int. Conv., Oct. 27, 1913.

HE liquid is sprayed by means of compressed air or steam to a series of vertical tubes arranged about a lamp nitting ultra-violet rays; the lower ends of the tubes e in connection with a collecting channel. Or, the quid may be sprayed directly into a chamber conining the lamp. Oil may be treated or mixed with ygen before being submitted to the action of the rays; bleaching effect is thereby obtained.—W. P. S.

iquids; Sterilisation of —— by ultra-violet rays. A. Douilhet. Fr. Pat. 468,617, April 28, 1913.

HE lamp is placed in the centre of the liquid to be erilised and may be surrounded by a quartz jacket order that it may be worked at a high temperature; the lamp is placed directly in the liquid, metal mounts e provided at the ends so that the electrodes are not oled. A photometer, depending on the principle that tra-violet rays pass through quartz but not through dinary glass, is used to ascertain whether the rays e traversing the liquid thoroughly. Baffle-plates in the erilising chamber cause the liquid to flow in close contact ith the lamp. The liquid, if opaque and containing fat obules, may be diluted with water before being passed rough the apparatus, and concentrated subsequently der reduced pressure; the sterilisation may be carried t at such a temperature that the fat globules are melted. —W. P. S.

wage sludge; Method and apparatus for concentrating ——. J. Grossmann, Manchester. Eng. Pat. 22,778, Oct. 9, 1913.

WAGE sludge is treated with a small quantity sulphuric other mineral acid, allowed to stand until separation s taken place, and the liquid portion drawn off. ith sludge containing about 10% of solid matter, out 0·3% of its weight of sulphuric acid may be used. e treatment may be carried out in a tank such as that scribed in Eng. Pat. 28,328 of 1911 (this J., 1913, 159). —W. P. S.

aste-water from towns and industries; Process and apparatus for removing solids from —— and for receiving the sludge in a solid state. Puech, Chabal et Cie. Fr. Pat. 468,134, Feb. 6, 1914.

E waste water is delivered on to a horizontal travelling nd of perforated metal and thence on to another band, d so on, the bands being arranged one below the other a series of steps and scrapers provided at the ends to move the residual solid matter and deliver it into ceptacles. The water is, finally, passed on to bacterial ds or on to land. The whole apparatus may be enclosed. —W. P. S.

wage sludge and similar substances; Process of treating ——. E. W. Janson. Fr. Pat. 468,864, Feb. 24, 1914.

ESSED sewage sludge is sprayed with 0·5 to 4% of its ight of petrol and is then distilled at 260°—480° C.; oils, ammonia, etc., distilling over are collected. e temperature is then raised to 650° C. and the final idue remaining in the retort is used as a manure or precipitating further quantities of raw sewage.—W.P.S.

Waste waters; Apparatus for the purification of ——. Geiger'sche Fabrik für Strassen-und-Haus-Entwässerungsartikel Ges. m. b. H. Fr. Pat. 468,763, Feb. 20, 1914.

AN inclined screen, composed of galvanised iron bars united by cross-bars, is placed in the channel conveying the waste-water. An endless chain band, carrying brushes, travels over the front face of the screen and removes the collected solids to a receptacle situated above the apparatus. Means are provided for raising the screen from the water channel.—W. P. S.

Refuse destructor. W. Ramsay, London. Eng. Pat. 19,083, Aug. 22, 1913.

THE destructor furnace consists of two conical portions connected by a vertical portion; a shoot delivers the refuse into the upper conical portion. The grate is placed at the bottom of the lower conical part and below this is an ash-pit. The air supplied to the furnace is preheated by passing it through pipes surrounding the lower part of the furnace; the fumes and combustion gases escape through a dust chamber and a flue.—W. P. S.

Industrial production of ultra-violet rays by means of [electric] sparks. Fr. Pat. 468,215. *See* XI.

Process and apparatus for the electro-chemical treatment of liquids [e.g. water]. Fr. Pats. 468,242 and 468,277. *See* XI.

PATENT CASE.

Permutite; Process of revivifying or restoring ——. G. Schweikert and A. Czeczowiczka, Vienna. Eng. Pat. 23,706 of 1912 (this J. 1913, 377, 548, 671). Repts. of Patent, Design, and Trade Mark Cases. Vol. XXXI. Appendix No. 1, Jan. 28, 1914. By permission.

THIS was an opposition to an application for the grant of a patent, on the ground that the word "permutite" used by the applicant was a registered trade mark. Permutite consists chiefly of sodium-aluminium silicate. The Comptroller-General held that the use of a registered trade mark in a specification by another was prejudicial to the rights of the registered owner, unless it were pointed out that it is a registered trade mark or is the property of a specified firm. The specification was ordered to be amended.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Nux vomica and its preparations; Determination of alkaloids in ——. M. Azadian. Ann. Chim. Analyt., 1914, **19**, 164—165.

10 GRMS. of powdered *Nux vomica* are made alkaline with 5 grms. of ammonia and repeatedly extracted with a mixture of 25 grms. of chloroform and 50 grms. of ether until all alkaloid is removed. The filtered extracts are united, concentrated, acidified with dilute nitric acid, and completely extracted with water. The acid liquid is warmed to expel volatile solvents, cooled and 10 c.c. of a 5% solution of silicotungstic acid and 10 c.c. of 10% nitric acid added. The mixture is heated to boiling, cooled and the precipitated silicotungstates of strychnine and brucine separated, washed, dried and ignited. The weight of residue multiplied by 0·498 gives the weight of alkaloid. Strychnine silicotungstate has the formula, $12WO_3,SiO_2.2H_2O,4C_{21}H_{22}N_2O_2.8H_2O$.—T.C.

Medicinal plants in England; Cultivation and collection of ——. W. A. Whatmough. J. Board Agric., 1914, **21**, 492—510.

CONTAINS information relative to the cultivation and collection of medicinal plants which grow or can be grown in England.

Cocaine ; New reaction of ——. F. Pisani. Rend. Soc. Chim. Ital., 1914, **6**, 132. Annali Chim. Appl., 1914, **2**, 51.

THE free alkaloid or its hydrochloride when heated with a few drops of concentrated sulphuric acid containing 2% of hexamethylenetetramine, gives a wine-red coloration becoming more intense as the temperature rises: after a short time the colour disappears and a brownish-grey sediment is left. The reaction, which is due to benzoic acid, and is not given by atropine, quinine, cinchonine, brucine, strychnine, morphine, apomorphine, codeine, or narcotine, is distinct with 0·001 grm. of cocaine. Papaverine under similar conditions, may also give a wine-red coloration, changing, however, after a short time, to yellow, reddish-brown, and orange: in doubtful cases papaverine may be identified by the violet coloration it gives with sulphuric acid alone, a reaction not given by cocaine.—A.S.

Lead and arsenic ; Limits of —— *in official substances and preparations.* Chem. and Drug., 1914, **85**, 492.

IN the fifth British Pharmacopœia the limiting quantities (parts per million) of lead and arsenic allowed in various pharmaceutical substances and preparations are :—

Chemical.	Parts per million.		Chemical.	Parts per million.	
	Pb.	As.		Pb.	As.
Acidum aceticum	—	2	Glycerinum	—	4
Acidum acetylsalicylicum	10	2	Liquor ammoniæ fortis	—	0·5
Acidum benzoicum	—	2	Liquor ferri perchloridi fortis	—	10
Acidum boricum	25	5	Liquor ferri persulphatis	—	5
Acidum citricum	20	1·4	Liquor magnesii bicarbonatis	0·5	0·2
Acidum hydriodicum dilutum	10	5	Lithii carbonas	10	5
Acidum hydrobromicum dilutum	5	5	Lithii citras	5	2
Acidum hydrochloricum	10	5	Magnesia levis	20	5
Acidum lacticum	10	5	Magnesia ponderosa	20	5
Acidum nitricum	20	5	Magnesii carbonas levis	20	5
Acidum phosphoricum conc.	10	5	Magnesii carbonas ponderosus	20	5
Acidum salicylicum	—	2	Magnesii sulphas	5	5
Acidum sulphuricum	20	5	Potassii acetas	10	5
Acidum suphurosum	10	5	Potassii bicarbonas	5	5
Acidum tartaricum	20	1·4	Potassii bromidum	10	5
Alumen purificatum	—	5	Potassii carbonas	5	2
Ammonii benzoas	10	2	Potassii chloras	10	5
Ammonii bromidum	10	5	Potassii citras	10	2
Ammonii carbonas	5	2	Potassii iodidum	10	5
Ammonii chloridum	5	5	Potassii nitras	10	5
Antimonium sulphuratum	—	1000	Potassii sulphas	20	5
Bismuthi carbonas	—	2	Potassii tartras	20	2
Bismuthi salicylas	—	2	Potassii tartras acidus	20	2
Bismuthi subnitras	—	2	Sodii benzoas	10	2
Borax purificatus	5	5	Sodii bicarbonas	5	2
Calci carbonas præcipitatus	10	5	Sodii bromidum	10	5
Calcii chloridum	20	5	Sodii carbonas	10	2
Calcii hydras	20	5	Sodii carbonas exsiccatus	25	5
Calcii hypophosphis	10	5	Sodii chloridum	10	2
Calcii lactas	10	5	Sodii et potassii tartras	20	2
Calcii phosphas	—	5	Sodii hypophosphis	10	5
Calx	—	5	Sodii iodidum	10	5
Creta præparata	—	5	Sodii nitris	—	5
Cupri sulphas	—	10	Sodii phosphas	5	5
Ferri carbonas saccharatus	—	5	Sodii phosphas acidus	5	2
Ferri et ammon. citras	—	5	Sodii salicylas	10	2
Ferri et potass. tartras	—	5	Sodii sulphas	5	2
Ferri et quin. citras	—	5	Sodii sulphis	—	5
Ferri phosphas sacch.	—	5	Strontii bromidum	20	5
Ferri sulphas	—	2	Sulphur præcipitatum	—	5
Ferri sulphas exsiccatus	—	5	Sulphur sublimatum	—	5
Ferrum	—	200	Zinci acetas	—	5
Ferrum redactum	—	200	Zinci carbonas	—	10
Glucosum	—	2	Zinci chloridum	—	5
			Zinci oxidum	—	10
			Zinci sulphas	—	5
			Zinci valerianas	—	5

(See also this J., 1912, 748.)

Syntheses in organic chemistry by means of light. X. *Behaviour of vegetable alkaloids with ketones.* E. Paternò. Gaz. chim. ital., 1914, **44**, II., 99—111.

THE alkaloids used in the experiments were nicotine, sparteine, coniine, piperine, papaverine, strychnine, and narceine, and the ketones were acetone, acetophenone, and benzophenone. In many cases the ketone was converted into the corresponding pinacone, and in several instances evidence of the formation of addition-compounds of alkaloid and ketone was obtained. Nicotine and benzo
phenone, for example, yielded a compound which crystal
lised in yellowish needles, m.pt. 151°—153° C., and corre
sponded in composition with a compound of 1 mol. eacl
of nicotine and benzophenone. A substance, probabl
an addition-compound, was also obtained from spartein
and acetophenone, but could not be isolated in a pure stat
owing to its pronounced colloidal character. Strychnin
and acetophenone gave a yellow amorphous powder, havin
marked colloidal properties, probably an addition com
pound of 2 mols. of acetophenone and 1 mol. of strychnin
From narceine and acetone, two bases were obtaine
melting at 231°—232° and 156°—160° C. respectivel
probably products of dehydration of narceine.—A. S.

a-Methyl- and a-ethyl glucosides ; Preparation of ——.
Aubry. J. Pharm. Chim., 1914, **10**, 202—207. (S
Bourquelot and others, this J., 1913, 251 ; 1914, 40).

THE following details are given for the biochemical pr
paration of a-methylglucoside in the laboratory :—18
grms. of pure methyl alcohol are mixed with a solution of 5
grms. of dextrose in 4 litres of water, and then with filter
maceration juice made from 300 grms. of bottom-ferment
tion beer yeast and 3 litres of water, and finally the who
is made up to 10 litres with distilled water, an
maintained at 18°—20° C. until its optical rotato
power has increased from 5° 18′ to 11° or 11° 30′. T
liquid is then treated with a little calcium carbonat
heated to boiling, filtered and concentrated to 5 litres
distillation under reduced pressure. The residue
treated with 50 grms. of fresh baker's yeast, and aft
all the unchanged dextrose has been fermented (about
days) the liquid is filtered, neutralised with calcium ca
bonate, heated to boiling, filtered and distilled und
reduced pressure on the water bath to complete dryne
The residue is boiled, first with 500 c.c. and afterwar
with smaller quantities of 95% ethyl alcohol, and t
boiling extracts are filtered and cooled. Crystals of a-meth
glucoside separate and may be purified by recrystallis
tion from ten times their weight of 95% alcohol. T
yield is about 150 grms. and the purified product h
$[a]_D = +157 \cdot 95°$ and m.pt. 168—169° C. On an industr
scale, where the excess of methyl alcohol can be efficien
recovered by rectification, it would be possible to obt
a somewhat higher yield by reducing the concentration
dextrose from 5 to 1 or 2%, and increasing the concent
tion of methyl alcohol from 18 to 22%.

For the preparation of a-ethylglucoside the followi
quantities may be employed :—500 grms. of dextro
1947 grms. of 95% ethyl alcohol, 3 litres of macerati
juice, and water to make up 10 litres. The liquid is
until its rotatory power has risen from 5° 18′ to about
The subsequent procedure is similar to that described
a-methylglucoside, but the alcoholic extracts made fr
the dried distillation residue do not deposit crystals
cooling. After being filtered they are evaporated to d
ness and the residue boiled several times with 500
of anhydrous ethyl acetate under a reflux conden
The extracts, filtered hot, and seeded with a trace
a-ethylglucoside, deposit long thin needles of this substa
on cooling. The yield is about 50 grms., and the produ
purified by recrystallisation once or twice from ten ti
its weight of acetone, has $[a]_D = +150 \cdot 9°$ and m.pt. 110
—J. H. L

Cyanogenetic plants of New South Wales. J. M. Pet
Brit. Assoc. (Sect. B.), Australia, 1914. Chem. N
1914, **110**, 126.

OVER a thousand species of plants growing in N
South Wales were examined for hydrocyanic acid
cyanogenetic glucosides. Sixty, including forty-f
species native to New South Wales in seventeen Nat
Orders, gave positive results with sodium picrate pa
Some plants, well known to be cyanophoric in Eur
when grown in N.S.W. never gave any reaction, altho
tested in all seasons. Only a few evolved free hydrocya
acid, naturally, but all showed the presence of a gluco
and enzyme. When the natural enzymes in these pla
were killed by boiling water, the reaction to sodium pic

paper ceased; if then a few drops of emulsin, prepared from sweet almonds, were added, positive reactions were again obtained. Of the sixty species stated, twenty are grasses, and these include eleven species indigenous to N.S.W. The *Sorghum vulgare* examined by Dunstan and Henry lost its glucoside when 11 ins high, but the Australian-grown plant retained it when 4 ft. high and mature. Both glucoside and enzyme slowly disappeared with air-drying. Some species of grasses gave negative results at particular seasons. Two species of grasses alone evolved free hydrocyanic acid, and only one of these is available for grazing. This is the only one, except the sorghums, which has been associated with fatalities among stock. Among the non-cyanogenetic grasses, thirty-three species contained emulsin-like enzymes.

Antipyrine; Determination of ——. Studies in synthetic drug analysis. II. W. O. Emery and S. Palkin. J. Ind. Eng. Chem., 1914, **6**, 751—753 (See also this J., 1914, 887.)

Two methods are described, the first of which is applicable when antipyrine is present alone or in such admixture that after treatment with iodine, no substance other than iodoantipyrine (Bougault, this J., 1900, 269) will be extracted by chloroform. A quantity of the sample containing not more than 0·25 grm. of antipyrine is dissolved in 20 c.c. of water, and treated with 5 c.c. of alcohol-free chloroform, 0·5 grm. of sodium bicarbonate, and a slight excess of iodine (15—20 c.c. of 0·2 *N* solution). After 5 mins., with vigorous agitation at intervals, the free iodine is removed by adding thiosulphate, and the iodoantipyrine extracted by shaking thrice with 25 c.c. of chloroform each time. The chloroform solution is washed with water, filtered, evaporated, and the residue dried for ½ hour at 110° C. and weighed. The weight multiplied by 0·5992 gives the quantity of antipyrine.

The second method can be used when antipyrine is mixed with acetanilide, phenacetin, sulfonal, or other substances which do not give an iodine-derivative insoluble in aqueous acid. The sample (containing not more than 0·25 grm. of antipyrine) is dissolved in 50 c.c. of water, shaken well with 20 c.c. of concentrated hydrochloric acid and 50—60 c.c. of *N*/10 iodine, and after 3 hours, the clear liquid is decanted through a filter of glass wool and asbestos and the tarry precipitate of antipyrine periodide washed 8 or 9 times by decantation with 5% hydrochloric acid, and dissolved in 50 c.c. of methyl alcohol free from ethyl alcohol and acetone. The solution is treated with 5 c.c. of sodium bicarbonate solution and 50 c.c. of water, shaken for 5 mins., whereby the periodide is converted into iodoantipyrine, the excess of iodine removed with thiosulphate and the iodoantipyrine extracted by shaking thrice with 40 c.c. of chloroform each time and determined as described above.—A. S.

Gelonida somnifera, a new hypnotic. H. W. Zahn. Deutsch. med. Wochenschr., 1914, 1273. J. Pharm. Chim., 1914, **10**, 207—208.

The preparation is made in tablets containing 0·01 grm. of codeine phosphate, 0·25 grm. of sodium-veronal and 0·25 grm. of calcium-ervasine (an acetylcresotic acid). —J. H. L.

Saccharin in complex mixtures; Detection and determination of ——. S. Condelli. Staz. sperim. agrar. ital., 1914, **47**, 308. Annali Chim. Appl., 1914, **2**, 47—48.

In the case of solids from 10 to 50 grms. are warmed with a saturated solution of magnesium sulphate and magnesia for about ½ hour at 37°—40° C., the liquid being kept alkaline, if necessary by addition of magnesia. The mixture is allowed to stand, and if the insoluble matter does not separate well, a small quantity of sodium tannate and 96% alcohol may be added. The whole is made up to a known volume with a saturated solution of magnesium sulphate and magnesia, filtered, and an aliquot part of the filtrate made strongly acid with sulphuric acid and extracted three times with a mixture of ether and petroleum ether (b.pt. below 70° C.). The ether extract is filtered, evaporated, the residue dissolved in sulphuric acid and treated with potassium permanganate, and the solution filtered and extracted with freshly distilled ether. The ether extract is allowed to evaporate in a tared dish, the residue of saccharin dried in an exsiccator, weighed, and submitted to known identification tests. Liquids are saturated with magnesium sulphate, warmed to 37°—40° C. for about ½ hour, with addition of sufficient magnesia to give a distinctly alkaline reaction, and then treated as described. If considerable quantities of fatty substances be present, the extraction with a mixture of ether and petroleum ether is preceded by an extraction of the distinctly alkaline solution with petroleum spirit (b.pt. 100°—120° C.).—A. S.

Oils of the Coniferae. I. The leaf and twig oils of Cuban pine (Pinus heterophylla) and longleaf pine (P. palustris) and the cone oil of longleaf pine. A. W. Schorger. J. Ind. Eng. Chem., 1914, **6**, 723—727.

The twigs and needles (leaves) were cut by a machine into lengths of 0·5—1 inch and the green cones were pulped before distillation. The results obtained were:—

	Cuban pine. Leaves and twigs.	Longleaf pine.		
		Leaves and twigs.	Leaves.	Cones.
Yield, %	0·271	0·404	0·417	0·363
Sp. gr. at 15° C...	0·8877— 0·8894	0·8829— 0·8849	0·8841	0·8756
n^{15}_D	1·4845— 1·4869	1·4818— 1·4825	1·4834	1·4760
α^{28}_D	—32·09° to —35·67	—26·38° to —30·49	—32·50°	—9·22°
Acid value......	0·69	0·66	0·67	0·42
Ester value	10·16	6·75	5·91	3·95
Ester value after acetylation ..	50·46	42·24	40·46	31·07
Furfural	trace	trace	trace	trace
l-α-Pinene, % ..	4	8—9	2	39—40[a]
l-Camphene, %	10	13—14	12—13	12
l-β-Pinene, % ..	35—36	44	50	25
Dipentene, % ..	8	5	5	6—7
Bornyl esters (as acetate), % ..	3·5	2·4	2	1·4
Alcohols (as borneol), %	11·4	10	9·8	7·6
Cadinene,[b] % ..	18—19	10—11	11	1—2

a. *d*-α-Pinene.

b. The sesquiterpene fractions containing the cadinene were dextro-rotatory, but yielded levo-rotatory dihydrochlorides.

—A. S.

Epicamphor; d- and dl ——. R. Furness and W. H. Perkin, jun. Chem. Soc. Trans., 1914, **105**, 2024—2027.

d-Epicamphor was prepared from *l*-camphor by a series of reactions similar to those used for converting *d*-camphor into *l*-epicamphor (this J., 1914, 101), the *l*-camphor being converted, by the action of sodamide and carbon dioxide, into *l*-camphorcarboxylic acid, m. pt. 125°—127° C., and the latter reduced electrolytically by Bredt's method (Annalen, 1906, **348**, 200; 1909, **366**, 1) to a mixture of *l*-borneolcarboxylic acids, from which by the action of acetyl chloride and subsequent distillation, 1-bornylene-3-carboxylic acid was obtained. The subsequent steps were the same as those described previously (*loc. cit.*), except that instead of the method of purification adopted formerly, it was found much more advantageous to convert the crude epicamphor, after distillation in steam, into the semicarbazone by boiling with an equal weight of semicarbazide hydrochloride and of sodium acetate in 70% alcoholic solution for 2 hours. The mixture is allowed to remain overnight in the ice-chest, the crystalline mass separated, washed with ice-cold alcohol until colourless, treated with hydrochloric acid, and pure epicamphor obtained by distilling with steam. The properties of *d*-epicamphor are practically identical with those of *l*-epicamphor except for the reversal of the sign of the optical rotation.—A. S.

Thujone and carone; Action of ammonium hydrosulphide on ——. C. Agostinelli. Gaz. chim. ital., 1914, **44**, II., 111—115.

Thujone when heated with ammonium hydrosulphide in alcoholic solution in a sealed tube, yielded *iso*thujone and a mixture of polysulphides, from the decomposition products of which thio*iso*thujone was isolated. Under similar conditions carone was not isomerised, but yielded a mixture of sulphur-compounds, two of which were probably $(C_{10}H_{17})_2S$ and $C_{40}H_{68}S_5$, respectively, the latter being analogous to the products obtained by Wuyts (this J., 1903, 509) by the action of ammonium sulphide on camphor.—A. S.

Benzoyl in benzoyl derivatives; Determination of ——. A. W. van der Haar. Arch. Pharm., 1914, **252**, 205—208.

The dried benzoyl compound (0·5 grm.) is saponified with alcoholic alkali beneath a reflux condenser, the alcohol evaporated, and the residue acidified with phosphoric acid and shaken with successive portions of ether, until not more than 1 mgrm. is extracted. The united extracts are treated with anhydrous sodium sulphate, and concentrated to a small bulk at a low temperature, the last traces of ether being allowed to evaporate spontaneously. The residue is dried at 40° C. until constant in weight, and then heated at 115° to 120° C. until the weight again becomes constant. The loss in weight gives the amount of benzoic acid volatilised from the benzoyl derivative. The results agree closely with theory in the case of compounds which do not themselves sublime near 115° C. Complete solubility in ether is also essential.—C. A. M.

Sulphonic acids; Reaction of alkali salts of —— *with alkali phenolates* [*phenoxides*] *by dry distillation.* E. H. Nollau and L. C. Daniels. J. Amer. Chem. Soc., 1914, **36**, 1885—1891.

Dry distillation of the alkali salts of sulphonic acids with alkali phenoxides furnishes a convenient method for the preparation of aryl ethers of phenols: $R.SO_3M + R'OM = R'OR + M_2SO_3$, where R represents a phenyl group, or its homologue provided the side chain is not too long, or a methyl group, and R′ a phenyl, or amino-phenyl group. The yields are less than those obtained by the Ullman and Sponagel method with reduced copper (Annalen, 1906, **350**, 83), but the starting materials are in many cases more accessible than the halogen derivatives required in that process. The preparation of a number of aryl ethers by the method is described.—G. F. M.

Ammonium salts of organic acids; Preparation and properties of the ——. *IV.* L. McMaster. J. Amer. Chem. Soc., 1914, **36**, 1916—1925.

Comparison of the properties of normal ammonium salts of organic acids prepared by using ether, alcohol or acetone as media, with the ammonium salts previously described in the literature shows that in many cases the latter were acid salts produced by hydrolysis due to the aqueous medium in which they were prepared. Ammonium palmitate, stearate and oleate were prepared by passing ammonia gas into ethereal solutions of the acids. The precipitates at first gelatinous, tended eventually to become crystalline. The salts were white, and readily lost ammonia when exposed to moist air. Ammonium elaidate was best prepared in an alcoholic medium; it formed white crystalline flakes. Normal ammonium aconitate was obtained from a saturated alcoholic solution of the acid containing a small quantity of ether. It was extremely deliquescent and readily lost ammonia, but its preparation shows that the method is applicable to tribasic acids. Ammonium *o*-, *m*-, and *p*-hydroxybenzoates, and *p*-methoxybenzoate were obtained from solutions of the respective acids in ether or acetone. By the further application of the above general methods the anhydrous normal ammonium salts of hydrocinnamic, hippuric, *o*-toluic, phenyl-acetic, mandelic and uvitic acids were also obtained.—G. F. M.

Mercuric iodide in tablets; Determination of ——. A. W. Bender. J. Ind. Eng. Chem., 1914, **6**, 753—754.

The tablets (containing 1—2 grains HgI_2) are powdered and digested with 20 c.c. of hydrochloric acid (1 : 1) and 0·5 grm. of potassium chlorate under a reflux condenser until the mercuric iodide is dissolved. After diluting to 100 c.c., and removing chlorine by a current of air, the solution is filtered, the insoluble matter washed by decantation, the filtrate treated with excess of ammonia an the mercury precipitated with hydrogen sulphide. Th method can also be used for the determination of mercur in mercury oleate.—A. S.

Autoxidations [*of xylene and benzaldehyde*]. *IV. Com munication on chemical action of light.* Suida. *See* III

Optimum temperature of salicin hydrolysis by enzyme action Compton. *See* XVIII.

Detection of methyl alcohol. Rinck. *See* XVIII.

Properties of some chlorohydrocarbons and their use i chemical analysis. II. Determination of the chloroethanes Gowing-Scopes. *See* XXIII.

Patents.

Condensation and like reactions and method of producin same. H. Hibbert, Wilmington, Del., U.S.A. Eng Pat. 5408, March 3, 1914. Under Int. Conv., Aug. 13 1913.

Iodine is used as condensing agent to effect intramolecula condensation. The reaction may be carried out unde reduced pressure. Mesityl oxide may be obtained almos quantitatively by distilling diacetone-alcohol with abou 0·0001% of its weight of iodine. Similarly pinacone i converted into dimethylbutadiene, using 0·002% iodine, and cyclohexanol into tetrahydrobenzene, usin 0·02% iodine.—T. F. B.

Perfumes in enfleurage with fatty substances; Proce for removing ——. Lautier fils. First Addition, date Jan. 31, 1914, to Fr. Pat. 465,941, Sept. 24, 1913 (se this J., 1914, 613).

The extracted flowers, together with portions of ster dirt, etc., are removed from the perfumed mass aspiration.—T. F. B.

Hydrocarbons and their derivatives; Process for produci ——. Badische Anilin und Soda Fabrik. Fr. Pa 468,427, Feb. 13, 1914. Under Int. Conv., March 1913.

Carbon monoxide or dioxide, or a mixture of the two, made to react with hydrogen or compounds rich hydrogen, such as methane, by passing the gases ov heated catalysts under high pressures. According to t nature of the catalyst and the pressure employed, a varie of products may be obtained, such as liquid hydrocarbon saturated and unsaturated, aldehydes, alcohols, keton and acids. To obtain larger quantities of liquid produ it is better to use gaseous mixtures containing relative small proportions of hydrogen. Metals or metallic oxid (Ce, Co, Mo, Os, Pd) may be used as catalysts, and in son cases their effect may be intensified by adding high basic substances, such as alkali hydroxides. *Example.* mixture of two parts of pure carbon monoxide to one pa of pure hydrogen is passed over asbestos impregnated wi cobalt oxide and a small quantity of caustic soda, heat to 300°—400° C., under a pressure of 100 atmos. deposit of carbon is generally formed, together with wat carbon dioxide, methane, and higher hydrocarbons a their oxygen compounds, which are condensed or absorb in a cooled vessel. The condensed liquid consists of aqueous solution of aldehydes, etc., on which floats an oi liquid containing saturated and unsaturated hydrocarbo of boiling-points up to 250° C. or more. If a gaseo mixture containing nitrogen or sulphur compounds used, compounds containing nitrogen and sulphur formed in some cases. Gaseous mixtures which cont traces of substances which act as "contact poison are purified by passing them over a heated mass of catal before bringing them to the reaction proper.—T. F. B.

Antiseptic substances [*6-halogen-1-methyl-3-hydroxybenz 4-carboxylic acids*]; *Process for making* ——. J. Riedel A.-G. Fr. Pat. 468,949, Feb. 26, 1914. Un Int. Conv., March 19, July 29, and Oct. 23, 1913.

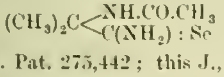
m-Cresotinic acid is converted into its monohalog derivatives, 6-halogen-1-methyl-3-hydroxybenzene-4-c boxylic acids, by treatment with the calcula quantity of halogen in presence of carbon tetrachloride, glacial acetic acid, etc. The preparation of 6-chloro-1-methyl-3-hydroxybenzene-4-carboxylic acid by another method is described in Ger. Pat. 275,093 (this J., 1914, 807). All the above acids are powerful antiseptics. Their soluble salts, as well as those of other derivatives of salicylic acid and its homologues halogenated in the *para*-position to the hydroxyl group, also possess antiseptic properties.—T. F. B.

Anhydrides of organic acids or mixtures of anhydrides with their acids; Process for making ——. R. Muller, and Deutsche Celluloid Fabrik. Fr. Pat. 468,963, Feb. 26, 1914. Under Int. Conv., Dec. 20, 1913.

ACETIC anhydride may be produced in almost theoretical yield by passing the vapours of nitric anhydride or a mixture of nitrogen oxides with air or oxygen over sodium or calcium acetate. If the materials used are not dry, mixtures of acetic anhydride and acetic acid are formed. The anhydride or mixture of anhydride and acid may be separated from the nitrate by heating in a vacuum or by extraction. The product contains only traces of oxides of nitrogen, which are easily separated by distillation over acetates. The reaction can be carried out equally well by passing nitrogen oxides into indifferent liquids containing the acetate in solution or suspension. The same process is applicable to the production of other organic anhydrides.
—T. F. B.

Cyanhydrins of aldehydes or ketones; Process for preparing derivatives of ——. A. Albert. Ger. Pat. 275,847, Aug. 5, 1913. Addition to Ger. Pat. 259,502 (this J., 1913, 673).

IN the process described in Ger. Pat. 273,073 (this J., 1914, 667), the acylated cyanhydrins may be replaced by arylated aminonitriles. For example, α-acetamino-isobutyronitrile is dissolved in alcohol, a small quantity of alcoholic ammonia is added, and the liquid is saturated with hydrogen selenide; a selenamide is obtained of the formula,



$$(CH_3)_2C{<}{\begin{matrix}NH.CO.CH_3\\C(NH_2):Se\end{matrix}}$$

(See also Ger. Pat. 275,442; this J., 1914, 890.)—T. F. B.

Salts of dimethyl-p-amidophenol and p-oxyphenyltrimethylammonium; Manufacture of ——. G. B. Ellis, London. From Chemical Works, formerly Sandoz, Basle, Switzerland. Eng. Pat. 28,736, Dec. 12, 1913.

SEE Fr. Pat. 467,085 of 1914; this J., 1914, 845.—T. F. B.

Arsenostibino compounds and process of making same. P. Ehrlich and P. Karrer, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,108,154, Aug. 25, 1914. Date of appl., July 30, 1913.

SEE Eng. Pat. 17,533 of 1913; this J., 1913, 1030.—T. F. B.

Carbamic acid ester of dichlorhydrin; Process of manufacturing the ——. B. Beckmann, Berlin. U.S. Pat. 1,108,676, Aug. 25, 1914. Date of appl., Nov. 22, 1913.

SEE Eng. Pat. 25,971 of 1913; this J., 1914, 439.—T. F. B.

Erythrene hydrocarbons; Process of manufacturing ——. I. Ostromislensky, Moscow, Russia. U.S. Pat. 1,108,781, Aug. 25, 1914. Date of appl., April 16, 1912.

SEE Fr. Pat. 442,980 of 1912; this J., 1912, 1007.—T. F. B.

Conversion of aliphatic hydrocarbons [of coal distillation gases] into alcohols. Fr. Pat. 468,244. *See* IIA.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic developing agents. Chem. and Drug., 1914, **85**, 413—414.

THERE are no patent-rights existing in connection with the most-used developers, and where these rights formerly existed the claim was for the use in photographic developers of substances well known in organic chemistry.

Pyrogallic acid, or pyrogallol, is prepared by heating gallic acid with two to three times its weight of water in a bronze digester at 200° to 210° C. for about half an hour, a paper ring being placed between the vessel and its cover to allow the carbon dioxide to escape. The resulting solution of pyrogallol is boiled with animal charcoal, filtered, and concentrated. The pyrogallol, crystallising out, is distilled under a pressure of 20 to 30 mm. in order to obtain it perfectly white. (See also Cazeneuve, this J., 1892, 1026). *Pinakol* is a pyrogallol developer containing sodium aminoacetate in place of part of the alkali usually present. *Hydroquinone* (*quinol*).—Aniline (1 part) is dissolved in sulphuric acid (8 parts) and water (30 parts), and a solution of sodium bichromate (2·5 parts) gradually added to the cooled (5° to 10° C.) solution. Potassium sulphite is added to the brown liquid thus obtained, and the whole extracted with ether. The ether is distilled off, the residue dissolved in the smallest possible quantity of hot water, sulphurous acid and animal charcoal added, and the solution boiled and filtered. On standing the quinol separates out from the filtrate. *Adurol* is a haloid substitution-product of quinol, the monochloro-compound being made by passing chlorine through quinol dissolved in benzene. The bromo-derivative is obtained by adding a benzene solution of bromine to one of quinol in the same solvent, evaporating the benzene, and crystallising from ligroin. *Pyrocatechol* (*catechol*) is obtained from beechwood-tar creosote, or by fusing phenol-*o*-sulphonic acid with 24 mol. proportions of caustic potash at 320° to 330° C. (See also Perkin, this J., 1890, 650, and Eng. Pat. 21,853 of 1893; this J., 1894, 879.) *Kachin* is a pyrocatechol developer. *Eikonogen* is the sodium salt of amino-β-naphthol-β-monosulphonic acid. It is prepared from Schaeffer's acid, obtained as a by-product in the aniline-dye industry. (See Meldola, this J., 1889, 958.) *Imogen* is eikonogen modified by the introduction of another amino group. *Diogen* is sodium amino-naphthol-disulphonate. *Para-aminophenol* is photographically of great importance. The following are two methods by which it is prepared: (1) *p*-Nitrophenol (25 kilos.) is added to hydrochloric acid (180 kilos.) at 20° B. (sp. gr. 1·162) and tin (75 kilos.) contained in an earthenware vessel, the temperature rising to 100° to 106° C. Concentrated sulphuric acid (200 kilos.) is next added in a fine stream. After standing for three days the *p*-aminophenol sulphate is filtered off, drained, dissolved in cold water (200 litres), and decomposed with soda, sodium bisulphite (1 kilo.) being added to the solution to protect the precipitated base from oxidation. The precipitate is filter-pressed and dissolved in boiling water (200 to 300 litres) along with sodium bisulphite (10 kilos.), the filtered solution on cooling depositing the base in colourless needles. (2) *p*-Nitrophenol (250 grms.), hydrochloric acid 20° B. (45 grms.), and water (500 c.c.) are heated to 98° C. in an iron vessel provided with an agitator, and iron borings (about 400 grms.) added gradually (15 to 20 grms. at a time) so long as a vigorous reaction takes place. The whole is then boiled for half an hour, and extracted with water (about 2 litres) and sodium carbonate (25 to 30 grms.). The filtered solution deposits *p*-aminophenol on cooling, and the mother-liquor is used for the next extraction, which is continued so long as *p*-aminophenol crystallises out on cooling. (See also Paul, this J., 1897, 63, and Eng. Pat. 5697 of 1897; this J., 1898, 344.) *Rodinol* is the hydrochloride of *p*-aminophenol in concentrated solution. *Unal* is the solid. *Ortol* is methyl-ortho-aminophenol combined with hydroquinone. The starting-point in the manufacture of *o*-aminophenol is *o*-nitrophenol, the ammonium salt being reduced by passing hydrogen sulphide into the solution slowly heated to 40° C. *Metol*, or methyl-*p*-aminophenol sulphate, is obtained by methylating *p*-aminophenol by an indirect method, such as the following: Two mols. of *p*-aminophenol and one mol. of chloroacetic acid in aqueous solution are boiled for about an hour. On cooling *p*-hydroxyglycine crystallises out, which, on melting at 245° to 247° C., decomposes into carbonic acid and metol base, the sulphate of which is the metol of commerce. (See also Paul, this J., 1897, 463, and Lumière and Seyewetz, this J., 1903, 759). *Amidol*, or diaminophenol sulphate, is prepared by reducing ordinary dinitrophenol with tin and hydrochloric acid in a similar way as indicated under *p*-aminophenol. Dinitrophenol is best prepared by warming *p*-nitrophenol with an equal weight of nitric acid (sp. gr. 1·37). (See also Reverdin and de la Harpe, this J., 1892, 157). *Glycin*, or *p*-hydroxyphenylglycocoll, is also prepared from *p*-aminophenol by the action of monochloroacetic acid. *Edinol* is *p*-aminosaligenin hydrochloride, the saligenin being made from salicin. *Diphenal*, or diamino-hydroxydiphenyl, is prepared by a method described in Eng. Pat. 25,136 of 1897 (expired) (see this J., 1898, 1139).

PATENTS.

Photographic printing and paper therefor. W. Willis, Brasted Chart, Kent. Eng. Pat. 20,022, Sept. 4, 1913.

PHOTOGRAPHIC paper which gives an ultimate image composed of silver and platinum, is made by coating paper with an emulsion containing salts of iron, silver, and platinum. It has been found that the reduction of silver chloride by a solution of ferrous oxalate in potassium oxalate is accelerated and rendered more complete in presence of a small quantity of platinic chloride or an alkali platino- or platini-chloride. One method of carrying out the invention consists in coating paper with silver chloride, or with an emulsion containing it, and applying a solution of ferric oxalate containing from 2 to 12 grms. of potassium platinochloride per litre. After exposure to light, the print is developed in a 25% solution of potassium oxalate, passed through a clearing bath containing potassium bisulphate and oxalate, and fixed. Silver bromide may be used in place of silver chloride, and the platinum salt may be added to the developer instead of to the solution used to coat the paper. Especially good results are obtained by using parchmentised paper.
—T. F. B.

Colour photography. P. D. Brewster. Fr. Pat. 468,297, Feb. 10, 1914. Under Int. Conv., Feb. 11, 1913.

IN carrying out this invention, a film or support coated on both sides with sensitive emulsions is used, and the light from the object to be reproduced is brought to the film in such a way that rays of one particular group of colours act on one of the emulsions whilst rays of another group of colours act on the second emulsion. The emulsion on one side of the support is made sensitive to blue and green, for example, whilst the other emulsion is sensitised for red and orange and made relatively non-sensitive to blue and green (*e.g.*, by means of Cyanine). The emulsion on the front of the film may be stained with a colour which absorbs those rays which are not required to act on the other emulsion; the same result is attained by colouring the support of the film. Negatives in colours may be produced on these films by staining the images on either side with different colours. In printing from these colour negatives, further colour-correction may be obtained in the positives by regulating the colour of the light used, *e.g.*, by means of a yellow screen.—T. F. B.

Photographic developer; Preparation and use of a new substance as ——. Union Photographique Industrielle, Etabl. Lumière et Jougla réunis. Fr. Pat. 468,338, April 19, 1913.

IN Fr. Pat. 325,385 (see this J., 1903, 709) is described a compound of methyl-*p*-aminophenol ("metol") with quinol which possesses developing properties and to which the name "metoquinone" was given. It has now been found that chloroquinol forms with methyl-*p*-aminophenol an analogous compound, of m.pt. 100° C., which is more readily soluble in water than "metoquinone," giving solutions which are less easily oxidised by air. It appears to be formed by the combination of two mols. of methyl-*p*-aminophenol with one mol. of chloroquinol. Its photographic developing powers are similar to those of "metoquinone," *viz.*, it can act in aqueous solutions containing alkali sulphite without alkali, whilst if small quantities of alkali carbonates are added to such solutions, the resulting liquids are very stable in air.—T. F. B.

Photographic developers. R. Vidal. Fr. Pat. 468,537, April 26, 1913.

THE products described in Fr. Pat. 391,465 (this J., 1908, 1150) may be used as photographic developers. They are obtained by condensing aromatic amines, hydroxyamines, or their alkyl derivatives with phenols, dihydroxynaphthalenes, hydroxyquinolines, hydroxyanthraquinones, or dihydroxydiphenylamines, especially in presence of hydrocarbons (benzene, etc.). Their activity depends on their constitution; thus, the product from one part of *p*-phenylenediamine and two parts of phenol is a slow developer, and that from three parts of *p*-phenylenediamine and two parts of pyrogallol is a rapid developer.
—T. F. B.

Radiographic plates; Fluorescent —— and process of making them. E. C. Saleil. Fr. Pat. 468,806, May 3, 1913.

PLATES for use in taking photographs by means of Röntgen rays are made by applying to a suitable support a coating of a salt which is phosphorescent under the influence of the rays, and a layer of sensitive silver salt emulsion. The glass or other support is coated with a thin film of gelatin, immersed in acetic acid for a few minutes, and coated with the phosphorescent salt, which may be applied in the form of a liquid made by adding 10 grms. of calcium tungstate and 5 grms. of castor oil to a solution of 4 grms. of nitrocotton in 80 grms. of amyl acetate and 20 grms. of methyl alcohol. When this is dry, the silver salt emulsion is applied. When such plates as these are used, the phosphorescent screen can be dispensed with.
—T. F. B.

Photographic processes; Bichromated-colloid ——. J. C. M. J. Sury, Wyneghem, Belgium. Eng. Pat. 21,958, Sept. 29, 1913.

SEE Fr. Pat. 460,426 of 1913; this J., 1914, 43.—T. F. B.

Photographic developers. Union Photographique Industrielle Etablissements Lumière et Jougla réunis, Lyons, France. Eng. Pat. 1795, Jan. 22, 1914. Under Int. Conv., April 19, 1913.

SEE Fr. Pat. 468,338 of 1913; preceding.—T. F. B.

Photographic sensitive plates and the like. R. E. Crowther, Carlisle. U.S. Pat. 1,109,514, Sept. 1, 1914. Date of appl., Dec., 23, 1913.

SEE Eng. Pat. 29,919 of 1912; this J., 1914, 221.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives in coal mines. Chem. Trade J., Oct. 3, 1914. [T.R.]

A HOME OFFICE ORDER (No. 1311 of Aug. 29, 1914) adds the following new explosives to the "permitted list":—

Ingredients.	Parts by weight.	
	Not more than	Not less than
Ammonite No. 1 (Miners' Safety Explosive Company, Ltd.):		
Nitrate of ammonium	77	73
Tri-nitro-naphthalene	6	4
Chloride of sodium	21·5	19·5
Moisture	1	0
Super-Ripite (Curtis's and Harvey, Ltd.):		
Nitro-glycerin	53	51
Nitro-cotton	4	2
Nitrate of potassium	15·5	13·5
Borax (dried at 100° C.)	17·5	15·5
Chloride of potassium	9	7
Moisture (total)	8	5

The usual stipulations as to quality, packing, markings, etc. are made in each case.

Patent.

Smokeless powders with a nitrocellulose base; Process of manufacturing ——. P. Joliot. Fr. Pat. 468,337, April 10, 1913.

Nitrocellulose of constant composition (N 12·7%) is prepared by nitrating "regenerated cellulose," *e.g.* from cotton cellulose dissolved in sulpho-carbonic solution (viscose). It is completely soluble in alcohol-ether, and yields a smokeless powder of more constant character than that made from ordinary nitrocellulose.—C. A. M.

XXIII.—ANALYTICAL PROCESSES.

Filtering by suction; Device for freeing a precipitate from mother liquor when ——. R. A. Gortner. J. Amer. Chem. Soc., 1914, **36**, 1967.

A piece of thin sheet rubber fastened over the top of a Büchner funnel by means of a rubber band will prevent the formation of cracks in the precipitate and greatly facilitate the removal of the mother liquor when filtering by suction. The suction draws the rubber down until it presses firmly over the top of the precipitate, and a vacuum of 15 mm. can easily be obtained within the flask.—G. F. M.

Chlorohydrocarbons; Properties of some —— and their use in chemical analysis. II. Determination of the chloroethanes. L. Gowing-Scopes. Analyst., 1914, **39**, 385—388.

The solid compound formed in the reaction between pentachloroethane and phenylhydrazine (this J., 1914, 160) is phenylhydrazine hydrochloride, whilst nitrogen and benzene are also produced. Hexachloroethane and, to a less extent, tetrachloroethane react in the same way. The proportions of hydrochloric acid and nitrogen formed varied with the conditions, which could not be controlled sufficiently to form a basis for a method of determining chloroethanes. The following method was based on the interaction of chloroethanes (except hexachloroethane) and alcoholic alkali to form alkali chloride: Ten c.c. of $N/1$ potassium hydroxide solution in absolute alcohol are introduced into a flask without wetting the neck, 20 c.c. of xylene added, and the flask stoppered and weighed. A few drops (not exceeding 0·15 grm.) of the chloroethane are added, and the flask re-weighed and allowed to stand for a few minutes. Sufficient water to dissolve the precipitated chloride is then added, the liquid acidified with dilute nitric acid, and the chlorine determined with silver nitrate and thiocyanate. One c.c. of $N/10$ silver nitrate corresponds to 0·0168 grm. of tetrachloroethane and 0·0202 grm. of pentachloroethane. The presence of hexachloroethane will cause the results to be low. The reaction does not take place in the cold with di-, tri- or perchloroethylene, chloroform or carbon tetrachloride, but on boiling the solution of a chloroethylene a heavy precipitate is formed. In the case of trichloroethylene the sodium ethoxide reacts with the formation of dichlorovinyl ether. When the solution of hexachloroethane in the xylene alkali solution is allowed to stand for some days or is boiled for some time, the solution becomes deep orange. This reaction is not given by the other chlorohydrocarbons.—C. A. M.

Rational analysis of clays. Burian and Juranek. *See* VIII.

Determination of carbon in iron and steel by direct combustion. Cain and Cleaves. *See* X.

Determination of silver and base metal in precious metal bullion. Dewey. *See* X.

Determination of zinc in alloys. Lundell and Bee. *See* X.

The Fachini-Dorta method of separating liquid from solid fatty acids. de Waele. *See* XII.

Insoluble bromide value of oils. Sutcliffe. *See* XII.

New German standards for the trade in beet seed. Edler. *See* XVII.

Valuation of raw sugars. Wiechmann. *See* XVII.

Determination of gum in [cane] molasses. Steuerwald and van der Linden. *See* XVII.

Detection of methyl alcohol. Rinck. *See* XVIII.

The ferric alum determination of casein [in milk]. Arny and Schaefer. *See* XIXa

Determination of alkaloids in Nux vomica and its preparations. Azadian. *See* XX.

New reaction of cocaine. Pisani. *See* XX.

Determination of antipyrine. Emery and Palkin. *See* XX.

Detection and determination of saccharin in complex mixtures. Condelli. *See* XX.

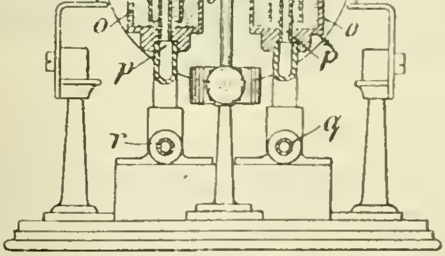
Determination of benzoyl in benzoyl derivatives. van der Haar. *See* XX.

Determination of mercuric iodide in tablets. Bender. *See* XX.

Patent.

Carbon dioxide: Apparatus for estimating the percentage of ——, *in flue gases.* G. Schauli, Cheshunt, Herts. Eng. Pat. 21,542, Sept. 24, 1913.

In a gas balance one end of the beam terminates in a light, hollow sphere, and the other in a pointer, which moves over a scale and is surrounded by a guard.



The method of leading gases into and out of the sphere is as follows: *k* (see fig.) is an inlet, and *l* an outlet, pipe extending, from separate chambers, *m*, below the cross-bar, *e*, attached to the beam, to opposite sides of the sphere, each chamber, *m*, being connected with a bell, *n*, which dips into a mercury-cup, *o*, and covers a vertical pipe, *p*; of the latter, the inlet communicates with a supply pipe, *q*, and the outlet with a delivery pipe, *r*, the air or gas being drawn or forced through the balance by any suitable pumping device. The balance is adjusted to point to zero by a rider on the beam, when the sphere contains pure air; and electrical means are provided for illuminating the scale and for actuating a hooter, when the beam assumes either of the extreme positions.—W. E. F. P.

Trade Report.

Prohibited exports. Order in Council, dated Sept. 25th, 1914, amending previous lists.

The heading "cotton suitable for use in the manufacture of explosives" is deleted from the Proclamation of Aug. 3rd (this J., 1914, 810), and the heading "cotton waste" is expanded to read "cotton waste of all descriptions."

The heading "coal tar products for use in dye manufacture" (Order in Council, Sept. 8th; this J., 1914, 896) is expanded so as to read "coal tar products for use in dye manufacture, except aniline oil and aniline salt."

The exportation of graphite is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of Russia (except Baltic Ports), Belgium, France, Spain, and Portugal.

"Peroxide of manganese" is added to the list of prohibitions of export to all destinations.

Russia; Exportation of prohibited goods from ——. Board of Trade, Oct. 3, 1914.

The export of the following from Russia has been prohibited:—Oilseeds, coal and coke, birch tar (for the manufacture of coal briquettes), iron ore, naphtha and naphtha waste, benzine, kerosine and other illuminating (petroleum) oils and lubricating (petroleum) oils, rubber tyres and rubber, fuses, nitric acid, and saltpetre.

The Russian Government are prepared to authorise without any formality the exportation of these goods in a British or an Allied vessel if the port of destination is a British or Allied port. If, on the other hand, the vessel's port of destination is a neutral port, the Russian Government can only authorise the exportation of prohibited goods by such vessels if the Embassy or Legation of the neutral country in which the port in question is situated certifies in agreement with the Embassy (or Legation) of the Allied country under whose flag the vessel sails that such prohibited goods will be unloaded in a neutral country and will not be re-exported to an enemy country. The Russian Government reserve the right to refuse permission for the exportation of any prohibited goods if such goods are required in Russia. In the case of goods which it is proposed to transport from Russia on neutral vessels, either direct to the United Kingdom or to a neutral port for transhipment to the United Kingdom, application to the Russian authorities for permission to export must be made by the Embassy or Legation of that country under whose flag the vessel sails. Such application will be supported by His Majesty's Embassy at Petrograd at the request of the consignees of the goods in the United Kingdom, provided that such request is addressed to the Embassy through the Foreign Office.

Germany; Prohibition of certain exports from ——. Chem. Trade J., Sept. 26, 1914.

The list of articles which may not be exported from Germany has been modified, and the following have been added to the prohibited list: Acetone, amidosulphonaphtholic acids, aniline, antimony, ether, barium nitrate, gun-cotton, benzidine, benzol, chloroform, dinitrochlorbenzol, dinitrophenol, dinitrotoluol, diphenylamine, ethyl acetate, potassium, sodium, and ammonium nitrates, metallic potassium, lime acetate, natural and synthetic camphor, carbolic acid, colophony, cresol and metacresol, mineral waters, sulphonaphtholic acids, naphthylamine and its sulpho acids, metallic sodium, sodium oxalate, nitraniline, nitrobenzol, phenol, picric acid, phosphorus, juices of fruits and plants (also when prepared with sugar or syrup and when they contain alcohol), nitric acid, sodium sulphide, turpentine oil, toluidine, toluol, trinitrotoluol, metallic wolfram, nitric compounds of cellulose. The prohibition of the exportation of pyrazolone and its products (*e.g.*, pyramidon) and of caustic soda and colour and dyeing materials has been revoked.

Book Received.

L'Industria dei Saponi. Del Dott. V. Scansetti. U. Hoepli, Milan. 1915. Price Lire 5.50.

The volume (6 by 4½ ins.) contains 469 pages of subject matter, with 131 illustrations and also an alphabetical index, the chapter-headings being:—I. Theory of saponification. II. Fats. III. Alkalis. IV. Auxiliary materials for the manufacture of soaps. V. Lyes—their preparation. VI. Apparatus for the manufacture of soap. VII. Hard or soda soaps. VIII. Semi-boiled soaps. IX. Eschweg soap (blue mottled soap). X. Potash or soft soaps. XI. Soaps for industrial use. XII. Toilet soaps. XIII. Extraction of the glycerin. XIV. Analysis of soaps. XV. Cost of production and statistics.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Copper-Alloy Three-Piece Unions* for Low and Medium Pressure, etc.; British Standard Specification for ——. (Engineering Standards Committee.) Folio, swd. C. Lockwood. London. 1914. Net 5s.

Salt Glazed Ware Pipes; British Standard Specification for ——. (Engineering Standards Committee.) Folio, swd. C. Lockwood. London. 1914. Net 5s.

IIA. *Henry*, J. D.: History and Romance of the Petroleum Industry. Vol. I. Royal 8vo, pp. 320. Author. 1914. Net 10s.

Redwood, I. I.: A Practical Treatise on Mineral Oils and their By-Products. New impression. 8vo. pp. 350 Spon. London. 1914. Net 10s. 6d.

V. *James*, G. W.: Indian blankets and their makers. Chic., McClurg il. 1914. $4.

VI. *Strobino*, G.: Apparecchiatura dei tessuti di lana: trattato teorico-pratico ad uso degli industrial lanieri, direttori di lanificio, capi apparecchio ed allievi delle scuole professionali. Milano, 16° fig., p. viii, 618. (U. Hoepli). 1914. Lire 8·50

IX. *Abrams*, D. A.: Tests of Bond between Concrete and Steel. 8vo. Chapman & Hall. London 1914. Net 4s. 6d.

Guidi, C.: Le costruzioni in beton armato. Appendice alle lezioni sulla scienza delle costruzioni date nel r. Politecnico di Torino. 4a ed. Torino, 8° fig., p. 168 con 9 tav. 1914. Lire 4.

X. *Steel Conductor Rails;* British Standard Method of Specifying Resistance of ——. (Engineering Standards Committee.) Folio, swd. C. Lockwood London. 1914. Net 10s. 6d.

Yensen, T. D.: Magnetic and other Properties of Electrolytic Iron Melted in Vacuo. 8vo, swd. Chapman & Hall. London. 1914. Net 1s. 9d.

Romegialli, E. A.: Metalli e loro lavorazione dal punto di vista tecnico, industriale, meccanico e chimico. Milano 16° fig., p. 216. Lire 2·50.

XIXA. *Richmond*, H. D.: Dairy Chemistry: Practical Handbook for Dairy Chemists an Others having Control of Dairies. With numerous table and 49 illustrations. 2nd ed., revised. 8vo, pp. 42 C. Griffin. London. 1914. Net 15s.

XXIV. *Snell*, J. F.: Elementary Household Chemistry. Cr. 8vo. Macmillan. London. 1914 Net 5s. 6d.

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* Compiled by H. Grevel and Co., 33, King Street, Cove Garden, London. W.C., from whom all the works in the precedin list can be obtained.

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No. 20, Vol. XXXIII. OCTOBER 31, 1914. No 20, Vol. XXXIII.

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Communications.

NOTES ON ALCOHOLOMETRY. II.

(Continued from page 856, Vol. XXXII., 1913.)

BY A. F. JOSEPH AND W. N. RAE.
Ceylon Medical College, Colombo.

I.—*Specific gravity of very dilute alcohol solutions.*

In alcoholometric tables, the strengths of dilute solutions appear always to have been obtained by linear interpolation, and no accurate measurements are recorded of the direct determination of the density of very dilute solutions. We have, therefore, carefully determined the density of solutions containing between 0 and 1·7% of alcohol.

The alcohol was prepared by repeatedly boiling Kahlbaum's 99·8% with pure freshly ignited calcium oxide until its density showed it to be practically anhydrous according to the tables of Osborne, McKelvy, and Bearce (this Journal, 1913, 304). As it was only required for preparing very dilute solutions, absolute freedom from water was not necessary, and the sample used, which had a density of 0·77871 at 32·5° C. and corresponding to 99·96% alcohol, was taken as anhydrous.

The mixtures were prepared by weighing about 170 grms. of water in a rubber-stoppered flask on a large Oertling balance, adding the proper quantity of alcohol, and reweighing.

The densities were determined in duplicate and usually by both of us independently. Two thermostats were used, one adjusted to 32·5° C. and the other to 32·57° C.; the results obtained with the use of the latter were reduced to 32·5° C. by means of the coefficients of expansion given by Osborne. Some of the determinations were made in 70 c.c. Bousfield pyknometers and others in ordinary specific gravity bottles provided with a glass cap ground over the outside of the neck. The thermostats were maintained constant to 0·002° C., and error in the densities is probably not greater than one unit in the fifth place of decimals. The following examples are given :—

% alcohol.	Density I.	II.
0·219	0·99447 (A.F.J.)	0·99446 (A.F.J.)
0·661	0·99363 (W.N.R.)	0·99363 (W.N.R.)
1·316	0·99240 (W.N.R.)	0·99239 (A.F.J.)

From the results of 17 duplicate experiments, a large-scale curve was drawn (reading directly to 3 units in the 6th place) and from it the following table has been constructed giving the density of dilute alcohol from 0 to 1·6%.

Alcohol % by weight.	Density (grms. per cc. at 32·5).	Difference for 0·2%
0·0	0·99489	
0·2	0·99451	38
0·4	0·99411	40
0·6	0·99373	38
0·8	0·99337	36
1·0	0·99299	38
1·2	0·99261	38
1·4	0·99224	37
1·6	0·99186	38

There is a slight change of curvature at about 0·7%—this has been confirmed by additional determinations.

The density of a 1% solution calculated from Osborne's table is 0·99301: our result is somewhat lower, but the difference is not large enough to affect ordinary work. Accepting the coefficients of expansion of Osborne, a table can be constructed for any temperature between 10° and 40° C.

II.—*The specific gravity tables contained in the books supplied for use with Sikes' hydrometers.*

At the end of the tables—both the ordinary sets and those of Bedford—is to be found a table ("Table I.") for reducing the readings of the hydrometer to specific gravity. The ordinary tables contain an inaccurate statement to the effect that a gallon of distilled water at 60° F. weighs 10 lb.; this is true at 62° F. (which is correctly given in Bedford's tables) and the specific gravities given in Table I. therefore refer to water at 62° F.

The specific gravity tables in the ordinary and Bedford's books are identical. In order to ascertain the correctness of these tables in a warm atmosphere, we have made determinations of the specific gravity of a few alcohol solutions at 32·5° C. (90·5° F.) and observed the hydrometer reading when the hydrometer jar was immersed in the thermostat. A standard set of glass hydrometers was used throughout.

The density was reduced to 62° F. and compared with that given in the tables :—

Specific gravity at 90·5° F. compared with water at 62° F.

From hydrometer and tables..	0·8345	0·8695	0·9091	0·9230	0·9427	0·9613	0·9810	0·9904
From direct determination ..	0·8344	0·8695	0·9092	0·9228	0·9427	0·9613	0·9810	0·9904]

Since the greatest difference observed could be caused by an error of half a scale division on the glass hydrometer, the Table I. referred to may be taken as correct in a warm atmosphere.

It is advisable that systematic checking should be applied at lower temperatures; we have made attempts to do so at 59° F., but with the room temperature at 82° F. accurate work with the hydrometer is almost impossible, probably owing to convection currents in the hydrometer jar; the following are given as examples of the determinations made :—

Specific gravity at 59° F. compared with water at 62° F.

From hydrometer and tables	0·8436	0·8713	0·9407	0·9674
From direct determination	0·8441	0·8710	0·9407	0·9672

From these and similar results we have tentatively assumed the table correct at all temperatures.

III.—*Comparison of the main hydrometer table with the specific gravity table ("Table I.").*

If we accept Table I. as being correct, it becomes of interest to compare it with the main table (for reducing hydrometer readings to alcoholic strength) in the following manner :—

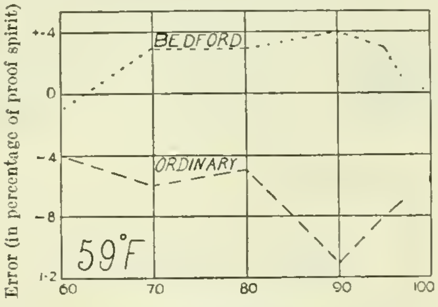
Select some point on the hydrometer scale, say 80, and select a temperature for comparison, say 59° F. (=15° C.).

The alcoholic strength from the ordinary tables is given as 40·2 U.P.=59·8% P.S.

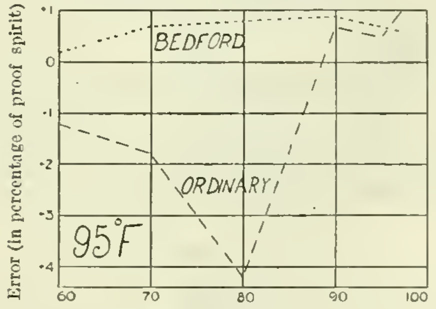
From Table I. the specific gravity is 0·9604 when the hydrometer reading is 80. This, reduced to true density (grams per c.c.), is 0·9593, and from the tables of Osborne, the solution having this density at 15° C. is 28·43% corresponding to 60·3% P.S. There is thus a small inconsistency between the two tables. If the specific gravity table be accepted as correct, then the general table must be wrong. We have calculated similar figures for a number of points on the hydrometer scale at the temperatures 59° F. (15° C.) and 95° F. (35° C.). These are shown in the following table :—

Hydrometer reading.	S.G. from hydrometer table referred to water at 62° F.	Density at 4° C. calculated from S.G.	At 59° F.			At 95° F.		
			True alcoholic strength from O.M. & B.'s tables (in % of proof spirit).	Strength from ordinary tables.	Strength from Bedford's tables.	True strength.	Strength from ordinary tables.	Strength from Bedford's tables.
60	0·9218	0·9207	98·9	98·5	98·8	85·7	84·5	85·9
70	0·9409	0·9398	82·0	81·4	82·3	67·8	66·0	68·5
80	0·9604	0·9593	60·3	59·8	60·6	45·5	41·3	46·3
90	0·9800	0·9789	28·5	27·4	28·9	19·0	19·7	19·9
95	0·9900	0·9889	12·9	12·1	13·2	6·1	6·6	6·8
97	0·9942	0·9931	7·4	6·7	7·5	1·1	2·1	1·7

The errors in the two sets of tables are shown in diagrams in which hydrometer readings are plotted against error expressed as percentages of proof spirit.



Hydrometer readings.



Hydrometer readings.

At these two temperatures Bedford's tables are far more consistent, and more accurate if the specific gravity table be accepted as correct.

Probably the best way of compiling a correct hydrometer table would be first to test thoroughly the correctness of the specific gravity table and then arrange the main table to be consistent with it by the use of the density tables of Osborne.

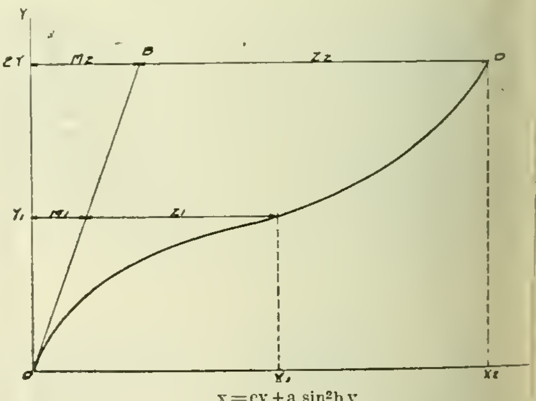
As far as our observations and calculations go, Bedford's tables are to be preferred on the whole, both at high and low temperatures. This was confirmed by a series of tests made on the same solutions of known strength, in Colombo (temperature about 85° F.) and Nuwara Eliya (temperature about 60° F.). At the former temperature, the ordinary tables gave slightly more satisfactory results for weak solutions (80 U.P. and weaker) than those of Bedford. The latter, however, are quite free from the very large errors (several per cent.) which are caused by the use of the ordinary tables for solutions 40 to 60 U.P. As far as we are aware, the errors or inconsistencies in Bedford's tables rarely exceed the error which would be caused by an error of one division in the reading of the hydrometer.

HYSTERESIS TESTS FOR RUBBER.

BY EARLE L. DAVIES.

(*Contribution from the Chemical Laboratory of The Goodyea Tire and Rubber Co., Akron, Ohio, U.S.A.*)

The expert usually judges a piece of rubber by mean of a crude hysteresis test which he performs by stretchin a small strip with his fingers. Experience enables him t judge fairly closely, but by no means accurately, smal differences between two samples; it does not enable hi to standardize his tests, nor to make his results availabl to others. Several machines have been devised to perforn and record these tests graphically, but they have not com into their full usefulness, due to the difficulty encountere in translating the graph into terms which are intelligibl and comparable. The object of this paper is to indicat and explain some of the relationships between the mathe matical equation for the curve and the properties of th rubber being tested, and to point out the close relationshi which some of the tests, which we have made in thi laboratory, show between the theoretical curve and actua curves made by the machine.



$x = cy + a \sin^2 by$

The typical form of curve produced by the machine shown in the figure. The ordinates represent tension an the abscissæ, stretch. Cheneveau and Heim* have shov that this curve has the equation :—

$$x = cy + a \sin_2 by \ldots\ldots\ldots\ldots\ldots($$

and that when OB is drawn tan. to the curve OD at O.

$$c = \tan. \text{ angle } YOB.$$

From equation (1)

$$a \sin^2 by_1 = x_1 - cy_1$$

and since $c = \frac{m_1}{y_1}$ and $z_1 = x_1 - m_1$

we have $z_1 = x_1 - cy_1$

or $z_1 = a \sin^2 by_1 \ldots\ldots\ldots\ldots\ldots$

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* Sur l'extensibilité du caoutchouc vulcanisé. Comptes Rend Feb. 6th, 1911, p. 320. Also "The Rubber Industry" (1911)

In like manner it may be shown that $z_2 = a \sin^2 2by_1$ .. (3)

where $$y_2 = 2y_1$$

From (2): $$\sin^2 by_1 = \frac{z_1}{a}$$

and since $$2 \sin^2 A = 1 - \cos 2A$$

we have $$\frac{2z_1}{a} = 1 - \cos 2by_1$$

or $$\cos 2by_1 = \frac{a - 2z_1}{a} \quad \ldots\ldots\ldots\ldots\ldots \quad (4)$$

From (3): $$\sin^2 2by_1 = \frac{z_2}{a}$$

(And since $\cos^2 A = 1 - \sin^2 A$)

we have $$\left(\frac{a - 2z_1}{a}\right)^2 = 1 - \frac{z_2}{a}$$

Whence $$a = \frac{4z_1^2}{4z_1 - z_2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

From (2):

$$\cos^2 by_1 = 1 - \frac{z_1}{a}$$

$$= 1 - \frac{z_1(4z_1 - z_2)}{4z_1^2} = \frac{z_2}{4z_1}$$

Whence $$b = \frac{\cos^{-1}\sqrt{\dfrac{z_2}{4z_1}}}{y_1} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

That these terms are not so mysterious as they appear, becomes evident after an analysis of the above proof. Thus we find that the constant, c, is dependant solely upon the initial resistance of the rubber to stretching; it will be largest for a pure gum stock and become relatively smaller and smaller as the stock is more heavily compounded. From the relationship in equation 5 we can readily see that in the case of a pure gum stock where the stretch is long and uniform, m_1 and m_2 having been large, a will be relatively large, in comparison with a "tread" stock which will be strong and cause the entire curve to be fairly steep, but will be small in comparison with a "whiting stock," which is characterised by an initial stiffness after which it offers comparatively little resistance to stretching. Equation 6 shows that for pure gum or tread stocks cos b will be small and b consequently large.

The ease with which these values could be standardised in specifications for a given stock is apparent, and the value of such standards both from the point of the manufacturer and the buyer is obvious.

We have done some work in this laboratory to find how closely the curve computed from the equation agrees with the actual curve, of which the following example is typical. For our work we used the "Schwartz Rubber Testing Machine." Test specimens were cut from a "Goodyear" auto inner tube, and from curves drawn in testing these specimens we obtained constants which gave the equation:—

$$x = 1{\cdot}17y + 2{\cdot}06 \sin^2 34{\cdot}6\,y.$$

Another tube made by the same formula was selected at random and a curve drawn from a sample of this tube. Assuming various values for y, the x to correspond was computed from the equation and compared with the same values as measured on the curve.

The results were as follows:—

y	by		x (computed).	x (from curve).	Diff.
inches.	deg.	min.	inches.	inches.	
0·2	6	55	0·26	0·26	0·00
0·5	17	18	0·77	0·78	−0·01
1·0	34	36	1·84	1·86	−0·02
1·5	51	54	3·04	3·05	−0·01
2·0	69	12	4·14	4·08	+0·06
2·5	86	30	4·78	4·70	+0·08
3·0	76	12	5·26	5·17	+0·09
3·5	58	48	5·61	5·60	+0·01
4·0	41	36	5·71	—	—

These are actual measurements from the curve representing only arbitrary values for x and y.

THE METHOD BY WHICH THE CORRECTED SIKES'S TABLES IN USE IN INDIA, FOR DETERMINING THE PROOF-STRENGTHS OF SPIRITS AT TEMPERATURES FROM 40° F. TO 100° F. BY SIKES'S HYDROMETER, WERE CALCULATED.

BY F. G. CARTER.

The Alcohol Tables "for the use of the Appraisers' Department, Calcutta Customs House," issued 1st September, 1889, which were taken originally from The Analyst, Vol. V. (1880, p. 42), were used by me as the basis for the specific gravities of spirits of varying degrees of proof-strengths at 60° F. compared with the sp. gr. of water at 60° F. In these tables the sp. gravity of spirit of proof strength at 60° F. as compared with the sp. gravity of water at 60° F. = 0·9198.

These sp. gravities at 60° F. compared with the sp. gravity of water at 60° F. were then converted into sp. gravities at 60° F. compared with the sp. gravity of water at 62° F. by multiplying by 1·000182 (the expansion of water from 60° F. to 62° F.).

Table B of the Spirits Act of 1880, Ch. 24, pp. 60 2, was then taken as giving the actual sp. gravities of liquids as compared with the sp. gravity of water at 62° F. which Sikes's hydrometers constructed to fit these tables, whether of glass or of brass, should give correctly at 62° F. (the corrected tables were calculated to be used with hydrometers, whether of glass or of brass, which should be constructed to indicate correctly at 62° F. the sp. gravities of Table B. as compared with the sp. gravity of water at 62° F.).

Tables of the expansion of mixtures of water and alcohol in proportions ranging from water to absolute alcohol from 60° F. to 100° F. and contractions from 60° F. to 40° F. were then prepared for calculating variations of temperature for the above (para. 2) sp. gravities, as follows:—

Separate co-ordinate curves were made for 70° F., 85° F., 100° F., 50° F., and 40° F. for expansion throughout the whole range of proof-strengths at these temperatures from the formulæ of Baumhauer,[*] Recknagel, Kopp and others (Castell-Evans's Physico-Chemical Tables, Vol. I) and data derived from these curves were tested against hydrometer determinations of various strengths and at different temperatures compared with pyknometer weighings of the same samples at 60° F. I then completed expansion tables, from which tables of variations of sp. gravities were obtained which agreed generally more nearly, perhaps, with Tralles' Tables, III. and IV.[†] (p. 492 of Bayley's Chemists' Pocket Book) than with the tables by Gilpin and Blagden, by Mendeléeff and others.

After calculating the various sp. gravities as above, for the final step of fitting them at all temperatures from 40° F. to 100° F. to indications, through Table B, of hydrometers (whether of glass or of brass) it was necessary to consider the volume-expansion and volume-contraction of glass and brass from 62° F. to 100° F., and from 62° F.

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[*] In Baumhauer's coefficients (p. 162 of Castell-Evans, Vol. I.) there is a misprint in the first coefficient of ·033981 for ·031981.

[†] Tralles' Table IV. should read "to be added" where "to be subtracted" is printed and "to be subtracted" where "to be added" is printed.

to 40° F. For this, coefficients of linear expansion for for 1° C. were taken from p. 284 of Deschanel. Part II., Heat, namely, for glass for 1° C. 0·0000081l6, for brass 0.00001878 These were multiplied by 3 for cubical expansion and by $\frac{5}{9}$ to apply them to degrees Fahrenheit.

A table of differences of sp. gravities for each degree of temperature from 40° F. to 100° F. (excepting 62° F.), of which the following is a short summary, was then made, and from this table the necessary adjustments were made before the specific gravities were finally fitted to hydrometer-indications, through Table B.

Having prepared all the preliminary data. on the above lines, the work was then taken in hand systematically.

	To be subtracted.					To be added.						
	40° F.	45° F.	50° F.	55° F.	62° F.	70° F.	75° F.	80° F.	85° F.	90° F.	95° F.	100° F.
For glass instruments	·0003	·00023	·00016	·0001		·0001	·000176	·00024	·0003	·00038	·00045	·00051
For brass do.	·00069	·00053	·000375	·00022		·00025	·0004	·00056	·00072	·00088	·00104	·0012

The following example will perhaps best make clear the above notes and demonstrate the essential system upon which the whole was elaborated.

Proof-spirit at 85° F. and at 50° F.

Data. Sp. gr. $\frac{60^\circ\text{ F.}}{\text{Aq. }60^\circ\text{ F.}} = 0{\cdot}9198$ (" The Analyst," *loc. cit.*).

$\therefore$ Sp. gr. $\frac{60^\circ\text{ F.}}{\text{Aq. }62^\circ\text{ F.}} = 0{\cdot}9198 \times 1{\cdot}000182 = 0{\cdot}919967$

For 85° F.

Expansion of Proof-spirit from 60° F. to 85° F. = 1·0125 approx.

$\therefore$ sp. gr. of $\frac{\text{Proof-spirit}}{\text{Aq. }62^\circ\text{ F.}}$ at 85° F. $= \frac{0{\cdot}919967}{1{\cdot}0125} = 0{\cdot}9086$ nearly.

For expansion of the hydrometer from 62° F. to 85° F.
if for glass instruments *add* 0·0003 to the above,
if for brass instruments *add* 0·0007 to the above.

The hydrometer-indication required, therefore, is that hydrometer-indication in Table B which corresponds,
if for glass instruments, to a sp. gr. of 0·9086 + 0·0003 = 0·9089,
if for brass instruments, to a sp. gr. of 0·9086 + 0·0007 = 0·9093,
that is, for glass hydrometers, an hydrometer-indication = 53·1
and for brass hydrometers, an hydrometer-indication = 53·3

For 50° F.

Contraction of Proof-spirit from 60° F. to 50° F. = 0·99536 approx.

sp. gr. of $\frac{\text{Proof-spirit}}{\text{Aq. }62^\circ\text{ F.}}$ at 50° F. $= \frac{0{\cdot}919967}{0{\cdot}99536} = 0{\cdot}924255$

For contraction of the hydrometer from 62° F. to 50° F.,
if for glass instruments *subtract* 0·00016
if for brass instruments *subtract* 0·000375

The hydrometer-indication required, therefore, is that hydrometer-indication in Table B which corresponds,
if for glass instruments, to a sp. gr. of 0·924255—0·00016 = 0·9241 approx.
if for brass instruments, to a sp. gr. of 0·924255—0·00037 = 0·9239
that is, for glass hydrometers, an hydrometer-indication 61·2
and for brass hydrometers, an hydrometer-indication 61·1

As it had been decided for the future to use glass hydrometers only in India, tables for glass instruments were alone elaborated, but I made a table of proof-degree differences for using or adapting these tables to brass instruments, of which the following is a summary.

NOTE.—Where the + sign is shown these differences are to be added to, and where a — sign to be subtracted from,* net proof-strength found in the tables for glass hydrometers.

Temperatures F.°	40° to 45°	45° to 50°	50° to 55°	55° to 62°	62° to 70°	70° to 75°	75° to 80°	80° to 85°	85° to 90°	90° to 95°	95° to 100°
Differences in sp. gr. between glass and brass	·00034	·00025	·00016	·0007	·00008	·00017	·00026	·00035	·00044	·00053	·00062
Hydrometer indications.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.	pf. degrees.
A 0 to A 10	—0·15	—0·1	—0·05	nil	nil	+0·05	+0·1	+0·15	+0·2	+0·25	+0·3
A 10 ,, A 20	—0·15	—0·1	—0·05	—0·05	+0·05	+0·05	+0·1	+0·15	+0·2	+0·25	+0·3
0 ,, 5	—0·15	—0·1	—0·05	—0·05	+0·05	+0·1	+0·15	+0·2	+0·25	+0·3	+0·35
5 ,, 10	—0·15	—0·1	—0·1	—0·05	+0·05	+0·1	+0·15	+0·2	+0·25	+0·3	+0·35
10 ,, 15	—0·2	—0·15	—0·1	—0·05	+0·05	+0·1	+0·15	+0·2	+0·25	+0·3	+0·4
15 ,, 20	—0·2	—0·15	—0·1	—0·05	+0·05	+0·1	+0·15	+0·2	+0·3	+0·35	+0·4
20 ,, 25	—0·2	—0·15	—0·1	—0·05	+0·05	+0·1	+0·15	+0·2	+0·3	+0·35	+0·4
25 ,, 30	—0·2	—0·15	—0·1	—0·05	+0·05	+0·1	+0·15	+0·25	+0·3	+0·35	+0·4
30 ,, 35	—0·2	—0·15	—0·1	—0·05	+0·05	+0·1	+0·15	+0·25	+0·3	+0·35	+0·45
35 ,, 40	—0·2	—0·15	—0·1	—0·05	+0·05	+0·1	+0·2	+0·25	+0·3	+0·35	+0·45
40 ,, 45	—0·25	—0·15	—0·1	—0·05	+0·05	+0·1	+0·2	+0·25	+0·35	+0·4	+0·5
45 ,, 50	—0·25	—0·2	—0·1	—0·05	+0·05	+0·15	+0·2	+0·25	+0·35	+0·4	+0·5
50 ,, 55	—0·25	—0·2	—0·1	—0·05	+0·05	+0·15	+0·2	+0·25	+0·35	+0·4	+0·5
55 ,, 60	—0·25	—0·2	—0·15	—0·05	+0·05	+0·15	+0·2	+0·3	+0·35	+0·45	+0·55
60 ,, 65	—0·3	—0·2	—0·15	—0·05	+0·05	+0·15	+0·25	+0·35	+0·4	+0·5	+0·6
65 ,, 70	—0·3	—0·2	—0·15	—0·05	+0·1	+0·15	+0·25	+0·35	+0·4	+0·5	+0·6
70 ,, 75	—0·35	—0·25	—0·15	—0·05	+0·1	+0·15	+0·3	+0·4	+0·5	+0·6	+0·7
75 ,, 80	—0·4	—0·3	—0·2	—0·1	+0·1	+0·2	+0·3	+0·45	+0·55	+0·6	+0·7
80 ,, 85	—0·5	—0·4	—0·25	—0·1	+0·1	+0·25	+0·35	+0·5	+0·6	+0·7	+0·8
85 ,, 90	—0·7	—0·5	—0·3	—0·1	+0·1	+0·3	+0·4	+0·55	+0·6	+0·7	+0·8
90 ,, 95	—0·6	—0·45	—0·25	—0·1	+0·1	+0·25	+0·35	+0·45	+0·6	+0·7	+0·85
95 ,, 100	—0·45	—0·35	—0·2	—0·1	+0·1	+0·2	+0·35	+0·45	+0·55	+0·7	+0·85

A RAPID AND ACCURATE METHOD FOR TH DETERMINATION OF CARBON IN IRON AND ITS ALLOYS.

BY DR. ERNST SZÁSZ, DIÓSGYÖR, HUNGARY.

Recently I described in a German journal (Z. angev Chem., 1913, I., 281) a method for the gas-volumetri determination of carbon in iron by dry combustion, whic was quicker and simpler than the methods hitherto employed, yet gave equally accurate results.

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* By " net proof-strengths " is meant that *e.g.* 60° u.p. 40° " net proof strength," 25° u.p. is 75° " net proof strength and 40° o.p. is 140° " net proof-strength."

It was based on the following facts and considerations :—If steel turnings be heated in a current of oxygen, very vigorous absorption of the gas occurs at a definite temperature. The flow of gas through the washing bottle connected with the inlet end of the combustion tube becomes much more rapid, whilst that through the washing bottle connected with the outlet end almost ceases. This is frequently referred to as the "suction period." If iron turnings be heated in a combustion apparatus filled with oxygen and a slow current of oxygen passed through the apparatus only after the "suction period" is reached, the oxygen in the apparatus, and that entering at first—so far as it is not utilised in forming carbon dioxide—will all combine with the iron until the latter is completely converted into oxide. The oxygen entering subsequently will serve merely to displace the carbon dioxide and carry it forward, *e.g.*, into a gas-burette, the quantity required for this purpose being less the smaller the size of the combustion apparatus. With a combustion apparatus of suitable dimensions it is possible to work safely with a gas-burette having a bulb of 150 c.c. capacity and a tube with 50 c.c. scale divisions. Care must be taken that during the heating-up period the gases present in the combustion apparatus, which usually contain carbon dioxide long before the suction period is reached (Bauer-Deiss, "*Probenahme u. Analyse von Eisen und Stahl,*" page 124, footnote), do not find their way into the soda-lime tube used for purifying the current of oxygen. This is easily prevented by a trap containing sulphuric acid or mercury. Also, the gas-inlet and outlet tubes must, of course, be as narrow as possible.

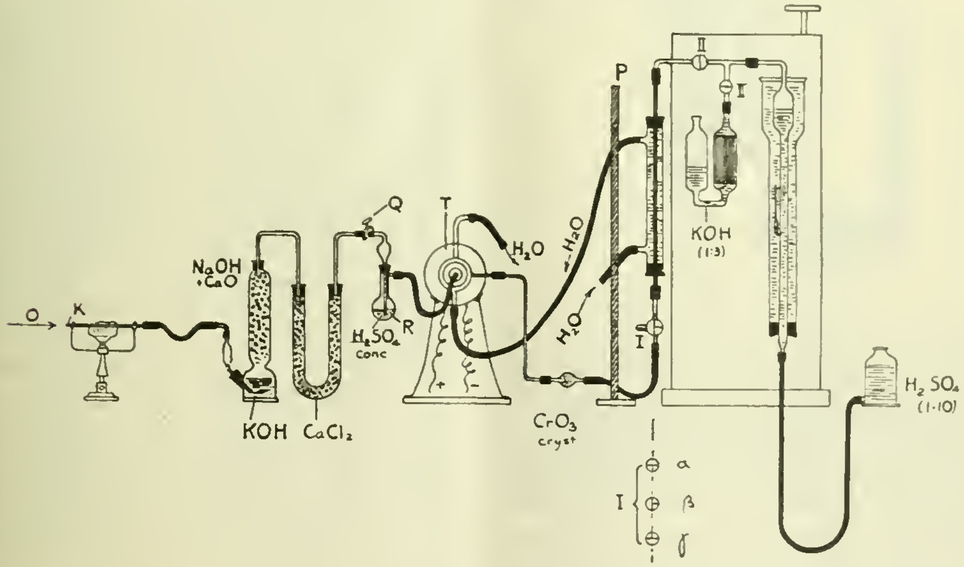

FIG. II.

In the communication referred to above I described an apparatus which was heated by a blast-lamp and in which a platinum container was used for the iron, and mercury as sealing liquid in the gas-burette. I have since been endeavouring to simplify the apparatus, and have succeeded in devising a modified form which should meet all requirements. In this new apparatus the simple electric crucible furnace—the cheapest, and perhaps the most durable, of all types of laboratory furnace—is used. This furnace, already fairly widely employed for other purposes, requires neither an interposed resistance nor a galvanometer, thermo-element and ampère-meter, but may be connected directly with the source of current, and gives the same service as the much more expensive and complicated arrangements hitherto used for steel combustions.

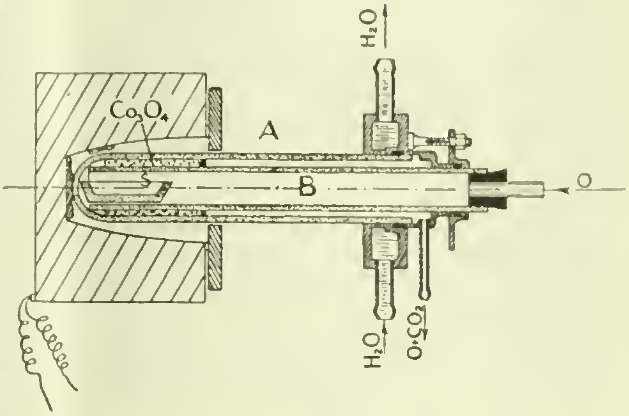

FIG. I.

The combustion apparatus is shown diagrammatically in Fig. I. In the porcelain tube, A, closed at one end, is another porcelain tube, B, open at both ends, the two being connected together by a double stuffing-box of metal. The joint is made tight by two rubber rings protected from heat by a water-cooling arrangement fixed to the stuffing-box. The path of the gas is indicated by arrows. The tubes are glazed only on the outside, and the portion of the annular intermediate space which comes within the furnace, is filled with a mixture of cobalt oxide and fireclay.*

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* The necessity for an oxygen-carrier in the determination of carbon by combustion has not been definitely established. According to my experience an oxygen-carrier is unnecessary when oxygen is introduced in excess continuously during the suction period (see, for instance, Fleming's procedure, Iron Age, Jan. 2, 1913, 97; Jan. 1, 1914, 64). If, however, no precautions be taken to ensure this, or if—as in the gas-volumetric process—oxygen is not introduced in excess during the suction period, then carbon monoxide may be formed, and the use of an oxygen-carrier is necessary. Cobalt oxide is a suitable material, by reason of its infusibility, but as it easily falls to powder, it is mixed with about an equal volume of fireclay of from 25- to 40-mesh size.

The glazed tube, A, is prevented from adhering to the wall of the furnace by plugs of asbestos pulp. The boat, S, is of suitable capacity for taking 2—2½ grms. of steel turnings.

The whole apparatus is shown diagrammatically in Fig. II. Oxygen passes first through the tube, K, containing platinised asbestos, copper oxide, or the like, and heated by a gas burner or electrically,[*] then through a thick-walled rubber tube, into the combustion apparatus described above, and here, together with the furnace, indicated by T. The combustion gases flow first through a glass capillary, then over solid chromic acid to retain any sulphur dioxide, and through a connecting piece of rubber tubing and a water-cooler, to the gas-burette. A thick metal wire is placed in the water-cooler to increase the cooling action. Dilute sulphuric acid (1 : 10) proved to be the best substitute for mercury as sealing liquid in the gas-burette. The cooling water takes the path indicated in the figure and then flows under the work-bench to feed the gas-holder fixed there.

The gas-holder (see Fig. III.) is arranged to supply a current of oxygen of constant low pressure. The overflow tube, movable up and down, allows of the withdrawal of the gas under any convenient constant pressure. In the present case it is adjusted so that, with the pinch-cock, Q, fully open and the tap, I, in position α, 1—2 bubbles of oxygen per second pass through the sulphuric acid in the trap, R. This is the case when the difference of level marked, Δ, is about 4—5 ins. A steel cylinder, with a reducing valve, might be used, but the gas-holder is simple and quite reliable and possesses advantages in many respects.

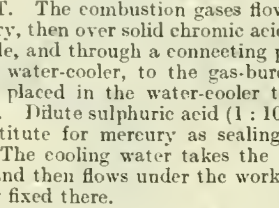

FIG. III.

In the combustion apparatus described, the temperature is, of course, not quite uniform. For example, one hour after turning on the current, I have found repeatedly at the inner end of the tube a temperature of 1070°—1110° C., but about 100° C. lower at the outer end. This fall of temperature is of no consequence in the gravimetric process, for if the soda-lime tube be removed 5—10 mins. after inserting the boat, the results obtained are quite satisfactory. In the gas-volumetric method, on the other hand, the success of the method depends upon attaining complete combustion in a definite, much shorter, period; to effect this the reaction velocity must be accelerated by addition of an oxidising agent. I use a mixture of equal volumes of powdered copper oxide and commercial alumina, well ignited and protected from atmospheric carbon dioxide. Addition of alumina prevents the unnecessarily vigorous reaction which occurs with copper oxide alone, and which would necessitate the premature renewal of the inner tube or cleaning it with acid. If no oxidising agent be added, but the process carried out otherwise exactly as described, the results obtained with steel—according to the composition and thickness of the turnings—are sometimes quite accurate but sometimes as much as 0·04% (or still more with rapid tool steels) too low.[*]

The method of working is as follows :—One hour before beginning a determination, the water supply is turned on, and the furnace connected in the current circuit. After the time mentioned the combustion apparatus has acquired a temperature equilibrium which permits of analyses being carried out successively without interruption. Shortly before proceeding with the test, the whole apparatus is filled up to tap, I, with purified oxygen, and this tap then turned to position γ. The barometric pressure is noted. The pinch-cock, Q, is now tightened somewhat, the rubber stopper withdrawn from the tube, B, and the boat with its contents quickly pushed in until it is in the position shown in Fig. I. The rubber stopper is then immediately replaced, and the pinch-cock, Q, opened fully. The gas-burette is now filled with dilute sulphuric acid, the levelling bottle placed in position, and the tap, I, turned to position, β. After two minutes have elapsed, that is until it is certain that the "suction period" has been attained,[†] the tap, II, is opened, and gas drawn into the measuring burette. The gases should be drawn over for at least 2 mins., the velocity being regulated simply by compressing the tube leading to the levelling bottle. When the current of gas is stopped (by closing the tap, II), the liquid in the burette should be somewhere between the 20 and 50 c.c. marks, according to the carbon content of the sample; the current of gas through R should not cease during this period. The volume of carbon dioxide formed is determined in the known manner by absorption in an Orsat tube (a thrice repeated treatment suffices), and finally the temperature registered by the thermometer in the water-jacket of the gas-burette is noted. The value corresponding to the temperature and barometric pressure taken from Table I, when multiplied by the number of c.c. of carbon dioxide found, gives directly the carbon content in mgrms. The time required for a complete determination, without any haste, is thus: waiting period, 2 mins., withdrawal of gases, 2; three absorptions and 2 readings (allowing ½ min. for the return flow of the sealing liquid), 3; total, 7 mins. The calculation of the result takes but a few seconds. For a carbon content of 0—2%, 1 grm.; 2—4%, 0·5 grm., and 4—8%, 0·25 grm. of sample is taken.

In Table II. results obtained by the chromic-sulphuric acid method (Corleis), by the gravimetric method in a current of oxygen, and by the new gas-volumetric method, are compared. The results are not specially selected, but were obtained partly by me and partly by other workers in my laboratory. In the column relating to the gravimetric method the results marked (A) were obtained when the sample was mixed with lead chromate, bismuth oxide, or copper oxide; those marked (B) by burning the sample either alone or with addition of ferric oxide, alumina, quartz powder, etc.

In carrying out the gas-volumetric process it should be noted that steel can be burnt in the form of tolerably thick turnings; indeed very light, "loose" turnings, which might project from the boat, should be avoided. It is not necessary to mix the turnings and the oxidising agent by shaking together in the weighing bottle; the mixture of copper oxide and alumina may be spread over the turnings in the weighing bottle and the whole distributed fairly uniformly when introduced into the boat. Turnings and oxidising agent should be in the proportion of from 1 : 1 to 1 : 2. Pig irons and iron alloys (including rapid tool steels) are dealt with in a similar manner, but a larger quantity of oxidising agent (corresponding to the capacity of the boat) is used. Only in the case of manganese alloys is it preferable to mix the oxidising agent with the sample by shaking together in the weighing bottle. Moreover these alloys are pulverised more finely the higher their manganese content. In the case of molybdenum steels, in order to fix, as far as possible, the molybdenum trioxide formed, which is troublesome on account of its volatility, the sample is spread over the bottom of the boat and covered with a thick layer of copper oxide (without alumina).

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[*] The oxygen from steel cylinders occasionally contains considerable quantities of carbon monoxide or hydrocarbons, and to avoid trouble these impurities must be oxidised by passing the oxgyen over incandescent platinum or the like, and the carbon dioxide formed absorbed by soda-lime (see also W. J. Keeler, Iron Age, July 22, 1909, 260).

[*] To ensure complete combustion of 1 grm. of steel turnings without addition of an oxidising agent, in 1—2 mins., an uniform temperature of about 1150° C. over the whole of the boat is necessary. This is attainable, at present, only in large furnaces with costly auxiliary apparatus.

[†] A longer period of waiting though not necessary is not injurious but shortening the period may easily lead to low results. However even with metal of only moderate carbon content, the beginning of combustion may be detected by the *second* return movement of the sulphuric acid in the trap, R.

In Table II. there is no reference to ferrochrome. I have determined the carbon content of this material quite satisfactorily by the gas-volumetric method by using a furnace provided with an interposed resistance and with a pyrometric measuring arrangement. The finely powdered ferrochrome was mixed with twice its weight of fine-steel turnings of known carbon content and placed between two layers of copper oxide in the boat. The furnace was kept at about 1200° C., and after a waiting period of 3 mins., gas was drawn over for a period of 4½—5 mins. Attempts to burn ferrochrome in the crucible furnace as described above, or by a similar procedure, failed, the results being too low. Indeed with the considerably lower and less uniform temperature obtained with the crucible furnace, it is necessary, as experiments showed, to prolong unduly (over 8 mins.) the period during which gas is drawn over, and it is then undoubtedly much simpler to use the gravimetric method, which can be carried out in the usual manner after attaching a drying and purifying train to the tap, 1. One advantage of the costly apparatus previously mentioned, as compared with the crucible furnace, is that it is possible therewith to use the gas-volumetric method with ferrochrome and certain other alloys rarely encountered. Another advantage is that in the combustion of steel, pig iron, etc., no waiting period of 2 mins. is necessary, but one can begin to draw over the gas immediately after introducing the boat into the furnace heated to 1150° C., so that instead of 7 mins., only 5 mins. are required for a determination. A third advantage is that steel can be burnt without addition of an oxidising agent. Against these are the following advantages of the crucible furnace :—(1) The cost of installation and the working expenses are very much less. (2) It requires no supervision (a point of special importance in apparatus installed alongside smelting furnaces for control purposes). (3) The number of porcelain tubes used up is less, as only the inner tube suffers, and this can easily be cleaned (with *aqua regia*) or replaced. (4) Less space is required. (5) It is less liable to injury.

For the gravimetric process the more expensive apparatus offers no advantages.

Both the method and apparatus are patented.

TABLE I.

$$1 \text{ c.c. moist } CO_2 = \frac{1\cdot9768}{(1+\alpha t)} \cdot \frac{(b-w)}{760} \cdot \frac{3}{11} = 0\cdot000709378\,\frac{(b-w)}{(1+\alpha t)} = \frac{\text{Figure in table}}{10\cdot000} \text{ mgr.C.}$$

For room temp. of 10—12, 13—20, 21—29, 30—35° C.
Deduct from barometer reading 1 2 3 4 m/m.

b m/m (corr.)	680	690	700	710	720	730	740	750	760	770	780
10° C.	4590	4659	4727	4796	4864	4932	5001	5069	5137	5206	5274
11° C.	4570	4638	4706	4774	4842	4911	4979	5047	5115	5183	5251
12° C.	4549	4617	4685	4753	4821	4888	4956	5025	5093	5160	5228
13° C.	4528	4596	4664	4731	4799	4867	4935	5002	5070	5138	5205
14° C.	4508	4575	4643	4710	4778	4845	4913	4980	5048	5115	5183
15° C.	4487	4554	4621	4688	4756	4823	4891	4957	5025	5092	5159
16° C.	4466	4533	4600	4667	4734	4801	4868	4935	5002	5069	5136
17° C.	4444	4511	4578	4645	4712	4778	4844	4911	4979	5045	5112
18° C.	4422	4489	4556	4622	4689	4755	4821	4889	4955	5021	5088
19° C.	4401	4467	4533	4600	4666	4732	4798	4865	4932	4998	5064
20° C.	4379	4445	4511	4577	4643	4709	4775	4842	4908	4974	5040
21° C.	4357	4423	4489	4554	4620	4686	4752	4818	4884	4950	5015
22° C.	4334	4400	4466	4531	4597	4662	4728	4793	4859	4925	4991
23° C.	4312	4377	4443	4508	4573	4639	4704	4770	4835	4900	4966
24° C.	4289	4354	4419	4484	4549	4615	4680	4745	4810	4876	4941
25° C.	4265	4330	4395	4460	4525	4590	4655	4720	4785	4850	4915
26° C.	4242	4307	4371	4436	4501	4566	4630	4695	4760	4825	4889
27° C.	4218	4282	4347	4411	4476	4541	4605	4670	4734	4799	4863
28° C.	4193	4258	4322	4387	4451	4515	4580	4644	4708	4773	4837
29° C.	4169	4233	4297	4361	4425	4489	4553	4618	4681	4746	4810
30° C.	4143	4207	4271	4335	4399	4463	4526	4591	4655	4719	4783
31° C.	4118	4182	4246	4309	4373	4437	4500	4564	4628	4692	4755
32° C.	4092	4156	4219	4283	4346	4410	4473	4537	4600	4664	4727
33° C.	4066	4129	4193	4256	4319	4382	4446	4509	4572	4636	4699
34° C.	4039	4102	4165	4228	4291	4354	4417	4480	4543	4606	4670
35° C.	4012	4075	4138	4201	4263	4326	4389	4452	4515	4578	4641

TABLE II.

		Carbon steel.	Steel 2% Ni 1·8% Cr.	Steel 18% W 5% Cr.	Grey pig iron.	White pig iron 0·31% S.	Ferromanganese 79% Mn.	Ferrotungsten 75% W.
Chromic acid-sulphuric acid method		1·433 1·415 1·424		0·618 0·612 0·606	3·54 3·46 3·46	2·51 2·51 2·45	6·88 6·85 6·87	
Direct combustion Gravimetric ..	A	1·417 1·414 1·411		0·606 0·596	3·48 3·48	2·42		
	B	1·417 1·410 1·405	0·657 0·684	0·605 0·614 0·628	3·45 3·47 3·48	2·45 2·42 2·44	6·89 6·88 6·80	5·37 5·37
New method		1·414 1·410 1·429 1·411	0·664 0·652 0·643 0·659	0·617 0·617	3·48 3·51 3·48	2·45 2·51 2·40	6·89 6·83 6·82	5·33 5·34 5·33

Prizes.

THE IRON AND STEEL INSTITUTE.

Hadfield Research Prize.

A Research Prize of the value of £200 has been placed by Sir Robert A. Hadfield, F.R.S., Past President, at the disposal of the Council of the Iron and Steel Institute, to be awarded by the Council to the author of the best contribution to the publications of the Institute on the subject of the Different Forms or Combinations of Carbon in Iron, Steel, and Alloys of Iron with other Elements. Competition for the Prize is open to metallurgists, chemists and others interested in Metallurgy, and it is proposed that the Prize shall be awarded at the Annual Meeting of the Institute in May, 1916, for the best paper presented before February 1st, 1916. Sir Robert Hadfield is also prepared to offer a second prize for the paper next in merit to the one which gains the first prize provided it is adjudged to be a really meritorious paper.

It is not desired to limit the scope of the research too closely, but it is suggested that the work should be in continuation of, or based upon, the work of previous investigators, such as Jullien, Abel, Müller, Ledebur, T. Sterry Hunt, Akerman, Arnold, E. D. Campbell, Hogg, Parry and others.

The object of the Research Prize is to stimulate the study of carbides in iron and iron alloys generally, also with a view to discovering the best method of determining the forms and combinations in which carbon occurs in iron and steel. These carbides are now spoken of by metallurgists in a general way, as sub-carbides, carbides, or double carbides. It is very desirable to define the composition of these more accuratoly and to ascertain whether other carbides exist which have hitherto not been identified.

The study of the molecular constitution of the carbides will also fall within the range of the investigation and, in this connection, attention may be directed to previous researches on particular combinations of carbon or forms of carbide. For instance, it would be of interest to determine whether the ordinary carbide is Fe_3C, Fe_6C_2, or some other combination. If so, what is its nature and molecular constitution ?

The foregoing is a general direction which should guide intending participants in this research. It is hoped that the results obtained will throw much light on the cause of hardness of steel, also on the nature and form of carbon combinations with iron and its alloys.

Intending competitors should communicate in the first place, with Mr. G. C. Lloyd, Secretary of the Iron and Steel Institute, 28 Victoria Street, London, S.W., from whom further information may be obtained.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

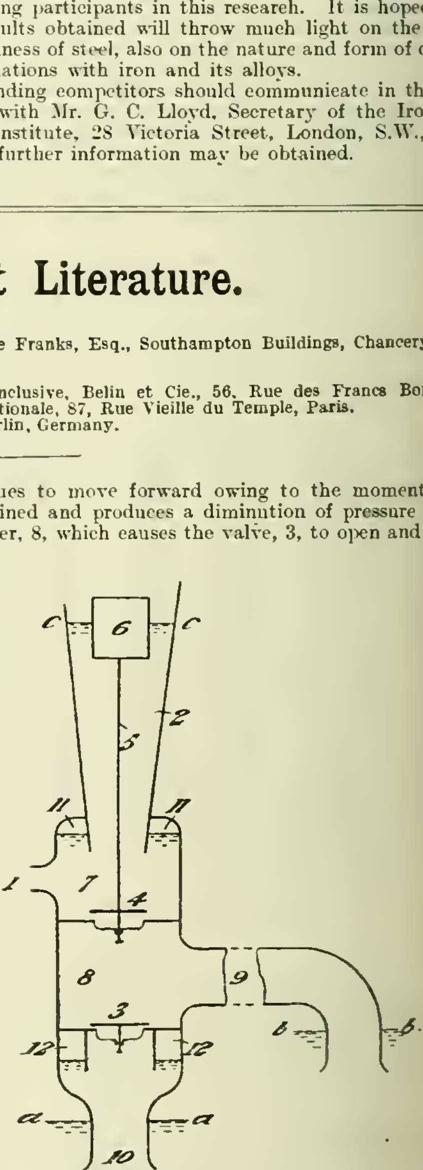
Heat insulation for refrigerating rooms. W. M. Thornton. Engineering, 1914, **98**, 375—376.

Slagwool, cork (built up in half-inch cubes into slabs and heated under pressure until it darkened and formed a coherent mass), granulated cork, and charcoal in small lumps, were investigated. In the first series of tests the material was packed round an electric heater in the middle of a galvanised iron box immersed in a large volume of water. Temperature-equilibrium was reached in 3—5 days, as shown by one thermometer close to the heater and another in the water. The order of conductivity was as given above, the slagwool being the most efficient insulator. In the second series of tests, in which the loss of weight of ice contained in a box jacketed with the material was used to determine its conductivity, the order was changed to cork (slab), slag wool, charcoal. Hence, slagwool is best for high temperatures, as for boilers, and baked cork slabs for rooms the external temperature of which may vary from 0° to 24° C.—O. E. M.

Patents.

Raising or forcing liquids; Methods of and apparatus for ——. H. A. Humphrey, London, and W. J. Rusdell, Wolverhampton. Eng. Pat. 19,169, Aug. 23, 1913.

A liquid under high pressure enters the high-pressure chamber, 7, through the pipe, 1, closes the valve, 4, and rises in the conical reservoir, 2, until it reaches the level, *c*, *c*, when the float, 6, lifts the valve. The high-pressure liquid then enters the chamber, 8, drives forward the liquid in the long main, 9, and delivers some of it into the high-level reservoir at *b*, *b*. The high-pressure liquid flows through the valve, 4, faster than it enters at 1, and consequently the level, *c*, *c*, in the reservoir, 2, falls, allowing the valve, 4, to close. However the liquid in the pipe, 9, continues to move forward owing to the momentum i has gained and produces a diminution of pressure in th chamber, 8, which causes the valve, 3, to open and liqui



from the low-level reservoir, *a*, *a*, enters the chamber, through the pipe, 10, and follows the mass of liquid the long pipe, 9. As soon as the level of the liquid in rises again to the line *c*, *c*, the operation is repeated. The changes of pressure head produced by a "Humphrey" pump may be utilised to supply and control the admission of the high-pressure liquid to the chamber, 8. Air chambers, 11, and 12, are provided to steady the flow. —W. H. C.

Furnaces. A. E. Swan, Derby, and G. W. Parker, Matlock. Eng. Pat. 24,403, Oct. 28, 1913.

Air is led to the rear portion of a furnace through a number of ducts which pass longitudinally through the bridge, terminate at the rear end and are connected with a transverse air-supply channel extending across the front of the bridge.—W. H. C.

Furnaces; Gas-fired ——. C. F. Priest, Normanby, Yorks. Eng. Pat. 25,995, Nov. 13, 1913.

Natural draught coal-fired furnaces are made suitable for direct gas-firing by means of a horizontal elbow-pipe through the ash-pit door opening. The outer end of the pipe has a vertical bracket across it, supporting the end of a steam pipe concentric with the elbow-pipe. Shutters with openings of different sizes may be placed at the outlet of the elbow-pipe to vary the quantity of air introduced and hence the quality of gas produced. The bed of fuel is supported on fire-bars just within and above the ash-pit door. A passage for superheated air for the combustion of the gas is provided in the crown of the producer chamber, the supply of air being controlled by a movable plate at the entrance.—W. F. F.

Automatically controlling the proportionate admixture of two or more liquids; Method and apparatus for ——. B. Bramwell, Belfast. Eng. Pat. 7324, March 23, 1914.

The variation in the difference of pressure produced by variations in the flow of one of the liquids through a Venturi tube is utilised to control the supply of the other liquid. Pipes connected upstream, and with the throat, of the Venturi tube, each deliver liquid into one of two balanced vessels suspended at either end of a cord which passes over a pulley. The vessels have small holes near the bottom so that they never become full and overflow. The oscillation in the levels of these vessels due to the variation in the rate at which the liquid is supplied to them from the two points in the main causes the shaft on which the pulley is arranged to rotate and to wind up or unwind a cord which operates a valve device by which the supply of the other liquid is controlled.—W. H. C.

Tanks; Manufacture of ——. W. Guest, Charlton, Kent, and H. Lenox, Ashtead, Surrey. Eng. Pat. 11,839, May 13. 1914.

To strengthen the construction, rolled channel or U-sections or column sections are interposed between the plates and at the corners of the tank which is built up of plates bolted together, all joints being on the outside. —W. H. C.

Desiccating; Process of ——. C. E. Gray, Eureka, Assignor to A. Jensen, Oakland, Cal. U.S. Pat. 1,107,784, Aug. 18, 1914; date of appl., Nov. 10, 1913.

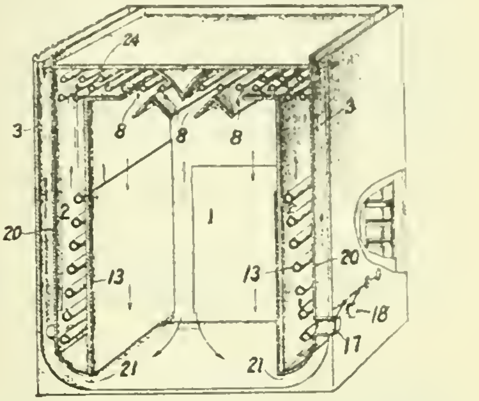
Hot air is blown through a funnel-shaped chamber to form a cyclonic or whirling current travelling inwards towards the axis of the chamber, and the fluid to be dried is admitted through an atomiser in the axis of the chamber so as to travel radially outwards, meeting air of gradually decreasing humidity and increasing temperature.—A. T. L.

Drying machine. W. R. Files, Providence, R.I. U.S. Pat. 1,109,977, Sept. 8, 1914; date of appl., July 14, 1913.

The exhaust steam from a series of steam-heated rotary drying cylinders or "cans" is passed through a separator to remove any entrained liquid and then into a "modifying" "can" or cylinder provided with suitable valves for controlling its temperature.—W. H. C.

Drying-room. C. Hultgren, Chicago, Ill., Assignor to Wenborne-Karpen Dryer Co. U.S. Pat. 1,110,788, Sept. 15, 1914; date of appl., Oct. 21, 1912.

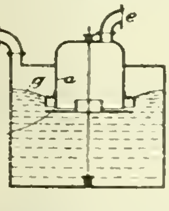
Air enters the inner jacket, 2 (see fig.), through the pipes, 17, 18, which are provided with dampers; passes upwards over the pipes, 13, 24, heated by steam or hot gas, and enters the drying chamber, 1, at the top through the openings, 8. It then passes downwards and escapes from the bottom of the chamber through the passages, 21, into the outer jacket, 3, where it is heated by contact with the metal wall, 20, thus increasing the draught.—W. H. C.



Liquids and gases; Apparatus for scrubbing or similarly treating ——. B. F. B. Sewell, Washington, D.C. U.S. Pat. 1,108,853, Aug. 25, 1914; date of appl., Oct. 21, 1910.

A column for fractionating or for scrubbing gases with liquids, is made up of sections carrying pairs of superposed perforated plates. The perforations are burred and the burrs of one plate of each pair come between those of the other and form a number of liquid seals. A finely perforated plate is submerged in the liquid in order to distribute the vapour bubbles passing through the seals.—A.T.L.

Bringing liquids and gases or vapours into contact with each other; Apparatus for ——. W. Feld, Linz, Germany; K. E. Markel, administrator. U.S. Pat. 1,110,914, Sept. 15, 1914; date of appl., July 18, 1914.



Gas enters the stationary bell, *a*, through the pipe, *e*, and is forced through the liquid, *g*, in an atomised condition by the rotation of the agitator, *d*, which also serves to agitate and mix the liquid. —W. H. C.

Refrigeration; Process of —— *and apparatus therefor.* N. H. Hiller, Carbondale, Pa. U.S. Pat. 1,109,923, Sept. 8, 1914; date of appl., June 15, 1912.

Compressed gas is expanded in a suitable refrigeration plant thereby absorbing heat. Part of the expanded gas is absorbed directly in a liquid and part is compressed to a higher pressure and then absorbed, the liquid being first saturated at the lower pressure and then flowing into another absorber where it is saturated at the higher pressure. The gas is subsequently expelled from the liquid by heating at the higher pressure and passed into the expansion chamber.—W. H. C.

Separator; Centrifugal ——. W. Mauss, Johannesburg. U.S. Pat. 1,111,600, Sept. 22, 1914. Date of appl., Dec. 17, 1912.

See Eng. Pat. 27,113 of 1912; this J., 1913, 702.—T. F. B.

Kiln. C. Hultgren, Assignor to Wenborne-Karpen Dryer Co., Chicago. U.S. Pat. 1,110,787, Sept. 15, 1914. Date of appl., Oct. 30, 1911.

See Eng. Pat. 12,224 of 1912; this J., 1913, 739.—T. F. B.

Furnace and fuel-feeding device therefor. C. J. Greenstreet, Webster Groves, Mo. U.S. Pat. 1,110,926, Sept. 15, 1914. Date of appl., Sept. 26, 1912.

See Eng. Pat. 1515 of 1913; this J., 1914, 635.—T. F. B.

[Vacuum] filter. G. Spence, Mexico. U.S. Pat. 1,111,275 Sept. 22, 1914. Date of appl., Aug. 16, 1913.

See Fr. Pat. 461,346 of 1913; this J., 1914, 187.—T. F. B.

Filter. Eng. Pat. 22,709. *See* XIXa.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coking industry; The by-product ——, and its relation to the manufacture of iron and steel. G. S. Cooper. Iron and Steel Inst., 1914. [Advance proof.] Pp. 31. (See also this J., 1914, 410.)

The Koppers' combination oven (*loc. cit.*) can be operated as a gas oven with blast-furnace gas instead of with producer gas, and by consuming all available blast-furnace gases in this way, a maximum amount of coke-oven gas becomes available in iron and steel works for heating open-hearth furnaces and for other purposes. The coal used for coking should not yield on distillation more than 7—8% H_2O reckoned on the dry coal. The coking character of Scotch coals deteriorates with exposure. The Koppers' process for the direct recovery of ammonia from coke-oven gas has now been applied for the first time to coal gas at the Budapest gas-works. The crude gas is cooled to 25° C., and delivered by an exhauster to the tar extractor. The gas is then reheated to 50°—60° C. and treated with sulphuric acid in a closed saturator from which ammonium sulphate is removed continuously by an ejector working with steam or compressed air. The liquor from the cooler and tar extractor is separated from tar and distilled with lime, the gases being delivered to the hot gas entering the saturator. The gas from the saturators is cooled and scrubbed with creosote oil for the recovery of benzene. The yield of benzene from coke-oven gas varies from 1—1½ galls. in South Wales to 2½—3 galls. per ton of coal carbonised in South Yorkshire, Derbyshire, the Midlands, and Cumberland. In open-hearth steel furnaces the durability of bulkheads and roofs is decreased by 8—10%, and that of the chequer-work increased by 50% by the use of coke-oven gas (see also this J., 1913, 1013). At Friedrich Wilhelmshütte the consumption of coal per ton of steel was reduced from 31·8 to 14·9%.—A. T. L.

Gas retorts; Manufacture of ——. German and English methods. Times Eng. Suppl., Sept. 25, 1914, 109.

While German retorts are hand-made, English manufacturers generally use a machine-press by which the clay is forced through a die of the required section on to a table which descends at the same rate as the ram. Machines of this type turn out 400—500 ft. length of retort per day. Hand-made retorts are built up in sections of about 2 ft. length on a vertical mandril, each section being left for a day or more to dry until it will bear the weight of the next section; or the clay is rammed by means of long-handled spiked punners into a mould consisting of an outer casing and a core. Manufacturing costs are about equal, but the hand-made retorts are more durable. "Segmental" retorts, built up of short lengths with tongued and grooved joints, are more expensive to instal, but last 5 years or more, as compared with about 1200 days for the ordinary moulded retorts. They are more flexible when unequally heated, and leakage at the joints owing to expansion and contraction is soon stopped by scurf. The arch of the retort is made of highly refractory siliceous material, whilst the shoulders and base are of Stourbridge clay which resists erosion by the friction of the coke. The mouth-piece is attached to a short length of moulded retort of Stourbridge clay, which is not injured by liquor falling from the ascension pipe.—A. T. L.

Coal; Absorption of oxygen by ——. T. F. Winmill and J. I. Graham. Times Eng. Suppl., Sept. 25, 114. (See also this J., 1913, 970.)

Coal from the Barnsley beds, dried in a high vacuum over potash and calcium chloride, was sealed up with air in flasks, and the oxygen absorbed was automatically replaced and the amount thus admitted was measured. The total amount of oxygen absorbed was about the same as in the experiments with undried coal in a current of air previously described (*loc. cit.*) but the rate of absorption was slower. Even at low temperatures and with finely powdered coal, oxidation did not cease after 60 days, hence weathering before stacking is not an effective safeguard against spontaneous ignition. Rise of temperature from 30° to 160° C. caused quicker oxidation and an increase in the total oxygen absorbed, especially above 100° C. Rise of temperature was checked by the moisture in the coal, since at 80° C. all the heat generated by oxidation was required to evaporate the moisture, amounting to 5% of the coal. Barnsley Hards and Softs are both capable of firing readily under certain conditions, but these conditions rarely occur in small stacks. In large stacks, evaporation of water may assist the heating, when for example, a narrow "break" fills gradually with coal-dust, and air passing through it becomes charged with water-vapour which heats the coal on which it condenses. This warm coal later comes in contact with air not deprived of its oxygen and the heating is carried further into the "break."—A. T. L.

Tar; Electrical separation of —— from coal gas. A. H White, P. B. Rowley, and C. K. Wirth. J. Gas Lighting, 1914, **127**, 719—721.

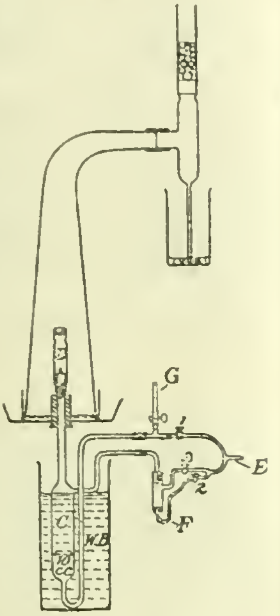
After leaving the Pelouze and Audouin tar separator, the gas was passed at the rate of 24,000 cb. ft. per hour through an inverted U of 8 in. pipe having in the axis of each limb a squirrel-cage electrode of sixteen 27-gauge steel wires strung between 4 in. iron discs 5 ft. 8 in. apart. A potential difference of 20,000 volts was maintained between the electrodes (negative) and the earthed pipes; about 0·2 kilowatt per hour being required. The removal of tar, as shown by filtering 1 cb. ft. of the gas through a 2½ in. circle of filter-paper, was complete. Among the advantages claimed for the method are the possibility of obtaining clean ammonia liquor, and white ammonium sulphate direct from the gas, and greater ease of purification, as tar is prevented from reaching the oxide.—O. E. M.

Flame in mixtures of methane and air; The velocities of —— A. Parker and A. V. Rhead. Chem. Soc. Trans., 1914, **105**, 2150—2158.

In connection with the study of fire-damp explosions in mines, the authors determined the velocity of flame propagation in mixtures of pure methane and air in straight horizontal tubes of glass, lead, copper and iron, 6·5 m. long and about 2·5 cm. diam. The tubes were closed at one end and the gas was ignited at the open end by a spark. The progress of the flame was recorded electrically by the fusing of thin strips of Wood's alloy arranged 1 m. apart in the tubes. The flame travelled at a constant velocity for about 4 m., then oscillated with increased velocity of propagation, and finally attained a constant velocity towards the end of the tube. The initial velocity varied with the strength of the mixture and with the material of the tube, being least with tubes having a high conductivity for heat. The maximum initial velocity was 70 cm. per sec. with a mixture containing CH_4 10%. The limits of inflammability occurred with CH_4 4·5 and 13·1% respectively.—A. T. L.

Sulphur in motor spirits; Determination of ——. W. A. Bradbury and F. Owen. Chem. News, 1914, **110**, 163—165.

When a mixture of carbon bisulphide or benzene with methylated spirit was burned in a wick lamp and the sulphur dioxide in the products absorbed as in the Referee apparatus for determining sulphur in coal gas, low results were obtained owing to incomplete combustion, the deficiency varying from 4 to 50% of the total sulphur. With the apparatus shown in the figure, the deficiency was only about 6·6%. The wick-burner was replaced by a carburettor, C, containing 10 c.c. of the benzene or petrol to be tested and the mixture from the carburettor passed to an atmospheric burner, D, in the trumpet tube of a Referee apparatus, the lower end of the trumpet tube being sealed in water. The sulphur dioxide was absorbed with perhydrol (a concentrated solution of hydrogen peroxide). At the commencement of a determination, taps, 1, 2, and 3, are closed, a water-blower started to deliver air at E, and the perhydrol solution allowed to flow down the absorption column. Tap, 2, is then opened, allowing air to bubble through pure benzene or petrol in tube, F, and tap, 3, is adjusted until the burner gives a perfect Bunsen flame with a maximum brightness of the platinum spiral which is arranged above the burner. The trumpet tube is then placed in position and tap, 1, opened and 2 closed so as to burn the spirit which is under test. When half the spirit has been consumed, the water-bath is heated to 150°—160° F. (65·5°—71° C.). Towards the end, turpentine is run into the carburettor at G, and this operation is repeated so as to burn all the spirit originally in C.—A. T. L



Report of Committee of American Society for Testing Materials on standard tests for lubricants. *See* XII.

Patents.

Peat; Impts. in the treatment and utilisation of ——. J. W. Leadbeater. Doncaster. Eng. Pat. 29,281, Dec. 19, 1913. Addition to Eng. Pat. 18,587, Aug. 13, 1912.

To produce a hard coke suitable for steel-smelting, 5—10% of coke obtained from bituminous coal is added to a mixture of the pure "carbon coke" and the special tar produced from peat as described in the prior patent (this J., 1913, 820). The mixture is compressed into blocks, and heated in a retort.—W. F. F.

Combustible mixtures; Surface combustion of ——. P. St. G. Kirke, and Bonecourt Surface Combustion, Ltd., London. Eng. Pat. 20,476, Sept. 10, 1913.

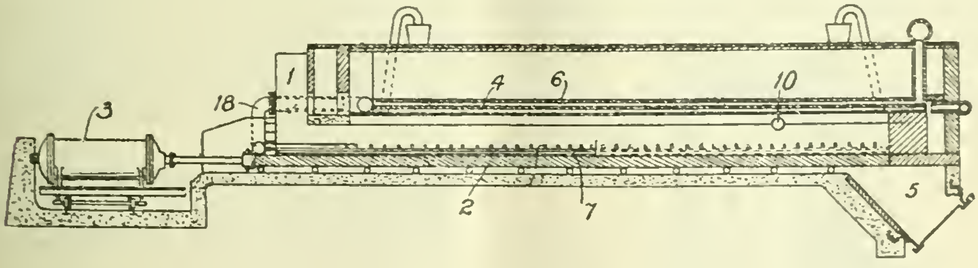
The mixture of fuel and air is introduced into the combustion bed in the manner described in Eng. Pats. 25,808 and 29,430 of 1909 and 19,490 of 1912 (this J., 1910, 1448; 1913, 936). To avoid intense local heating and consequent disintegration of the refractory material at the points of impact near the inlet, the combustion bed may be formed by a layer of refractory blocks at the base of the heating furnace, arranged so as to leave a network of channels open at the top. The gas inlet is in a line with one of these channels so that no immediate impact takes place, and the bed may be loosely covered with granular refractory material. In another form (*e.g.* a bath enamelling furnace), the heating ducts may be arranged on the internal surface of a cylinder and in another form the combustion surface may be within the body to be heated.—W. F. F.

Combustion; Process of regulating the temperature of ——. J. M. Rusby and J. H. Taussig, Assignors to United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,110,991, Sept. 15, 1914; date of appl., Dec. 27, 1909.

A burning mixture of producer gas and air is diluted by the incombustible products of combustion.—W. F. F.

Coking process. J. P. O'Donnell, London. From L. L. Summers, Chicago, Ill. Eng. Pat. 2069, Jan. 26, 1914.

The retort, which is particularly adapted for coal rich in volatile matter, has a reciprocating floor, 2, actuated by a ram, 3, fuel being fed from the bin, 1, and discharged into the hopper, 5. The retort is heated by hot gases which pass through the passages, 4, in the crown. Retort gases pass by the duct, 10, to a recuperator and condenser, and thence through the ducts, 6, in the retort crown, and pipe, 18, to the nozzles, 7. These hot gases thus pass upwards through that portion of the fuel which is between the fresh charge and the highly heated part. A more uniform heating is obtained, which results in a maximum amount of rich hydrocarbons and tar, while the fuel assumes a plastic condition and is compressed by the reciprocation of the floor, 2, being discharged as a hard dense coke.—W. F. F.



Coke dust; Process for making briquettes of —— *by means of cement and pitch, for use in gas manufacture.* Deutsch-Luxemburgische Bergwerks- u. Hütten-A.-G. Ger. Pat 275,511, July 31, 1913.

Briquettes made from coke dust with cement alone require some time to harden, and therefore must be stored in the works. To avoid this it is proposed to add a quantity of pitch so small that the impurities in the gas, made from the briquettes, can be eliminated in the ordinary purifying process. The following proportions are given: Coke, 85%; cement, 12%; coal tar pitch, 3%.—T. F. B.

(a) *Carbon monoxide, hydrogen and nitrogen,* (b) *carbon monoxide and hydrogen; Process of making* ——. R. H. Brownlee and R. H. Uhlinger, Assignors to American Nitro-Products Co., Pittsburgh, Pa. U.S. Pats. 1,107,581, and 1,107,582, Aug. 18, 1914; date of appl., April 12, 1913.

(a) Carbonaceous fuel together with insufficient air for complete combustion, is drawn periodically into a cylinder fitted with a reciprocating piston, the mixture is exploded, and the products are exhausted and passed through apparatus for separating the carbon monoxide, hydrogen and nitrogen from one another and from the other products of combustion. (b) Oxygen is used instead of air, and carbon dioxide and monoxide, and hydrogen are separated from the combustion products. —A. T. L

Ethane: Process of manufacturing ——. S. P. Mulliken, Newburyport, Mass., and H. K. Moore, Berlin, N.H. U.S. Pat. 1,107,696, Aug. 18, 1914; date of appl., Dec. 8, 1910.

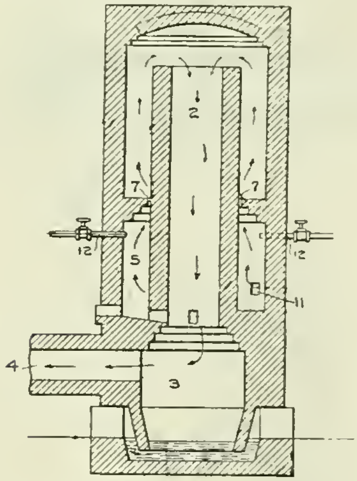
Ethylene is reduced to ethane by hydrogen in the presence of a catalyser which is cooled in order to remove the heat generated by the reaction.—A. T. L.

Gas-producer. T. B. Benner, Cortland, N.Y. U.S. Pat. 1,110,372, Sept. 15, 1914; date of appl., March 21, 1914.

The producer comprises two superposed retorts communicating with each other and with a fuel-charging hopper by co-axial ports. Gas-receiving chambers at the end of each retort are in communication with each other, and a pipe leads from the upper chamber into a hydraulic main.—W. F. F.

Gas; Process of making ——. J. H. Hirt, El Paso, Tex., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,110,782, Sept. 15, 1914; date of appl., Feb. 14, 1910.

An ignited mixture of fuel and air is injected from the conduit, 11, into the annular chamber, 5, with an upward spiral motion, and is caused to contract at the point, 7. The mixture is cooled at this point by introducing an endothermic agent (moisture) by pipe, 12, and then passes by the central passage, 2, and water-sealed chamber, 3, to the outlet, 4.—W. F. F.



Scrubbers for gases. A. Hollis, Stockton-on-Tees. Eng. Pat. 2609, Jan. 31, 1914.

The scrubber, suitable for purifying producer-gas, consists of a number of perforated shelves packed with sawdust or similar material, one shelf near the top being in the form of a tray with openings covered by hoods. Liquid collects on the tray, thus avoiding fouling of the lower layers through which the gas afterwards passes. —W. F. F.

Natural gas; Process of separating the hydrocarbons contained in ——. H. Koppers, Assignor to H. Koppers Co., Chicago, Ill. U.S. Pat. 1,107,803, Aug. 18, 1914; date of appl., July 8, 1913.

The gas is passed under pressure through a solvent oil in a cast-iron bell-washer which is relieved of pressure by placing it within a wrought iron casing through which the gas passes.—A. T. L.

Explosive-engines; Method for economizing fuel and preventing carbon deposits in ——. C. L. Nedoma, Assignor to J. H. Fletcher, San Francisco, Cal. U.S. Pat. 1,108,608, Aug. 25, 1914; date of appl., Sept. 2, 1913.

The vaporised hydrocarbon fuel is mixed with oxygen and steam obtained by heating hydrogen peroxide. —A. T. L.

Petroleum and its by-products; Refining ——. E. A. Starke, Berkeley, Cal. U.S. Pat. 1,109,187, Sept. 1, 1914; date of appl., May 25, 1911.

Petroleum or a distillate thereof containing benzene derivatives is saturated with sulphur dioxide, and agitated, whilst hot, with sulphuric acid in a closed vessel, until the specific gravity is constant. The sulphur dioxide generated from the acid is not allowed to escape from the vessel. The liquid is allowed to stand, and the separated sulphonic acids drawn off and treated for the recovery of "benzene." —A. T. L.

Petroleum; Apparatus for refining ——. M. H. Warren, Mexico. U.S. Pat. 1,110,361, Sept. 15, 1914; date of appl., Nov. 17, 1913.

The petroleum is passed through a series of heat-exchanging apparatus to stills containing horizontal baffles providing a tortuous path for the flow of a thin stream of oil. Superheated steam is admitted to the stills and the light and heavy vapours are led away separately to condensers. —A. T. L.

Lubricant grease. F. E. Mariner, Assignor to The Pensacola Tar and Turpentine Co., Gull Point, Fla. U.S. Pat. 1,109,298, Sept. 1, 1914; date of appl., Oct. 2, 1913.

A mixture of mineral oil, 90, rosin (containing more than 60% of abietic acid) 8, and milk of lime 20 parts.—A. T. L.

Hydrocarbon oils: Process of treating heavy ——. C. J. Greenstreet, Denver, Colo. U.S. Pats. (a) 1,110,923 and (b) 1,110,924, Sept. 15, 1914; dates of appl., Mar 13, 1911, and May 13, 1912.

(a) Oil vapour mixed with steam is passed through a pip coil heated above 1000° F. (538° C.) and the proportion are adjusted so that the product burns at a test-burne with a bluish flame. The product is then fractionall condensed in order to obtain light oils. (b) An unobstructed coil of pipe, 100 ft. long and $1\frac{1}{2}$ in. diam., is used and oil at a pressure of 50 lb. per sq. in. is injected into th coil under a steam pressure of 100 lb. per sq. in.—A. T. L

Olefines and their oxidation products [from mineral oils] Process of manufacturing ——. C. J. Greenstreet Webster Groves, Mo. U.S. Pat. 1,110,925. Sept. 1 1914; date of appl., June 7, 1912.

Mineral oil mixed with steam is passed repeatedly throug a long coil of pipe at cherry-red heat, the olefines forme are oxidised and the product separated by fractiona distillation.—A. T. L.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood distillation works, Forest of Dean. Reprinted from [Cd. 7488]. Price 3d.

These works have been erected with the object of utilising the considerable quantities of almost unmarketable cord-wood and small branch-wood which are left over when the broadleaved trees in Dean Forest and the adjoining woodlands are felled. The works were opened in October, 1913.

The total capital cost was approximately as follows:—Buildings, £8000; machinery, £6500; fittings, architect's commission, fencing, etc., £1000; total, £15,500.

The process of F. H. Meyer, of Hannover-Hainholz, was adopted, and the machinery was designed and supplied by his firm, the engine, boiler, and principal non-patented apparatus being of English manufacture. The buildings were erected from Meyer's plans. The works are designed to produce charcoal, wood tar, wood alcohol, and grey acetate of lime. It is not intended at present to manufacture acetone, but the works have been designed for installing the additional machinery necessary for that purpose, if required.

The contractor estimated that the following products would be obtained from the plant by carbonising 420,000 cubic feet of wood per annum:—Grey acetate of lime, 384 tons; tar, 270 tons; charcoal, 1380 tons; wood spirit, 90 tons (equal to 23,400 gallons of 8·61 lb. each). As production commenced only a few months ago, it is not possible to compare fully the results and estimates, but the experience already gained leads to the conclusion that the above output will scarcely be obtained.

Most of the wood used is oak, which is brought in by hauliers from the Crown forests, in the centre of which the works are situated, and is stored in large stacks, a stock of 1500 to 2000 cords being kept at the works.

The retort for the carbonisation of the wood is built of iron plate and is about 56 feet in length and 7½ feet in diameter. It is fired from a furnace on the left side, and is set in flues which enable the wood to be carbonised effectually. The wood is packed into cylindrical trucks, each holding about two cords, or 256 cubic feet, stacked, and five trucks form one charge for the retort. When ready the iron door of the retort is lifted and the trucks of wood are drawn in by an electric motor. The door is then closed and the temperature raised to between 330 and 350° C. Distillation usually commences in about two hours and continues for twenty to twenty-two hours.

After the process is completed the door at the other end of the retort is raised, and the trucks, which now contain charcoal, are quickly drawn by motor into an iron cooling-chamber similar in form to the retort. The doors at each end of the cooling-chamber are made secure and the exterior is cooled with water. From the cooler the trucks of charcoal are removed, on the following day, to the charcoal shed, where they are emptied and the charcoal filled into bags ready for despatch.

During the process of distillation about 70% of the weight of the wood is gasified: the gases pass out of the top of the retort through two copper pipes into a tar separator, where the tar is condensed and flows into a tank. The tar is then run into a *montejus* and lifted by a compressor into the tar still, where it is freed from the acid, oils, and water. It is run direct from the still into casks, and is then ready for marketing. The gases and vapours, freed from tar, pass out at the top of the separator, and on into a tubular condenser, where the naphtha and acid vapours are condensed and run into large storage vats. This pyroligneous liquor is left in the vat three or four days to free it from any tar in suspension, and is then ready for further treatment. The incondensible gases pass from the tubular condenser into a washer, where any residual naphtha or acid is removed by water, and are then conveyed by a pipe to the furnace, where they are utilised in the process of carbonisation.

The pyroligneous liquor, freed from tar, is pumped from the storage tanks to a vat in the acid room and neutralised with lime, the liquor being stirred continuously by a mechanical stirrer until the mixing and neutralisation are complete. Thence it is pumped into settling tanks at the top of the building, then into sludge tanks on the first floor, where further impurities are removed, and thence into a storage tank in the acid room.

It is now pumped into a small "clear liquor" tank on the top floor, and runs thence into the iron column of the continuous apparatus, where the neutralised acid liquor is completely separated from the naphtha. This apparatus consists of a wrought-iron base or still, containing a copper coil, surmounted by a series of cast-iron plates. The neutralised liquor is run off continuously from the still into a tank below, and while still hot is pumped into an evaporating pan. It is there boiled down to a strength of about 10° B. (sp. gr. 1·075), and then run into the pan of a rotary dryer. This is a large wrought-iron drum, heated internally with live steam. The drum revolves slowly in a shallow tank and picks up a coating of the neutralised liquor. The liquor is dried, as the drum revolves, to a content of about 70% of grey acetate of lime, and then removed by a series of scrapers on the other side. The acetate, which is now in a pasty condition, is spread upon a concrete drying floor, under which pass the gases from the retort to the chimney stack, and, after being dried for several hours, is filled into sacks. The acetate now contains from 84 to 85% of true acetate of lime.

The naphtha which runs from the top of the iron still and column, after being freed from the acetate of lime liquor as previously described and also from some of the heavy oils, is passed through a copper wash-column, into which a weak solution of sulphuric acid trickles, and is here further purified. Thence it goes into a second column, where it is treated with a weak solution of caustic soda, and more oils are separated out. After passing through a small condenser the purified methyl alcohol is run into a storage tank below, and is ready for filling into drums for despatch.

Power is provided by a 27 ft. by 7 ft. 6 ins. boiler, which supplies steam to the following machines:—a 35 H.P. single-cylinder, non-condensing engine; a steam pump for the cooling water; the fan engine; the condenser engine; the evaporating pan; the rotary dryer; the continuous apparatus; the tar still; the tar condenser; and the boiler-feed pump.

The main engine drives a dynamo, which, in addition to lighting the works, provides power for the motors used in charging and discharging the retort and cooler, and for the acid pump, the neutralised liquor pump, the clear liquor pump, the evaporator pump, the lime stirrer, and the rotary dryer.

Patents.

Peat or the like: Treatment of wet-carbonised ——. T. Rigby, Dumfries, and Wetcarbonizing Ltd. London. Eng. Pat. 17,773, Aug. 2, 1913.

Peat pulp resulting from the wet-carbonising process (see Eng. Pat. 17 610 of 1911 and 25,146 of 1912; this J., 1912, 1171; 1914, 346) is partially dehydrated by treatment in a very thin layer on a continuous band or rotary filter, filtration being effected either by a partial vacuum or by pressure produced by the gases from the wetcarbonising process. The moisture is reduced from 94 to 75% by this treatment, and the product is further dehydrated in a band press or other suitable manner. (See Eng. Pats. 4684 and 24,748 of 1911; this J., 1912, 323; 1913, 77)

—W. H. C.

Wood; Destructive distillation of ——. S. E. Seaman, Brooklyn, N.Y. U.S. Pat. 1,108,403, Aug. 25, 1914; date of appl., Dec. 27, 1913.

Sawdust is carbonised in a closed retort, and the cooled tar-free gas obtained in the distillation is forced through the fresh sawdust in a closed vessel to remove air from the charge before it enters the retort. The resulting mixture of air and gases is burned beneath the retort.

—A. T. L.

Carbonaceous material; Process for treating ——. C. W. Tozer, London. Eng. Pat. 7117, March 20, 1914.

Coal or other carbonaceous material is heated in retorts at 300°—700° C. and under an absolute pressure of 4·9 to 12·25 lb. per sq. in. (*i.e.*, a vacuum of 20 to 5 in. of mercury). More efficient recovery of by-products and the production of smokeless fuel, which is easily ignited, are the advantages claimed for this process.—T. F. B.

[*Wood*] *Distillation; Process of* ——. T. W. Pritchard, Wilmington, N.C., and M. C. Whitaker, New York. U.S. Pat. 1,110,820, Sept. 15, 1914; date of appl., Nov. 12, 1912.

Wood or other solid material is introduced into an externally-heated retort in containers which leave a free space between the charge and the retort walls. The vapours from the retort are drawn off by an exhauster, cooled, and the uncondensed portion reheated by the flue gases and circulated again through the retort in order to equalise the heating throughout the charge.—A. T. L.

[*Wood*] *Distillation; Process of* ——. M. C. Whitaker, New York. U.S. Pat. 1,110,850, Sept. 15, 1914; date of appl., Nov. 12, 1912.

The vapours from the retort (see preceding abstract) are drawn by a fan through a passage beneath the floor of the retort and delivered again to the space above the charge without condensation.—A. T. L.

Lamps; Electric incandescent ——. G. M. J. Mackay, Schenectady, N.Y., U.S.A. Eng. Pat. 1252, Jan. 16, 1914. Under Int. Conv., Sept. 8, 1913.

To prevent blackening of the bulb of metal (*e.g.*, tungsten) filament lamps, a small quantity of an oxide of phosphorus, preferably P_2O_5, is placed in the lamp.—W. F. F.

Lamps; Manufacture of electric filament ——. C. A. von Welsbach, Vienna, Assignor to Welsbach Light Co., Gloucester City, N.J. U.S. Pat. 1,109,886, Sept. 8, 1914; date of appl., Aug. 9, 1898.

Successive coatings containing osmium, are applied to a wire, *e.g.*, platinum, which is heated after the application of each coating. The core is finally volatilised by passing a gradually increasing current through the wire in an atmosphere which oxidises any carbon in the coating. —W. F. F.

Vacuum [*in electric lamp bulbs*]; *Means for improving a* ——. M. von Recklinghausen, Suresnes, France, Assignor to Cooper Hewitt Electric Co., Hoboken, N.J. U.S. Pat. 1,110,576, Sept. 15, 1914; date of appl., July 29, 1913.

An arc is temporarily formed in the bulb between electrodes, one of which is of boron. The residual gases are absorbed by the heated boron.—W. F. F.

Electric filaments; Manufacture of ——. C. Auer von Welsbach, Vienna. U.S. Pats. 1,109,887 and 1,109,888, Sept. 8, 1914. Dates of appl., Aug. 24, 1899.

See Eng. Pat. 13,116 of 1898; this J., 1899, 571.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Patents.

Coal tar or its products; Treatment of —— for the removal of the properties therein tending to induce pitch cancer. H. W. Robinson, Sedgley, Stafford. Eng. Pat. 20,767, Sept. 15, 1913.

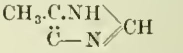
The "auxetic" properties can be removed from coal tar or its products by treatment with ozonised air; the process is not carried further than is necessary for the specific purpose, so that practically the normal distillation products are obtained by the usual method. The ozonised air may be applied at a pressure of 20 to 30 lb. per sq inch for 60 to 90 minutes. (See also Eng. Pat. 4159 of 1913; this J., 1914, 412.)—T. F. B.

Carbon: Manufacture of ——. Soc. Anon. des Combustibles Industriels, Haine-St.-Paul, Belgium. Eng. Pat. 6354, March 12, 1914. Under Int. Conv., July 24, 1913.

Hydrocarbons such as coal tar or tar oils, petroleum tar or tar oils, are freed from suspended mineral matter and then heated and subjected to a prolonged treatment with air or other oxidising gas supplied in the form of a number of fine jets: the temperature should not be raised above 400°—500° C., and the heating is stopped before carbonisation begins. The mass thus produced is extracted with benzene or petroleum and the residue is carbonised by heating. The extract is distilled and the residue is submitted, either alone or mixed with other hydrocarbons to be carbonised, to the same treatment by oxygen and heat.—T. F. B.

5(4)-Methyl-4(5)-arylaminomethyliminazoles; Preparation of ——. O. Gerngross. Ger. Pat. 276,541, July 23, 1913.

The Schiff's bases obtained by condensing 5(4)-methyliminazyl-4(5)-glyoxylic acid with a primary aromatic amine of the benzene series, are treated with an alkaline reducing agent; the products have the constitution:—



$$\begin{array}{l} CH_3.C.NH\diagdown \\ \quad\ \ \ddot{C}—N\!\!/\!\!/ \quad CH \\ \quad\ \ \dot{C}H_2.NH.Aryl. \end{array}$$

—T. F. B.

Process for increasing the fungicidal and insecticidal properties of the nitrogenous bases from tar or tar oils. Ger. Pat. 276,685. *See* XIXb.

IV.—COLOURING MATTERS AND DYES.

6.6′-Dimethylindigotin; p-Toluoylacetic acid, o-nitro-p toluoylacetic acid and ——. J. C. Duff. Chem. Soc Trans., 1914, **105**, 2182—2186.

The sodium salt of ethyl-o-nitro-*p*-toluoylacetoacetate was prepared from the corresponding aceto-*p*-toluidide and by hydrolysis with ammonia and ammonium chloride gave ethyl-*o*-nitro-*p*-toluoylacetate. This mixed with twice its weight of concentrated sulphuric acid, heated to 80° C. and poured on to ice, yielded *o*-nitro-*p*-toluoylacetic acid, which crystallises from benzene as colourless needles melting with decomposition at 110° C. Its solution in alcohol gave a deep red colour with ferric chloride solution and when boiled with water evolved carbon dioxide forming a yellow oil, proved to be *o*-nitro-*p*-tolyl-methy ketone similar to *o*-nitro-acetophenone. On dissolving *o*-nitro-*p*-toluoylacetic acid in ten times its weight o 10% sodium hydroxide solution, a 50% yield of an indigo blue precipitate of 6.6′-dimethylindigotin was obtained —G. H. F.

o-Cyanophenol; Nitro- and amino-derivatives of —— Cousin and Volmar. J. Pharm. Chim., 1914, 10 231—237.

A mixture of equal weights of glacial acetic and nitri acids was added to a cooled solution of *o*-cyanopheno (salicylic acid nitrile) in glacial acetic acid. On dilutin with water at first nitro-3-*o*-cyanophenol and later nitro 5-*o*-cyanophenol separated. The former crystallised from alcohol in fine golden-yellow crystals, m. pt. 132°—133° C Amino-3-*o*-cyanophenol melted at 145° C., rapidly turne grey on exposure to light, and gave a hydrochloride m. pt. 130° C. Amino-5-*o*-cyanophenol, m. pt. 155—160° C. (Maquenne block), gave a hydrochloride, m. p 180° C. (Maquenne block) and also darkened on exposur to light. The diazo compound combined with amines an phenols to give orange to red dyestuffs.—F. Shdn.

Researches on chlorophyll. XXIV. Colouring matters of brown algæ. R. Willstätter and H. J. Page. Annalen, 1914, **404**, 237—271.

Chlorophyll is present in brown algæ accompanied by three yellow colouring matters, fucoxanthin, carotin and xanthophyll, the proportion of yellow colouring matters to chlorophyll being much greater than in land plants. To extract the pigments the fresh algæ are extracted with 40% acetone which removes much slimy matter, then ground and extracted with 85% acetone. The first extracts are yellowish brown and contain chiefly fucoxanthin. The different colouring matters can be separated by taking advantage of their varying solubilities in dilute methyl alcohol and ether-petroleum spirit, but the process is long and tedious. The chlorophyll of brown algæ consists almost entirely of chlorophyll *a*, not more than 5% of chlorophyll *b* being present. Fresh *Fucus virsoides* contains about 0·05% chlorophyll *a*, 0·017% fucoxanthin, 0·009% carotin and 0·009% xanthophyll. Fucoxanthin, $C_{40}H_{54}O_6$, m. pt. 159·5°—160·5° C., crystallises from methyl alcohol in monoclinic prisms containing 3 mols. CH_3OH, or in hexagonal plates with 2 mols. H_2O and from ether-petroleum spirit in needles. With ethereal hydrogen chloride it gives a hydrochloride, $C_{40}H_{54}O_6.4HCl$, m. pt. 215° C., and with iodine in carbon bisulphide a tetraiodide, $C_{40}H_{54}O_6.I_4$, m. pt. 134°—135° C.—T. C.

Coal-tar dyes. Ch. of Comm. J., Oct., 1914. [T.R.]

The value of the imports of coal-tar dyes to the United Kingdom from Germany in 1913 was: alizarin and anthracene dyes, £271,119; aniline and naphthalene dyes, £1,382,478; synthetic indigo, £76,681; other kinds, £543; total, £1,730,821. Not only has the demand in this country to be met but also the important requirements of India, Japan, China, Turkey, Egypt, etc. India imported from Germany in 1911–12 aniline dyes to the value of £339,248, alizarin dyes £140,279, and synthetic indigo £37,412. Japan in 1913 imported from Germany aniline dyes to the value of £372,022, alizarin dyes £26,494, and artificial indigo £301,052. China imported from Germany in 1911 artificial indigo to the value of about £575,000.

Coal tar colours; Development of domestic ——. Paper read before the New York Section of the American Chemical Society, October 9, 1914. By I. F. Stone. Oil, Paint, and Drug Rep., Oct. 12, 1914. [T.R.]

If the United States were to be independent of Germany, the intermediate products must be made on a large scale. This would require a protective duty sufficient to allow the business to be developed. The present duty of 10% was insufficient, by reason of the convention which controlled the manufacture in Germany and immediately reduced the price by an equivalent amount. This had happened in the case of aniline oil, the manufacture of which was begun about three years ago by the Schoellkopf Anilin Works at Buffalo, and which furnished now about one-quarter of the consumption of the United States, taking oil and salts as one product. The unfair competition of Germany could be readily checked if the Government would incorporate in their tariff what was known as the "dumping" clause which forbids the importation into and the selling in the United States of any products at a less price than they are sold in the country where they were produced. The Schoellkopf factory produced aniline oil thirty years ago, but had to abandon it owing to being unable to obtain benzol. That was no longer a difficulty; moreover, by-product coke ovens could readily be established to increase the supply.

There was also the manufacture of explosives to increase the consumption of intermediate products. No Government could afford to be dependent on a foreign supply of such bodies as trinitrotoluol and carbolic acid. In self-defence it must create some sort of tariff or subsidy to protect the industry. Dr. Hesse had stated that out of 900 dyes, 76 were made in the United States. The real number was about 100, and when it was remembered that many of the 900 were defective or obsolete, the proportion was larger than appeared on the surface. They could satisfy 90% of U.S. colour demands, referring to types not quantities, the remaining 10% being mainly alizarin and indigo.

The amount of dyestuffs imported into the U.S.A. in 1913 was:—

Aniline dyes	$7,000,000
Indigo	1,000,000
Alizarins	1,500,000

These were cost prices, and when the United States duty of 30% and the expenses were added, it meant that Americans were paying about $12,000,000 for their supplies, not including the home manufacture which might be $2,000,000 more.

The author then combated some statements of the "Scientific American" in regard to a protective tariff—and considered that a higher tariff would stimulate production and competition and that competition would always control the price. Indigo and alizarin were not made in America and there was no duty on them. Yet customers had to pay more for them, because their prices were controlled by a combination.

Direct Cotton Black was made in America and there was an import duty of 30% on it. In consequence the Europeans had been compelled to reduce their selling prices in America to less than they were charging their customers in Europe.

The author also demanded a revision of the United States patent laws on the lines of the recent British amendments. In 1909 this was proposed, but Germany negotiated a treaty by which the German working clause was made inoperative on American inventions. Whether this was beneficial was a question, but it certainly did not benefit the United States coal tar industry.

From 1880 to 1883, when there was an import duty of 35% ad val. and 50c. per lb., specific, there were ten dye factories in U.S.A. In 1883 the specific duty of 50c. was abolished, and within one year five of these factories succumbed, and now only four were left, and these had had a great struggle to maintain themselves.

The change in the patent laws was of less importance in the case of colours than in other lines, as there were quite enough dyes on which the patents had expired to constitute a large industry.

America could manufacture dyes if it were made commercially possible, but whenever conditions became normal, without protection, they would have to give up the manufacture of intermediate products because they could get them cheaper in Europe than they could make them.

Patents.

Azo dyestuffs; Manufacture of substantive ——, which are rendered faster by after-treatment with formaldehyde. Kalle und Co. A.-G. Ger. Pat. 276,546, Nov. 20, 1912.

A mononitrobenzoyldiamine is diazotised and combined with 2.5.7-aminonaphtholsulphonic acid or an N-derivative thereof, the nitro-group is reduced, and the dyestuffs thus produced are diazotised and combined with one or more mols. of resorcinol or *m*-aminophenol or their homologues or derivatives.—T. F. B.

Producing colouring matter for paper-making and similar manufactures. U.S. Pat. 1,110,775. *See* V.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Paper; Tests for determining quality of ——. K. B. Lamb. Chem. News, 1914, **110**, 180—181.

The various tests applicable to papers are classified.—J.F.B.

The dyeing of army cloths. Chem. Trade J., Oct. 17, 1914. [T.R.]

The Association of Chambers of Commerce have received a communication from the War Office as to the standard exacted by the Department in respect of the dyeing of Army cloth. This states that "owing to the probable exhaustion of the stock of dyeing stuffs which have hitherto been obtained from abroad, it has for some time past been decided to allow other coal-tar and vegetable dyestuffs in the production of drab mixture materials, provided that the dye is the fastest that can be obtained, and approximates closely in colour to the standard pattern."

Patents.

Fibres, gums and juices from fibrous plants; Apparatus for obtaining ——. F. V. Raymond, Invercargill, W. O. Beere, Wellington, and J. E. Rough, Foxton, New Zealand. U.S. Pat. 1,107,840, Aug. 18, 1914; date of appl., Sept. 11, 1912.

The apparatus consists of a plain drum with a series of rollers pressing against its periphery. The fibre passes between the drum and the rollers, the pressure being increased at each successive roller. Conduits are provided for conducting away expressed juices, also water sprays and scrapers for cleaning the rollers.—J. B.

Porous fabrics; Treating textile and other ——. F. J. Staunton, Milwaukee, Wis. U.S. Pat. 1,108,408, Aug. 25, 1914; date of appl., July 30, 1913.

A liquid composed of a base pigment, a binding medium for the pigment, and a thinning material in amount not less than 32% of the whole is applied to the material, whereby its porous nature is preserved.—J. B.

Drying apparatus [for textiles]. E. Feuillette, Assignor to Soc. Etablissements E. Feuillette, Boulogne-sur-Seine, France. U.S. Pat. 1,108,565, Aug. 25, 1914; date of appl., Jan. 6, 1914.

An installation for drying flax, hemp, or other textile materials by circulating hot gases over them, comprises a fixed drum for the introduction of hot gases, and a series of horizontal drying chambers carried on rails on traversing trucks so that they can be brought into position and connected with the fixed drum. The chambers have inclined supports for the material arranged so as to form parallel undulating passages for the gases which are thus caused to mix and render the drying uniform. The roof of each chamber is formed by a pair of plates hinged on a transverse rod.—A. T. L.

Fibrous substances of all kinds; Process for impregnating ——. Anhydat Leder-Werke A.-G. Ger. Pat. 276,619, June 24, 1913. Addition to Ger. Pat. 273,652 (see this J., 1914, 759).

The material is immersed in a solution of asphaltum or similar material, and then in a molten substance soluble in the solvent first used; a substance insoluble in this solvent may be applied before the final treatment, if necessary. *Example:* The material is treated with a solution of petroleum tar in benzene, and then immersed for 24 hours in a mixture of 90—95 parts of petroleum tar and 10—5 parts of boiled linseed oil, heated to 85°—110° C. —T. F. B.

Bamboo and the like; Process for the production of paper pulp or cellulose from ——. J. L. Jardine, Penicuik, and T. A. Nelson, Edinburgh. Eng. Pat. 18,371, Aug. 13, 1913.

Bamboo, previously crushed, is digested with a solution of magnesium or sodium bisulphite which may initially contain an excess of SO_2. During the heating up of the charge the SO_2 not absorbed by the material is allowed to escape freely and during the whole course of the digestion the accumulation of liberated SO_2 in the digester is prevented by a suitable continuous or intermittent discharge of the gases. The pressure in the digester must correspond only with the pressure of steam at the temperature employed. A suitable liquor, made from a magnesium base, may contain initially 3·25% of total SO_2, of which 1·45% is combined. The full pressure of 75 lb. per sq. in. is attained in 4—5 hours and digestion is continued for 10—12 hours with live steam until the total SO_2 is reduced to about 1%.—J. F. B.

Pulping engines and the like. R. J. Marx, London. Eng. Pat. 5018, Feb. 26, 1914.

In a pulping or kneading engine into which water and steam are passed simultaneously with the waste paper or other material to be pulped, both the revolving members on the shaft and the stationary members, which may be cast on the shell, are provided with detachable and exchangeable end-pieces made of wear-resisting material, such as tempered steel, so that the predetermined clearances between the members may be maintained without change.—J. F. B.

Sulphite fibre: Reclaiming waste products [SO_2] in the manufacture of ——. H. K. Moore and R. B. Wolf, Berlin, N.H. U.S. Pat. 1,110,454, Sept. 15, 1914; date of appl., Dec. 30, 1913.

In connection with a sulphite pulp digester a blow-pit is provided having a vomit stack with a removable cap and connected with a surface condenser. The blow-pit is filled with steam to expel the air and then connected with an air-pump; the contents of the digester are discharged into the pit, the vapours rising from which are condensed and the sulphur dioxide separated and recovered.—J. F. B.

Colouring matter for paper-making and similar manufactures; Process of producing ——. J. Hahn, Buffalo, N.Y. U.S. Pat. 1,110,775, Sept. 15, 1914; date of appl., Oct. 8, 1913.

A pigment is thoroughly mixed with rosin size and water and the mixture precipitated by a suitable salt; the supernatant liquid is separated and the precipitate washed with water, drained and dried.—J. F. B.

Wool-scouring and analogous liquors; Recovery of ingredients from ——. W. G. Abbott, jun., Wilton, N.H. U.S. Pat. 1,110,277, Sept. 8, 1914; date of appl., Jan. 2, 1913.

The liquor is heated to about 165° C. under pressure until the fatty matters are separated, the light grease collecting at the top as the liquor cools and the heavy grease settling to the bottom.—J. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Patents.

Woollen goods; Treatment of —— *[to render them less liable to absorb moisture].* A. E. Garrett, St. Albans, Herts. Eng. Pats. 29,512, Dec. 22, 1913, and 2394, Jan. 29, 1914.

Woollen goods that have been rendered unshrinkable by chlorination, etc., absorb moisture much more readily than the untreated stuff. This defect is remedied by treatment in a weak soap bath containing from 4 to 15 c.c. of ammonia (sp. gr. 0·880) per litre at not above 50° C., 1 litre of liquor being allowed for each 60 grms. of fabric. The goods are afterwards rinsed thoroughly, bleached with peroxide if necessary, and finished.—J. B.

Dyeing and sizing warps and apparatus therefor. J. Pyrah, Bradford. Eng. Pat. 24,851, Oct. 31, 1913.

The warp is dyed, squeezed, and after a short passage through the air and whilst still warm, is passed directly into the sizing bath and thence to the drying machine. Continuous dyeing and sizing machines are used with the necessary distance between them for the air passage, and the warp is taken from back beams and finally wound on to loom beams.—J. B.

Dyeing apparatus. A. J. and J. A. Rau, Clifton, N.J. U.S. Pat. 1,108,233, Aug. 25, 1914; date of appl. March 4, 1914.

The web of material passes under a perforated drum as it travels through the dye-vat. Means are provided for removing liquor from the inside of the drum to the body of the vat so that there is an excess hydrostatic pressure on the outer side of the drum.—J. B.

Fabrics; Apparatus for treating ——. C. Buhl, Assignor to D. McCausland, Paterson, N.J. U.S. Pat. 1,109,819, Sept. 8, 1914; date of appl., Feb. 25, 1914.

A hollow perforated drum revolves on a horizontal axis in a tank containing the liquid with which the fabric is to be treated. The fabric is guided through the liquid in contact with the walls of the drum. Means are provided for producing a difference in pressure between the interior and exterior of the drum and for closing communication through the perforated portion which is not covered by the fabric under treatment.—J. F. B.

Dyeing textile materials; Apparatus for ——. W. R. Smith, Assignor to Buffalo Leather Co., Buffalo, N.Y. U.S. Pat. 1,111,104, Sept. 22, 1914. Date of appl., March 1, 1913.

See Eng. Pat. 294 of 1913; this J., 1913, 866.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Potash from felspar and other sources; The preparation of ——. Chem. News, 1914, **110**, 175.

In view of the stoppage of supplies of potassium salts from Germany, attention is directed to a process developed by Ward and Wynants (Eng. Pat. 3185, Dec. 30, 1857) for the extraction of potassium salts from felspar, which at the time was found to give thoroughly satisfactory results. Felspar ground to the fineness of Portland cement was mixed with powdered fluorspar or other fluoride, the fluorine being calculated equivalent to the alkali in the rock. A mixture of chalk and lime was then mixed with the materials so that the proportion of Ca was double that of the SiO_2 and one and a half times that of the Al. On the large scale it was found preferable to employ about 10% excess of lime. The mixture was made into cakes and heated to a yellowish-red for a few hours. The porous frit obtained was lixiviated with boiling water which extracted 90% of the potash originally present in the rock in the form of hydroxide and carbonate. The residue might be worked up into hydraulic cement by removing the fluorine. Another possible source of potash is the spent wash from the fermentation of molasses from the beet sugar industry. The wash, neutralised by chalk, is decanted, evaporated and calcined. The crude ash, if calcination has been carefully performed, contains about 50% of potassium salts. Lastly the revival of the kelp industry appears by no means impracticable as a source of potash, with the additional advantage of yielding iodine.—J. F. B.

(a) *Magnesium carbonate, carbonic acid, and water; and* (b) *calcium carbonate, magnesium carbonate, carbonic acid, and water; The systems* ——. J. W. Leather, and J. N. Sen. Mem. Dept. Agric., India, Chem. Ser., 1914, **3**, 205—234. (See also Mem. Dept. Agric., India, Chem. Ser., 1909, **1**, No. 7).

From a study of the system $H_2O,MgCO_3,CO_2$, at 20°, 25°, 30°, 34°, and 39° C., it is found that the concentration of bicarbonate for any specified partial pressure of CO_2 is from 5 to 15 times greater than in a similar system containing Ca instead of Mg; that the solution contains only a small excess of H_2CO_3 beyond the unimolecular ratio $MgCO_3 : H_2CO_3$, and that the solution of $MgHCO_3$ is more stable than that of $CaHCO_3$. From a study of the system $H_2O,CaCO_3,MgCO_3,CO_2$ between 23° and 30° C., it is found that $CaCO_3$ is not dissolved by CO_2 and water in presence of $MgCO_3$, that while dolomite is thus dissolved it is protected partially by $CaCO_3$ and completely by $MgCO_3$, that a small quantity of $MgCO_3$ is precipitated by $CaCO_3$ from the dolomite solution, and that the treatment of soil with $MgCO_3$ may cause a precipitation of $CaCO_3$, and render it infertile.—O. E. M.

Potassium nitrate, sodium chloride, water; The system ——. J. W. Leather and J. N. Mukerji. Mem. Dept. Agric. India, Chem. Ser., 1914, **3**, 177—201.

The results of the study of several systems between the temperatures 20°—91° C. are reproduced in copious tables. In general, in the case of the systems $NaCl,KCl,H_2O$; KCl,KNO_3,H_2O; and $NaNO_3,NaCl,H_2O$, either salt decreases the solubility of the other: in the system $KNO_3,NaNO_3,H_2O$, either salt increases the solubility of the other: in the system $KNO_3,NaCl,H_2O$, up to a limit of concentration, either salt increases the solubility of the other, except that near 40° C. the solubility of KNO_3 is unaffected by the addition of NaCl. The conditions under which the various solid phases can occur are described in detail.—O. E. M.

Iodine and bromine in haloid salts; Determination of —— *by means of telluric acid.* H. I. Cole. Amer. J. Sci., 1914, **38**, 265—272.

The method previously described for bromine (this J., 1914, 352) has been modified to include the determination of iodine by dividing the distillation into two stages, in the first of which very dilute sulphuric acid is used. The graduated, tubular distillation flask is provided with an adjustable electric heating collar, and a steam flask is inserted between the distillation flask and the carbon dioxide generator. The salt is introduced, together with 50 c.c. of water, into the tubular flask, and this is connected with a receiver (immersed in ice-water) charged with 200 c.c. of a 1·5% solution of potassium iodide: 1 grm. of telluric acid, dissolved in 15 c.c. of sulphuric acid, sp. gr. 1·015, is added, the volume made up to 100 c.c. with water, and carbon dioxide and steam are passed very slowly through the mixture, which is not allowed to concentrate below 100 c.c., until all traces of free iodine have been expelled; the mixture is then evaporated, with only sufficient steam to prevent the return of any colour, to 64—67 c.c., and, after necessary cooling, the liberated iodine in the receiver and trap is titrated with thiosulphate. The receiver is again charged with 200 c.c. of potassium iodide solution, 10 c.c. of sulphuric acid (1 : 1) are introduced into the flask, carbon dioxide is passed very slowly through the apparatus, and as soon as the boiling mixture becomes discoloured, steam is passed in at a rate just sufficient to compensate for the vapour carried over, until all the colour is removed. The concentration is slowly continued, with the help of steam, to a volume of 30 c.c., the remaining solution rapidly boiled down to 24 c.c., and the free iodine titrated as before, its amount being taken as a measure of the bromine expelled. The method allows the determination of iodine or bromine up to 0·3 grm. when associated in haloid salts with amounts of chlorine up to 0·25 grm., the entire operation occupying not more than two and a half hours.—F. Sodn.

Iron-cyanogen compounds; Blue ——. H. E. Williams. J. Chem., Met. and Min. Soc., S. Africa, 1914, **15**, 1—5.

Blue compounds prepared by the interaction of alkali ferrocyanide and ferric salts in most cases contained alkali metal in a definite ratio to the ferrocyanogen. Those prepared from ammonium and potassium ferrocyanides were very similar in composition and appearance, but sodium ferrocyanide gave products containing a lower proportion of alkali metal, with sometimes a large proportion of combined water, and the air-dried compounds were relatively low in density, light in colour, and almost devoid of bronze lustre. $Fe_2'''(NH_4)_6[Fe(CN)_6]27H_2O$ was obtained as a fine green powder by adding an ammoniacal solution of ferric tartrate, containing ammonium tartrate, to a large excess of ammonium ferrocyanide solution, and gradually introducing hydrochloric acid so as to liberate the organic acid only; further addition of mineral acid gave a blue compound

$Fe_8'''(NH_4)_{12}[Fe(CN)_6]_9,52H_2O$. With potassium salts, a green compound was similarly formed, but this changed on washing to the dull blue, $Fe_{10}'''K_{18}[Fe(CN)_6]_{12},45H_2O$ and, on further addition of acid, to $Fe_8'''K_{12}[Fe(CN)_6]_9$ corresponding to the ammonium compound above. A dilute solution of ammonium ferrocyanide reacted with an excess of dilute ferric chloride to give $Fe_7'''(NH_4)_3[Fe(CN)_5]_6,50H_2O$, and the same compound was obtained by adding ammonium ferrocyanide to a boiling excess of ferric chloride, but when, in the latter case, the ferric solution contained excess of potassium chloride, or when ferric chloride solution was added, in slight excess, to a solution of potassium ferrocyanide containing ammonium chloride, $Fe_7'''(NH_4)_2K[Fe(CN)_6]_6,50H_2O$ was precipitated. The sodium salt $Fe_7'''Na_3[Fe(CN)_6]_6,50H_2O$ was prepared by oxidising white ferrous sodium ferrocyanide with an excess of ferric chloride or (with $24H_2O$) by treating a boiling solution of ferrous sodium ferrocyanide with excess of ferric chloride. $Fe_{11}'''K_3[Fe(CN)_6]_9,100H_2O$ was precipitated by adding a ferric salt in slight excess, to potassium ferrocyanide solution, or a large excess of the iron salt to ferrocyanide solution containing an equivalent quantity of potassium chloride, and the same salt, with $81H_2O$, was prepared by agitating freshly prepared ferrous potassium ferrocyanide with excess of ferric chloride solution; the sodium salt, $Fe_{11}Na_3[Fe(CN)_6]_9.90H_2O$, was obtained by oxidising ferrous sodium ferrocyanide with dilute chromic acid in the cold. $Fe_9'''K[Fe(CN)_6]_7.78H_2O$ was prepared by adding potassium ferrocyanide to a boiling excess of ferric chloride, and with sodium ferrocyanide a precipitate of composition $Fe_{13}'''Na[Fe(CN)_6]_{10},100H_2O$ was obtained, the same compound being formed by precipitating sodium ferrocyanide solution with an excess of ferric chloride; a dilute solution of sodium ferrocyanide containing twice the equivalent quantity of ammonium chloride, when precipitated in the cold with a large excess of ferric chloride, gave $Fe_{22}'''(NH_4)_9Na[Fe(CN)_6]_{19},140H_2O$. Freshly precipitated and washed copper ferrocyanide on boiling for some hours with excess of ferric chloride, yielded $Fe_2'''Cu''[Fe(CN_6)]_2,28H_2O$, as a rather light blue powder. All the above are regarded as molecular compounds of ferric ferrocyanide and the double salt $Fe_2'''M_6'[Fe(CN)_6]_3$; and the blue and green ferrosoferric ferrocyanides previously described (this J., 1913, 286), as molecular compounds of the same double salt with $Fe''M_2'Fe(CN)_6$ or with ferrous ferrocyanide. $Fe_2'''Fe_2''K_6[Fe(CN)_6]_4$ was prepared as a dull blue precipitate by adding ferric chloride solution to a large excess of potassium ferrocyanide and boiling the mixture for some time.—F. Sodn.

Lead; The arsenates of ——. H. V. Tartar and R. H. Robinson. J. Amer. Chem. Soc., 1914, **36**, 1843—1853.

Pure $PbHAsO_4$ was prepared, as a white amorphous powder, by treating lead nitrate solution with disodium arsenate, washing the precipitate, dissolving in the minimum quantity of nitric acid, slowly adding dilute ammonia, with constant stirring, until about three-fourths of the acid were neutralised, allowing to stand overnight, filtering, washing the precipitate with water slightly acidified with nitric acid, and then with boiled water until free from nitrates, and drying at 110° C. When fused at a dull red heat, it gave the pyroarsenate, and, by heating with ammonia, a basic salt, $21Pb_3(AsO_4)_2,2Pb(OH)_2,10H_2O$. The precipitates formed by treating lead acetate or nitrate with disodium arsenate were, in each case, mixtures of the acid and basic salt, both of which are insoluble in water. The sp. gr. of $PbHAsO_4$ at 20°/4° C. was 5·786, and that of the basic salt, 7·105. The acid arsenate is determined in commercial arsenate of lead by digesting 3—10 grms. (dried at 100° C.) for a few hours, at the ordinary temperature, with 200 c.c. of a 5% solution of ammonia (free from carbonate), filtering by means of a Buchner funnel, prepared with a pad of two sheets of filter paper, with a layer of asbestos between (the upper paper being a hardened filter), washing with boiled water until the washings give no turbidity with lead nitrate, and determining arsenic in an aliquot part of the clear filtrate, after boiling off ammonia, by the modified method of Gooch and Browning (Bull. 107 (Revised), Bur. Chem., U.S. Dept. Agric.). The amount of arsenic in the total filtrate, calculated as As_2O_3 and multiplied by the factor 7·6034, gives the weight of $PbHAsO_4$ present in the original mixture.—F. Sodn.

Thorium ammonium oxalate. C. James, C. F. Whittemore, and H. C. Holden. J. Amer. Chem. Soc., 1914, **36**, 1853—1856.

A study of the solubility curves of thorium oxalate and ammonium oxalate, in the presence of each other, in water at 25° C., indicated the existence of only two double salts, probably $2Th(C_2O_4)_2,(NH_4)_2C_2O_4,2H_2O$ and $2Th(C_2O_4)_2,(NH_4)_2C_2O_4,7H_2O$ (compare Brauner, this J., 1898, 372).—F. Sodn.

Boron; Amorphous —— and magnesium boride. R. C. Ray. Chem. Soc. Trans., 1914, **105**, 2162—2168.

The so-called amorphous boron prepared from boron trioxide and magnesium always contains a considerable quantity of oxygen and magnesia. It is probably a solid solution of a lower oxide of boron, possibly combined with the magnesia as borite, in elementary boron in the amorphous state. The magnesia may be removed by fusion with boron trioxide, but not by heating with acids. The only form of boron in an approximately pure state is the crystalline variety, which is practically insoluble in nitric acid. It will not combine with magnesium directly, but amorphous boron treated with magnesium yields Mg_3B_2, which appears to be the only boride of magnesium formed at a red heat and under normal pressure. On heating this boride strongly magnesium is driven off, and the greater part of the boron separates in the crystalline state.—G. F. M.

Erratum.

Page 960; col. 2; line 5 from bottom, *for* "W. H. C.," *read* "W. C. H."

Patents.

Sulphuric acid manufacture. U. Wedge, Ardmore, Pa. U.S. Pat. 1,106,999, Aug. 11, 1914; date of appl., Oct. 2, 1912. Renewed June 25, 1914.

The chambers are operated so as to maintain in the exit gases a predetermined percentage of sulphur dioxide insuring the best recovery of nitre in the Gay Lussac towers.—F. Sodn.

Boric acid; Process for the production of ——. A. Burger, New Brighton, N.Y. U.S. Pat. 1,108,129, Aug. 25, 1914; date of appl., Jan. 22, 1914.

A borate, *e.g.*, natural calcium borate, is calcined and treated with carbon dioxide in the presence of water, the resulting acid borate decomposed, preferably with a mineral acid under pressure, and the boric acid separated.—F. Sodn.

Ferrous liquors; Process of utilising waste ——. W. F Oesterle, jun., C. A. Beale, and J. McFetridge, Vandergrift, Pa., Assignors to American Sheet and Tin Plate Co., Pittsburgh, Pa. U.S. Pat. 1,108,387, Aug. 25, 1914; date of appl., Oct. 10, 1913.

The liquor is neutralised (*e.g.*, with ferric oxide) and then oxidised and used as a depolariser in the electrolytic cleaning of metals with acid solutions. Oxidation may be effected by "furnacing," the soluble salts being extracted from the product by water.—F. Sodn.

Saline solutions; Method and means for electrolysing ——. E. A. Allen, Rumford Falls, Me. U.S. Pat. 1,109,311, Sept. 1, 1914; date of appl., Jan. 6, 1912.

The electrolyte is confined between horizontal diaphragms, of which the lower rests upon an unimmersed carbon anode, whilst the upper is covered by a mercury cathode in contact with water. An electric current is passed from the anode, through the electrolyte and superposed mercury and water, to terminal electrodes above, so as to liberate metal in contact with the under surface of the mercury and cause it to form a hydroxide with the water at the upper surface, setting free chlorine at a point out of contact with the body of the electrolyte. Means are provided for circulating electrolyte between the diaphragms and for supplying water to the cathode space.—F. Sodn.

Aluminium fluoride; Process of obtaining ——. C. A. Doremus, New York. U.S. Pat. 1,110,675, Sept. 15, 1914; date of appl., April 2, 1914.

Aluminium fluoride is obtained in the anhydrous form, or with variable amounts of water of crystallisation, by heating, and preferably stirring, its solution in a closed vessel.—F. Sodn.

Potassium salts; Preparation of magnesium oxide and hydrochloric acid from the waste lyes from the manufacture of ——. E. Dietz. Ger. Pat. 275,617, July 5, 1913.

The waste lyes are evaporated to remove excess of potassium and sodium chlorides, and electrolysed, with or without the use of a diaphragm. Magnesium hydroxide is first formed at the cathode, but as the electrolysis proceeds it is converted into the oxychloride, which is removed and heated to produce hydrochloric acid and magnesium oxide.—T. F. B.

Nitrogen with hydrogen or with oxygen; Catalytic combination of ——. F. Hlavati. Ger. Pat. 275,663, March 15, 1910.

The catalyst consists of a mixture of a metal of the platinum group and a metal which is capable of combining with nitrogen, precipitated together on a porous carrier. For example, pumice is impregnated with a solution containing a titanium salt and a platinum salt, and treated with a reducing agent.—T. F. B.

Alkaline silicate; Process of producing a ferrated and borated ——. T. Rouse, Stamford Hill, Assignor to Bessler Waechter und Co., Ltd., London. U.S. Pat. 1,109,704, Sept. 8, 1914. Date of appl., Feb. 9, 1911.

See Eng. Pat. 21,563 of 1910; this J., 1911, 956.—T. F. B.

Hydrogen peroxide; Stable —— and method of making the same. A. Schadhauf, Frankfort, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,109,791, Sept. 8, 1914. Date of appl., June 20, 1912.

See Ger. Pat. 263,650 of 1912; this J., 1913, 1010.—T. F. B.

Nitrates and nitrites; Process of obtaining —— from nitrate-nitrite mixtures. E. Collett. Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,110,481, Sept. 15, 1914. Date of appl., Feb. 9, 1911.

See Fr. Pat. 425,997 of 1911; this J., 1911, 1014.—T. F. B.

Process of making carbon monoxide, hydrogen, and nitrogen. U.S. Pats. 1,107,581 and 1,107,582. *See* IIa.

Manufacture of carbon. Eng. Pat. 6354. *See* III.

[*Medicinal*] *Table salt.* Eng. Pat. 22,322. *See* XX.

VIII.—GLASS; CERAMICS.

Fireclay in coal-mines. J. W. Mellor. Times Eng. Suppl., Sept. 25, 1914, 114.

A small number of samples of clay from North Staffordshire coal-mines have been tested with satisfactory results and the author suggests that a valuable source of fireclay is being overlooked. One sample collapsed only at the same temperature as Seger cone No. 33, a good British fireclay collapsing at about cone No. 30 or 31, *i.e.*, at a lower temperature.—A. T. L.

Patents.

Porcelain kiln. H. C. Kapelle, Schenectady, N.Y. U.S. Pat. 1,108,585, Aug. 25, 1914; date of appl., Jan. 2, 1914.

The kiln comprises an outer wall and a central masonry mass, about which alternating direct and indirect firing holes (with intervening equalising flues) are radially disposed. The direct firing holes extend to the centre of the kiln over the masonry mass, and the indirect firing holes terminate short of the centre. A baking chamber, situated above the firing holes, communicates with these by openings in the chamber bottom, and the inner ends of those flues which extend to the centre of the kiln join beneath the central opening.—F. Sodn.

Ceramic material. A. Malinovsky, Assignor to H. H. Randolph, Chicago. U.S. Pat. 1,110,449, Sept. 15, 1914. Date of appl., March 13, 1912.

See Fr. Pat. 456,837 of 1913; this J., 1913, 1069.—T. F. B.

IX.—BUILDING MATERIALS.

Paint protection of Portland-cement surfaces. Gardner. *See* XIII.

Patents.

Cement kilns and the like [; Rotary ——]. W. J. Mellersh-Jackson, London. From T. J. Fleming, Los Angeles, Cal., U.S.A. Eng. Pat. 19,877, Sept. 2, 1913.

A draught through the kiln is produced by means of a fan which also forces the waste gases through a primary dust house (preferably with metal walls), having baffles and grills for separating the heavier dust particles, into a secondary dust house fitted with a series of baffles ensuring a tortuous passage and a second series arranged to intercept water sprayed from above. The fan is driven by a motor provided with a controlling rheostat for regulating the draught conditions. The discharge of dust has been reduced by one such installation from 22 tons to 200 lb. *per diem.*—F. Sodn.

Cement; Water-repellent —— and process of making same. C. Ellis, Montclair, N.J. U.S. Pat. 1,109,120, Sept. 1, 1914; date of appl., Feb. 20, 1912.

Cement is mixed with an emulsion containing mineral oil, soap solution, and an insoluble soap.—A. T. L.

Concrete composition; Waterproof ——. H. M. Olson, Beaumont, Cal. U.S. Pat. 1,109,540, Sept. 1, 1914; date of appl., Aug. 26, 1912.

A mixture of lime, 10 lb., crude oil, 1 gall., and water. —A. T. L.

Mortar made of lime and sand; Method of dressing ——. C. Siedentopf, Magdeburg, Germany. U.S. Pat. 1,108,406, Aug. 25, 1914; date of appl., Nov. 24, 1913.

Mortar from a previous "dressing," whilst still hot, is incorporated with a fresh mixture of lime and sand, for the purpose of substituting the heat of the already dressed mortar for the heat from slaking.—F. Sodn.

Mortar; Process for preparing dry —— from lime and sand. Mörtelwerk Jolit G. m. b. H. Ger. Pat. 275,607, Oct. 23, 1912.

Quicklime is mixed with sand and calcium carbonate and heated in presence of water at 80°—100° C. Magnesium, calcium, aluminium, ammonium, or ferric chloride may also be added to the mixture.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron-ore deposits of Eastern and Western France. P. Nicou. Iron and Steel Inst., 1914. [Advance proof.]

A STATISTICAL and geological description, with two maps of the great French ore-fields is given. The western field, which is the more favourably situated geographically for the supply of ore to Great Britain, includes Normandy, producing hæmatite with a maximum of 55% Fe, and carbonate ores containing, after calcination, up to 50%, and Anjou and Brittany, producing oolitic iron ore, hæmatite, and magnetite, with about 55% Fe and 13—20% SiO_2. The eastern field, French Lorraine, yields a hydrated oolitic hæmatite containing from 33 to 40% Fe, and phosphorus in such ratio that iron containing P 1·7 to 1·9% can be produced with regularity.—O. E. M.

Blast-furnace stoves; A new process for heating ——. A. Spannagel. Iron and Steel Inst., 1914. [Advance proof.]

THE process consists essentially in forcing the heating gases through the stoves at a high velocity, experiments having shown that whilst at first the temperature of the exit gases rises when the velocity is increased, the reverse is the case after a critical point is passed. In the first tests rough-cleaned gas (containing about 0·5 grm. of dust per cubic metre), at a pressure of 4 ins. water-gauge was forced through the stove by the aid of air under a pressure of 12 ins. For a blast temperature of 800° C. the heating period was reduced from 4½—5 to about 1½ hours and the maximum temperature of waste gases from 700° to 350° C., as compared with former conditions. By using highly-cleaned gas it was possible to reduce the cross-section of the heating passages. In an installation at Neunkirchen the stoves are fitted with octagonal bricks having passages of 75 mm. diam. and so disposed as to leave an additional passage, 50 mm. sq., in the centre of each group of 4 bricks. Lateral openings are also provided at one end of the bricks to allow the gases to pass even if the vertical path is blocked. Using air at a pressure of 16 ins. water-gauge to force the gases through the stoves, the waste gases were 90°—116° C. at the end of the heating period of 1½ hours, as compared with 410°—440° C. under the old system. At Neunkirchen 6 blast-furnaces will be worked with 15 stoves, of which not more than 12 will be running continuously. The method can also be applied to boiler firing.—A. S.

Electrolytic iron, its manufacture, properties, and uses. L. Guillet. Iron and Steel Inst., 1914. [Advance proof.]

IN the manufacture of electrolytic iron taken on a commercial scale in France, a revolving cathode is used, with a solution of iron salts kept neutral by circulation over the surface of the iron. A depolariser, such as iron oxide, is added periodically to the bath, to eliminate, at least in part, the hydrogen deposited at the cathode. It is possible to work with a current density up to 1000 ampères per sq. metre, with a yield of 2 tons of metal per kilowatt-year, including the current for accessory services, especially for the rotation of the cathode. Using pig iron containing C 2·35, Si 1·31, S 0·07 and P 1·07%, electrolytic iron containing C 0·004, Si 0·007, S 0·006, and P 0·008%, after removal of the gases by annealing has been obtained, and iron of similar quality can be obtained from any grade of pig iron. For the properties of the electrolytic iron, see this J., 1913, 290. Tubes of 100—200 mm. diam., 0·1—6 mm. thick and 4 m. long are made regularly at the rate of 100 tubes per day. A tube of 100 mm. diam. and 0·75 mm. thick, when subjected to a pressure of 1200 lb. per sq. in., was deformed permanently and uniformly as if squeezed in a press. Another specimen after being heated at 120° C. in a boiler for 2½ months withstood a pressure of 1200 lb. per sq. in. without any trace of fracture. Good results have also been obtained with sheets in laboratory trials. The metal can be easily worked and is specially suitable for the construction of electrical machinery. In consequence of the magnetic properties of the electrolytic iron and its regularity of thickness and compressive strength, its use permits of a saving in weight of material of 33—40% in transformers and 16% in direct current machines, whilst the capacity of alternating motors, running at the same temperature and occupying the same space, can be increased by 50%. The total cost of the iron as it leaves the electrolytic bath depends on cost of material and labour, but is placed at from £6 to £7 12s. per ton by the author.—A. S.

Iron; A microscopic study of electrolytic ——. O. W. Storey. Trans. Amer. Electrochem. Soc., 1914, 25, 489—527.

THE deposits of electrolytic iron were crystalline but variable in character (being fine or coarse, soft and porous or hard and dense, nodular, etc.) and frequently resembled the minerals manganite, hæmatite and limonite in structure. On heating to 910°—915° C., the crystalline structure of the deposit was converted into the grain structure of ordinary ferrite, the grain being large or small as the original deposit was coarse or fine; but no change occurred below the A_3 point. By long annealing at the Ac_3 point the coarse-grained ferrite structure became somewhat finer, but never as fine as that resulting from a fine-grained deposit. The grains of electrolytic iron did not grow appreciably at 1150° C. The ferrite grains of fused electrolytic iron were composed of smaller grains, the boundaries of the latter being merely shallow depressions whereas those of the former were V-shaped grooves; continuity of inner grain structure was observed between merging grains of similar crystal orientation, and this inner structure was only destroyed by several annealings above the Ac_3 point. The inner grains are probably groups of similarly-oriented iron crystals, the orientation in all the grains being alike throughout the ferrite grain; and the large γ grains formed during the slow cooling of the molten metal contain numerous, similarly-oriented, non-γ nuclei, and are changed to the non-γ state without altering in size. The microstructure of rolled electrolytic iron consisted of clean ferrite, and that of the forged metal of fine-grained ferrite containing a minimum of impurities.—W. E. F. P.

Steel; The oxygen content of open-hearth ——. J. A. Pickard and F. M. Potter. Iron and Steel Inst., 1914. [Advance proof.]

OXYGEN was determined by heating the steel in a confined volume of hydrogen in the presence of a weighed boat containing phosphoric anhydride (Carnegie Scholarship Memoirs, Iron and Steel Inst., 1913, 70). The results given are :—

Sample.	C %	Mn %	Si %	S %	P %	O %	
Acid :						i.	ii.
1	0·67	0·73	0·950	0·035	0·027	0·004	0·004
2	0·79	0·65	0·210	0·030	0·050	0·020	0·021
3	0·93	0·68	0·035	0·031	0·027	0·007	0·006
4	1·08	0·62	0·024	0·033	0·022	0·012	0·016
5	1·18	0·65	0·056	0·027	0·025	0·005	0·006
6	1·33	0·42	0·140	0·030	0·024	0·004	0·007
7	1·55	0·49	0·100	0·027	0·026	0·010	0·012
Basic :							
8	0·10	—	—	—	—	0·038	0·036
9	0·14	0·35	0·020	0·033	0·018	0·010	0·011
10	0·20	—	—	—	—	0·031	0·028
11	0·23	0·70	—	0·060	0·026	0·013	0·014
12	0·26	0·49	0·120	0·030	0·031	0·003	0·006
13	0·30	—	—	—	—	0·030	0·027
14	0·32	0·62	—	0·051	0·020	0·040	0·041
15	0·33	0·62	—	0·057	0·025	0·024	0·021
16	0·35	0·56	0·182	0·027	0·020	0·005	0·008
17	0·41	0·52	0·026	0·032	0·023	0·019	0·014
18	0·44	—	—	—	—	0·029	0·025
19	0·54	0·69	0·085	0·022	0·024	0·003	0·003
20	0·55	0·97	—	0·055	0·011	0·016	0·017
21	0·55	—	—	—	—	0·020	0·020
22	0·61	0·74	—	0·053	0·021	0·038	0·044
23	0·66	0·65	0·100	0·033	0·052	0·005	0·006
24	0·75	0·38	0·025	0·025	0·022	0·025	0·026
25	0·82	0·67	0·096	0·030	0·028	0·004	0·007
26	1·00	0·67	0·036	0·016	0·025	0·006	0·007

he higher proportions of oxygen were present in the heaper steels (of which Nos. 8, 10, 13, 18 and 21 are xamples), and the general superiority of acid, over basic, teels may be due in some measure to its lower oxygen ontent. The high results for oxygen, in good quality teels, obtained by previous workers are discussed and he methods of analysis criticised.—W. E. F. P.

teel castings; Electric ——. C. A. Hansen. Trans. Amer. Electrochem. Soc., 1914, **25**, 133—137.

s a foundry of the Treadwell Engineering Co., Easton, a., a 3-phase arc furnace (nominal capacity 2 tons per harge) is employed, the current—supplied at 2200 volts,) cycles—is stepped down to 85 volts by means of two 0 K-V.A. transformers, and direct current motors are sed for regulating the electrodes. The foundry is perated on day-shift only, a good quality of steel scrap eing charged cold with sufficient pig and ore to keep the arge off the furnace bottom and produce a casting metal ntaining about 0·2% C (as against a minimum of 3—0·4% in ordinary crucible-steel castings); it has not en found economical to reduce the carbon content of e metal further, to preheat the furnace by means of xiliary fuel-burning apparatus, or to employ molten pola metal for charging. 15 heats per week are made, e average weight per heat being 4600 lb.; the average wer consumption is 900 kilowatt-hours, and the costs of pairs and of electrodes each $2.50 (10s. 5d.), per 2000 lb. e average weight of castings made is 9 lb.; the ratio cleaned castings, risers, etc., to charged weight, 92—95%; d the ratio of finished castings to charged weight, about %. The furnace lining is repaired after every 35 heats. —W. E. F. P.

rromanganese in steel processes; Use of molten ——. A. Sahlin. Iron and Steel Inst., 1914. [Advance proof.]

avoid the loss of ferromanganese caused by adding it the charge in the solid state, it is frequently melted in ctric furnaces; those in use have a furnace efficiency only about 44%. With the Rennerfelt furnace (this J., 12, 1188) an efficiency of 78—79% is reached if the ferro-nganese is charged into the empty previously-heated rnace, or 47% if it is dropped into an existing liquid th in the furnace. To obtain the higher efficiency e cold ferromanganese is placed upon a bridge the surface which is slightly below the highest level of the bath en the furnace is charged, or several small furnaces are d and discharged into a travelling receiver in succession. —O. E. M.

els; Transformations of ——. H. de Nolly and L. Veyret. Iron and Steel Inst., 1914. [Advance proof.]

the authors' view the transformation-point is marked the allotropic change of α- into β- or γ-iron, with a more less complete dissociation of carbide and solution of the bon liberated in γ-iron. If it be admitted that the allo-pic change involves shrinkage, and that the dissociation d solution involve dilatation, this view is supported by numerous dilatation curves given for steels of various nposition.—O. E. M.

n and steel; The brittleness produced in ——, by deforma-ion at different temperatures. G. Charpy. Comptes end., 1914, **158**, 311—314.

E brittleness of steel increases regularly with the nperature of deformation and attains a maximum, rying according to the nature of the steel, at about ° C., this temperature being coincident with that of nimum ductility, and nearly 200° below that of nimum resilience.—W. E. F. P.

el; Influence of coalescence on the mechanical properties f —— and on alloys. A. M. Portevin and V. Bernard. ron and Steel Inst., 1914. [Advance proof.]

the result of coalescence—induced by prolonged ealing—of an eutectoid steel (C 0·8, Mn 0·3, Si 0·37%), tensile strength, elastic limit and Brinell hardness were reduced, and the elongation and reduction of area increased. In the case of a hypoeutectic steel (C 0·5, Mn 0·5, Si 1·8%) the effect of liquation and coalescence phenomena upon the resilience and hardness of specimens which had been subjected to different heat treatments was determined. When heated for 10 mins. before hardening, the mechanical properties of the specimens differed according to the nature of the preliminary heat treatment, but by increasing the heating period to 30 mins. all the specimens were "restored" irrespective of their previous condition. The explanation of many experimental facts relative to the heat treatment of alloys generally may be traced to the phenomena of coalescence and liquation.—W. E. F. P.

Cobalt; Determination of —— in high-speed steels. L. Dufty. Iron and Steel Inst., 1914. [Advance proof.]

THE volumetric cyanide and gravimetric nitrite methods hitherto employed for determining cobalt in steels are liable to considerable error, but quite satisfactory results are obtained by precipitating the metal as ammonium cobalt phosphate. 3 grms. of filings are dissolved in hydrochloric acid, oxidised with nitric acid, and tungstic acid filtered off. The excess of acid is neutralised with ammonia, the iron precipitated with acetic acid and ammonium acetate and an aliquot portion of the filtrate, representing 2 grms. of steel, is acidified with hydrochloric acid, evaporated to 50 c.c., and neutralised with ammonia, the precipitate being dissolved and re-precipitated with ammonium acetate. The combined filtrates (200 c.c.) are neutralised with acetic acid and 4 c.c. excess of acid and 15 c.c. of ammonium acetate solution added. Hydrogen sulphide is passed through the solution for 15 mins., the cobalt sulphide is separated, dissolved in hot dilute nitric acid, 20 c.c. hydrochloric acid added, and after evaporation to 10 c.c., the solution is diluted and the cobalt precipitated in a volume of about 125 c.c. by adding 1 grm. of ammonium phosphate, and just enough ammonia to produce a slight precipitate, then 15 c.c. of ammonium acetate, and finally ammonia till slightly alkaline. The liquid is warmed until the flocculent blue precipitate changes to a crystalline purple-rose one. This is ignited in a muffle and weighed as $Co_2P_2O_7$. The filtrate will still contain a trace of cobalt, but this is counterbalanced by the presence of traces of iron phosphate and silica in the precipitate. If nickel is present it is separated by the dimethylgloxime method from the original acetate filtrate, and the cobalt determined as phosphate in the filtrate.—G. F. M.

Chloridizing leaching at Park City, Utah. [Recovery of copper, silver and gold from low-grade ores]. T. P. Holt. Min. and Eng. World, 1914, 383—386.

THE ore containing per ton 6—14 oz. Ag, 1—2 lb. Cu, 0·01—0·015 oz. Au, and a little Pb and Zn, is crushed, mixed with coaldust and salt, roasted by the combustion of the fuel in the charge, leached with acid salt solution, and the Ag, Cu, Au, and Pb precipitated together on scrap iron. Recently the shaft furnaces previously used for roasting have been replaced by a continuous furnace in which the column of ore moves down at intervals as the roasting zone travels upwards. The charge contains 2·4—3·0% of fuel and 7·5% of salt, and must be thoroughly mixed. The leaching solution consists of soluble salts from the roasted ore with some free acid, derived in part from the condensed roaster fumes. The product deposited on the scrap iron contains Au 1·78 oz. and Ag 6868·5 oz. per ton, Pb 13·2%, Cu 36·94%, insoluble residue 7·5%, Fe 2·5%, S 1·6%, and Zn *nil*.—A. T. L.

Copper ores; Leaching and electrolytic treatment of —— at Chuquicamata, Chile. E. A. C. Smith. Trans. Amer. Electrochem. Soc., 1914, **25**, 193—206.

THE ore deposit at Chuquicamata is probably the largest copper deposit known. It extends a distance of about 8000 ft., with an average width of 500 ft., and up to the present 200,000,000 tons of ore have been developed. The copper-bearing mineral is mainly brochantite (oxysulphate) and is readily extracted by cold dilute sulphuric acid. No deleterious impurities other than chlorine, derived from a deposit of salt in the upper parts of the ore body, are dissolved and the acid produced in depositing copper electrolytically from the solution more than suffices to make up the losses in working. Before electrolysis the chlorine is precipitated as cuprous chloride by treating the solution with copper shot placed in a revolving drum. In tests with an experimental plant of 15 tons capacity, an extraction of 90·96% of the copper was obtained. A description of the plant now in course of construction is given. The daily capacity of the plant will be about 10,000 tons of ore and that of the electrolytic refinery 335,000 lb. of copper.—A. S.

Copper ores; Hydro-electric treatment of ——. R. R. Goodrich. Trans. Amer. Electrochem. Soc., 1914, **25**, 207—242.

A REVIEW, with copious references, of the practised and suggested hydrometallurgical processes for the extraction of copper from ores, including both purely chemical and electrolytic methods.—A. S.

Zinc; Electrolytic deposition of ——. J. W. Richards. Trans. Amer. Electrochem. Soc., 1914, **25**, 281—290.

A REVIEW of electrolytic methods for the deposition of zinc. The refining of impure zinc in the absence or presence of precious metals may be commercially successful with cheap sources of power and high market values of zinc. Processes for the direct estimation of zinc in compounds, using soluble anodes containing zinc compounds or no zinc, or using insoluble anodes, but utilising or not utilising the electro-chemical reaction at the anode, have either been abandoned or are only moderately successful commercially, with the exception of direct estimation using insoluble anodes in which the electrochemical reaction at the anode is not utilised. Ordinarily zinc can only be efficiently deposited from slightly acid solutions with a low current density, but Pring and Tainton have shown that in the presence of a small amount of colloidal matter, the reverse is the case (see this J., 1914, 423).—B. N.

Zinc from zinc sulphate solutions; Addition agents in the [electro] deposition of ——. O. P. Watts and A. C. Shape. Trans. Amer. Electrochem. Soc., 1914, **25**, 291—296.

THE most promising addition agents for obtaining good electrolytic deposits of zinc were found to be eikonogen, pyrogallol and β-naphthol, the latter being the best, though gum arabic, benzoic acid, caffeine, formin, and terpin hydrate gave fair results, the most common defect being the production of vertical grooves or striations. One gram of the agent per litre was added to a solution of zinc sulphate (25% of $ZnSO_4,7H_2O$), using a zinc anode and iron cathode and a current density of about 10 amps. per sq. ft.—B. N.

Brass foundry; Safety and sanitation in the ——. F. Moerl. Amer. Inst. Metals, Sept. 7—11, 1914. [Advance proof.]

AN account of the measures adopted in a brass foundry in Chicago.

Brass melting; Electric ——. G. H. Clamer and C. Hering. Amer. Inst. of Metals, Sept. 7—11, 1914. [Advance proof.] (See also this J., 1913, 27.)

THE furnace of the Hering type, used in the tests, consists of a shell lined, so as to form a hearth, in the bottom of which are several inclined cylindrical holes, extending into the lining and terminating at their outer ends in electrodes of graphite or of the same metal as that to be melted. The current passes through the liquid metal in these holes, or resisters, squirting it out by the "pinch effect" into the mass of metal on the hearth. Suspended matter is thus removed to the top and the metal is refined. The rapid flow in the heating holes is based on the use of a heavy current of low voltage. The furnace may be made to tilt, thus facilitating direct casting into the moulds and avoiding expensive superheating. The electrodes are attached to transformers of the two- or three-phase type, which are secured to the shell, thus permitting heating during the tilting operation. The furnace is normally sealed, and opened only for pouring, the zinc loss being reduced to an almost negligible amount, as a reducing atmosphere can be maintained in the furnace.—B. N.

Zinc bronze: 2Zn-10Sn-88Cu; Standard test bars of the ——. C. P. Karr. Amer. Inst. of Metals, Chicago, Sept. 7—11, 1914. [Advance proof.]

THE most suitable conditions for pouring and moulding test bars so as to secure high and uniform tensile strength and ductility, were investigated by the U.S. Bureau of Standards. The sand cast-to-size shape is recommended as the standard form for general foundry practice, since it is easy to mould (a dry sand mould is used and the bar cast flat or vertical), inexpensive to machine to the shape and size required for testing, and gives uniformly good results irrespective of the pouring temperature. Normalised chill bars, comparable to the sand cast-to-size shape, were obtained by annealing chill cast bars between 500° and 700° C. For all types of bar, the best results were obtained by pouring between 1150° and 1270° C.
—W. E. F. P.

Nickel; Electrodeposition of ——. C. W. Bennett, H. C. Kenny and R. P. Dugliss. Trans. Amer. Electrochem. Soc., 1914, **25**, 335—346.

THE best deposits of nickel are obtained when a definite amount of ammonia is added to the solution of nickel ammonium sulphate, the efficiency being dependent upon the degree of alkalinity of the cathode film, and if the solution is vigorously stirred the efficiency is decreased. It is probable that, in acid solutions, nickel is deposited only when the impoverishment of the hydrogen ions causes the solution to become alkaline. The iron content of the anode does not materially affect the efficiency, but with a rotating cathode the iron content of the deposit is greater than that formed on a stationary one. Probably the ammoniacal film prevents the electrodeposition of the iron, except by mechanical occlusion, owing to the formation of a deposit of hydrated oxide.—B. N.

Cadmium; Electrodeposition of ——. *Part I.—Review; Part II.—Experimental.* F. C. Mathers and H. M. Marble. Trans. Amer. Electrochem. Soc., 1914, **25**, 297—333.

A HISTORICAL review of the electrodeposition of cadmium, dealing with inorganic and organic salts and with ammoniacal solutions, is given. In almost all cases, rough crystalline deposits are obtained. Experiments have shown that good and smooth deposits of cadmium may be obtained from perchlorate, fluosilicate, fluoborate and fluoride solutions, by the addition of clove oil, glue, peptone, and phloridizin.—B.N.

Lead in tinning baths and solders; Determination of small quantities of ——. P. Breteau and P. Fleury. J. Pharm. Chim., 1914, **10**, 265—273.

ONE grm. of the sample is fused with sulphur and sodium carbonate, the product digested with warm water, and the sulphides of Pb, Cu and Fe filtered off, washed with sodium sulphide solution, and dissolved in the least possible quantity of hydrochloric acid containing bromine. After boiling and reducing the Fe with sulphurous acid, the cooled solution is treated with excess of potassium cyanide, made alkaline and the Pb precipitated by sodium sulphide. The precipitate is washed with sodium sulphide solution, dissolved in warm nitric acid, the solution evaporated, the residue dried at 130°—150° C., and dissolved in 10 c.c. of water. The solution is evaporated, the residue dissolved in 5 c.c. of water together with a crystal of sodium acetate, and the solution poured into 25 c.c. of a solution containing 0·1423 grm. of $K_2Cr_2O_7$ per litre. The colloidal precipitate of normal lead chromate (a basic chromate is precipitated if the bichromate be added to the lead solution) is aggregated by shaking with 0·1 grm. of powdered asbestos, filtered off, the filtrate and washings made up to 100 c.c., and the excess of bichromate determined iodometrically.—F. Sodn.

Aluminium alloys ; A hot-shortness testing machine for ——. A. B. Norton. Amer. Inst. of Metals, Chicago, Sept. 7—11, 1914. [Advance proof.]

A test-piece 2 in. long and ½ in. diam., having each end connected (unfilleted) to the end of a cylinder 5 in. long and 1 in. diam., is cast horizontally, in sand, so that, as it contracts during solidification, it lifts a weight or cracks in the attempt. The specimen is cast, without a riser, in an iron flask, but has at the gate end a bolt which is fixed rigidly to the flask and holds the test-piece stationary when contraction begins ; tension is applied to the opposite end through another bolt (also cast in the test-piece) attached to a flexible wire cable passing over a pulley and provided with a scale pan. The largest load the alloy will raise without cracking is the figure taken for comparison ; and the results of the tests agree well with foundry experience.—W. E. F. P.

Aluminium die-castings. A. B. Norton. Amer. Inst. Metals, Chicago. Sept. 7—11, 1914. Pp. 1—7. [Advance proof.]

The difficulties in using aluminium alloys for die-castings are the high melting point, the tendency to absorb iron, the high shrinkage on solidification and the weakness developed by aluminium when burned or soaked. Iron moulds are used, constructed in sections containing loose pieces serving as cores or chills or forming projecting parts which would otherwise interfere with the opening of the mould. After assembling the mould, and heating it to the proper temperature, cooling pieces are inserted, the metal poured, and the cooling pieces removed in the proper order. The castings have a smooth finish and a fine grain, and will take a high polish. They are made up to 30 lb. in weight and are stronger than sand castings (see table) :—

	Sand castings.	Die castings.
Tensile strength	20,000	25,000
Approx. elastic limit (Stress for 0·01" elongation in 2") ..	13·000	13,000
Percentage elongation in 2" ..	1·7	3·1
Specific gravity	2·84	2·87

—A. T. L.

Aluminium and aluminium wares. Board of Trade Bulletin, No. 77. [T.R.]

May be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Electrical conduction [of metals] at high temperatures and its measurement. E. F. Northrup. Trans. Amer. Electrochem. Soc., 1914, **25**, 373—392. (See also this J., 1914, 141, 357, 358, 792.)

The author determined the resistivity in the molten state of Na, K, Hg, Cd, Pb, Zn, Sn, Bi, Sb, Cu, Al, Ag, Au, and also alloys of Na and K and brass. A change of state was always accompanied by an almost sudden change in resistivity. With metals which expand or contract on liquefaction, the resistivity was either a little more than doubled or halved respectively. With the exception of Zn, Cd and Sb, the increase in resistivity with increase in temperature was very nearly linear in the molten state, and with Na, K, Sn, Hg, Pb and Bi, the ratio of the coefficient of resistance to the coefficient of cubical expansion for the same temperature was practically the same.—B. N.

Calcium hydride ; Thermodynamics of the formation of ——. J. N. Brönsted. Z. Elektrochem., 1914, **20**, 81—83.

Combination between calcium and hydrogen occurs appreciably at 400° C., whilst at 900° C. the hydride dissociates rapidly at 0·1 atmosphere pressure. The dissociation curve was investigated between 650° and 750° C. The heat of formation of calcium hydride was deduced therefrom as 43,930 calories, and a direct calorimetric estimation gave 45,100 calories.—J. R.

The by-product coking industry and its relation to the manufacture of iron and steel. Cooper. *See* IIa.

Iron and Steel Institute. Hadfield Research Prize. See page 998

Patents.

Steel making ; Converter for use in ——. R. and J. R. Hyde, Sheffield. Eng. Pat. 16,653, July 21, 1913.

A combined cupola and converter arranged vertically. The lower, or converter, part may be tilted, raised or lowered as required.—W. E. F. P.

Iron ; Process of smelting and purifying ——. G. R. Gehrandt, Chicago, Ill. U.S. Pat. 1,110,540, Sept. 15, 1914 ; date of appl., June 14, 1913.

The ore is smelted in a blast-furnace having two series of tuyères arranged one above the other at the upper part of the crucible, so that the freshly reduced metal is subjected to horizontal and upwardly inclined blasts from the upper and lower tuyères respectively.—W. E. F. P.

Alloy-steel scrap ; Method of treating ——. P. P. Reese and E. L. Diehl, Munhall, Pa. U.S. Pat. 1,108,235, Aug. 25, 1914 ; date of appl., Feb. 7, 1911.

Steel scrap (containing Ni alone or with Cr, V and Mn) is first heated to about its melting-point by regenerative heat and then melted, by means of an electric current, in a stream of non-oxidising gases and in presence of fluxes and reducing agents.—W. E. F. P.

Ferromanganese and silicon ; Making an alloy of ——. J. C. Walker, Yonkers, N.Y. U.S. Pat. 1,109,640, Sept. 1, 1914 ; date of appl., Feb. 4, 1913.

Silica is reduced while in contact with molten ferromanganese, portions of the silicon alloy being periodically removed from the bath and replaced by ferromanganese. —W. E. F. P.

Steel ; Method of preparing —— *for painting.* G. D. Feidt, Assignor to American Chemical Paint Co., Philadelphia, Pa. U.S. Pat. 1,109,670, Sept. 8, 1914 ; date of appl., Feb. 4, 1914.

A mixture of alcohol and phosphoric acid is applied to the steel which is then rubbed with an abrasive and finally wiped.—W. E. F. P.

Metals or other fusible materials ; Formation and application of alloys or mixtures of ——. R. K. Morcom, London. Eng. Pat. 19,005, Aug. 21, 1913.

The solid (wire or rod) or molten metals (or other materials) are fed into a blowpipe whence, by the action of the blast, they are projected, as spray or dust, into a receiver (containing water or not) or against a preheated metal surface. The constituents of the alloy may form the electrodes of an arc and the latter subjected to the action of a blast. (See also this J., 1914, 925.)—W. E. F. P.

Metals from their solutions and apparatus therefor ; Electrolytic recovery of ——. U. C. Tainton and M. F. L. A. Aymard, Johannesburg, Transvaal. Eng. Pat. 19,669, Aug. 30, 1913.

The filtering body of the cathode is made of very finely-divided conducting substance spread upon a perforated conducting support, so that in the passage of the liquid under treatment through the cathode, turbulent or eddying flow takes place. The finely-divided substance, *e.g.*, graphite, may be added to the liquid so that it is deposited on the cathode during working. Three forms of apparatus are described, one with a horizontal support, a second with a vertical one, and a third with a porous carbon tube as support.—B. N.

Electroplating apparatus. J. T. Daniels, Assignor to The Hanson and Van Winkle Co., Newark, N.J. U.S. Pat. 1,108,145, Aug. 25, 1914; date of appl., March 10, 1913.

Two electrically-conductive conveyer screws are mounted on the tank, and carry electrically-conductive hangers, extending into the bath. A stationary curved transfer rod is connected with the screws, and, by means of a transfer wheel journaled on an axis perpendicular to the screws and the transfer rod and provided with transfer fingers, the hangers may be moved from one screw to the other by way of the transfer rod when the screws are turned.—B. N.

Electro-galvanising solution. G. Saccrdote, Assignor to The Metal Treating and Equipment Co., Inc., New York. U.S. Pat. 1,109,181, Sept. 1, 1914; date of appl., July 21, 1909.

A solution of a salt of the metal to be deposited, together with sulphate of iron, acetates of aluminium and manganese, free from alkali salts.—B. N.

Cobalt or nickel and copper; Process of extracting ——, from cobalt or nickel bearing copper. L. J. G. de Burlet, Hoboken, Belgium. Eng. Pat. 27,150, Nov. 25, 1913.

Silicate ore or slag is fused to extract the greater part of the copper as impure metal, then pulverised, treated with sulphuric acid of 32° B. or sp. gr. 1·285 (2500 litres per ton of material), the mass dried at 150°—200° C., treated with hot water and filter-pressed. After adding calcium carbonate to the solution to precipitate the iron and part of the copper, the remainder of the latter is removed by electrolysis, the liquid made ammoniacal, and the cobalt or nickel recovered electrolytically.—W. E. F. P.

Furnace for heat treatment of metals. W. A. Russell and J. Lord, Manchester. Eng. Pat. 3339, Feb. 9, 1914.

The horizontal heating-chamber of the furnace has an arched roof, inlets for flame or hot gas at each springer or base of the arch, and a gas outlet at the mouth, the walls being provided with studs or projections for abstracting heat from the gases.—W. E. F. P.

Tin; Process for the recovery of —— by conversion into volatile tin compounds. A. Richards, London. Eng. Pat. 8611, Apr. 4, 1914.

A mixture of the tin-bearing material with coal and sodium chloride is heated to about 800° C. in a reducing atmosphere and preferably under reduced pressure. The mixture may be agitated by means of rabbles; showered into, or against, the stream of hot, reducing gases and flame; or treated in the form of shallow layers or blocks. (See also Eng. Pats. 26,644 of 1911 and 56 of 1912; this J., 1913, 440, 821.)—W. E. F. P.

Furnace; Electric —— [for reduction of zinc ores]. A. L. J. Queneau, Jemeppe-sur-Meuse, Belgium. Eng. Pat. 10,061, April 23, 1914.

Tubular condensers of refractory material of the same cross-section throughout are grouped together in openings in the walls of the furnace with a suitable inclination towards the outside. The dimensions and number of the condensers are chosen so that they act like those of the Belgian type. The condensers have internally a circular cross-section each being closed at the outside end by a cylindrical plug, the upper part of the periphery being of a radius less than that of the interior of the nozzle so as to leave a passage for gas, and the lower part having an opening for the passage of a scraper. The condensers are arranged in superposed layers, with orifices in their walls, the upper ones delivering condensed liquid metal to the last layer from which the metal is run off. The electrodes are in the central part of the furnace, and the charge is introduced through a series of shoots in the walls, alternating with the groups of condensing tubes. The material is delivered on opposite sides of the electrodes, at such a level that it falls in a sloping manner towards the electrodes, giving a minimum of thickness around the electrodes where the reduction is most intense, and the transference of dust with the vapours is thus largely prevented.—B. N.

[Metal-heating] Furnace working-openings through which hot gases are discharged; Impts. in ——. W. S. Rockwell, New York, U.S.A. Eng. Pat. 12,270, May 18, 1914. Under Int. Conv., Aug. 15, 1913.

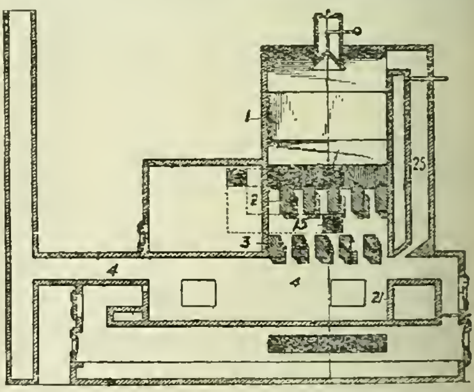
A vertical casing is fixed in front of the furnace so that the hot waste gases issuing from the working opening pass up through the casing and preheat the air for combustion which is passed through an inclined series of horizontal pipes connected at each side with a header. A sheet of non-conducting material is fixed to the front wall of the casing to protect the workmen from the heat. —W. H. C.

Smelting furnace. E. Riveroll, Los Angeles, Cal. U.S. Pat. 1,105,001, July 28, 1914; date of appl., Nov. 5, 1912

Ore is fed into an inclined chamber, the width of which increases from either end towards the middle, and which opens at its lower end into a combustion chamber above a crucible. Oil and air are supplied to the lower part of the crucible and hot products of combustion are directed across the top of the crucible and through the combustion chamber and ore chamber to a stack. As the ore is fused it flows down and collects in the crucible.—A. S.

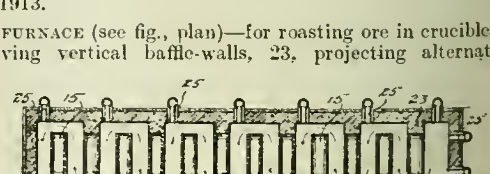
Smelting-furnace. W. E. Williams, Massillon, Ohio, Assignor to P. H. Holdsworth, Seattle, Wash. U.S. Pat. 1,108,821, Aug. 25, 1914; date of appl., Dec. 21, 1910.

The furnace (see fig.) consists of a vertical and a horizontal portion separated by two superposed sets of grate-bars, 2, 3. The horizontal portion, 4, communicates at one end with a chimney and at the other end with a down-draught flue, 25, leading from the top of the vertical part, 1. Below the horizontal portion is a slag-chamber connected with the vertical part by air-flues having branches to a heating-chamber which adjoins both portions of the apparatus.—W. F. F. P.



Ore-roasting furnace. G. P. Gibson, Braddock, Pa. U.S. Pat. 1,107,604, Aug. 18, 1914; date of appl., June 27, 1913.

A furnace (see fig., plan)—for roasting ore in crucibles—having vertical baffle-walls, 23, projecting alternately from opposite sides, and a horizontal burner, 25, adjoining each baffle wall. Removable, covered, rectangular



"crucibles," 15, which rest upon the bottom and project hrough openings in the roof, are disposed one at the nd of each baffle wall, so as to form a circuitous channel or the heating gases. Each crucible has a gas exit pipe nd also a vertical air-supply pipe extending downwards rom a common main above.—W. E. F. P.

urnace ; Ore-roasting ——. A. F. Herzig, East St. Louis, Ill. U.S. Pat. 1,108,906, Sept. 1, 1914 ; date of appl., Aug. 13, 1913.

A FURNACE of the superposed-chamber type in which the abbling mechanism is actuated from a pair of vertical hafts geared to rotate together in opposite directions rithin the apparatus.—W. E. F. P.

urnace ; Metallurgical ——. E. McCabe, Granite City, Ill. U.S. Pat. 1,109,241, Sept. 1, 1914 ; date of appl., March 13, 1914.

HE furnace consists of a hearth-chamber, each end of hich is provided with a horizontal burner (the two eing operated alternately) and connected, by a vertical own-take flue (for the passage of gas and molten slag), ith a separate air-and-gas chamber the lower part of hich communicates with a chequer-work regenerator nd is provided with a pair of catch-basins or slag eceptacles ; the latter, situated under the down-take flue nd to one side of the terminal of the regenerator, are eparated by a dividing ridge and each has an opening at he bottom through which the slag passes into a slag-pot ontained in a sealed tunnel below.—W. E. F. P.

letallurgical process. [Treating arsenicol silver-nickel-cobalt ores.] W. McA. Johnson, Hartford, Conn. U.S. Pat. 1,107,310, Aug. 18, 1914 ; date of appl., Sept. 20, 1909.

HE ore is heated in a current of moist chlorine to remove rsenic, then leached with water to extract nickel and obalt chlorides and finally treated to recover silver. —W. E. F. P.

res ; Agitator and filter for treating ——. J. D. Fields, Maxville, Mont. U.S. Pat. 1,107,922, Aug. 18, 1914 ; date of appl., Sept. 13, 1913.

HE ore is treated in a closed vertical cylindrical tank ivided into upper and lower compartments by a porous onical filter, the treating liquid being admitted from a istributor at the top of the tank and circulated by a pump hich draws it from an inclined pipe leading from the ottom of the filter. The lower compartment of the tank exhausted by an air pump. The conical filter is made f upper and lower sections joined by means of a flanged ng. The upper section makes a tight joint with a flange n the inner wall of the tank, and the lower section has a ange bolted to a central pillar in the lower compartment.—A. T. L.

letals ; Process of welding ——. J. C. Lincoln, East Cleveland, Ohio. U.S. Pat. 1,108,592, Aug. 25, 1914 ; date of appl., Jan. 21, 1913.

MINUTE quantity of a finely-divided, metallic deoxidant .g. magnesium) is applied to the surfaces of the metal .g. iron or steel) before welding.—W. E. F. P.

node residues [containing copper and precious metals] ; Process for treating ——. E. Keller, Perth Amboy, N.J. U.S. Pat. 1,110,493, Sept. 15, 1914 ; date of appl., April 17, 1913.

HE residue, freed from excess of liquid, is treated with fficient concentrated sulphuric acid to convert the pper into sulphate, the mixture (which should not be uid) heated to about 450° F. (232° C.) and then agitated th water.—W. E. F. P.

Clad metals ; Method of making ——. J. F. Monnot, Paris. Assignor to Duplex Metals Co., New York. U.S. Pat. 1,110,638, Sept. 15, 1914 ; date of appl., April 2, 1910.

THE metal (iron or steel) to be coated is passed into and withdrawn from a bath of molten metal through a layer of molten flux (sodium chloride). A further layer of the molten metal is cast upon the coating.—W. E. F. P.

[Zinc.] Process for arresting sulphurous gases and fumes and utilising the heat and gases contained therein. C. S. Vadner, Salt Lake City, Utah. U.S. Pat. 1,110,660, Sept. 15, 1914 ; date of appl., Oct. 29, 1913.

A FINELY-GROUND pulp of oxidised (or roasted sulphide) ore containing zinc and other metals is sprayed into the sulphurous gases (hot smelter fumes), and the resulting solution passed over metallic iron to eliminate copper, then oxidised, treated in the cold with sufficient finely-divided calcium carbonate to precipitate iron, arsenic, etc., filtered and heated with a further quantity of calcium carbonate to precipitate zinc as basic carbonate. The latter is re-dissolved in aqueous sulphurous acid and the solution electrolysed to recover the zinc.—W. E. F. P.

Ores ; Reduction of —— by fractional and successive meltings in a cupola. R. E. Trottier. Fr. Pat. 468,418, April 23, 1914.

AN annular partition, perforated to permit passage of gases, extends downwards from the feed hopper, a considerable distance into the shaft of the furnace. The fuel is fed into the space enclosed by the partition, whilst a mixture of the ore with fluxes and the carbon necessary for reduction is fed between the partition and the wall of the furnace. By the time the charge reaches the bosh, the lower part of which is heated to about 1200° C., the iron is practically completely reduced. In this zone the iron combines with carbon and the molten pig iron flows into an annular trough, whilst the pasty slag-forming impurities descend further into the well, heated to 1500°—1600° C. by means of additional tuyères, and are there rendered sufficiently fluid to allow of being tapped off. With a furnace of this type very friable ores, such as the minette ores of Lorraine and Luxemburg can be smelted without being previously briquetted or sintered.—A. S.

Slag ; Process of granulating molten ——. Façoneisen-Walzwerk L. Mannstaedt und Co. Act.-Ges. Fr. Pat. 469,114, Feb. 28, 1914.

THE molten slag is fed into a mechanical disintegrator into which jets of water are also injected.—A. S.

Silicon-steel. W. E. Ruder, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,110,010, Sept. 8, 1914. Date of appl., June 22, 1912.

SEE Eng. Pat. 11,370 of 1913 ; this J., 1914, 697.—T. F. B.

Armour-plates for warships and other steel articles ; Process of producing —— without case-hardening. A. Lucertini, Terni, Italy. U.S. Pat. 1,110,395, Sept. 15, 1914. Date of appl., April 22, 1910.

SEE Fr. Pat. 415,389 of 1910 ; this J., 1910, 1314.—T.F.B.

Metals ; Process of electrically treating, melting, and refining ——. C. A. Keller, Paris. U.S. Pat. 1,110,208, Sept. 8, 1914. Date of appl., Aug. 12, 1902.

SEE Eng. Pat. 15,271 of 1902 ; this J., 1903, 371.—T.F.B.

Alloys of tungsten and other highly-refractory metals related to it ; Method of manufacturing ——. H. Kreusler, Wilmersdorf, Germany, Assignor to General Electric Co., New York. U.S. Pat. 1,110,303, Sept. 8, 1914. Date of appl., Aug. 25, 1908.

SEE Fr. Pat. 393,595 of 1908 ; this J., 1909, 149.—T. F. B.

Zinc-furnace; Electric —— with integral condenser. C. V. Thierry, Paris. U.S. Pat. 1,110,359, Sept. 15, 1914. Date of appl., May 21, 1913.

See Fr. Pat. 456,180 of 1913; this J., 1913, 949.—T. F. B.

Solutions: Apparatus for making and filtering ——, applicable in the extraction of metals from ores and for like purposes. P. C. C. Isherwood, Bushey Heath. U.S. Pat., 1,110,790, Sept. 15, 1914. Date of appl., June 26, 1914.

See Eng. Pat. 6413 of 1913; this J., 1914, 793.—T. F. B.

Patent Cases.

Precious metal-bearing ores; Process for treating ——. A. H. Brown, Boulder, Colo. U.S. Pat. 781,711 of 1905 (this J., 1905, 242). Mining and Engineering World, Chicago, March 28, 1914, 601.

In an action brought against the Tonopah Mining Co. by Jas. A. Vincent, the U.S. District Court of Delaware found that this patent was valid and had been infringed. Brown's process treated ores, first by cyanide and afterwards by concentration, thus reversing previous practice. On appeal the U.S. Circuit Court of Appeals held that Brown's patent disclosed no new principle of operation; its substantial feature was the transposition of concentration from initial to final stage and of cyaniding from final to initial stage. The field of invention was narrow and the claims should not by construction be enlarged to include within infringing fences, processes which were not within the field of his inventive disclosure. Any process which made concentration precede final and effective cyaniding was a different one. The defendants, in common with Brown, used cyanide in the earlier stages of their process; but beyond this the resemblance ceased, for in the defendant's process concentration was the initial and intermediate step. The fruits of concentration were withdrawn and the residue afterwards treated by a protracted process of cyaniding. Thus the defendants' process, which was proved to be of great practical value, was worked in express disregard of Brown's instructions. The Court held that there was no infringement, and reversed the decree of the Court below.

Refractory metals and alloys; Manufacture of articles of ——. P. Schwarzkopf and others. Eng. Pat. 13,282 of 1912 (see Fr. Pat. 448,229; this J., 1913, 431). Reports of Patent Cases. Illustr. Off. J. (Patents), Oct. 7, 1914, 473. By permission.

The grant of this patent was opposed on the ground of anticipation and insufficient description. The Chief Examiner allowed the grant. The opponents appealed and the Law Officer allowed a patent to be granted on the Application after an amendment of the specification by way of reference to a patent No. 8031 of 1910, British Thomson-Houston Co. (see Fr. Pat. 426,299 of 1911, this J., 1911, 945, and also 946), and omission of a certain passage.

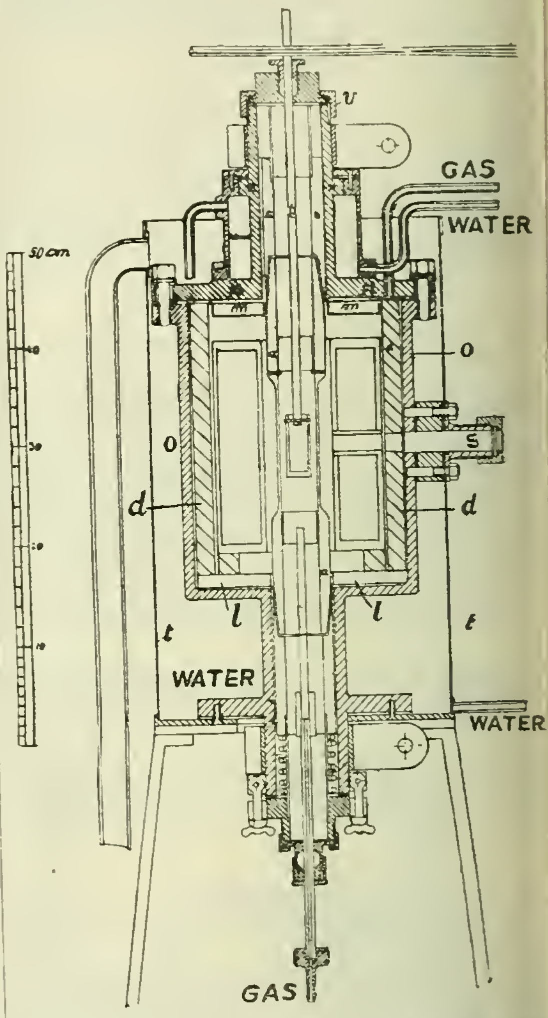
The invention related to the production of masses of tungsten, etc., by submitting to the action of a reducing gas a powder, each particle of which essentially consists of metal and oxygen in the same relative proportion; reduction was effected after consolidation of the powder by pressure in moulds; and under such conditions as simultaneously to sinter the reduced mass.

The Law Officer held that if, in a Specification of confused and complicated form, an invention that is sufficiently and fairly described can be discovered, the grant of a patent should not be refused simply because it is easy to see how much more clearly and simply the invention might have been described. He also drew attention to Eng. Pat. 4644 of 1908 (this J., 1909, 24 ref.) (see also Van Brunt, U.S. Pat. 903,922 of 1908; this J., 1909, 145).

XI.—ELECTRO-CHEMISTRY.

Electric vacuum-furnace for high temperatures. O. Ruff. Z. Elektrochem., 1914, 20, 177—179. (See also this J., 1913, 866.)

An improved form of the electric vacuum-furnace previously described (this J., 1910, 886). The heating-tube, *a*, of retort-carbon is of 4 cm. diam., and for 2000° C., 7·6 kilowatts are required, rising to 18 kilowatts for 2700° C. An additional fitting is provided which replace the upper cap, *v*, to enable a thermo-element to be introduced into the heating tube. The latter is surrounde by the fireclay cylinder, *d*, which is closed top and bottom by graphite plates, *l*, *m*, and contained in the bronze vesse *o*, cooled externally by the water-jacket, *t*. The vessel, is hermetically closed by the bronze cover, *n*, and b means of the gas tubes above and below can be exhauste as desired. An observation window, *s*, is provided the side.—G. F. M.



Electrical conduction at high temperatures and its measurement. Northrup. See X.

Electric cultivation. Löb. See XVI.

Patents.

Electrolytic apparatus. J. T. Niblett, Denmark Hi Surrey. Eng. Pat. 24,559, Oct. 29, 1913.

Hollow electrodes are arranged between an upp reservoir for the electrolyte and a lower tank for receivi the solution, the liquid being delivered on to the electrod as spray. A cooling medium, such as water, is pass successively through the electrodes. The upper a lower tanks may be in the same plane, with horizont electrodes between, or the tanks may be in differe planes, the electrodes forming an inclined plane ov which the electrolyte flows.—B. N.

Cell; Electrolytic ——. J. B. Burdett, Assignor to Davis-Bournonville Co., Chicago, Ill. U.S. Pats. (A) 1,107,257, (B) 1,107,258 and (C) 1,107,259, Aug. 18, 1914; dates of appl., (A) Oct. 29, and (B) and (C), Nov. 6, 1912.

(A) THE cover of the containing vessel carries a support, upon which inverted gas-collecting bells with bevelled mouths are suspended by means of side lugs. Each bell is arranged over an electrode and is provided with a gas-delivery pipe. (B) The inverted bells are assembled in flat-wise relationship against each other, and are provided with extended portions or fingers extending beyond the side walls. An electrode is supported within each bell, extending beyond the side walls, and porous diaphragms are interposed between adjacent bells and clamped in position between the fingers. The outer bells are provided with ears and the intermediate ones with supporting lugs at the ends, rods engaging the ears to clamp the assembled bells, whilst the clamping rods form supports for the lugs of the intermediate members. Terminal rods, passing through openings in the base of the bells, are secured to the upper edges of the electrodes, and the rods are insulated by sleeves and washers. (C) The cover of the tank is provided with integral wall portions depending from the lower surface into the electrolyte, and forming separated chambers, communicating with each other by passages in the cover. Electrodes are supported in the chamber, and co-operating electrodes in the tank, by means of suitable rods through the cover. Porous diaphragms separate the electrodes, and gas-delivery connections communicate respectively with the chambers and the tank.—B. N.

Cells; Galvanic ——. M. L. Kaplan, Brooklyn, N.Y. U.S. Pats. (A) 1,109,128 and (B) 1,109,129, Sept. 1, 1914; dates of appl., Jan. 27 and June 1, 1914.

(A) AN alkali salt of a polymanganic acid is treated with a solution of a metallic salt, so as to obtain blue neutral salts of a hydrated polymanganic acid, comprising 4 mols. of manganese dioxide to one of base, suitable as a depolarising agent. (B) Manganous polymanganite is used as the depolarising agent.—B. N.

Electrolytic cells for continuous electrolysis; Liquid supply device for ——. Ges. f. Chem. Industrie in Basel. Ger. Pat. 275,616, Aug. 17, 1913.

TROUBLE is frequently experienced in continuous electrolytic processes, owing to the shunt of the current through the stream of fresh liquid. This may be avoided by passing the liquid, on its way to the cell, through two or more superimposed vessels, each provided with intermittent siphoning arrangements.—T. F. B.

Furnace; Electric —— *and method of operating the same.* R. A. Bayard, Niagara Falls, N.Y. U.S. Pat. 1,107,478, Aug. 18, 1914; date of appl., May 27, 1913.

THE furnace consists of two movable parts, viz., a container composed of bottom and side walls, and end walls carrying the electrodes. Temporary end walls are substituted for the walls carrying the electrodes when the container is moved for charging and discharging material.—B. N.

Furnace; Electric ——. J. W. Moffat, Toronto, Canada. U.S. Pat. 1,108,924, Sept. 1, 1914; date of appl., Nov. 22, 1913.

A STATIONARY reduction chamber, opening into a stack above, is provided with an opening below, which registers with a corresponding opening in a crucible, so that when the latter is tilted connection between the chamber and crucible is cut off. Means are provided for lifting the crucible, so as to bring it into close connection with the lower part of the chamber, the crucible being also furnished with a tap hole and with electrodes extending into it from the outside.—B. N.

Chemical reactions in gases; Process of carrying out —— *by means of electric arcs.* E. Edwin, M. Hahnle, and B. Strasse, Ludwigshafen, Germany, Assignors to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,111,301, Sept. 22, 1914. Date of appl., July 3, 1913.

SEE Ger. Pat. 265,413 of 1912; this J., 1913, 1068.—T. F. B.

Method and means for electrolysing saline solutions. U.S. Pat. 1,109,311. *See* VII.

XII.—FATS; OILS; WAXES.

Olive oils extracted with carbon bisulphide; Examination of ——. F. Canzoneri and G. Bianchini. Annali Chim. Appl., 1914, 2, 1—9.

CARBON bisulphide in extracted olive oils is detected by Macagno's method of distillation with steam and testing the first portions of the distillate with a copper solution. Or, Halphen's method may be used, the distillate being shaken with amyl alcohol and kapok oil and the mixture heated at 110° C.; a pink coloration indicates carbon bisulphide. Free sulphur and sulphides are detected by placing a globule of mercury or a fragment of copper in the oil, the formation of the metallic sulphide being accelerated at 100° C. Mercaptans are invariably present in commercial oils extracted with bisulphide, and may be detected by means of mercuric chloride in the aqueous distillate. In new refining processes the proportion of sulphur compounds and the unpleasant odour are greatly reduced by treating the oil (heated to 35° to 45° C.) with low-pressure steam. The sulphur test will detect the presence of 10% of extracted oil in expressed olive oil. Colza and ravison rape oils do not give the reaction with mercury and may be distinguished from extracted olive oils by their high refractometer reading. Six samples of extracted olive oils gave the following results: Sp. gr. at 15° C., 0·9168 to 0·9198; refractometer reading at 25° C., 59 to 63·3; saponif. value, 95·6 to 95·9; Hehner value, 95·6 to 95·9; iodine value, 74·1 to 77·9; solidif. pt. of fatty acids, 17·5° to 19·7° C.; acidity (as oleic acid) 2·65 to 55·9%; ash, 0·046 to 0·056%; and total sulphur as $BaSO_4$ (4 samples), 0·4 to 0·55%. These oils differed from expressed olive oil in having a slightly higher sp. gr., a much lower iodine value, solidif. pt. of fatty acids, and refractometer reading, and a higher acetyl value (*e.g.* 31 as compared with 4·1). On extracting commercial extracted oils with carbon bisulphide 0·5 to 1·5% of a dirty white residue was obtained, largely soluble in alcohol, and in ether. It contained a wax (m.pt. 70° to 75° C.) and a resin of the type found in olive leaves, together with calcium salts of oxidised fatty acids.—C. A. M.

Chinese wood [*tung*] *oil; Examination of* ——. E. E. Ware and C. L. Schumann. Proc. Amer. Soc. for Testing Materials, 1914. [Advance proof.]

RESULTS of heat polymerisation tests (see Boughton, Proc. Amer. Soc. Test. Mats. 1913, 13, 923) are liable to variation with different observers. By the action of light on the oil an isomeric glyceride insoluble in petroleum spirit is formed, and the reaction is accelerated by the addition of a catalytic agent such as a trace of iodine or sulphur chloride. Five grms. of the oil are diluted with 25 c.c. of petroleum spirit (b.pt. 60° C.), the liquid cooled to 0° C. and mixed with 5 c.c. of chilled petroleum spirit saturated with iodine. After 1 hour's exposure to light more petroleum spirit is added, the mass left for another 3 hours, and the precipitate separated. The filtrate is chilled and again exposed to light, a little more iodine being added if necessary. The same process is repeated after the second filtration, and the final residue of unprecipitated oil (which in the case of pure Chinese wood oil averages 7%) is freed from solvent and weighed. In this way approximate determinations may be made of the quantities of other oils (*e.g.* sesamé, soya bean). Formation of iodine addition compounds (this J., 1909, 719) does not take place if sufficient petroleum spirit be added. The potassium soap of Chinese wood oil is more soluble in water than stated by Morrell (this J., 1912, 1189), but is practically insoluble in absolute alcohol, and may thus be separated from the soaps of other oils used as adulterants:—Three grms. of the sample are saponified for 30 mins. beneath a reflux condenser with 100 c.c. of *N*/4 absolute alcoholic potassium hydroxide, and the soap solution cooled for 10 mins. at 0° C. and filtered through a Gooch crucible surrounded by ice. The precipitate is washed with ice-cold absolute alcohol previously saturated with the potassium soap of elæomargaric acid, and dried *in vacuo* at 75° to 80° C. in a current of hydrogen or carbon dioxide and weighed. The weight of the dried insoluble soap may be taken as that of the wood oil in the sample. With test mixtures containing 5 to 40% of linseed and soya bean oils the results were within 1 to 2% of theory. The presence of rosin in Chinese wood oil varnish does not interfere with the heat polymerisation of the wood oil. The separated fatty acid of the polymerised oil in the varnish has twice the mol. weight of the fatty acid of the raw oil.—C. A. M.

Chinese wood oils [*and candle-nut oil*]; *Tests of* ——. Report of Committee D-1, of Amer. Soc. for Testing Materials, on Preservative Coatings for Structural Materials, 1914, 17—38. [Advance proof.]

A SAMPLE of oil expressed from the hand-picked kernels of the nuts of *Aleurites Fordii* was examined by 11 chemists with the following average results:—Sp. gr. at 15·5°/15·5° C., 0·9396; refractive index at 25° C., 1·5186; acid value, 0·9; saponif. value, 193·02; iodine value (Hübl, 18 hours), 169·6; moisture, 0·02%; ash, 0·0026%; unsaponif. matter, 0·473%; iodine-jelly test, 4 mins. 43 secs.; and heating test (Browne, this J., 1912, 731), 9 mins. 23 secs. *Iodine-jelly test*:—One grm. of oil is placed in a dish of about 6 cm. diam., which is floated on water at 25° C. The oil is dissolved in 5 c.c. of chloroform and treated (with continual stirring) with 5 c.c. of chloroform saturated at 25° C. with iodine. The stirring is continued until gelatinisation occurs and the time (usually 1½ to 2 mins.) noted. In the oxygen absorption test the maximum increase in weight was 10% after 8 days, as against an increase of 13·8% in 3 days with linseed oil. The characters of American grown tung oils agreed closely with those of Chinese oils.

Candlenut oil:—Oil extracted from the kernels of *Aleurites molucana* (yield 65·8%) had the following characters:—Sp. gr. at 15·5° C., 0·9276; refractive index at 25° C., 1·4970; acid value, 0·8; saponification value, 188·2, and iodine value, 151·6. (See also this J., 1910, 704; 1912, 782, 997.)—C. A. M.

Lubricants; *Report of Committee on standard tests for* ——. Amer. Soc. Testing Materials, 1914. [Advance proof.]

THE "Proposed Provisional Tests," of which standardised details are given, are: Viscosity test, by the Saybolt viscometer; specific gravity, by the hydrometer, Westphal balance, or Geissler pyknometer; flash and fire test, by the Cleveland open cup or Pensky-Martens apparatus; soap test; saponification-value; free acid test; sulphur test; water test; precipitation test; microscopic examination; carbon residue test. In a minority report the retention of the Engler viscometer as an alternative is recommended.—O. E. M.

Coconut and palm oil imports from Germany. Ch. of Comm. J., Oct., 1914. [T.R.]

A LARGE quantity of coconut oil was imported last year to the United Kingdom *via* Germany, namely, 210,604 cwt. of refined coconut oil, value £521,414, and 397,016 cwt. of unrefined, value £859,654. In addition 91,854 cwt. of unrefined palm oil, value £186,234, and 58,230 cwt. of refined palm oil, value £141,967, were imported *via* Germany. Rubber to the value of £269,583 was also imported in 1913 from Germany. In 1912 the exports of palm kernels from British Nigeria amounted to 184,625 tons, valued at £2,797,411, and of this quantity on
25,491 tons, valued at £365,461, were sent to Great Britai
practically the whole of the remainder going to Germar
These palm kernels are used in Germany for the p
paration of palm kernel oil and palm kernel oil-cake. T
former is largely re-exported to England, either as such
in the form or prepared cooking fats and butter substitut
The whole of this industry could well be carried on in t
country, and the palm kernel cake would form a valua
addition to the cattle feeds available to the farmer.

PATENTS.

Fats, oils, and the like: Bleaching of ——. F. G. Donn
London, H. Rai, Belfast, and R. H. F. Finlay, Belfa
Eng. Pat. 17,784, Feb. 2, 1914.

THE oil is mixed with about 0·1% of its weight of a cob
or copper compound, such as the oxide, borate, oxala
or as a metallic soap, and then subjected to the action
ozone, oxygen, or air in the usual manner. The operati
may be carried out at 80° to 90° C., but in certain cases
presence of the catalytic compounds causes the oxidati
to proceed so rapidly that it is necessary to cool the
The cobalt compounds give the better results. T
catalyst may be removed from the bleached oil by filtrati
or treatment with dilute sulphuric acid.—W. P. S.

Mixing devices for use in the hydrogenisation of oil and
similar processes. G. Calvert, Stoke Newington. E
Pat. 18,350, Aug. 12, 1913.

SEE Fr. Pat. 468,426 of 1914; this J., 1914, 973.—T. F.

Scouring agent. H. Ockelmann, Gross-Jena, Germa
U.S. Pat. 1,111,488, Sept. 22, 1914. Date of ap
Dec. 15, 1913.

SEE Ger. Pat. 259,360 of 1911; this J., 1913, 654.—T. F.

XIII.—PAINTS; PIGMENTS; VARNISHES RESINS.

White paints; Condition of fence coated with ——. Re t
of Committee D-1, of Amer. Soc. for Testing Materi ,
on Preservative Coatings for Structural Materials, 1 ,
62—86. [Advance proof.]

THE panels of a field fence were painted with diffe t
classes of white paints and examined after 15 mon
exposure. The paints used were:—*Primary pigme*
including three types of white lead, zinc oxide, ba -
sulphate white lead, and zinc-lead white. *Binary con* -
sitions, consisting of 80 to 50% of white lead and 20 to 5 o
of zinc oxide, basic-sulphate white lead, silica, asbest
China clay, calcium carbonate, calcium sulphate or bar n
sulphate. *Ternary compositions*, including white d
mixed with zinc oxide or basic-sulphate white lead, d
one of the other pigments in variable proportions. (-
ternary composition, consisting of equal parts of w e
lead, zinc oxide, basic-sulphate white lead, and one of e
other pigments. None of the primary paints (except
lead white) were equal to the composite paints. T y
showed fine surface cracking. In the binary and ter y
series the compositions containing zinc oxide were wl r
and cleaner and showed less cracking than paints not n-
taining it, whilst the panel painted with the quater y
composition was in better condition than any of e
others.—C. A. M.

Paint protection for Portland-cement surfaces. H. A.
Gardner. Proc. Amer. Soc. Testing Materials, 1914 4.
[Authorised reprint.]

THIRTY-FIVE samples of paint were applied to co te
surfaces and exposed in the open for 2 years. Pain o
white lead, or zinc oxide, or both, ground in pure lin
oil, or of both ground in mixtures of raw and boiled lin
oil or in treated China wood oil and thinned with tur n-
tine, in general gave good results. Paints made wit oil

varnishes containing acid resins, spirit varnishes, and glue or casein paints were unsatisfactory. When the concrete surface is damp, a zinc sulphate priming, to neutralise free lime, should be applied. Oil paints containing wear-resisting pigments were successfully applied to cement floors.—O. E. M.

White pigments ; Analysis of ——. Report of Committee D-1, of Amer. Soc. for Testing Materials, on Preservative Coatings for Structural Materials, 1914, 44—55. [Advance proof.]

Iron in lead pigments :—The sample is dissolved in nitric acid (1 : 1), the solution diluted, lead precipitated as sulphate, and iron determined colorimetrically in the filtrate by the thiocyanate method.

White lead :—*Total lead* is determined by dissolving 1 grm. of the pigment in nitric acid (1 : 1), boiling, diluting to about 120 c.c. with hot water, filtering, and adding 20 c.c. of sulphuric acid (1 : 1) to the filtrate. After evaporation till fumes appear, the liquid is diluted with 150 c.c. of water and 150 c.c. of alcohol, allowed to stand for 2 hours, filtered, and the lead sulphate washed with 95% alcohol, dried for 1 hour at 110° C. and weighed. Or the lead may be precipitated and weighed as chromate. In the absence of acetic acid or other organic matter 1 grm. of the pigment may be heated in a current of dry air (free from carbon dioxide), the water and carbon dioxide absorbed, and the residue of lead oxide weighed. The CO_2 is calculated into $PbCO_3$, and the water into $Pb(OH)_2$. For the determination of *acetic acid* Thompson's method (this J., 1905, 487) is recommended. *Metallic lead* is determined by boiling 50 grms. with 60 c.c. of 40% acetic acid, diluting the solution, decanting the clear liquid and boiling the residue with 100 c.c. of a mixture of 360 c.c. of ammonia, 1080 c.c. of water and 2160 c.c. of 80% acetic acid. This solution is also diluted and decanted, and the residue of metallic lead dried and weighed.

Basic lead sulphate :—*Moisture* is determined by heating 2 grms. of the pigment for 2 hours at 105° C. For total soluble sulphates 1 grm. is heated for 5 mins. on a steam bath with 10 c.c. of water, 10 c.c. of strong hydrochloric acid saturated with bromine, and 5 grms. of ammonium chloride, and the liquid diluted to 400 c.c., boiled for 5 mins. and filtered. Lead is removed from the filtrate by two precipitations with sodium carbonate, and sulphates precipitated from the filtrate with barium chloride. *Soluble zinc sulphate* is determined by boiling 2 grms. with 150 c.c. of water and 50 c.c. of alcohol for 30 mins., filtering, washing the residue with alcohol and water (1 : 3) and precipitating the sulphate from the filtrate. *Total lead and zinc* (*in presence of calcium and magnesium*) :—The lead is precipitated as sulphide and weighed as sulphate. The filtrate is boiled, any iron being oxidised with bromine, and iron and aluminium precipitated with ammonia. Manganese if present is precipitated by bromine water and ammonia, and weighed as Mn_3O_4. The united filtrates are acidified with acetic acid, boiled, saturated with hydrogen sulphide, treated with 5 grms. of ammonium chloride and left for 5 hours. The zinc sulphide is dissolved in hydrochloric acid and determined as phosphate. Calcium and magnesium are determined in the filtrate. *Sulphur dioxide* :—2 grms. are digested for 10 to 15 mins. with 100 c.c. of recently-boiled cold water and 5 c.c. of hydrochloric acid, an excess of 0·01 *N*-iodine solution added, and the excess titrated with thiosulphate.

Zinc white :—The loss on ignition is obtained by heating 1 grm. for 15 mins. over a Bunsen flame. Other ingredients are determined as described above.

Lithopone is analysed by the methods of Drawe (this J., 1902, 427) and Copalle (this J., 1907, 476).

Calcium pigments (*Whiting*) :—Moisture and loss on ignition are determined as above. Calcium is precipitated as oxalate and weighed as calcium oxide, and magnesium is precipitated from the filtrate. *Alkalinity* :—2 grms. are boiled for 5 mins. with 100 c.c, of water, and titrated with *N*/10 acid, with phenolphthalein as indicator. (*Gypsum*) :—Combined water and moisture are determined by heating 1 grm. for 15 mins. in a covered porcelain crucible on an asbestos plate, then for 10 mins. at a dull red heat over a Bunsen burner, and finally 30 to 40 mins. at a lower temperature until constant in weight. Soluble and insoluble constituents (in HCl), soluble sulphate, and carbon dioxide evolved on adding acid are determined by usual methods.

Barium pigments :—The determinations include moisture, loss on ignition, insoluble matter, alumina, iron oxide, etc., soluble sulphate, barium carbonate, iron (as above), and water-soluble constituents.

Silica pigments :—Insoluble matter is determined by boiling 2 grms. for 30 mins. with 50 c.c. of hydrochloric acid (1 : 1), diluting with 50 c.c. of water and filtering. It should not be less than 95%. Silica is determined by treating the ignited residue with sulphuric and hydrofluoric acids. Aluminium, iron, calcium, and magnesium are determined both in the residue and the filtrate.

China clay and asbestine :—Qualitative tests are usually sufficient. For a complete analysis 1 grm. is fused with 10 grms. of sodium carbonate (30 mins. to 1 hour), the mass treated with hot water, acidified with hydrochloric acid, and silica, barium, aluminium, iron, calcium and magnesium, carbon dioxide and soluble sulphates determined.—C. A. M.

Red lead ; Analysis of ——. Report of Committee D-1, of Amer. Soc. for Testing Materials, on Preservative Coatings for Structural Materials, 1914, 56—61. [Advance proof.]

Fineness :—10 grms. are washed with water through No. 21 silk bolting cloth and the residue dried and weighed. *Moisture* is determined as in the case of *white pigments* (see preceding abstract). *Organic colour* :—2 grms. are boiled with 25 c.c. of 95% alcohol, the liquid decanted, and the residue boiled successively with water and very dilute ammonia solution. Any coloration of the extracts indicates the presence of organic colouring matter. *Total lead and insoluble matter* :—1 grm. is heated on the water bath with 15 c.c. of nitric acid (1 : 1) and sufficient hydrogen peroxide to dissolve all lead peroxide, and the solution diluted and filtered from insoluble matter (silica, silicates, barium sulphate). The filtrate is treated with 20 c.c. of sulphuric acid, evaporated till fumes appear, and the lead sulphate determined as described under *white pigments* (see preceding abstract), and calculated to PbO. Any barium (from soluble barium compounds) in the lead sulphate is determined by digesting with acid ammonium acetate solution and weighing the insoluble residue. Calcium and magnesium are determined in the filtrate from a lead sulphide precipitation. *Lead peroxide and true red lead* (Pb_3O_4) :—Topf's modification (Z. anal. Chem., **26**, 296) of Diehl's method (Dingl. polyt. J., **248**, 196) is used, except when substances other than lead oxide, which liberate iodine under those conditions are present :—One grm. of the finely-powdered pigment is made into a smooth paste with water, and treated with a cold solution containing 30 grms. of crystallised sodium acetate, 2·4 grms. of potassium iodide, 10 c.c. of water and 10 c.c. of 50% acetic acid. After solution of the red lead the liquid is treated with 30 c.c. of water containing 5 to 6 grms. of sodium acetate, and titrated with *N*/10 sodium thiosulphate solution. The iodine equivalent of the latter multiplied by $0·94193 = PbO_2$ and by $2·69973 = Pb_3O_4$. *Water-soluble substances* :—10 grms. are digested for 1 hour on the water bath with 200 c.c. of water, the filtrate and washings evaporated and dried at 105° C. Any alkalinity is calculated as sodium carbonate. Other portions of the extract are tested for nitrates, nitrites, carbonates, sodium and lead. *Silica* :—5 grms. are digested with 5 c.c. of hydrochloric acid and 15 c.c. of nitric acid (1 : 1), the liquid evaporated to dryness, and the residue boiled with dilute nitric acid, washed successively with hot acid ammonium acetate solution, dilute hydrochloric acid and water, ignited and weighed. *Iron oxide* :—Schaeffer's colorimetric method is used (J. Ind. Eng. Chem., 1912, 4, 659). Twenty grms. of the sample are heated with 20 c.c. of water, 20 c.c. of nitric acid (sp. gr. 1·4), and 3 c.c. of formaldehyde solution until all lead peroxide has dissolved. The residue is washed with hot water, filtered off, and evaporated with sulphuric acid and hydrofluoric acid. The filtrate from the insoluble matter is treated with 14 c.c. of sulphuric acid (1 : 1) and the lead sulphate separated. The residue from the hydrofluoric treatment is dissolved in sulphuric acid, and added to the filtrate from the lead sulphate, which is then diluted to 500 c.c., and used for the colorimetric determination.—C. A. M.

Oil of turpentine; Examination of ——. Report of Committee D-1, of Amer. Soc. for Testing Materials, on Preservative Coatings for Structural Materials, 1914, 91—118. [Advance proof.]

THE following specifications applicable to oil of turpentine of all kinds are proposed:—(1) The purchaser should specify whether oil of gum turpentine or wood turpentine is required, no differentiation between the two being attempted. (2) The sample should be clear and free from suspended matter and water. (3) It should be of a standard colour. (4) The sp. gr. should fall within the limits of 0·860 and 0·875 at 15·5° C. (5) The limits for the refractive index at 15·5° C. should be 1·468 and 1·478. (6) The initial b. pt. should be 150° to 160° C. (7) 90% of the oil should distil below 170° C. (8) The polymerisation residue should not exceed 1% and its refractive index at 15·5° C. not be less than 1·500. *Methods of analysis*:—In determining the sp. gr. the factor 0·00082 should be applied for each 1° C. by which the temperature differs from 15·5° C., whilst for the refractive index the corresponding correction of 0·00045 is to be used. In the distillation test, an ordinary Engler's flask and condenser are to be used and the oil distilled at the rate of 2 drops per second. The mercury bulb of the thermometer (range from 145° to 200° C.) should be fixed opposite the side tube of the flask, with the 175° C. mark below the cork. *Polymerisation*:—20 c.c. of 38*N*-sulphuric acid are cooled (with ice-water) in a graduated Babcock flask, and 5 c.c. of the oil of turpentine slowly added with constant cooling (below 60° C.). When the reaction is over the flask is heated for about 10 mins. in water at 60° to 65° C., with occasional shaking, then cooled to the ordinary temperature, and sulphuric acid added to bring the unaltered oil into the neck. After centrifuging and standing for 12 hours its amount is read.—C. A. M.

Shellac; Analysis of ——. Report of Committee D-1, of Amer. Soc. for Testing Materials, on Preservative Coatings for Structural Materials, 1914, 119—125. [Advance proof.]

Rosin:—Langmuir's method of determination (this J., 1905, 12) is recommended as the standard test, the iodine values of shellac and rosin being taken as 18 and 228, respectively. *Insoluble test*—The method and apparatus previously described (this J., 1913, 613) are recommended for official adoption.—C. A. M.

Varnish; Quantitative determination of body and solvent in ——. A. L. Brown. Amer. Soc. for Testing Materials, June 30—July 3, 1914. [Advance proof.]

A WEIGHED quantity of the varnish is diluted to about 12 times its volume with ether, chloroform or other very volatile solvent, the solution poured over a weighed, levelled, ground-glass plate, and the latter exposed to the air or placed in a current of illuminating gas (according to the "drying" properties of the varnish) until no further loss in weight occurs; another portion of the varnish is distilled—with water (McIlhiney's method) if the solvent is gum turpentine—and the sp. gr. of the solvent determined. The percentage by volume of the solvent (x) is then calculated from the formula, $x=\frac{(100A)B}{C}$, where A is the sp. gr. of the varnish, B the percentage by weight of the solvent, and C the sp. gr. of the latter. More accurate and practical results are obtained by this method (intended primarily for insulating varnishes) than by the ordinary distillation process.—W. E. F. P.

Examination of Chinese wood [tung] oil. Ware and Schumann. *See* XII.

Tests of Chinese wood oils [and candle-nut oil]. *See* XII.

PATENTS.

Pigment; Composition of matter to be used as a ——. E. Euston, St. Louis, Mo. U.S. Pat. 1,108,562, Aug. 25, 1914; date of appl., June 27, 1913.

THE pigment consists of basic zinc carbonate and lead hydroxide, "in intimate molecular combination." (See also this J., 1914, 603.)—E. W. L.

Zinc-white, Process of making ——. E. B. Cutten, Erie, Pa. U.S. Pat. 1,109,113, Sept. 1, 1914; date of appl., Sept. 15, 1913.

ZINC and any associated metals to which zinc is electropositive are converted into oxides and the latter treated at a low temperature with a suitable acid. The acid is added slowly in quantity just sufficient to combine with the zinc, the solution is then separated, and the zinc precipitated by ammonia.—W. P. S.

Varnish; Manufacture of ——. S. E. Ford, Scotia, N.Y., Assignor to General Electric Co. U.S. Pat. 1,109,979, Sept. 8, 1914; date of appl., April 4, 1913.

A LIQUID to be oxidised to form varnish is heated under oxidising conditions in a jacketed chamber provided with an agitator which divides it into a fine spray.—A. T. L.

Linseed-oil; Process for preparing substitutes for boiled ——. E. F. Waentig. Ger. Pat. 276,430, Feb. 28, 1913 Addition to Ger. Pat. 272,465 (see this J., 1914, 604).

A FISH oil or whale oil is mixed with water and a hydrolytic ferment, a small quantity of manganous sulphate is added, and the mixture is stirred at about 25° C. for some time. When partial hydrolysis has been effected, the solid fatty acids are separated and the remaining liquid is distilled by means of steam; the residue is a thick, oily product, free from acid, which may be used as a substitute for boiled linseed oil.—T. F. B.

Turpentine; Process of producing pure ——. T. W. Pritchard, Wilmington, N.C. U.S. Pat. 1,110,819, Sept. 15, 1914; date of appl., Sept. 3, 1912.

CRUDE turpentine is heated to about 212° F. (100° C.), air at the same temperature is passed through it, and the vapours are condensed.—A. T. L.

Turpentine and rosin from wood; Process of extracting ——. J. H. Castona, Gulfport, Miss. U.S. Pat. 1,111,644, Sept. 22, 1914; date of appl., Oct. 8, 1912.

MODERATELY heated turpentine is allowed to percolate downwards through the wood, the bottom of the container, and the solvent turpentine as it passes to the container, being subjected to external heat, so as to evaporate the extracted volatile elements and keep the extracted rosin liquefied. The rosin and turpentine collect in the bottom of the container and are there subjected to a higher temperature to vaporise a portion of the turpentine whilst maintaining the rosin in a liquefied condition, the residue being discharged and the unvolatilised turpentine separated from the rosin. Steam is injected internally throughout the wood, at a low temperature and pressure, to vaporise the unextracted turpentine and the retained solvent. The turpentine vapour and steam are collected and condensed and separated from the rosin.—B. N.

Insulating composition and the method of making the same. L. E. Barringer, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,111,430, Sept. 22, 1914; date of appl., May 7, 1914.

A HARD dense insulating composition is obtained by exposing a mixture, comprising linseed oil, copal gum, zinc oxide and sulphur, to the air for about 5 to 9 days, the mixture being then moulded and finally baked for several days at a temperature rising gradually about 50° to 60° C. to about 120° C.—B. N.

Emulsifying resin soap in water ; Process for ——. W. J. Dolan, Rhinelander, Wis. U.S. Pat. 1,111,689, Sept. 22, 1914 ; date of appl., April 9, 1913.

The resin soap is introduced into hot water under pressure, and then emulsified and atomised by agitating the mixture by means operated by the water pressure.—B. N.

Gelatin printing colours ; Process for preparing —— P. Charles. Ger. Pat. 276,477, April 11, 1913.

Size, or a mixture of size and glue, or a very soft glue, is ised as a binding medium for the colours. A hard glue nay be utilised for the purposes if its properties (setting oint) are suitably modified by heat or by a chemical reatment which does not affect the colours.—T. F. B.

Gelatin printing colours ; Process for preparing ——. P. Charles. Ger. Pat. 276,622, Nov. 8, 1911. Addition to Ger. Pat. 276,477 (see preceding abstract).

An alkali or alkaline-earth or ammonia is added to the gelatin solution, in the proportion of 5 to 20% on the weight of dry gelatin.—T. F. B.

Plastic composition. J. W. Aylsworth, Assignor to Condensite Co. of America, East Orange, N.J. U.S. Pat. 1,111,284, Sept. 22, 1914. Date of appl., Nov. 4, 1910.

See Fr. Pat. 435,944 of 1911 ; this J., 1912, 446.—T. F. B.

Manufacture of carbon. Eng. Pat. 6354. *See* III.

Preparing steel for printing. U.S. Pat. 1,109,670. *See* X.

XV.—LEATHER ; BONE ; HORN ; GLUE.

lue ; Specifications and tests of ——. O. Linder and E. C. Frost. Amer. Soc. Testing Materials, 1914. [Advance proof.]

pecifications for checking the quality of cabinet glue, hould be based upon the viscosity, jelly-strength, odour, eaction, grease, foaming, ash, moisture, and appearance. he glue should be clean and free from an excessive umber of air bubbles, the presence of the latter indicating ecomposition during manufacture. About 6% of ash is he permissible maximum : the quantity usually found lies etween 2·3 and 4·5%. The glue should be neutral, or ractically so to litmus paper. The jelly-strength is best scertained by steeping the glue in cold water for 16 hours nd then melting it at 160° F. (71° C.), the proportions of lue to water being such that the resulting jelly will ontain from 7 to 10% of glue (7% in the case of higher-rade glues and 10% for lower qualities). The jelly is hen cooled to about 45° F. (7° C.) and its firmness, judged y pressing with the fingers, is compared with that of a lly prepared from a standard sample. Viscosity is etermined at 30° C. in an Engler's viscometer, using a 15% lue solution ; the time of flow for a high-grade glue is bout 350 seconds. Glue should not contain any fatty ubstance, as determined by heating the glue solution ith hydrochloric acid and extracting the cooled mixture ith ether. Excessive foaming is undesirable : 300 c.c. of 10% glue solution are heated for 1 min. to 150° F. 5 C.) in a beaker of about 2·5 in. diameter, when the yer of foam produced should not exceed 0·25 in. in epth.—W. P. S.

lue from hide fleshings preserved with formaldehyde. Verein Deutscher Lederleimfabriken. Z. angew. Chem., 1914, **27**, III., 348—349.

ide fleshings bought in summer have often been found uite useless for glue manufacture. When boiled in the ue kettle they became red and hard, giving, even after rolonged boiling, a very small yield of glue of inferior uality. This has been found to be due to the use of rmaldehyde or preparations containing formaldehyde for preserving the original hides or the fleshings from them and the use of this substance is strongly condemned. —T. C.

Patents.

Leather ; Process of tanning ——. J. C. Cleary, Assignor to M. W. Borders, Chicago, Ill. U.S. Pat. 1,107,759, Aug. 18, 1914 ; date of appl., Oct. 30, 1911.

Hides are pickled, and soaked for four weeks in a liquor such as is produced by the destructive distillation of "Ouachita" cretaceous lignite, to which a tanning extract is added in about the proportion of 40 galls. of distillate to 1 lb. of extract, further quantities (3, 3, and 4 lb.) of extract being added at the beginning of the second, third, and fourth week respectively.—E. W. L.

Leather and leather goods ; Process for impregnating and preserving ——. W. Eitner and R. Kind. Ger. Pat. 276,434, July 2, 1913.

Leather is impregnated with a resinous condensation product of a phenol and an aldehyde, with or without addition of a vulcanised fat or fatty acid.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Soil ; Sterilisation of ——. J. d'Agric. Prat., Apr. 23, 1914. J. Board Agric., 1914, **21**, 332. (See also this J., 1913, 1136 ; 1914, 560.)

In experiments at Rennes crops were doubled in certain cases by the use of antiseptics. Toluene, carbon bisulphide, formaldehyde and tar gave increased yields in box experiments with white mustard ; baryta, naphthol, and creosote were harmful. In field trials similar results were obtained except that copper sulphate was beneficial in the field while harmful in box experiments. When used in quantities up to 50 c.c. of liquid and 5 grms. of solid per sq. metre, the antiseptics produced harmful results except in the cases of sulphur and potassium permanganate. Toluene, carbon bisulphide, and formaldehyde up to 10 c.c. per sq. metre were beneficial ; 1 c.c. of tar was effective. Sulphur produced results proportional to the amount used. Potassium permanganate was very effective even when 5 grms. per sq. metre were used.—R. G. P.

Nitrates in soil : Relation of certain plants to the formation of ——. T. L. Lyon and J. A. Bizzell. Cornell Univ., Agric. Expt. Stat., Memoir No. 1. J. Board Agric., 1914, **21**, 440—441.

The nitrate content of soil under various crops differed for each different crop on the same soil and a characteristic relation was observed between the nitrate content of the soil and the crop at different stages of growth. The crops had also a distinct influence on the nitrate content of the soil in following years. Mixed grasses caused very low nitrate contents which may account for the known injurious effect of grass in fruit orchards where available nitrogen is deficient.—R. G. P.

Soil constituents : Assimilation of —— *by oats.* J. W. Paterson and P. R. Scott. J. Agric., Victoria, April, 1914. J. Board. Agric., 1914, **21**, 331—332.

Nitrogen, potash, lime, magnesia, phosphoric acid and silica were determined in the grain, straw and roots of oat plants (*a*) just before flowering, (*b*) when the plants were well in the ear and the lower leaves turning yellow, and (*c*) when the crop was ripening. Maximum assimilation of food constituents was reached before ripening and absorption from the soil apparently ceased some time before growth stopped. Nitrogen and potash ceased to be absorbed about the time of full bloom between stages (*a*) and (*b*). Phosphoric acid, lime and magnesia were absorbed till somewhat later : silica was absorbed as long as the plants were green. The early absorption of nitrogen and potash shows the need for a readily available supply for young oats. As phosphatic manures have a more prolonged action and are absorbed during later growth, they should be more favourable for oats than nitrogenous manures.—R. G. P.

Sodium and potassium manuring; Effect of —— on composition and yield of plants. Rhode Island Agric. Expt. Stat., Bull. 153. J. Board Agric., 1914, **21**, 441.

THE experiment was commenced in 1894 to ascertain the effect of different relative quantities of sodium and potassium applied to root crops as chloride and carbonate. Liberal amounts of nitrogen and phosphoric acid were used and lime was applied also. The full amounts of sodium and potassium applied per acre were, sodium chloride 250 lb.; sodium carbonate 220 lb.; potassium chloride 420 lb.; potassium carbonate 330 lb.; in later years about one-third of these amounts was used. Increase of sodium manures raised the amount of phosphorus but not nitrogen in the crop; the percentage of sodium in the crops was increased but the potassium generally was decreased. In most cases substitution of sodium for potassium caused a decrease in the crop. With beet-root a 25% increase in yield resulted on adding sodium manures; the percentage of total sugar in the crop was lowered, but the actual amount of sugar produced was increased. With potatoes substitution of sodium for potassium decreased their growth without altering the percentage of starch, although the nitrogen was increased.—R. G. P.

Nitrogenous manures; Experiments with new ——. E. Haselhoff. Landw. Versuchs-Stat., 1914, **84**, [1 and 2]. J. Board Agric., 1914, **21**, 332—333.

EXPERIMENTS have been made at Harleshausen during the last six years with calcium cyanamide (nitrolim), calcium nitrate, liquid manure, Schlösing nitrate (calcium nitrate containing free lime), Burkheiser salts (by-product of the Burkheiser gas-purification process), and Galalith (residue from the manufacture of a substitute for horn, etc., from casein), in comparison with ammonium sulphate and sodium nitrate, particularly with regard to time and manner of application. The utilisation of the nitrogen of ammonium sulphate was equal to that of sodium nitrate. Ammonium sulphate gave better results on loamy than on sandy soils, except when used as top-dressing for barley. Calcium nitrate was somewhat inferior to sodium nitrate, and produced a better effect on sandy than on loamy soils. Schlösing nitrate was about equal to sodium nitrate for spring wheat and barley. Calcium cyanamide applied deeply in autumn was better for barley than sodium nitrate, but if applied in autumn to the surface or in the spring either deeply or on the surface, sodium nitrate was superior. The nitrogen of calcium cyanamide was utilised better on loamy than on sandy soils. Liquid manure gave better results when mixed with the soil than when used as top-dressing. Burkheiser salts were inferior to ammonium sulphate with buckwheat or mustard, but superior to sodium nitrate with barley. Galalith gave good results on loamy soil, but was less effective on sandy soils; the nitrogen was less readily utilised than that of nitrates and much nitrogen remained in the soil for succeeding crops. (See also this J., 1913, 300.)—R. G. P.

Electric cultivation. W. Löb. Z. angew. Chem., 1914, **27**, 530—531.

EXPERIMENTS were made to determine the cause of the stimulating effect of high-tension electric discharges upon the growth of plants. The silent discharge and the glow discharge were used. Starch solutions were hydrolysed in absence of oxygen, and the portion of the starch which was not hydrolysed was rendered resistant to diastase. Peptone was slightly hydrolysed, ammonia being formed, but the amino-acids and "non-colloidal nitrogen" were not appreciably increased. The diastatic properties of pancreatin were greatly decreased, and to some extent also the tryptic properties, the action on fibrin being more strongly diminished than that on casein. The formation of sugar from starch by diastase was decreased.—J. H. J.

Egyptian phosphate industry. Ch. of Comm. J., Oct., 1914. [T.R.]

THE extensive deposits of phosphates near the Red Sea are connected by a 20-mile railway with Port Safaga on the Red Sea, where the rock is loaded and exported. The rock contains 65 per cent. or more of tricalcic phosphate. An Italian company has obtained extensive concessions about 12 miles inland from Kosseir and also at Sebaia on the eastern bank of the Nile, between Keneh and Assouan; the former concession is being linked up to the port of Kosseir with a light railway, which should shortly be completed, and the rock from the latte mines will be transported down to the Nile by a ropeway and thence to Alexandria by boat for shipment. It is expected that exports will begin that year. The total output of phosphates in Egypt for the years 1908 to 1912, according to the Survey Department, was as follows: 1908, 700 tons; 1909, 1,000 tons; 1910, 2,397 tons 1911, 11,925 tons; and 1912, 69,958 tons. According t the Financial Adviser's report, the output during 191 exceeded that for 1912 by about 33,000 tons. The Re Sea area is responsible for almost the whole output Practically all the raw phosphates produced is shippe from Egypt, principally to Japan. That country in 191 took about 49,000 tons out of a total export of 52,000 tons and in 1913 59,000 tons out of a total of 64,000 tons According to the customs returns, the average value o the raw phosphate shipped during 1913 at Port Safag was about £1 per ton. The local demand for ra phosphates for manure is practically negligible, but abou 13,000 tons of superphosphates were imported during th past year. Projects for the manufacture of superphos phates at Alexandria, with the aid of pyrites importe from Greece, are said to be under consideration, and th reported discovery of pyrites in the Sinai Peninsula is interest in view of the proximity to the Red Sea phosphat field. Should the manufacture of superphosphates b established on a considerable scale in Egypt, the workin of other deposits might become commercially possible.

The system: potassium nitrate, sodium chloride, wate Leather and Mukerji. *See* VII.

The systems: (A) water, magnesium carbonate, and ca bonic acid, and (B) water, calcium carbonate, magnesiu carbonate, and carbonic acid. Leather and Sen. *See* VI

XVII.—SUGARS; STARCHES; GUMS.

Glucose (Dextrose); Absorption of —— by bone-black. H. Morton. J. Amer. Chem. Soc., 1914, **36**, 1832—1838.

KNOWN amounts of purified bone-black and dextr solution were heated in sealed tubes at about 80° until equilibrium was established (in most cases, ab 10 days). The ratio of the weight of sugar per grm. solution to that per grm. of bone-black, after equilibri was established, was practically constant over the ent range of concentrations studied (4·63% to 50·58% dextrose). The equilibrium amount of sugar cotnained 1 grm. of the solution. At the ordinary temperatu absorption was exceedingly slow.—F. SODN.

Sugar imports from Germany. Ch. of Comm. J., O 1914. [T.R.]

THE following table shows our imports of sugar fr Germany in 1913:—

	Cwt.	£
Refined	9,309,064	6,161,
Unrefined	9,440,520	4,733,
Total value	18,749,584	10,891,

The countries whence we may expect to obtain in course supplies of cane sugar are Cuba, Java, Haiti, P Brazil, etc. A useful quantity of cane sugar is fo coming from India, British Guiana, Trinidad, and ot British West Indian Islands and Mauritius, though it hardly be expected that the output is capable of g extension at short notice.

Proposed sugar beet factory at Kidderminster. Ch. of Comm. J., Oct., 1914. [T.R.]

Difficulties in connection with the supply of machinery and beet seed having now been overcome, the Chairman of the Kidderminster Chamber of Commerce announces that a sugar beet factory will shortly be established there.

Sugar; Prohibited import and export of ——. See page 1038.

Patents.

Filter [for saccharine juice]; Continuously-operating ——. J. H. Fleetwood, New Orleans, La. U.S. Pat. 1,107,924, Aug. 18, 1914; date of appl., Mar. 24, 1914.

The saccharine juice is circulated by a pump from a reservoir, through a series of filter-casings in which the liquid flows over the outside of a number of separate filter-bags, the unfiltered liquid returning to the reservoir. The interior of the filter-bags is connected with a receiving ank fitted with a water-supply. The filter-casings are connected with a steam-supply.—A. T. L.

Sugar solutions; Process and apparatus for the clarification of ——. Köpke Clarifier Co., Ltd Fr. Pat. 467,981, Feb. 2, 1914. (See also U.S. Pat. 1,101,940, June 30, 1914; this J., 1914, 841).

The solution is introduced into a centrifugal drum through a pipe extending below a horizontal plate at the lower part of the drum, the latter having been filled previously with a charge of the solution and set in rotation. The solution which is introduced subsequently attains the velocity of the solution already in the drum before it escapes from under the outer edge of the horizontal plate; a perforated plate fitted below this horizontal plate aids n subdividing the solution. The heavier solid impurities are deposited on the wall of the drum whilst the lighter particles collect at the centre. The drum is surrounded by a casing and the process and apparatus may be used or raw, heated, defecated, or concentrated juices. Means are provided for washing and removing the separated mpurities.—W. P. S.

Sugars; Process for producing syrups and ——. C. B. Duryea, New York. U.S. Pat. 1,110,755, Sept. 15, 1914; date of appl., April 12, 1911.

Crude green starch is modified, purified, and cooked with acid; the product is neutralised, saccharified with an xtract of raw grain, refined and concentrated.—L. E.

Maltose; Process of producing ——. C. B. Duryea, New York. U.S. Pat. 1,110,756, Sept. 15, 1914; date of appl., Mar. 27, 1913.

Thick boiling starch is modified (*e.g.*, by the "in suspension" process), purified, and cooked at a concentration of about 14°—18° Bé. (sp. gr. 1·108—1·142) "under acidic onditions." The product is neutralised, saccharified by nzyme action, refined and concentrated.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Glycogen; Hydrolysis of —— by diastasic enzymes. III. Factors influencing the end-point of the hydrolysis. R. V. Norris. Biochem. J., 1914, **8**, 421—433.

A solution of glycogen is not completely hydrolysed to maltose by pancreatic glycogenase unless very high encentrations of enzyme are used, although even with low concentrations the whole of the glycogen may disppear and the liquid lose its capacity for producing a oloration with iodine. The total degree of hydrolysis produced (measured by reducing power in terms of maltose) ises with the concentration of enzyme but not proportionally After the "stationary point" has been attained. urther hydrolysis takes place on addition of more enzyme r glycogen. The activity of a glycogenase preparation is almost completely lost on dialysis, but is restored by ldition of certain salts, notably chlorides (cp. Starkenein, this J., 1910, 507). According as the quantity of salt added is large or small, so is the initial velocity and the total degree of hydrolysis produced when the enzyme is added to a solution of glycogen. After the "stationary point" has been reached, further hydrolysis can be induced by addition of more salt or more enzyme, so that there appears to be an equilibrium established between free salt, free enzyme and salt-enzyme complex. Hydrolysis is retarded by addition of the mixed hydrolytic products, but maltose alone has very little effect. It is concluded that the arrest of hydrolysis is not due to any considerable destruction of the enzyme, or to an inherent resistance of the residual dextrin to further hydrolysis, but mainly to the retarding influence of the mixed hydrolytic products.—J. H. L.

Brewing and distilling machinery and apparatus. Board of Trade Bulletin. No. 78. [T.R.]

May be obtained from the Board of Trade, Comm. Intelligence Branch, 73, Basinghall Street, E.C.

Patents.

Distilling column; High-proof, water-cooled, spirit ——. P. Publicker, Philadelphia, Pa. U.S. Pat. 1,109,701, Sept. 8, 1914; date of appl., May 9, 1914.

The column, which is submerged in a cooling liquid in a receptacle, consists of a number of superposed units, each having a concavo-convex bottom, a flat top, a concavo-convex pan above the bottom and concentric therewith, and a screen over the pan; the distillate passes through this screen before collecting in the pan. The top and bottom of the unit are braced against pressure from without, and the pan is spaced from both the bottom and the top, by brackets. The bottom of each unit is connected with the top of the unit below, and a drain pipe leads from each of the pans to a common manifold pipe. —L. E.

Producing maltose. U.S. Pat. 1,110,756. *See* XVII.

XIXa.—FOODS.

Casein; Phosphorus content of ——. A. W. Bosworth and L. L. van Slyke. J. Biol. Chem., 1914, 19, 67—71.

The phosphorus content of casein is usually given as about 0·85%, but, by treating a solution of casein in ammonia with ammonium oxalate, adding an excess of ammonia and allowing the mixture to stand for 12 hours, the phosphorus is reduced to about 0·70%. Some of the casein is hydrolysed by the treatment and some phosphorus is split off, but the hydrolysed portion is not precipitated by acetic acid and does not affect the composition of the final preparation. The higher figure ordinarily given is due to the presence of inorganic phosphorus compounds (dicalcium phosphate) derived from the milk and not removed by the usual methods of preparation. As the molecular weight of casein is approximately 8888, the lower percentage corresponds very closely with the presence of two atoms of phosphorus in the casein molecule. Analyses of various caseins show that there is a general relation between the yield of ash and the phosphorus content.—W. P. S.

Caseinogen; Action of diazomethane on ——. (Preliminary communication). A. Geake and M. Nierenstein. Biochem. J., 1914, **8**, 287—292.

Methylocaseinogen, obtained by the very prolonged action of ethereal solutions of diazomethane on caseinogen (*cp.* Herzig and Landsteiner, this J., 1914, 571), is indistinguishable in appearance from caseinogen, but contains 3·5% more methyl (in OCH_3 and NCH_3 groups) determinable by the Herzig-Meyer method. It is much less readily soluble in acids and alkalis than caseinogen, and its solution in alkalis appears to be accompanied by partial loss of methyl groups. Determinations of nitrogen in methylocaseinogen by Kjeldahl's method give consistently lower results than by Dumas' method, *e.g.*, 14·84 compared with 15·49%, yet there appears to be no evolution of free nitrogen when the substance is boiled with concentrated sulphuric acid. Methylocaseinogen gives Millon's reaction, and it is therefore doubtful whether methylation affects the tyrosin nucleus. The Adamkiewicz-Hopkins reaction is more pronounced than with caseinogen.—J. H. L.

Pentosans and methylpentosans; Production of ω-hydroxy-s-methylfurfuraldehyde from carbohydrates and its influence on the determination of ——. M. Cunningham and C. Dorée. Biochem. J., 1914, **8**, 438—447.

ω-Hydroxymethylfurfural is formed by the action of dilute hydrochloric acid on hexoses, starch and the celluloses (*cp.* van Ekenstein and Blanksma, this J., 1910, 1028). Like methylfurfural it yields a phloroglucide soluble in alcohol, and gives a red colour with solutions of aniline in alcohol, but none with aniline acetate. Owing to its slow formation it does not interfere with the determination of pentosans by the Kröber phloroglucinol method (see this J., 1901, 396) if the distillation is stopped as soon as the distillate ceases to react with aniline acetate. If, however, distillation is continued as long as the distillate produces a rose colour with an alcoholic solution of aniline, an additional large volume of distillate is obtained which yields a phloroglucide precipitate soluble in alcohol and containing ω-hydroxymethylfurfural besides methylfurfural derived from methylpentosans in the original material. If dextrose, starch or pure cellulose is subjected to acid distillation under these conditions, the distillate yields a phloroglucide precipitate entirely soluble in alcohol, and amounting to 1—2% of the material employed. Hence determinations of methylpentosans made hitherto (see Ellett and Tollens, this J., 1905, 212) are of doubtful value. ω-Hydroxymethylfurfural is probably the unknown substance precipitable by phloroglucinol, referred to by previous workers, and its presence explains many of their observations, *e.g.*, that if the distillates obtained in determining pentosans in natural products are redistilled there is often a considerable loss of "furfural" (*cp.* Fraps, this J., 1901, 843), this being doubtless due to hydrolysis of ω-hydroxymethylfurfural present, to formic and lævulinic acids, by the hydrochloric acid (see van Ekenstein and Blanksma, *loc. cit.*).—J. H. L.

Canned foods; Abnormal quantities of tin in ——. Rossée and von Morgenstern. Z. öffentl. Chem., 1914, 20, 171—172.

Canned vegetables and other foodstuffs always contain tin derived from the receptacle but, as a rule, the extent of the metallic contamination is slight. Large quantities of tin are, however, dissolved when the substance is allowed to remain in the tin after the latter has been opened. For instance, a sample of spinach contained 18 mgrms. Sn per kilo., which increased to 1038 mgrms. per kilo. when the can was left open for 6 days. A sample of canned sorrel contained 315 mgrms. Sn per kilo., whilst a sample of spinach mixed with sorrel contained 807 mgrms. per kilo. The latter sample contained 0·434% of oxalic acid. The tin forms an insoluble compound with the vegetable substances and is not re-dissolved by the gastric juice; consequently, the presence of small quantities of tin in foods is not likely to cause injury to health. Copper salts, when added to vegetables to impart a green colour to the same, also form insoluble compounds.
—W. P. S.

Feeding stuffs (*oilcake und bran*). Board of Trade Bulletin, No. 76. [T.R.]

May be obtained from the Board of Trade, Comm. Intelligence Board, 73, Basinghall Street, E.C.

Patents.

Filters [*for milk*]. W. Poupart, Twickenham. Eng. Pat. 22,709, Oct. 8, 1913.

A shallow circular domed regulating plate having perforations round the circumference to distribute the milk over the filter-cloth is provided with a heavy circumferential ring which rests on a flange formed in the funnel-shaped filtering vessel and serves to retain the filter-cloth in position.—W. H. C.

[*Milk*] *Separators; Centrifugal* ——. I. David. Fr. Pat. 468,811, May 3, 1913.

In the bowl of the separator is a spiral formed of a number of thin plates spaced very slightly apart so that a number of relatively short spiral passages are formed for the liquid. The upper surface of the compound spiral has the form of an inverted cone and follows very closely the contour which the surface of the liquid would assume if it were rotated in an empty bowl.—W. H. C.

Finely divided solid materials [*milk powder, etc.*] *suspended in air or other fluid; Recovery of* ——. Merrell-Soule Co. Fr. Pat. 468,859, Feb. 24, 1914.

The process is intended particularly for the recovery of fine powders obtained by evaporating milk or other organic liquids. The milk or the like is sprayed into a desiccating chamber along with a current of air and the resulting solid particles are collected either in the chamber itself or in a series of filter-chambers, so arranged that the powder falls from the filters on to the floor of the desiccating chamber. Each of the filter-chambers can be independently isolated to allow the powder that has collected to be shaken down. The powder from all the filter-chambers is thoroughly mixed in order to obtain a product of uniform quality.—W. H. C.

Sour-milk preparations; Production of stable, concentrated ——. F. Sauer. Ger. Pat. 276,452, May 10, 1913.

Milk containing an acid ferment, *e.g.*, yoghurt milk, is separated into its solid and liquid components; the whey, which contains lactic acid, is mixed with sucrose, evaporated to a syrupy consistency, and mixed with the curd, which contains the ferment.—T. F. B.

Butter; Process of producing renovated and artificial ——. E. B. Heller, New York, Assignor to Beatrice Creamery Co., Lincoln, Nebr. U.S. Pat. 1,109,750, Sept. 8, 1914; date of appl., Mar. 25, 1912.

Butter material (consisting of a fatty substance and a lacteal fluid) is melted *in vacuo*, washed, and then chilled and granulated *in vacuo*. The product is mixed, in absenc of air, with milk that has previously been pasteurised and inoculated with flavouring bacteria. The mixture i allowed to ripen *in vacuo*, and finally churned and worked *in vacuo*.—L. E.

Fruits; Process of treating ——. P. J. Scheuermann, St Louis, Mo., Assignor to S. G. Martin, Chicago, Ill. W. O. Bartholomew, St. Louis, Mo., and E. Schaaf, St Marys, Mo. U.S. Pat. 1,108,521, Aug. 25, 1914; dat of appl., May 24, 1909. Renewed, July 16, 1914.

Fruit is treated with air containing 2% of an oxide o nitrogen.—W. P. S.

Food for infants, invalids, and old persons; Process f preparing ——. M. F. Doming, Tappan, N.Y. U.S Pat. 1,108,555, Aug. 25, 1914; date of appl., June 1 1913.

A mixture of ground cereals, water, protein, fat, carb hydrates, and diastatic enzyme is heated until it becom flocculent.—W. P. S.

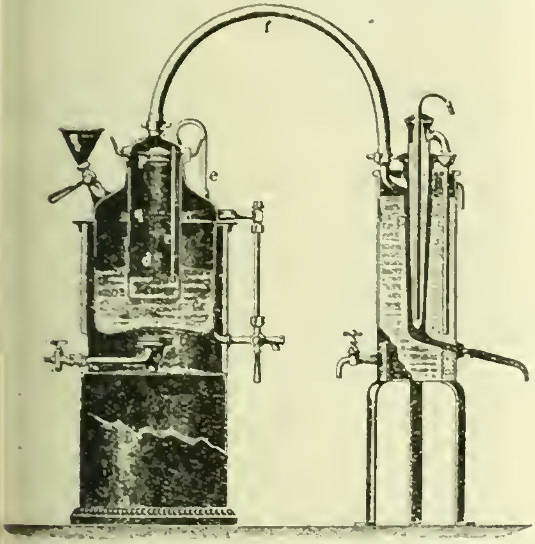
Food; Method of producing predigested ——. C. I Duryea, New York. U.S. Pat. 1,110,754, Sept. 15, 191 date of appl., Feb. 17, 1910.

A purified modified starch is cooked, then furth converted by the action of an electric current, and final refined and concentrated.—L.E.

XIXb.—WATER PURIFICATION; SANITATION.

Water; Apparatus for the preparation and preservation of pure —— in considerable quantity. T. Paul. Z. Elektrochem., 1914, **20**, 179—185.

The general arrangement of the apparatus is shown in the diagram. Fresh spring water, freed from carbon dioxide by standing for some days with calcium hydroxide, s decanted into the tinned copper still, c, of about 30 itres capacity, and is slightly acidified with phosphoric icid. The steam passes through the tin U-tube, *e*, into he bottom of the inner vessel, *d*, also of block tin. This ontains milk of lime, and is provided with sieve plates, , *q*, to prevent calcium hydroxide blowing over into the ube, *f*, leading to the double surface condenser, *g*. The listillate is collected in well cleaned and steamed Jena lass vessels. After about 2 litres have passed over the onductivity of the condensed water should have sunk to bout $0·7 \times 10^{-6}$ and about 10 litres of distillate of high urity can then be collected. This may be further purified y bubbling through it carbon-dioxide-free air for from 4 to 36 hours, whereby the conductivity will be further educed to from $0·45 \times 10^{-6}$ to $0·5 \times 10^{-6}$. For this purpose, nd for the preservation of the water for use as required, flask of about 15 litres capacity is fitted with a rubber topper through which pass two glass tubes leading to the ottom of the flask, and a third short one connected hrough a soda-lime tube with a water pump. One of he longer tubes serves for the admission of purified air. he third tube, provided with a pinch-cock, serves for rawing off the pure water for use and for sucking up resh distillate into the flask.—G. F. M.



Arsenates of lead. Tartar and Robinson. *See* VII.

Patents.

Vater softening, purifying or filtering devices. G. R. Shankland, Manchester. Eng. Pat. 25,730, Nov. 11, 1913.

PORTABLE apparatus consists of two superimposed ylindrical vessels, the upper one containing a layer of rtificial zeolites or other filtering material through which he water flows into the lower vessel. Or, the ltering material may be contained in a vessel situated etween hte other two, and when not in use, the upper and iddle vessels may be pacfied into the lower and enclosed y a lid.—W. P. S.

Water; Method of softening ——. G. E. Bailey and B. A. Hatch, Assignors to The Ferrochem Co., Los Angeles, Cal. U.S. Pat. 1,108,514, Aug. 25, 1914; date of appl., June 15, 1912.

Solid rollers, constructed of material suitable for the softening of water, are immersed in the water and caused to rotate one against the other under pressure; the abraded particles mix with the water.—W. P. S.

Sterilising bottles; Method of ——. E. C. R. Marks, London. From The Zahm Manufacturing Co., Buffalo, N.Y., U.S.A. Eng. Pat. 9636, April 18, 1914.

The bottles are carried on an endless band through a conduit containing heated air, then immersed in water heated to 140° F. (60° C.) and filled with the same, next emptied and carried through a conduit containing cold air, and finally discharged from the band. The air current forced through the cooling conduit is led through a narrow chamber in the hot water vessel and thence into the hot air conduit.—W. P. S.

Solidified oil [Insectifuge] and process of making same. C. Ellis, Assignor to Ellis-Foster Co., N.J. U.S. Pat. 1,109,119, Sept. 1, 1914; date of appl., March 29, 1910.

An insectifugal composition consists of a mixture of pine oil, naphthalene, a small quantity of sodium stearate, and a non-volatile oil, heated together at above 100° C. to form a clear and transparent cake.—W. P. S.

Nitrogenous bases from tar or tar oils; Process for increasing the fungicidal and insecticidal properties of the ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 276,685, July 2, 1913. Addition to Ger. Pat. 257,848 (see this J., 1913, 479).

The bases are heated with sodium or potassium in presence of an alcohol. *Example:* 50 kilos. of coal tar bases are mixed with 180 kilos. of sodium, and 700 kilos. of absolute alcohol is added at such a rate that a brisk reaction takes place: when the addition is complete, the mixture is heated under a reflux condenser till all the sodium is dissolved and is then treated with water; 45—50 kilos. of bases of increased insecticidal powers are obtained. Other bases, such as those obtained in the dry distillation of molasses, may be treated similarly.—T. F. B.

Water; Process of softening ——. H. Ley, Assignor to Verein. Seidenfärbereien C. A. Langenbeck und I. P. Lohe, Elberfeld, Germany. U.S. Pat. 1,109,849, Sept. 8, 1914. Date of appl., Nov. 24, 1913.

See Fr. Pat. 463,044 of 1913; this J., 1914, 331.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Drugs and preparations derived therefrom; Comparison of the methods used in the various Pharmacopoeias for the determination of the active principles of potent ——. H. Dichgans, Inaug. Dissert., Berne. Reviewed by H. Hérissey. J. Pharm. Chim., 1914, **10**, 238—243.

The methods compared are those of the Pharmacopœias of Austria, Belgium, Great Britain, Denmark, Spain, France, Germany, Holland, Hungary, Italy, Japan, Norway, Sweden, Russia, Servia, and the United States. The processes were tested with regard to their cheapness, rapidity, and precision. *Nux vomica.* The Keller-Fromme method is recommended for the drug. 7·50 grms. of the fairly fine powder are macerated with 50 grms. of ether, 25 grms. of chloroofrm and 5 grms. of ammonia for 30 mins. with frequent shaking. 50 grms. of the liquid are filtered through a double filter, evaporated, and the residue treated with 2 grms. of chloroform, 20 c.c. of ether and 20 c.c. of water. After the addition of 5 c.c. of *N*/10 hydrochloric acid to the solution, the excess is titrated using iodeosin as indicator. 1 c.c. of acid is equivalent to 0·0364 grm. of alkaloid. For the extract,

1·25 grms. are heated on the water bath for a short time with 10 c.c. of water. After cooling 50 grms. of ether, 25 grms. of chloroform and 3 grms. of ammonia are added and the whole shaken vigorously for 15 mins. 60 grms. are filtered off, evaporated, and the residue dissolved in 10 c.c. of chloroform and titrated after the addition of 10 c.c. of $N/10$ hydrochloric acid, 20 c.c. of ether and 20 c.c. of water. *Ipecacuanha root.*—6 grms. of the fine powder are shaken occasionally during 30 mins. with 90 grms. of ether and 5 grms. of 10% ammoniated alcohol. 75 grms. are filtered through absorbent cotton wool, evaporated, and the residue dissolved in 5 c.c. of absolute alcohol and treated with 20 c.c. of ether and 10 c.c. of water. The alkaloids are titrated with $N/10$ acid using hæmatoxylin as indicator, adding about 30 c.c. of water during the titration, and vigorously shaking after the addition of each portion of the acid. 1 c.c. of acid corresponds to 0·0241 grm. of total alkaloid. Or the same weight of drug may be treated as above with 120 grms. of ether, and 100 grms. filtered off and shaken out with 20, 10 and 10 c.c. of 1% hydrochloric acid. The acid extract is made alkaline with ammonia, shaken out with 20, 10, and 10 c.c. of ether, which is filtered, and evaporated to constant weight. For the tincture the method of the Hungarian Pharmacopœia is recommended. *Aconite root.*—The best results are obtained by the Keller gravimetric method (this J., 1895, 773) or the volumetric methods of the Russian and Swiss Pharmacopœias. The processes of the French, Russian and Swiss Pharmacopœias are recommended for the tincture. *Pomegranate bark.*—7 grms. of the moderately fine air-dry powder are shaken vigorously with 70 grms. of ether, 5 grms. of 15% sodium hydroxide solution added and the whole shaken occasionally during half an hour. The ether solution is filtered through absorbent cotton and allowed to stand after shaking with 5—10 grms. of water 50 grms. of the clear ethereal liquid are extracted first with 5 c.c. of $N/10$ hydrochloric acid mixed with 5 c.c. of water, and then twice with 10 c.c. of water. The excess of acid is titrated after the addition of 10 c.c. of ether and iodeosin as indicator, 1 c.c. of acid corresponding to 0·10475 grm. of total alkaloid. For the gravimetric process the same quantities are used, but the ethereal solution is shaken out with 20, 10, and 10 c.c. of 1% hydrochloric acid. The combined acid extracts are made strongly alkaline by the addition of sodium carbonate and shaken out with 20, 10, and 10 c.c. of chloroform. The latter solution is filtered into a tared flask, evaporated after the addition of 5 drops of hydrochloric acid, and the residue dried at 70°—80° C. 184 pts. of the hydrochlorides are equivalent to 147·5 pts. of the alkaloids. The volumetric processes of the Swiss Pharmacopœia are recommended for *belladonna* and *henbane leaves* and their preparations. Ethyl orange is a suitable indicator for the titration of hydrastine in *hydrastis root.* 7 grms. of the fluid extract of the latter are warmed in a current of air till the weight is reduced to 6 grms. After cooling 1 grm. of 12·5% hydrochloric acid is added and the whole made up to 14 grms. with water. This is shaken with 0·5 grm. of talc and 10 grms. of the liquid filtered off. The latter is then shaken for a few minutes with 4 grms. of 10% ammonia and 75 grms. of ether. The ethereal liquid is cleared by the addition of 1·5 grms. of gum tragacanth, and 60 grms. filtered into a tared flask, evaporated to dryness, and the residue evaporated three times with 5 c.c. of ether. It may be warmed with 10 c.c. of $N/10$ hydrochloric acid and the excess titrated with alkali using ethyl orange as indicator.
—F. SHDN.

Papaver orientale ; Subsidiary alkaloids of——. J. Gadamer. Arch. Pharm., 1914, **252,** 274—280. (See also this J., 1914, 885).

THEBAINE and isothebaine are accompanied in *Papaver orientale* by exceedingly small amounts of at least two non-phenolic and at least three phenolic alkaloids. The non-phenolic alkaloids consist of protopine, m. pt. 204°—205° C., and an amorphous alkaloid very soluble in organic solvents, whilst the phenolic alkaloids consist of a new alkaloid, *glaucidine*, m. pt. about 238°—239° C., $[\alpha]_D$ about +47 to +54°, giving colour reactions similar to, and apparently closely related to glaucine, and a mixture of amorphous alkaloids too small in amount to separate and characterise.—T. C.

Rhubarb root ; A Chinese——. L. Rosenthaler and K. Kiene. Ber. Deuts. Pharm. Ges., 1914, **24,** 234—243.

A NEW kind of rhubarb root has recently appeared, purporting to come from China. Anatomical and chemical examination show only slight differences, such as might be produced by differences of climate and soil, between this root and European rhaponticum root.—F. SHDN.

Green plants ; Constituents of——. *II. Volatile constituents of hornbeam leaves.* T. Curtius and H. Franzen. Annalen, 1914, **404,** 93—130. (See also this J., 1912, 706, 958.)

1500 KILOS. of hornbeam leaves were distilled in steam in portions of 15 kilos., the distillate made alkaline with baryta water and redistilled to remove barium salts of volatile acids. The distillate was then treated with freshly precipitated silver oxide and the silver salts of the acids thus produced from the aldehydes present were subsequently converted into the barium salts and separated from unchanged alcohols and ketones by again distilling. The following substances were isolated and identified :—formic, acetic and hexylenic acids with one or more higher homologues of the latter, acetaldehyde, *n*-butylaldehyde, valerylaldehyde, *αβ*-hexylenealdehyde with several higher homologues, butylene, pentylene and hexylene alcohols, and an alcohol of the formula, $C_8H_{14}O$, with one or more higher alcohols. The method previously used by the authors to detect the presence of formaldehyde in hornbeam leaves (oxidation of the volatile aldehydes with moist silver oxide and subsequent identification of formic acid, see this J., 1912, 706) has been proved to be fallacious, as methyl alcohol is also oxidised to formic acid under similar conditions.—T. C.

Flowers of Matricaria Chamomilla ; Constituents of——. F. B. Power and H. Browning, jun. Chem. Soc. Trans., 1914, **105,** 2280—2291.

22·23 KILOS. of the ground flowers of *Matricaria Chamomilla* Linné (German chamomile) were completely extracted with hot alcohol, the alcoholic solution concentrated to a soft extract and then distilled in steam. 23 grms. of a deep blue essential oil distilling over a wide range of temperature, together with an aqueous extract and an oily resin were thus obtained, and were separately examined The following substances were isolated and identified :—salicylic acid ; an acid, probably $C_8H_{16}O_2$, apigenin $C_{15}H_{10}O_5$, and a glucoside of apigenin which could not be obtained crystalline ; umbelliferone methyl ether $C_{10}H_8O_3$, and a crystalline substance, m. pt. 237°—239° C. which was apparently a mixture of umbelliferone and dihydroxycoumarin ; choline ; triacontane ; a phytosterol $C_{27}H_{46}O$, a phytosterol glucoside, $C_{33}H_{56}O_6$; palmitic stearic, cerotic, oleic, linolic and volatile fatty acids together with a sugar yielding *d*-phenylglucosazone There are considerable differences between the constituents of German chamomile and Roman or Englis chamomile, *Anthemis nobilis* (see this J., 1914, 885).—T. C

Cotton-root bark [Gossypium herbaceum] ; Chemica examination of——. F. B. Power and H. Browning jun. Pharm. J., 1914, **93,** 420—423.

A CONCENTRATED alcoholic extract of cotton-root bar distilled in steam yielded a very small amount of essentia oil, which gave the furfural colour reaction and deposite crystals of acetovanillone, m. pt. 112°—114° C. Th aqueous liquid from the steam distillation and the resi insoluble in water were examined separately. The follow ing substances were isolated and identified :—a phenoli acid, m. pt. 196°—199° C., probably 2.3-dihydrox benzoic acid, salicylic acid, a new *phenolic substanc* $C_9H_{10}O_3$, m. pt. 258°—260° C., giving an acetyl derivati of m. pt. 152° C., a new *yellow phenolic substance*, $C_{13}H_{18}O$ m. pt. 210°—212° C., giving an acetyl derivative of m. p

147°—149° C., betaine, a fatty alcohol, $C_{20}H_{42}O$, m. pt. 77·5°—78·5° C., a phytosterol, a small amount of hydrocarbon probably triacontane, ceryl alcohol, a mixture of fatty acids, chiefly oleic and palmitic acids, and a considerable quantity of sugar, yielding *d*-phenylglucosazone. The bark contains no tannin and no alkaloid.—T. C.

Cholin; Some new physiologically active derivatives of ——. A. J. Ewins. Biochem. J., 1914, **8**, 367—373. (See also this J., 1914, 664.)

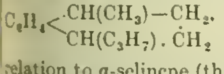
For purposes of comparison with natural muscarin from *Amanita muscaria*, the author prepared eighteen derivatives of cholin, of which the following are new:—formylcholin, $HO{\cdot}N(CH_3)_3{\cdot}CH_2CH_2O{\cdot}OCH$, cholin propyl ether, $HO{\cdot}N(CH_3)_3{\cdot}CH_2CH_2O{\cdot}C_3H_7$, cholin ether, $[HO{\cdot}N(CH_3)_3{\cdot}CH_2CH_2]_2O$, trimethyl-$\beta$-cyano- (and amino-) ethylammonium hydroxide, $HO{\cdot}N(CH_3)_3{\cdot}CH_2CH_2{\cdot}CN$ and $HO{\cdot}N(CH_3)_3{\cdot}CH_2CH_2{\cdot}NH_2$, dimethyl oxazolium hydroxide, $HO{\cdot}N(CH_3)_2{\cdot}CH_2CH_2{\cdot}OCH_2$, and formocholin methyl, ethyl, propyl and butyl ethers, $HO{\cdot}N(CH_3)_3{\cdot}CH_2OR$. All the bases prepared showed considerable physiological activity, those approaching most nearly to muscarin being cholin ethyl ether, cholin nitric acid ester, and trimethyl-β-aminoethylammonium hydroxide. The curare-like action of all these is however more pronounced than in the case of natural muscarin. The ethers of formocholin exert a physiological action similar to, but less powerful than that of the corresponding cholin ethers. The preparation and properties of the new compounds are described.—J. H. L.

Geranium oil; Production of ——. D. R. Mason. Amer. Perfumer and Essent. Oil Rev., 1914, **9**, 192. (See this J., 1913, 1127.)

The geranium rosat was taken from South Africa to France about 1690. It was first cultivated for the oil at Grasse in 1847 and taken to Algeria in the following year. Although the French oil is superior, it can be produced more economically in Algeria, as the rosat has to be planted annually in France. It should be possible to grow it in Southern California in localities not subject to severe frost. Cuttings packed for shipment can be obtained at Algiers at about 12s. to 16s. per 1000.—F. Shdn

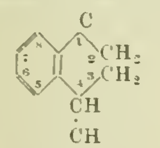
Benzoterpenes; Experiments on the synthesis of the ——. *Part I. Derivatives of benzonor-p-menthane.* F. W. Kay and A. Morton. Chem. Soc. Trans., 1914, **105**, 1565—1583.

The term "benzoterpene" is used to describe those aromatic, terpene-like substances which contain a benzene nucleus condensed to the normal monocyclic terpene skeleton such as is present in dipentene, for example. The benzoterpenes form a connecting link between naphthalene and the sesquiterpenes, benzo-*p*-menthane,



$$C_6H_4<\begin{matrix}CH(CH_3)-CH_2\\CH(C_3H_7).CH_2\end{matrix}$$

for example bearing the same relation to *a*-selinene (this J., 1913, 107) as *p*-cymene does to the monocylic terpenes in general. The preparation of a number of derivatives of benzonor-*p*-menthane,



is described. Tetrahydro-*a*-naphthoic acid, obtained by reducing *a*-naphthoic acid with sodium in boiling alcoholic solution was treated with phosphorus pentachloride and then with bromine and the resulting *a*-bromo-acid converted into its ethyl ester. The latter was boiled with diethylaniline, whereby hydrogen bromide was eliminated and a good yield of ethyl Δ^1-dihydro-*a*-naphthoate obtained. This was treated with an ethereal solution of magnesium methyl iodide and gave a good yield of benzo-Δ^3-nor-*p*-menthen-10-ol, a crystalline solid, m. pt. 101°—102° C., having a peculiar penetrating odour resembling that of naphthalene. When digested with potassium pyrosulphate it loses water and is converted into benzo-$\Delta^{3-10\,11}$-nor-*p*-menthadiene, an oil, which distils at 255°—256° C. at 750 mm. and has a pronounced odour resembling that of petroleum. Ethyl tetrahydro-*a*-naphthoate when left in contact with an ethereal solution of magnesium methyl iodide is gradually converted into benzonor-*p*-menthan-10-ol, a viscid oil having a camphoraceous odour, which distils at 166° C. at 30 mm., and when digested with potassium pyrosulphate loses water, with formation of benzo-Δ^{10-11}-nor-*p*-menthene, b. pt. 259°—261° C. at 745 mm., which has a pronounced odour recalling that of cedrene. Benzo-Δ^{10-4}-nor-*p*-menthene, b. pt 245°—247° C. at 744 mm., was obtained by reduction of benzo-$\Delta^{3-10\,11}$-nor-*p*-menthadiene with sodium and alcohol.—A. S.

Catechol; Compounds of —— *with alkali salts of carboxylic acids.* R. F. Weinland and W. Denzel. Ber., 1914, **47**, 2244—2252.

Catechol forms with the alkali salts of organic acids additive compounds, of which those with the formates acetates, succinates and salicylates of sodium and potassium have been prepared and isolated in crystalline form. They were obtained directly from the aqueous or alcoholic solutions of their components. A number of different compounds were produced from the same alkali salt, as for example $H.COONa+C_6H_4(OH)_2+H_2O$; $H.COONa+2C_6H_4(OH)_2$; $COOK.CH_2.CH_2.COOK+3C_6H_4(OH)_2+4{\cdot}5H_2O$; and $COOK.CH_2.CH_2.COOK+5C_6H_4(OH)_2+H_2O$. Only one salicylate compound was prepared; it contained 1 mol. of each component and 1 mol. H_2O.—G. F. M.

Diacetates and glycols; Preparation of —— *from dibromides.* E. G. Bainbridge. Chem. Soc. Trans., 1914, **105**, 2291—2302.

Ethylene dibromide and trimethylene dibromide when heated with potassium or silver acetates and glacial acetic acid give the corresponding glycol diacetates; propylene dibromide similarly treated gives a mixture of the glycol diacetate and an unsaturated bromide, $CH_3CH:CHBr$, with elimination of hydrobromic acid, whilst *iso*-butylene dibromide gives an unsaturated bromide and no diacetate. The diacetates of ethylene-, trimethylene-, propylene-, $\alpha\gamma$-butylene- and ω-butylene-glycols give good yields of the corresponding glycol on boiling with an equimolecular quantity of sodium ethoxide in alcohol, distilling off the solvent, saturating the residue with carbon dioxide, then boiling with 2 molecular proportions of water and fractionally distilling. Ethylene- and trimethylene-glycol diacetates are catalytically hydrolysed by boiling with very small amounts of sodium ethoxide in alcoholic solution and also by boiling with alcoholic sodium hydroxide, the yield being however adversely affected by presence of water.—T. C.

Partial pressures of liquid mixtures; Rapid laboratory method of measuring the ——. M. A. Rosanoff, C. W. Bacon, and R. H. White. J. Amer. Chem. Soc., 1914, **36**, 1803—1825.

The liquid is fractionally distilled in such a way as to avoid reflux condensation and then the composition and weight of each fraction is determined and the composition of the successive added distillates plotted against their weights, so as to obtain by extrapolation, the composition of the distillate when its weight is zero (that is, of the first trace of vapour given off by the liquid). The distillation is effected by an electric heater which is immersed in the liquid in a jacketed vessel supported in a constant-temperature bath. The vapour passes downwards through the jacket to a condenser, and thence to a receiver having compartments for the collection of consecutive fractions. The distillates are analysed by determination of the refractive index or, for ternary mixtures, by Schulze's method (J. Amer. Chem. Soc., 1914, **36**, 498). Results and curves are given for mixtures of carbon bisulphide and carbon tetrachloride, chloroform and toluene, acetone and toluene, and ethyl iodide and ethyl acetate.—F. Sodn.

Para-oxyarylarsinic acids, nitro-oxyarylarsinic acids, and 3.3′-diamino-4.4′-dioxyarsenobenzene; Applications to suspend patents for ——. Illus. Off. Journal (Patents), Sept. 9 and Oct. 21, 1914.

Mr. H. S. Wellcome has been granted a licence under the Patents, Designs, and Trade Marks (Temporary Rules Acts), 1914, to work patents for the manufacture of the above arsenic compounds (Meister, Lucius, und Brüning. Eng. Pats. 13,485 of 1910, 5595 of 1911, and 7865 of 1912; see this J., 1911, 155, 768; 1912, 900).

Synthetic drugs, new remedies, photographic developers, etc.; Index list of trade names of ——. Compiled chiefly from *The Extra Pharmacopoeia*, W. H. Martindale and W. W. Westcott, 15th Ed., 1912; *Die Arzneimittel-Synthese*, S. Fränkel, III. Aufl., 1912; *Synthetic Drugs or Medicinal Products*, V. Coblentz, in Thorpe's *Dict. of Appl. Chem*, 1913, Vol. V., 357—380; and *Merck's Index*, III. Aufl., 1910.

The following is a supplement to the list published in this Journal, 1900, pages 1131 to 1138.

Abanone.—Magnesium phosphotartrate.

Acetomorphine.—Diacetylmorphine,

$$C_{17}H_{17}NO_3(C_2H_3O)_2.$$

Acetopyrin.—Antipyrine acetylsalicylate,

$$C_{11}H_{12}N_2O,C_2H_3O.OC_6H_4.COOH.$$

Acetosal.—Acetylsalicylic acid, $C_2H_3O.OC_6H_4.CO_2H$.

Acetozone.—Mixture of equal parts of acetyl-benzoyl peroxide, $C_6H_5CO.O.O.C_2H_3O$, and kieselguhr.

Acetysal. See acetosal.

Acidol.—Betaine hydrochloride, $C_5H_{11}NO_2,HCl$.

Acitrin.—2-Phenylquinoline-4-carboxylic acid ethyl ester, $C_9H_5N(C_6H_5)CO_2C_2H_5$.

Acopyrin. See acetopyrin.

Adalin.—Bromodiethylacetylurea,

$$(C_2H_5)_2CBr.CO.NH.CO.NH_2.$$

Adamon.—Dibromodihydrocinnamic acid bornyl ester, $C_6H_5(CHBr)_2CO_2C_{10}H_{17}$.

Adigan.—Digitalis preparation containing all the active principles except digitonin, this having been removed by precipitation with cholesterol in alcoholic solution.

Adrenal.—Crystalline base from the suprarenal gland.

Adrenaline.—*o*-Dihydroxyphenylmethylaminomethylcarbinol hydrochloride,

$$(HO)_2C_6H_3.CH(OH).CH_2.NH(CH_3),HCl.$$

Adreucaine. See eudrenine.

Afridol.—Sodium salt of hydroxymercury-o-toluic acid,

$$CH_3.C_6H_3(CO_2Na)HgOH.$$

Agnin.—Adeps lanæ or purified wool fat.

Agnolin. See agnin.

Agobilin.—Strontium cholate mixed with small quantities of strontium salicylate and diacetylphenolphthalein.

Agurin.—Addition product of theobromine-sodium and sodium acetate, $C_7H_7N_4O_2Na,C_2H_3O_2Na$.

Albargin.—Gelatose-silver (15% Ag).

Aldoform.—A formaldehyde preparation.

Aleudrin.—Carbamic acid ester of *αα*-dichloroisopropyl alcohol, $(CH_2Cl)_2.CH.O.CO.NH_2$.

Alformin.—16% solution of basic aluminium formate,

$$Al_2(OH)_2(HCO_2)_4.$$

Alginoid iron. See algiron.

Algiron.—Iron compound of alginic acid (from seaweed); contains 11% Fe.

Allmatein.—Condensation product of hæmatoxylin and formaldehyde, $CH_2O_2(C_{16}H_{12}O_5)_2 : CH_2$.

Allosan.—Santalyl allophanate, $NH_2.CO.NH.CO_2.C_{15}H_{23}$.

Alphogen.—Succinyl peroxide, $(COOH.CH_2.CH_2.CO)_2O_2$.

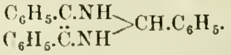
Alphozone. See alphogen.

Althein.—Asparagin, $C_2H_3(NH_2)(CO_2H)CO.NH_2+H_2O$.

Alypin.—Benzoyl-1.3-tetramethyldiaminoethyl-2-isopropyl alcohol hydrochloride,

$$C_6H_5CO.O(C_2H_5)C[CH_2.N(CH_3)_2]_2,HCl.$$

Amarin.—Triphenyldihydroglyoxaline,



$$\begin{matrix} C_6H_5.C.NH \\ C_6H_5.\ddot{C}.NH \end{matrix}\!\!>CH.C_6H_5.$$

Amenyl.—Methylhydrastimide hydrochloride,

$$CH_2O_2 : C_6H_2(CO)_2N(CH_3),HCl.$$

Amidopyrin.—Dimethylaminoantipyrine,

$$C_{11}H_{11}N_2O.N(CH_3)_2.$$

Amphotropin.—Hexamethylenetetramine camphorate,

$$(C_6H_{12}N_4)_2,C_8H_{14}(COOH)_2.$$

Amylarine.—Isoamyltrimethylammonium hydroxide,

$$C_5H_{11}(CH_3)_3N.OH.$$

Anæsthesin.—Ethyl ester of *p*-aminobenzoic acid.

$$NH_2.C_6H_4.CO_2C_2H_5.$$

Anæsthone. See anæsthesin.

Analutos.—See kalmopyrin.

Angioneurosin.—Nitroglycerin, $C_3H_5(O.NO_2)_3$.

Anisotheobromine.—Addition product of theobromine-sodium and sodium anisate,

$$C_7H_7N_4O_2Na,C_6H_4(OCH_3)CO_2Na.$$

Anogon.—Mercury salt of 2.6-di-iodophenol-4-sulphonic acid, $C_6H_2I_2(OHg)(SO_3Hg)$.

Antacedin.—Calcium saccharate.

Anthrosol.—Coal tar distillate having colour and consistence of olive oil.

Antiarthrin.—Condensation product of saligenin and tannin, probably the hydroxybenzyl ester of tannic acid.

Antileprol.—Purified chaulmoogra oil.

Antiluetin.—Potassium-ammonium antimonyltartrate, $[SbO(C_4H_4O_6)_2KNH_4]_2H_2O$.

Antiperiostin.—Mercury iodocantharidate,

$$C_8H_{11}IO(COO)_2Hg.$$

Antipyoninum.—"Neutral" sodium tetraborate, prepared by fusing together borax and boric acid.

Antisclerosine.—Mixed inorganic salts of normal blood.

Antodin.—Phenyl ether of glycerol, $C_2H_5(OH)_2O.C_6H_5$

Aperitol.—Mixture of equal parts of isovaleryl- an acetyl-phenolphthalein.

Aponal.—Amyl carbamate, $NH_2.COOC_5H_{11}$.

Appallagin.—Mercury compound of nosophen (tetra iodophenolphthalein).

Apyron.—Lithium acetylsalicylate, $C_2H_3O.OC_6H_4.CO_2L$

Archibromin.—Monobromoisovalerylglycolylurea,

$$CH_2(OH).CO.NH.CO.NH.CO.C_4H_8Br.$$

Archiodin.—Monoiodoisovalerylglycolylurea.

Argaldin.—Combination of albumin-silver and hexa methylenetetramine (10% Ag).

Argoferment.—Colloidal silver.

Argyrol.—Silver-vitellin (20—30% Ag).

Argulan.—Mercury compound of dimethylpheny pyrazolonesulphamine, $C_{11}H_{11}N_2O.NH.SO_3HgOH$.

Arhéol.—Santalol, $C_{15}H_{24}O$.

Arhoin.—Addition product of diphenylamine and ethy thymyl-benzoate, $(C_6H_5)_2NH,C_{10}H_{13}.C_6H_4.CO_2C_2H_5$.

Aristochin. See aristoquinine.

Aristoquinine.—Carbonic ester of quinine,

$$CO(OC_{20}H_{23}N_2O)_2.$$

Arrhenal.—Sodium methylarsinate,

$$AsO(CH_3)(ONa)_2,6H_2O.$$

Arsacetin.—Sodium *p*-acetylaminophenylarsinate,

$$C_2H_3O.NH.C_6H_4AsO(ONa)(OH),3\text{–}4H_2O.$$

Arsacetin-quinine.—Contains 43% of arsacetin a 54% of quinine.

Arsalyt.—Bismethylaminotetra-aminoarsenobenzene.

Arsamin. See atoxyl.

Arsan.—Glidin preparation containing silver.

Arsanilic acid.—*p*-Aminophenylarsinic acid,

$$NH_2.C_6H_4AsO(OH)_2.$$

Arsen-phenol-amine. See salvarsan.

Arterenol.—*o*-Dihydroxyphenylaminomethylcarbinol hydrochloride, $(HO)_2C_6H_3.CH(OH).CH_2NH_2.HCl$.

Asiphyl. See asyphil.

Aspirin, Soluble.—See kalmopyrin.

Aspirophen.—Aminoacetphenetidide acetylsalicylate,

$$C_2H_3O.C_6H_4.NH.C_2H_2O.NH_2,C_2H_3O.OC_6H_4.COOH.$$

Asquirrol.—Mercury dimethoxide, $(CH_3O)_2Hg$.

Astrolin.—Antipyrine methyl-ethyl-glycollate.

Asurol.—Addition product of mercury salicylate and sodium aminohydroxy-isobutyrate.

Asyphil.—Mercury salt of atoxyl,

$$(NH_2C_6H_4.AsO.(OH)O)_2Hg.$$

Atophan.—2-Phenylquinoline-4-carboxylic acid,

$$C_9H_5N(C_6H_5)COOH.$$

Atoxyl.—Sodium *p*-aminophenylarsinate,

$$NH_2.C_6H_4.AsO(OH)(ONa),xH_2O.$$

Atrinal.—Atropinesulphuric acid, $C_{17}H_{23}O_6NS$.

Atyrosyl. See asyphil.

Azovernin.—Acetylaminoazotoluene,

$$CH_3.C_6H_4.N_2.C_6H_3(CH_3).NH.C_2H_3O.$$

Barbitone.—See veronal.

Barutin.—Addition product of theobromine-barium and sodium salicylate.

Benzinoform.—Carbon tetrachloride.

Benzosalin.—Methyl benzoyl salicylate,

$$C_6H_4(O.CO.C_6H_5)COOCH_3.$$

Biogen.—Magnesium peroxide.

Biolactyl.—Preparation of lactic acid bacilli.

Bisciniod.—Combination of cinchonidine hydriodide and bismuth iodide, $C_{19}H_{22}N_2O,HI,BiI_3$.

Bismon.—Colloidal bismuth.

Bismutose.—Contains about 22% Bi and 66% albumin.

Blankit.—Sodium hydrosulphite.

Blenal.—Carbonic acid ester of santalol, $CO(OC_{15}H_{23})_2$.

Bornyval.—Bornyl isovalerate, $C_4H_9CO.O.C_{10}H_{17}$.

Bornyval, New.—Bornyl isovaleryl glycollate,

$$C_4H_9COOCH_2.COOC_{10}H_{17}.$$

Boroform.—Solution of formaldehyde in sodium glyceroborate.

Borsalyl.—Sodium borosalicylate.

Bororertin.—Hexamethylenetetramine triborate,

$$C_6H_{12}N_4,3HBO_2.$$

Bromeigon.—Albumin preparation containing bromine.

Bromelia, cryst.—β-Naphthyl ethyl ether, $C_{10}H_7.O.C_2H_5$.

Brometone.—Tribromo tertiary butyl alcohol,

$$CBr_3.C(CH_3)_2OH.$$

Brominol.—Brominated sesamé oil (33% Br).

Brominoleum. See brominol.

Bromochinol.—Acid dibromosalicylate of quinine, $C_{20}H_{24}N_2O_2,2C_6H_2Br_2(OH)COOH$.

Bromoglidin.—Wheat gluten preparation containing 10% Br.

Bromogluten.—Vegetable albumin preparation containing 8% Br.

Bromolein.—Brominated unsaturated fatty acids of almond oil (20% Br).

Bromoprotein. See bromogluten.

Bromotan.—Bromotannin-methylene-urea.

Bromural.—α-Bromoisovalerylurea,

$$C_4H_8Br.CO.NH.CO.NH_2.$$

Brophenin.—Bromoisovalerylphenocoll; a brominated phenetidine derivative.

Brovalol.—Bornyl bromovalerate, $C_4H_8Br.COO.C_{10}H_{17}$.

Bynin.—Liquid malt extract.

Cacodyliagol.—Guaiacol cacodylate,

$$(CH_3)_2AsO.O.C_6H_4(OCH_3),H_2O.$$

Cajuputol.—Cineol (eucalyptol), $C_{10}H_{18}O$.

Calcidine.—Calcium iodide.

Calcinol.—Calcium iodate.

Calcusol.—Effervescent preparation of potassium bicarbonate and piperidine-*p*-sulphamine benzoate,

$$SO_2(NH_2)C_6H_4COOH,C_5H_{11}N.$$

Calomelol.—Colloidal calomel.

Camphoid.—Collodion substitute; 1 part of pyroxylin in 20 parts each of camphor and absolute alcohol, by weight.

Camphoral.—Camphoric acid ester of santalol,

$$C_8H_{14}(COO)_2(C_{15}H_{23})_2.$$

Camphosan.—Solution of 15 parts of camphoric acid methyl ester in 85 parts of santalol.

Canadol.—Light petroleum spirit, sp. gr. 0·650—0·700.

Casumen.—Soluble form of casein ("flocculent casein"); contains 90% of protein.

Celloidin.—Pyroxylin purified by solution in alcohol and ether.

Cellotropin.—Benzoic ester of arbutin,

$$C_6H_4OC_6H_{11}O_5.O.COC_6H_5.$$

Ceredine.—Special dry powdered yeast.

Cerolin.—Solid extract of yeast, containing fat

Cetiacol.—Pyrocatechol methyl cetyl ether,

$$C_6H_4(OCH_3)(OC_{16}H_{33}).$$

Chinaphenin. See quinaphenin.

Chinaphthol. See quinaphthol.

Chineonal. See quineonal.

Chininum lygosinatum. See quinine lygosinate.

Chinoform. See quinoform.

Chinosol. See quinosol.

Chloralamid.—Chloral formamide, $CCl_3.CH(OH).CO.NH_2$

Chloretone.—Trichloro tertiary butyl alcohol, $CCl_3.(CH_3)_2C.OH,\frac{1}{2}H_2O$.

Chlorin.—Dinitroresorcinol, $(NOH)O : C_6H_2 : O(NOH)$.

Chlorobrom.—A solution of potassium bromide 6, chloral formamide 6, and water 58 parts.

Chloryl anaesthetic.—Ethyl chloride.

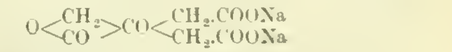
Chromoform.—Combination of methylhexamethylenetetramine and dichromic acid, $(C_6H_{12}N_4CH_3)_2Cr_2O_7$.

Chrysoform.—Dibromodi-iodohexamethylenetetramine, $C_6H_8Br_2I_2N_4$.

Cibrola.—Preparation of milk and glycerophosphates.

Cicatricine.—A solution containing thiosinamine, 20, antipyrine 33. and eucaine lactate 0·65 part per 100.

Citarin.—Sodium anhydromethylenecitrate,



$$O<\begin{matrix}CH_2\\CO\end{matrix}>CO<\begin{matrix}CH_2.COONa\\CH_2.COONa\end{matrix}$$

Citrocoll.—Neutral aminophenacetin citrate.

Cocaethylin.—Ethyl ester of benzoylecgonine,

$$C_6H_5CO.C_8H_{13}NO.COOC_2H_5.$$

Codeonal.—Mixture of 1 part of medinal and 2 of codeine-veronal.

Colalin.—Cholalic acid. $C_{24}H_{40}O_5,H_2O$.

Coryfin.—Menthyl ethyl glycollate,

$$CH_2O(C_{10}H_{19}).COOC_2H_5.$$

Coxpyrin. See acetosal.

Cresegol.—Mercury-potassium salt of cresolsulphonic acid.

Cresosteril.—Acid ortho-oxalic ester of *m*-cresol,

$$CH_3.C_6H_4O.C(OH)_2.C(OH)_2.OC_6H_4(CH_3).$$

Cryogenin.—*m*-Benzaminosemicarbazide,

$$NH_2.CO.C_6H_4NH.NH.CO.NH_2.$$

Cupferron.—Ammonium compound of nitrosophenylhydroxylamine.

Cupratin.—Copper albuminate.

Cupri-aseptol.—Copper *m*-phenolsulphonate,

$$(HO.C_6H_4.SO_3)_2Cu.$$

Cupricin.—Cuprous cyanide.

Cuprocitrol.—Copper citrate, $2Cu_2C_6H_4O_7,5H_2O$.

Cuprol.—Compound of nucleinic acid and copper.

Cusylol.—Soluble copper citrate.

Cycloform.—Isobutyl ester of *p*-aminobenzoic acid, $C_6H_4(NH_2)COOC_4H_9$.

Cypridol.—Mercuric iodide (1%) in sterilised oil.

Cystamin. See hexamine.

Cystogen. See hexamine.

Cystopurin.—Addition product of hexamethylenetetramine and sodium acetate, $C_6H_{12}N_4.2C_2H_3O_2Na,6H_2O$.

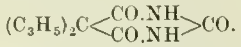
Deba. See veronal.

Dentalone.—Solution of chloretone in essential oils.

Dermogen. See ektogen.

Desalgin.—"Colloidal chloroform": an albuminous substance combined with about 25% $CHCl_3$.

Dial-Ciba.—Diallylbarbituric acid,



$$(C_3H_5)_2C<\begin{matrix}CO.NH\\CO.NH\end{matrix}>CO.$$

Diaspirin.—Succinylsalicylic acid,

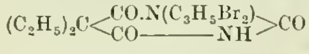
$$(CH_2.COO)_2(C_6H_4COOH)_2.$$

Digipotene.—Preparation containing the whole of the glucosides of digitalis leaves.

Dioform.—Acetylene dichloride, $CHCl : CHCl$.

Diogen.—Sodium salt of aminonaphtholdisulphonic acid, $NH_2.C_{10}H_4(OH)(SO_3Na)_2$.

Diogenal.—Dibromopropyldiethylbarbituric acid,



$$(C_2H_5)_2C<\begin{matrix}CO.N(C_3H_5Br_2)\\CO\text{———}NH\end{matrix}>CO$$

Dioxogen.—A 3% solution of hydrogen peroxide.

Diplosal.—Salicylosalicylic acid,

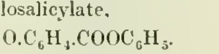
$$HO.C_6H_4.CO.O.C_6H_4.COOH.$$

Dipropæsin.—Urea derivative containing the residues of 2 mols. of propæsin, $CO(NH.C_6H_4.CO_2C_3H_7)_2$.

Disalol.—Phenyl salicylosalicylate,

$$HO.C_6H_4.CO.O.C_6H_4.COOC_6H_5.$$

Dispermin.—Piperazine.



$$NH<\begin{matrix}CH_2.CH_2\\CH_2.CH_2\end{matrix}>NH.$$

Durine.—A formalin preparation.

Dymal.—Didymium salicylate.

Edinol.—*m*-Amino-*o*-hydroxybenzyl alcohol hydrochloride, $HO.C_6H_3(NH_2)CH_2OH,HCl$.

Ehrlich-Hata "606." See salvarsan.

Ektogen. Zinc peroxide.

Elarson.—Strontium salt of chloroarsenobehenolic acid (13% As.).

Elbon.—Cinnamoyl-*p*-hydroxyphenylurea.

Electrargol.—Electrolytic colloidal silver.

Embarin.—Sodium mercurisalicylsulphonate.

Empyroform.—Condensation product of tar and formaldehyde.

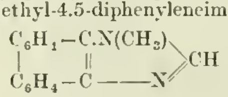
Enesol.—Mercury salicylarsenate (38% Hg).

Epinene.—3.4-Dihydroxyphenylethylmethylamine,

$$(HO)_2C_6H_3.CH_2.CH_2.NH.CH_3.$$

Epinephrine.—*o*-Dihydroxy-4-methylaminoethanolbenzene, $(HO)_2.C_6H_3.CH(OH).CH_2.NH.CH_3$.

Epiosine.—1-Methyl-4.5-diphenyleneimidazole,



Epirenan. See adrenaline.

Erepton.—Meat preparation in which proteins are completely resolved into amino-acids.

Ericin. See mesotan.

Ervasin.—Acetylcresotinic acid.

Escalin.—Aluminium powder mixed to a paste with glycerin.

Estoral.—Menthyl borate, $B(O.C_{10}H_{19})_3$.

Euboruyl.—α-Bromoisovaleric ester of borneol.

$$C_4H_8Br.COOC_{10}H_{17}.$$

Eucodeine.—Codeine methyl bromide, $C_{18}H_{21}NO_3.CH_3Br$.

Eucol.—Guaiacol acetate, $CH_3O.C_6H_4O.C_2H_3O$.

Eudrenine.—A solution containing 0·01 grm. of eucaine and 0·03 mgrm. of adrenaline per c.c.

Euguform.—Acetylated guaiaform (condensation product of guaiacol and formaldehyde).

Eulatin.—Mixture of *p*-bromobenzoic acid, *o*-aminobenzoic acid, and antipyrine.

Eumydrine.—Methylatropine nitrate,

$$C_{16}H_{20}NO_2(CH_3)_2NO_3.$$

Euphyllin.—Mixture of equal proportions of primary and secondary theophylline-ethylenediamine,

$$C_2H_4(NH_2)_2,C_7H_8N_4O_2+C_2H_4(NH_2)_2,2C_7H_8N_4O_2.$$

Eupnine.—Caffeine preparation containing iodine.

Euporphine.—Apomorphine methyl bromide,

$$C_{17}H_{17}NO_2.CH_3Br,H_2O.$$

Eupyrine.—*p*-Phenetidine-vanillin ethyl carbonate.

$$C_6H_4(OC_2H_5)N : CH.C_6H_3(OCH_3)O.CO_2C_2H_5.$$

Euresol.—Resorcinol monoacetate, $C_6H_4(OH)(O·C_2H_3O)$.

Euquinine.—Quinine ethyl carbonate,

$$C_2H_5O.CO.OC_{20}H_{23}N_2O.$$

Euscopol.—Inactive scopolamine hydrobromide,

$$C_{17}H_{21}NO_4,HBr.$$

Eustenin.—Addition product of theobromine-sodium and sodium iodide, $C_7H_7N_4O_2Na,NaI$.

Exodin.—Mixture of diacetylrufigallic acid tetramethyl ether 23, rufigallic hexamethyl ether 30, and acetylrufigallic pentamethyl ether 47%.

Fæxin. See ceredine.

Fermenlactyl.—Preparation of lactic acid bacilli.

Feronuclin.—Dry yeast extract.

Ferratogen. See ferrinol.

Ferrichthol.—Ichthyol preparation containing iron.

Ferrinol.—Iron nucleinate; contains 21% Fe_2O_3 and 2½% P.

Fibrolysin.—15% solution of a combination of thiosinamine (2 mols.) and sodium salicylate (1 mol.).

Fluoram.—Ammonium bifluoride.

Forgenin.—Tetramethyl-ammonium formate,

$$H.COON(CH_3)_4.$$

Formamint.—Preparation obtained from 1 mol. of lactose and at least 5 mols. of formaldehyde.

Forman.—Chloromethyl menthyl ether, $C_{10}H_{19}O.CH_2Cl$.

Formicin.—Formaldehyde-acetamide,

$$CH_3.CO.NH.CH_2OH \text{ or } CH_3.C(: NH).O.CH_2OH.$$

Formidin.—Methylenedisalicylic iodide, $C_{15}H_{16}O_6I_2$.

Formitrol.—Formaldehyde preparation.

Formolyptol. See formitrol.

Formurol.—Addition product of hexamethylenetetramine and sodium citrate, $C_6H_{12}N_4,C_6H_7O_7Na$.

Fredo.—Calcium hydrosulphite.

Furfurin.—A glyoxaline derivative, $C_3H_3N_2(C_4H_3O)_3$.

Gaduol.—Extract containing the alcohol-soluble constituents of cod-liver oil.

Gallogen.—Ellagic acid, $C_{14}H_6O_8$.

Gastrosan.—Bismuth bisalicylate.

Gaultheriasalol.—Methyl salicylosalicylate,

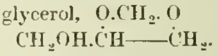
$$HO.C_6H_4.CO.OC_6H_4.COOCH_3.$$

Glidine.—A protein preparation from wheat.

Glonoin.—Nitroglycerin.

Glycarbin.—Glyceryl carbonate.

Glycerin-formal.—A condensation product of formaldehyde and glycerol,



$$\begin{matrix} & O.CH_2.O & \\ CH_2OH.CH & \text{——} & CH_2.\end{matrix}$$

Glycobrom.—Glyceryl ester of dibromohydrocinnamic acid, $C_3H_5[O.CO.(CHBr)_2C_6H_5]_3$.

Glycocyamine.—Guanidine acetic acid.

Glycosal.—Monosalicylic ester of glycerol,

$$C_3H_5(OH)_2.O.CO.C_6H_4(OH).$$

Gomaine.—Solution of iodoform and camphor in sesamé oil.

Griserin, Novum.—Iodohydroxyquinoline sulphonic acid, $C_9H_4I(OH)(SO_3H)N$, mixed with 20% $NaHCO_3$.

Guaiachinol.—Quinine dibromoguaiacolate,

$$C_6H_2Br_2(OCH_3)OH,C_{20}H_{24}N_2O_2.$$

Guaiamaltin.—Mixture of malt extract and potassium sulphoguaiacolate.

Guatannin.—Guaiacol tannocinnamate.

Gynoval.—Isobornyl isovalerate, $C_4H_9.COOC_{10}H_{17}$.

Hectine.—Sodium benzosulpho-*p*-aminophenylarsinate, $C_6H_5.SO_2.NH.C_6H_4.AsO(OH)(ONa)$.

Hediorite.—Lactone of α-glucoheptonic acid.

Hegonon.—Ammonio-silver nitrate-albumose (7% Ag).
Helcosol.—Basic bismuth pyrogallate, $HO.C_6H_3O_2BiOH$.
Helicon. See acetosal.
Helmitol.—Hexamethylenetetramine anhydromethylene-citrate, $C_6H_{12}N_4.C_7H_6O_7$.
Hemisine. See adrenaline.
Hermophenyl.—Mercury sodium phenoldisulphonate, $(SO_3Na)_2C_6H_2O(Hg)$.
Hetoform.—Basic bismuth cinnamate,

$$(C_6H_5.CH:CH.CO_2)_3Bi,Bi_2O_3.$$

Hetralin.—Addition product of resorcinol and hexamethylenetetramine, $C_6H_{12}N_4.C_6H_4(OH)_2$.
Hexal.—Hexamethylenetetramine salicylsulphonic acid, $C_6H_{12}N_4.(HO)C_6H_3(COOH)SO_3H$.
Hexamine.—Hexamethylenetetramine, $C_6H_{12}N_4$.
Hexanatrin.—Combination of hexamethylenetetramine and acid sodium phosphate.
Hexanitrin.—Mannitol hexanitrate,—

$$CH_2O(NO_2)(CHO.NO_2)_4.CH_2ONO_2.$$

Histamin.—β-Iminazolylethylamino.
Homorenon.—Ethylaminoacetopyrocatechol hydrochloride, $(HO)_2.C_6H_3.CO.CH_2.NH(C_2H_5).HCl$.
Hopogan. See magnesium perhydrol.
Hydramin.—A combination of *p*-phenylenediamine and quinol.
Hydrargol.—Mercury succinimide, $[C_2H_4(CO)_2N]_2Hg$.
Hydrargotin.—Mercury tannate (50% Hg).
Hydrarsan.—Solution of a mixture of arsenious, mercuric and potassium iodides and antipyrine.
Hydriodol. See cypridol.
Hydropyrin. See apyron.
Hydrosulphite N.F.—Condensation product of formaldehyde and sodium hydrosulphite; a mixture of formaldehyde sodium bisulphite, $NaHSO_3,CH_2O$, and formaldehyde-sodium sulphoxylate, $NaHSO_2,CH_2O$.
Hydrosulphite N.F. extra, or conc., or extra conc.—Formaldehyde-sodium-sulphoxylate.
Hyperol.—Compound of hydrogen peroxide and urea, with a trace of citric acid to render it stable.
Hypnogen. See veronal.
Hydraldite A.—See hydrosulphite N.F.
Hydraldite C.—See hydrosulphite N.F. extra.
Iachiol.—Silver fluoride.
Ichthargan.—Silver ichthyolsulphonate (30% Ag).
Ichthermol.—Mercury compound of ichthyol.
Ichthosulphol.—Ichthyol.
Ichthynal. See ichthosulphol.
Ichthyolidin.—Piperazine ichthyolate.
Ichthyol-salicyl.—Mixture of ichthyol and sodium salicylate.
Imogen.—Sodium diaminonaphtholsulphonate,

$$(NH_2)_2C_{10}H_4(OH)SO_3Na.$$

Indoform.—Salicylic methylene acetate; from formaldehyde and acetylsalicylic acid.
Insipin.—Diglycollic ester of quinine sulphate,

$$(CH_2COO.C_{20}H_{23}N_2O)_2O,H_2SO_4,3H_2O.$$

Iodanytol.—10% solution of iodine in anytin (a 33% solution of ichthyol).
Iodeigon.—Albumin preparation containing iodine.
Iodin.—Iodised arachis oil.
Iodinol.—Iodised sesamé oil.
Iodival.—Monoiodoisovalerylurea.

$$(CH_3)_2CH.CHI.CO.NH.CO.NH_2.$$

Iodocol.—Prepared from guaiacol and iodine in sodium oline.
Iodofan.—Monoiododihydroxybenzene-formaldehyde.
Iodoglidine.—Preparation of wheat gluten containing 10% I.
Iodoglobin.—Di-iodotyrosine,

$$HO.C_6H_2I_2.CH_2.CH(COOH)NH_2.$$

Iodogluten.—Preparation of vegetable albumin containing 8% I.
Iodolen.—Combination of iodol (tetra-iodopyrrole) and lbumin; contains 30% iodol.
Iodolin.—Quinoline chloromethyliodochloride,

$$C_9H_7N(CH_3Cl)CH.$$

Iodolinum. See iodolin.
Iodolysin.—Preparation similar to tiodine; contains 43% thiosinamine and 47% I.
Iodomenin.—Iodised casein containing bismuth (10% I).
Iodophenin.—Tri-iodophenacetin.
Iodoprotein.—Albumin preparation containing 10% I.
Iodozol.—Di-iodo-p-phenolsulphonic acid,

$$C_6H_2I_2(OH)SO_3H,3H_2O.$$

Iodylin.—Bismuth iodosalicylate.
Iodyloform.—Iodised gelatin (10% I).
Iohydrin.—Di-iodoisopropyl alcohol,

$$CH_2I.CH(OH).CH_2I.$$

Iothion. See iohydrin.
Isarol. See ichthosulphol.
Isoform.—*p*-Iodoxyanisol, $CH_3O.C_6H_4.IO_2$.
Isopral.—Trichloroisopropyl alcohol, $CCl_3.CH(OH).CH_3$.
Istizin.—1.8-Dihydroxyanthraquinone.
Jecovol.—Emulsion of cod-liver oil with glycerophosphates of sodium, calcium and iron.
Joha.—Solution of 40% of salvarsan in iodinol.
Kachin.—A pyrocatechol photographic developer.
Kakodyljacol. See cacodyliagol.
Kalmopyrin.—Calcium acetylsalicylate,

$$(C_2H_3O.OC_6H_4.COO)_2Ca$$

Kalzose.—Casein preparation containing calcium.
Kephaldol.—Preparation made from phenetidine and salicylic and citric acids.
Kinetine.—Combination of quinine and hectine.
Kineurine.—Quinine glycerophosphate,

$$C_3H_7O_3H_2PO_3(C_{20}H_{24}N_2O_2)_2,4H_2O.$$

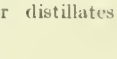
Koronium bromide.—Strontium bromide, $SrBr_2.6H_2O$.
Krelos.—Mixture of tar distillates and rosin soap solution.
Kresegol. See cresegol.
Kresosteril. See cresosteril.
Kryogenin. See cryogenin.
Kynurin.—*p*-Hydroxyquinoline, $C_9H_6(OH)N$.
Lactagol.—Powdered extract of cotton-seed.
Lactanin.—Bismuth bilacto-monotannate.
Lacteol.—Preparation of lactic acid baccilli.
Lactigen. See lacteol.
Lactilloids. See lacteol.
Lactobaccilline. See lacteol.
Lactone. See lacteol.
Laxans. See purgen.
Laxatol. See purgen.
Laxen. See purgen.
Laxoin. See purgen.
Lecithol.—Lecithin from egg yolk.
Lecutyl.—Combination of lecithin and copper cinnamate (1·5% Cu).
Lenicet.—Basic aluminium acetate,

$$Al_2(OH)_2(C_2H_3O_2)_4,H_2O.$$

Lentin.—*m*-Phenylenediamine hydrochloride,

$$C_6H_4(NH_2)_2,2HCl.$$

Leptynol.—Colloidal palladous hydroxide suspended in sesamé oil.

Leucoline.—Quinoline, 

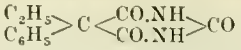
$$C_6H_4\left<\begin{matrix}CH:CH\\ N:\dot{C}H\end{matrix}\right.$$

Levurargyre.—Mercury compound of nucleoprotein.
Levuretin.—Dried yeast cells.
Levurinose. See levuretin.
Lipobromol.—Brominated poppyseed oil (33% Br).
Lipoiodin.—Di-iodobrassidic acid ethyl ester,

$$C_{19}H_{39}CI:CI.CO_2C_2H_5.$$

Lithium-diuretin.—Addition product of theobromine-lithium and lithium salicylate, $C_7H_7N_4O_2Li,HO.C_6H_4.CO_2Li$.
Lithyol. See ichthosulphol.
Lodal.—An oxidation product of laudanosine.
Lofotol.—Cod-liver oil charged with carbon dioxide.
Lucidol.—Benzoyl peroxide, $(C_6H_5.COO)_2O_2$.
Luesan.—Glidine preparation containing mercury.

Luminal.—Phenyl ethyl malonylurea,



$$\begin{matrix}C_2H_5\\C_6H_5\end{matrix}>C<\begin{matrix}CO.NH\\CO.NH\end{matrix}>CO$$

Lycin. See acidol.

Lygosin.—Di-hydroxydibenzalacetone,

$$(HO.C_6H_4.CH : CH)_2CO.$$

Lysochlor.—Chloro-*m*-cresol, $C_6H_3Cl(CH_3)OH$.

Lysoform.—A liquid formaldehyde potassium soap.

Magnesium-perhydrol.—Mixture containing magnesia and 15 or 25% MgO_2.

Malonal. See veronal.

Malourea. See veronal.

Maltyl.—Dry malt extract; contains about 90% of soluble carbohydrates.

Maretin.—*m*-Tolylsemicarbazide,

$$CH_3.C_6H_4.NH.NH.CO.NH_2.$$

Maricol.—Magnesium ricinoleate, $(HO.C_{17}H_{32}CO_2)_2Mg$.

Medinal.—Sodium compound of veronal.

Melrubin.—Sodium 1-phenyl-2.3-dimethylpyrazolone-4-aminomethane sulphonate, $C_{11}H_{11}N_2O.NH.CH_2.SO_3Na$.

Melubrin.—Mercury salicylsulphonate.

Menthophenol.—Mixture of phenol 1, menthol 3 parts.

Mercuriocoleolo.—Double oleate of cholesterol and mercury.

Mergal.—A combination of mercury cholate and albumin tannate.

Merjodin.—Mercury di-iodophenol-*p*-sulphonate,

$$(HO.C_6H_2I_2.SO_3)_2Hg.$$

Merlusan.—Mercury compound of tyrosine (53% Hg), $C_9H_9O_3NHg$.

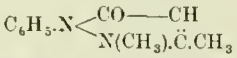
Merochinol.—Mercury hydroxyquinolinesulphonate,

$$(HO.C_9H_5N.SO_3)_2Hg.$$

Mesotan.—Salicylic methoxymethyl ester,

$$HO.C_6H_4.COO.CH_2.OCH_3.$$

Methozin.—Antipyrine (phenyldimethylpyrazolone),



$$C_6H_5.N<\begin{matrix}CO—\!—CH\\N(CH_3).\ddot{C}.CH_3\end{matrix}$$

Methylrhodin.—Methyl acetylsalicylate,

$$C_2H_3O.O.C_6H_4.CO_2CH_3.$$

Metoquinone.—Addition product of metol (methyl-*p*-aminophenol) and quinol, $C_6H_4[HO(CH_3)NH.C_6H_4.OH]_2$.

Metramine.—See hexamine.

Migralgine.—Mixture of antipyrine 88, caffeine 9, and salicylic acid 3 parts, fused together.

Momordicine.—Elaterin, $C_{20}H_{28}O_5$.

Monotal.—Guaiacol methyl glycollate,

$$CH_2(OCH_3).COOC_6H_4.OCH_3.$$

Morphosan.—Morphine methyl bromide,

$$C_{17}H_{19}O_3N.CH_3Br,H_2O.$$

Mucogeène.—An anthraquinone derivative,

$$C_{18}H_{15}N_2O_2Cl.$$

Mydriasine.—Atropine methyl bromide,

$$C_{17}H_{23}NO_3,CH_3Br.$$

Naphtholsalol.—β-Naphthyl salicylate,

$$HO.C_6H_4.COO.C_{10}H_7.$$

Narcyl.—Ethylnarceine hydrochloride,

$$C_{23}H_{26}(C_2H_5)NO_8,HCl.$$

Nargol.—Silver nucleinate (10% Ag).

Nealpon. See pantopon.

Neoform.—Bismuth compound of tri-iodophenol,

$$C_6H_2I_3OBi(OH)_2,Bi_2O_3.$$

Neoleptol.—Triformyltrimethylenetriamine.

Neopine.—Hydroxycodeine, $C_{18}H_{20}NO_3(OH)$.

Neopyrin.—Valerylaminoantipyrine.

Neosalvarsan.—Sodium 3.3′-diamino-4.4′-dihydroxyarsenobenzene-formaldehyde sulphoxylate,

$$NH_2.C_6H_3(OH)As.As.C_6H_3(OH)NH(CH_2O)SONa.$$

Neosiode.—Iodocatechin, $(C_{15}H_{14}O_6,3H_2O)_3I$.

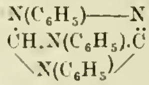
Nerolin.—β-Naphthyl methyl ether, $C_{10}H_7O.CH_3$.

Neuraltein.—Sodium *p*-ethoxyphenylaminomethane sulphonate, $C_2H_5O.C_6H_4.NH.CH_2.SO_3Na$.

Neuronal.—Diethylbromo-acetamide,

$$(C_2H_5)_2CBr.CO.NH_2.$$

Nitron.—1.4-Diphenyl-3.5-endanilodihydrotriazole,



Nizin.—Zinc sulphanilate, $(NH_2.C_6H_4.SO_3)_2Zn$.

Novargan.—Protein preparation containing 10% Ag.

Novaspirin.—Methylenecitrylsalicylic acid.

Novatophan.—Ethyl 6-methyl-2-phenylquinoline-4-carboxylate, $C_6H_5.C_9H_4N(CH_3)COOC_2H_5$.

Noviform.—Bismuth compound of tetrabromopyrocatechol.

Novocaine.—*p*-Aminobenzoyldiethylaminoethanol hydrochloride, $NH_2.C_6H_4CO.O.CH_2.CH_2.N(C_2H_5)_2,HCl$.

Novocol.—Sodium monoguaiacol phosphate.

Nucleogen.—Preparation containing iron nucleinate and arsenic.

Oleanodyne.—Preparation containing oleic acid, aconitine, atropine, morphine, and veratrine.

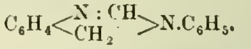
Oleoguaiacol.—Guaiacol oleate, $CH_3O.C_6H_4O.CO.C_{17}H_{33}$.

Omnopon. See pantopon.

Omorol. See novargan.

Optochin.—Ethylhydrocupreine.

Orexin.—Phenyldihydroquinazoline,



$$C_6H_4<\begin{matrix}N : CH\\CH_2\end{matrix}>N.C_6H_5.$$

Orsudan.—Sodium methyl acetyl-*p*-aminophenylarsinate $C_2H_3O.NH.C_6H_3(CH_3).AsO(OH)(ONa)$.

Ortizon.—See hyperol.

Ovoferrin.—Vitellin preparation containing iron.

Oxylith.—Sodium peroxide.

Oxyntin.—A combination of albumin and hydrochloric acid.

Palmiacol. See cetiacol.

Pantopon.—Mixture of the soluble hydrochlorides of opium alkaloids.

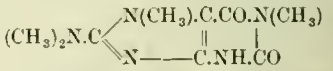
Parabismut.—Bismuth paranucleinate.

Paracodine.—Dihydrocodeine, $C_{17}H_{19}(OCH_3)(OH)NO$.

Paralysol.—Solid cresol preparation,

$$C_6H_4(CH_3)OK,3C_6H_4(CH_3)OH.$$

Paraxin.—Dimethylamino-1.7-dimethylxanthine,



Pegnine.—Preparation of lactose and rennet.

Pellidol.—Diacetylaminoazotoluene.

Pepsalia.—Preparation of pepsin and sodium chloride.

Perborax.—Sodium perborate, $NaBO_3,4H_2O$.

Perborol.—See perborax.

Perhydrit.—See hyperol.

Perhydrol.—Solution of hydrogen peroxide, 100 vol., o 30% by weight.

Permidan.—Dimethylaminopyrazolone, $C_5H_9N_3O$.

Phenalgin.—Phosphoammonioacetanilide.

Phenamine.—Amino-acet-*p*-phenetidine hydrochloride

$$C_2H_5O.C_6H_4.NH.CO.CH_2.NH_2,HCl.$$

Phenolax. See purgen.

Phenosal.—Monophenetidide of salicylacetic acid.

$$COOH.C_6H_4.O.CH_2.CO.NH.C_6H_4.OC_2H_5.$$

Phenoval.—Bromovalerylphenetidine,

$$C_4H_8Br.CO.NH.C_6H_4.OC_2H_5.$$

Phenyform.—Condensation product of phenol an formaldehyde.

Phenylon. See methozin.

Phobrol.—50% solution of chloro-*m*-cresol in potas castor oil soap.

Photoxylin. See celloidin.

Picrastol.—Dimethyloldiformylmethenyltetramethylen pentamine, $C_9H_{17}N_5O_4$.

Picratol.—Silver picrate.

Pinakol.—A pyrogallol photographic developer in which part of the alkali usually employed is replaced by sodium aminoacetate.

Piral.—Pyrogallol, $C_6H_3(OH)_3$.

Plecavol.—Consists chiefly of *p*-aminobenzoyleugenol, $NH_2.C_6H_4CO.O.C_6H_3(C_3H_5)OCH_3$, tricresol (a mixture of the three cresols) and formaldehyde.

Pleistopon.—Similar to pantopon, except that it contains no narcotine.

Pneumin.—Condensation product of creosote and formaldehyde.

Pneumosan.—Amyl thiotrimethylamine.

Propæsin.—Propyl ester of *p*-aminobenzoic acid,

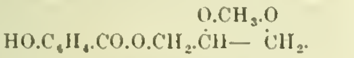
$$NH_2.C_6H_4.COOC_3H_7.$$

Proponol.—Dipropylbarbituric acid,

$$(C_3H_7)_2C{<}\begin{array}{l}CO.NH\\CO.NH\end{array}{>}CO$$

Proposote.—Creosote phenylpropionate.

Protosal.—Salicyclic acid glycerol formal ester,



$$\begin{array}{r}O.CH_3.O\\HO.C_4H_4.CO.O.CH_2.\dot{C}H—\ \dot{C}H_2.\end{array}$$

Protylin.—Albumin preparation containing phosphorus.

Purgatin.—Anthrapurpurin diacetate,

$$C_{14}H_5O_2(OH)(O.C_2H_3O)_2$$

Purgatol. See purgatin.

Purgen.—Phenolphthalein, $C_6H_4{<}\begin{array}{l}C(C_6H_4.OH)_2\\OC\text{————}\end{array}{>}O.$

Pyoktanin.—Methyl Violet,

$$[C_6H_4.N(CH_3)_2]_2(C_6H_4.NH.CH_3)C.Cl.$$

Pyracetosalyl.—Addition product of antipyrine and acetylsalicylic acid, $C_{11}H_{12}N_2O+C_2H_3O.OC_6H_4.COOH_1$.

Pyrobromone.—Bromodimethylaminoantipyrine.

Pyronal.—Antipyrine salicylacetate,

$$C_{11}H_{12}N_2O,HO.C_6H_4CO.CH_2.COOH.$$

Pyrophan.—Combination of pyrogallol and dimethylamine.

Quietol.—Dimethylaminodimethylisovalerylpropyl ester hydrobromide.

Quinaphenin.—Phenetidine quinine carbonic ester,

$$CO(NH.C_6H_4.OC_2H_5)(C_{20}H_{23}N_2O_2).$$

Quinaphthol.—Quinine β-naphtholsulphonate,

$$C_{20}H_{24}N_2O_2,(HO.C_{10}H_6.SO_3H)_2.$$

Quineonal.—Compound of quinine and veronal

Quinine lygosinate.—Dihydroxydibenzalacetone-quinine,

$$CO(CH:CH.C_6H_4OH.C_{20}H_{24}N_2O_2)_2.$$

Quinoform.—Quinine formate, $C_{20}H_{24}N_2O_2,HCOOH$; also a condensation product of cinchotannic acid and formaldehyde.

Quinopyrin.—A combination of antipyrine, 2, and quinine hydrochloride, 3 parts.

Quinosol.—Mixture of hydroxyquinoline and potassium sulphates, $C_9H_6NOSO_3K,4H_2O$.

Quinotropin.—Hexamethylenetetramine quinate,

$$C_6H_{12}N_4,C_6H_7(OH)_4CO_2H.$$

Regulin.—Broken-up agar-agar with 25% of Cascara extract.

Resaldol.—Resorcylbenzoic acid ethyl ester,

$$(HO)_2C_6H_3.CO.C_6H_4.CO_2C_2H_5.$$

Rexotan.—Methylenetannin-urea,

$$C_{14}H_9O_9.CH_2.NH.CO.NH_2.$$

Rheumatin.—Saloquinine salicylate,

$$HO.C_6H_4.COO.C_{20}H_{23}N_2O,C_6H_4(OH)COOH.$$

Rhodaform.—Addition product of hexamethylenetetramine and methyl thiocyanate, $C_6H_{12}N_4,CH_3CNS$.

Riopan.—Soluble brown powder containing 50% of ipecacuanha alkaloids in the form of their hydrochlorides.

Rongalite C.—See hydrosulphite N.F. extra.

Sabromine.—Calcium dibromobehenate (29% Br),

$$(C_{22}H_{41}O_2Br_2)_2Ca$$

Sajodin.—Calcium monoiodobehenate, $(C_{22}H_{42}O_2I)_2Ca$.

Salacetin. See acetosal.

Saletin. See acetosal.

Salibromin.—Dibromosalicylic methyl ester,

$$C_6H_2Br_2(OH)COOCH_3.$$

Salicreol.—Creosote salicylate.

Salimenthol.—Menthyl salicylate, $HO.C_6H_4.COOC_{10}H_{19}$.

Salit.—Bornyl salicylate, $HO.C_6H_4.COO.C_{10}H_{17}$.

Salocreol. See salicreol.

Saloquinine.—Salicylquinine, $HO.C_6H_4.CO_2.C_{20}H_{23}N_2O$.

Salufer.—Sodium silicofluoride.

Salvarsan.—Dihydroxydiaminoarsenobenzene dihydrochloride,

$$HCl.NH_2(OH)C_6H_3.As.As.C_6H_3(OH)NH_2.HCl,2H_2O.$$

Salvarsan, New.—See neosalvarsan.

Santheose.—Theobromine, $C_5H_2(CH_3)_2N_4O_2$.

Santyl.—Santalyl salicylate, $HO.C_6H_4.COO.C_{15}H_{23}$.

Sauerin.—Preparation of lactic acid baccilli.

Savore.—Preparation of milk, cereal proteins and albumoses, and carbohydrates.

Scopomorphine.—Sterilised solution containing per c.c., 0·0006 grm. of euscopol and 0·015 grm. of morphine hydrochloride.

Sedeff.—Effervescent preparation containing opium, bismuth, and digestive ferments.

Sennatin.—Preparation containing the active principles of senna leaves.

Sennax.—Preparation containing the water-soluble glucosides of senna leaves.

Sidonal, New.—Mixture of quinic acid, $C_6H_7(OH)_4CO_2H$, and its anhydride.

Soamin.—Sodium arsanilate,

$$NH_2.C_6H_4.AsO(OH)(ONa),5H_2O.$$

Solurol.—Thyminic acid (nucleotinphosphoric acid).

$$C_{30}H_{46}N_4O_{15}(P_2O_5)_2.$$

Somnoform.—Mixture of ethyl chloride 60, methyl chloride 35, and ethyl bromide 5%.

Sophol.—Silver formonucleinate (20% Ag).

Spirarsyl.—Sodium salt of arsenophenylglycine,

$$(CO_2Na.CH_2.NH.C_6H_4)_2As_2.$$

Spirosal.—Monoglycol ester of salicylic acid,

$$HO.C_6H_4.COO.CH_2.CH_2OH.$$

Stearosan.—Compound of santalol and stearic acid.

Stovaine.—Hydrochloride of dimethylamino tertiary amyl benzoate, $C_6H_5COO.C(CH_3)(C_2H_5)CH_2N(CH_3)_2,HCl$.

Styptol.—Cotarnine phthalate,

$$(C_{12}H_{13}NO_3)_2,C_6H_4(COOH)_2.$$

Subcutin.—Anæsthesin phenolsulphonate,

$$C_6H_4(COOC_2H_5)NH_2,HO.C_6H_4.SO_3H.$$

Sublamine.—Mercuric ethylenediamine sulphate (43% Hg).

Sucramine.—Ammonium salt of saccharin.

Sulfoid.—Preparation of colloidal sulphur (80% S) with an albuminous substance as protective colloid.

Sulphoform.—Triphenylstibine sulphide, $(C_6H_5)_3SbS$.

Suprarenaline. See epinephrine.

Suprarenine. See adrenaline.

Synthalin.—Piperonylquinolinecarboxylic acid methyl ester, $CH_2O_2.C_6H_3.C_9H_5N.COOCH_3$.

Syrgol.—Colloidal silver.

Tachiol.—Silver fluoride.

Tanargan.—A combination of tannin and silver albuminate.

Tanninphenolmethane.—Condensation product of tannin formaldehyde and phenol.

Tanninthymolmethane.—Condensation product of tannin, formaldehyde, and thymol.

Tannismuth.—Bismuth bitannate.

Tannisol.—Methyleneditannin $(C_{14}H_9O_9)_2CH_2$.

Tannobromine.—A combination of dibromotannin and formaldehyde.

Tannocreosoform.—Condensation product of tannin, formaldehyde, and creosote.

Tannoguaiaform.—Condensation product of tannin, formaldehyde, and guaiacol.

Tannothymal. See tanninthymolmethane.

Tannyl.—Oxychlorocasein tannate.

Tenosin.—Solution containing, per c.c., 0·0005 grm. of β-iminazolylethylamine and 0·02 grm. of *p*-hydroxyphenylethylamine.

Testijodyl.—Combination of coagulated blood albumin and iodine.

Theobromose.—Lithium compound of theobromine, $C_7H_7N_4O_2Li$.

Theocin.—Sodium compound of theobromine,

$$C_7H_7N_4O_2Na.$$

Theolactin.—Addition product of theobromine sodium and sodium lactate.

Theosalin.—Addition product of theobromine-sodium and sodium sulphosalicylate, $C_7H_7N_4O_2Na,C_7H_5O_3.SO_3Na$.

Thephorin.—Addition product of theobromine-sodium and sodium formate, $C_7H_7N_4O_2Na,HCO_2Na,H_2O$.

Thermiol.—Sodium phenylpropiolate, $C_6H_5.C \vdots C.CO_2Na$.

Thialion.—Preparation containing sodium sulphate (26%), citrates of sodium (56), potassium (3) and lithium (3), sodium chloride (3) and water (9%).

Thigenol.—Sodium salt of ichthoform (condensation product of ichthyol and formaldehyde).

Thiophysem.—See tiodine.

Tholaform.—Mixture of equal parts of menthol and trioxymethylene.

Throphleol.—50% solution of erythrophleine hydrochloride (from casca bark) in eugenol.

Thymatol.—Thymol carbonate, $CO(O.C_{10}H_{13})_2$.

Thymegol.—Mercury potassium salt of thymol-*p*-sulphonate.

Thymolin.—Mixture of naphthalene 18, camphor 1, and thymol 1 part.

Thymoloform.—Condensation product of formaldehyde and thymol.

Thyresol.—Santalol methyl ether, $C_{15}H_{23}O.CH_3$.

Tiodine.—Thiosinamine ethyl iodide,

$$C_3H_5.NH.CS.NH_2,C_2H_5I.$$

Toxynon.—Sodium *m*-acetylaminomercuribenzoate, $HgOH.C_6H_3(NH.C_2H_3O)CO_2Na$.

Tricalcol.—Colloidal combination of tricalcium phosphate and albumin.

Tricarbin. See glycarbin.

Triferrin. See ferrinol.

Trigemin.—Compound of butyl chloral hydrate and pyramidone (dimethylaminoantipyrine).

Trilactine.—Preparation of lactic acid bacilli.

Trinitrin.—Nitroglycerin.

Trixidin.—An emulsion of antimony trioxide (30% Sb_2O_3).

Tryen.—See Griserin, Novum.

Trygase.—Dried yeast cells.

Trypan Red.—Prepared from tetrazotised benzidinesulphonic acid and 2 mols. of sodium naphthylaminedisulphonate,

$$\begin{array}{l}(SO_3H)C_6H_3.N_2.C_{10}H_4(SO_3Na)_2NH_2\\ \dot{C}_6H_4.N_2.C_{10}H_4(SO_3Na)_2NH_2.\end{array}$$

Tryparosan.—Chlorinated Parafuchsin.

Tylcalsin. See kalmopyrin.

Tyllithin. See apyron.

Tylmarin.—Acetyl-o-coumaric acid—

$$C_2H_3O.OC_6H_4.CH : CH.CO_2H.$$

Tylnatrin.—Sodium acetylsalicylate,

$$C_2H_3O.OC_6H_4.COONa.$$

Tyramine.—*p*-Hydroxyphenylethylamine hydrochloride,

$$HO.C_6H_4.C_2H_4.NH_2,HCl.$$

Ulmarene. See mesotan.

Unal.—Alkali salt of *p*-aminophenol hydrochloride; *rodinal* is the concentrated solution.

Uraminoantipyrin.—Antipyrylurea,

$$NH_2.CO.NH.C_{11}H_{11}N_2O.$$

Urapurgol. See helmitol.

Urea-bromine.—Combination of urea and calcium bromide (36% Br),$4CO(NH_2)_2,CaBr_2$.

Uritone.—See hexamine.

Urocitral.—Addition product of theobromine-sodium and sodium citrate.

Urodonal.—Granular preparation of hexamethylenetetramine, sidonal (piperazine quinate), and lysidine (methylglyoxalidine).

Urogenin.—Addition product of theobromine and lithium hippurate, $C_7H_8N_4O_2,C_6H_5.CO.NH.CH_2.CO_2Li$.

Urol.—Urea quinate.

Urosin.—Lithium quinate, $C_6H_7(OH)_4COOLi$.

Urotropine, New. See helmitol.

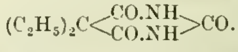
Valamin.—Isovaleric ester of tertiary amyl alcohol.

Valearin.—Valeryltrimethylammonium chloride.

Valisan.—Bornylbromoisovalerate,$C_4H_8BrCO.OC_{10}H_{17}$.

Valyl.—Valeric diethylamide, $C_4H_9.CO.N(C_2H_5)_2$.

Veronal.—Diethylbarbituric acid (diethylmalonylurea),



$$(C_2H_5)_2C\Big<\begin{matrix}CO.NH\\CO.NH\end{matrix}\Big>CO.$$

Veropyrin.—Mixture of dionine (ethylmorphine hydrochloride) 0·01, veronal-sodium 0·2, and kalmopyrin, 0·5 part.

Vesalvine. See hexamine.

Vesipyrine.—Phenyl acetylsalicylate,

$$CH_3.CO.OC_6H_4.COOC_6H_5.$$

Vimopyrin.—*p*-Phenetidine tartrate.

Vioform.—Hydroxyquinoline chloroiodide,

$$C_9H_6N(OH)ICl.$$

Vitafer.—Preparation of milk and glycerophosphates of calcium and sodium.

Xaxa. See acetosal.

Xaxaquin.—Quinine acetylsalicylate,

$$C_{20}H_{24}N_2O_2.CH_3CO.OC_6H_4.COOH.$$

Yara-yara.—See nerolin.

Yatren.—See Griserin, Novum.

Zymin.—Special dry powdered yeast.—A. S.

Report of Select Committee on Patent Medicines. Parliamentary Paper. Wyman and Sons, Fetter Lane, E.C. Price 3d. [T.R.]

The Select Committee appointed to consider and inquire into the question of the sale of patent and proprietary medicines and medical preparations and appliances, and advertisements relating thereto, and to report what amendments, if any, in the law are necessary or desirable," have issued their report. It deals with the law in foreign countries, in British Dominions and in the United Kingdom, legal and official anomalies, the inadequacy of existing law, statistics of the trade in proprietary remedies, analysis of secret remedies, fraudulent claims, etc.

Findings of the Committee.

After careful consideration of the evidence laid before them the Committee find :—

(1) That there is a large and increasing sale in this country of patent and proprietary remedies and appliances and of medicated wines.

(2) That these remedies are of widely differing characters, comprising (*a*) genuine scientific preparations; (*b*) unobjectionable remedies for simple ailments; and (*c*) many secret remedies making grossly exaggerated claims of efficacy; causing injury by leading sick persons to delay in securing medical treatment; containing in disguise large proportions of alcohol: sold for improper purposes; professing to cure diseases incurable by medication; or essentially and deliberately fraudulent.

(3) That this last-mentioned class (*c*) of remedies contains none which spring from therapeutical or medical knowledge, but that they are put upon the market by ignorant persons, and in many cases by cunning swindlers who exploit for their own profit the apparently invincible credulity of the public.

(4) That this constitutes a grave and widespread public evil.

(5) That in British Dominions and foreign countries severe legal restrictions exist, and that there is a tendency still further to strengthen the law against these articles.

(6) That no Department of State and no public officer is charged with the duty of controlling the sale and advertisement of proprietary remedies in this country; that the Home Office and the Local Government Board are virtually powerless in this respect; that the Privy Council Office, though supposed to be specially concerned with the sale of drugs, has no initiative in the matter, and, in fact, it fulfils no useful function in this connection.

(7) That the existing law is chaotic and has proved inoperative, and that successful prosecution for fraud in the advertisement and sale of secret remedies is fraught with the greatest difficulty, though the Public Prosecutor has perhaps not sufficiently tested the powers of the existing law in respect to such cases.

(8) That consequently the traffic in secret remedies, except as regards scheduled poisons and the grosser forms of impropriety, is practically uncontrolled in this country.

(9) That this is an intolerable state of things, and that new legislation to deal with it, rather than merely the amendment of existing laws, is urgently needed in the public interest.

(10) That grave injury is caused to the public by the existing large sale of medicated wines.

(11) And that while, for reasons already given, it is not desirable to require the exhibition of formula of every secret remedy, nevertheless it is improper that under the protection of the law enormous quantities of alleged remedies should be sold the composition of which is unknown to any person except the manufacturers of them; and that, therefore, the formulæ of all secret remedies should be required to be communicated to a competent officer appointed under the authority of a Minister of State, but that such formulæ should not be divulged to any other person except as hereinafter recommended.

Recommendations of the Committee.

The Committee, therefore, recommend:—

(1) That the administration of the law governing the advertisement and sale of patent, secret and proprietary medicines and appliances be co-ordinated and combined under the authority of one Department of State.

(2) That this administration be part of the functions of the Ministry of Public Health when such a Department is created, and that in the meanwhile it be undertaken by the Local Government Board.

(3) That a competent officer be appointed to this Department, with the duty of advising the Minister at the head of the Department concerned regarding the enforcement of the law in respect of these remedies.

(5) That there be established at the Department concerned a register of manufacturers, proprietors, and importers of patent, secret and proprietary remedies, and that every such person be required to apply for a certificate of registration and to furnish (*a*) the principal address of the responsible manufacturer or representative in this country, and (*b*) a list of the medicine or medicines proposed to be made or imported.

(6) That an exact and complete statement of the ingredients and the proportions of the same of every patent, secret, and proprietary remedy; of the contents other than wine, and the alcoholic strength of every medicated wine, and a full statement of the therapeutic claims made or to be made; and a specimen of every appliance for the cure of ailments other than recognised surgical appliances, be furnished to this Department, such information not to be disclosed except as hereinafter recommended, the Department to control such statement, at their discretion, by analyses made confidentially by the Government Chemist.

(7) That a Special Court or Commission be constituted with power to permit or to prohibit in the public interest, or on the ground of non-compliance with the law, the sale and advertisement of any patent, secret, or proprietary remedy or appliance, and that the Commission appointed for the purpose be a judicial authority such as a metropolitan police magistrate sitting with two assessors, one appointed by the Department and the other by some such body as the London Chamber of Commerce.

(8) That the President of the Local Government Board (or Minister of Health) have power to institute the necessary proceedings to enforce compliance with the law, the sale and advertisement of any patent, secret, or proprietary remedy, or appliance

(9) That a registration number be assigned to every remedy permitted to be sold, and that every bottle or package of it be required to bear the imprint "R.N. . . ." (with the number), and that no other words referring to the registration be permitted.

(10) That in the case of a remedy the sale of which is prohibited, the proprietor or manufacturer be entitled to appeal to the High Court against the prohibition.

(11) That the Department be empowered to require the name and proportion of any poisonous or potent drug forming an ingredient of any remedy to be exhibited upon the label.

(12) That inspectors be placed at the disposal of the Department to examine advertisements and observe the sale of proprietary remedies and appliances.

(13) That an annual fee be payable in respect of every registration number issued.

The Committee makes the following recommendations regarding the amendment of existing laws:—

(1) That the Stamp Acts be consolidated and amended to remove the numerous existing anomalies and unreasonable exceptions. In this connection, pure drugs vended entire under a fancy name should no longer be exempt from duty; the distinction between the name of an ailment, and the name of an organ the seat of that ailment, should be abandoned; and the exemption of medicines generating carbonic acid gas should be omitted. Further, any reference in advertising matter to the Government stamp should be prohibited, and no name of a proprietor or firm should be printed upon the stamp.

(2) That the Indecent Advertisements Act be amended on the lines of Lord Braye's Bill.

The Committee further recommend the following legislative enactments:—

(1) That every medicated wine, and every proprietary remedy containing more alcohol than that required for pharmacological purposes, be required to state upon the label the proportion of alcohol contained in it.

(2) That the advertisement and sale (except the sale by a doctor's order) of medicines purporting to cure the following diseases be prohibited:—

Cancer.	Diabetes.	Locomotor ataxy.
Consumption.	Paralysis.	Bright's disease.
Lupus.	Fits.	Rupture (without operation or appliance).
Deafness.	Epilepsy.	

(3) That all advertisements of remedies for diseases arising from sexual intercourse or referring to sexual weakness be prohibited.

(4) That all advertisements likely to suggest that a medicine is an abortifacient be prohibited.

(5) That it be a breach of the law to change the composition of a remedy without informing the Department of the proposed change.

(6) That fancy names for recognised drugs be subject to regulation.

(7) That the period of validity of a name used as a trade mark for a drug be limited, as in the case of patents and copyrights.

(8) That it be a breach of the law to give a false trade description of any remedy, and that the following be a definition of a false trade description:—"A statement, design, or device regarding any article or preparation, or the drugs or ingredients or substances contained therein, or the curative or therapeutic effect thereof, which is false or misleading in any particular." And that the onus of proof that he had reasonable ground for belief in the truth of any statement by him regarding a remedy be placed upon the manufacturer or proprietor of such remedy.

(9) That it be a breach of the law—

(*a*) To enclose with one remedy printed matter recommending another remedy.

(*b*) To invite sufferers from any ailment to correspond with the vendor of a remedy.

(*c*) To make use of the name of a fictitious person in connection with a remedy. (But it should be within the power of the Department to permit the exemption of an old-established remedy from this provision).

(*d*) To make use of fictitious testimonials.

(*e*) To publish a recommendation of a secret remedy by a medical practitioner unless his or her full name, qualifications, and address be given.

(*f*) To promise to return money paid if a cure is not effected.

In conclusion, the Committee believe that departmental and legislative action as outlined above will not inflict injustice upon any patent or proprietary medicine or appliance; that it will, alike by its operative and its deterrent effect, afford the public efficient and urgently needed protection against injury and fraud; and that no measures of a smaller scope will secure this result.

Patents.

[Medicinal] Table salt. F. Howe, Woodford Green, Essex. Eng. Pat. 22,322, Oct. 3, 1913.

Volatile oil of celery is incorporated by spraying with a mixture of sodium chloride and acetosalicylic acid. Proportions given are 10 grms. of the acid, 427·5 of sodium chloride, and 7·5 minims of a solution (1 in 10) of the oil in rectified spirit. The product is dried at a low temperature and sifted.—F. Sodn.

Formaldehyde; Process of making ——. H. von Hochstetter, Constance, Germany, Assignor to Perth Amboy Chemical Works, New York. U.S. Pat. 1,110,289, Sept. 8, 1914. Date of appl., April 28, 1914.

A mixture of methyl alcohol vapour and air is passed at a suitable temperature over a metal of the platinum group with which "is associated" another metal; rhodium and silver may be used as the two metals (see also U.S. Pat. 1,100,076; this J., 1914, 844).—T. F. B.

Organic bases; Manufacture of double compounds of —— [*with gold salts*]. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 276,134, Jan. 25, 1913.

Organic bases or their salts, other than cantharidylethylenediamine, are combined with auricyanic acid or an auricyanate, forming compounds which may be used in the treatment of tuberculosis (see also Ger. Pats. 269,661 and 272,291, and Eng. Pats. 1837 and 1869 of 1914; this J., 1914, 375, 568, 767, 806).—T. F. B.

Scopolamine solutions; Process for preparing ——. W. Straub. Ger. Pat. 276,554, Aug. 19, 1913. Addition to Ger. Pat. 266,415 (see this J., 1914, 42).

The polyhydric alcohol used in the process of the principal patent, is now replaced by a sugar. For example, a stable solution is obtained by dissolving 2 grms. of scopolamine hydrobromide in 7·5 litres of water, adding 600 grms. of dextrose, and pasteurising or sterilising.—T. F. B.

Coumarin; Process for preparing ——. Kinzlberger und Co. Ger. Pat. 276,667, Nov. 11, 1913.

Chlorohydrocinnamic acid is heated with an alkali hydroxide above 200° C., under pressure; the melilotic acid, which is produced in good yield, is converted by heat into hydrocoumarin, and this is dehydrogenated, *e.g.*, by heating with chlorine or sulphur, at a temperature near the boiling-point of coumarin.—T. F. B.

Sodium salt of acetylsalicylic acid and its homologues; Process for preparing the ——. J. A. Wülfing. Ger. Pat. 276,668, April 4, 1913. Addition to Ger. Pat. 270,326 (see this J., 1914, 139).

Acetylsalicylic acid or one of its homologues (in the benzene ring) is dried, finely powdered, and treated with an equivalent quantity of anhydrous sodium carbonate in presence of an alkyl ester of an aliphatic acid, *e.g.*, ethyl or methyl formate, or methyl or amyl acetate, but not ethyl acetate when making sodium acetylsalicylate.
—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Explosive; Antimony-sulphide-coated granulated ——. W. R. Hibbard, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,108,437, Aug. 25, 1914; date of appl., Sept. 20, 1913.

A black powder, the grains of which are coated with antimony pentasulphide.—E. W. L.

Explosives with liquid oxygen; Composition for forming ——. *Protective sheath or envelope for liquid-air or liquid-oxygen explosives.* G. Claude, Assignor to Soc. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude), Paris. U.S. Pats. 1,111,247 and 1,111,248, Sept. 22, 1914. Dates of appl., Jan. 25 and Feb. 4, 1913.

See Fr. Pats. 450,750 and 451,265 of 1912; this J., 1913, 627.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Benzene; The freezing point of —— *as a fixed point in thermometry.* T. W. Richards and J. W. Shipley. J. Amer. Chem. Soc., 1914, **36**, 1825—1832.

The freezing point of pure benzene is recommended as a fixed temperature to be used, in connection with the ice point of water, for calibrating Beckmann thermometers. Samples of benzene from coal tar and prepared by synthesis, when purified by chemical treatment and fractional crystallisation, gave as a constant freezing point, 5·483° ± 0·002° C. on the international hydrogen scale.
—F. Sodn.

Electro-titrametric method and its application to general analytical chemistry; The ——. F. H. H. van Suchtelen and A. Itano. J. Amer. Chem. Soc., 1914, **36**, 1793—1803.

The precision and accuracy of the conductivity method of titration is illustrated by curves obtained in titrating strong and weak acids, besides Cl, Ag, SO_4, Ba, U, PO_4, NO_3, K, Ca, and Fe'', all of which were readily determined. The results were not affected by the presence of foreign substances, and it was found possible to determine more than one radical in the same solution by a suitable choice of reagents, Cl and SO_4, for example, being titrated with silver nitrate and barium nitrate respectively. The method has been successfully applied to the examination of biological liquids, such as urine.—F. Sodn.

Titanium; Volumetric determination of —— *by means of ferric chloride.* T. R. Ball and G. McP. Smith. J. Amer. Chem. Soc., 1914, **36**, 1838—1843.

The strongly acid solution, together with a large excess of zinc, is introduced into a separating funnel of 250 c.c. capacity, the funnel stem and an attached tube containing a filter of glass-wool and asbestos having previously been filled with freshly boiled water, air is displaced by carbon dioxide, the mouth of the funnel fitted with a Contat-Göckel valve (a modified form of which is figured), and reduction allowed to proceed for about 2 hours. The valve is then removed, the solution drawn through the filter into a suction flask (previously filled with carbon dioxide), the funnel washed with boiled water, without admitting air to the funnel tube, and the filtered liquid and washings (now containing titanium in the titanous condition) rapidly titrated with standard ferric chloride solution using potassium thiocyanate as indicator (see Hibbert, this J., 1909, 189). The metals Sn, Cr, V, W, and Mo interfere with the determination.—F. Sodn.

Carbon; Volumetric determination of —— *in aliphatic substances in the wet way.* E. C. Grey. Chem. Soc. Trans., 1914, **105**, 2204—2210.

Aliphatic substances can be oxidised to carbon dioxide, or to a mixture of carbon dioxide and acetic acid, by boiling with a mixture of potassium bichromate and phosphoric acid, and a volumetric determination of total carbon is based upon the estimation of these two products, the former gasometrically, and the latter by titration. 15 grms. of bichromate, 15 c.c. of phosphoric acid, and the substance (in solution) are placed in a 75 c.c. flask connected through a reflux condenser and a three-way tap to a gas burette charged with mercury on the one hand, and a small bulb-shaped gas reservoir on the other. Thirty minutes boiling is in most cases sufficient for oxidation, and the carbon dioxide is then displaced by means of water into the reservoir, and finally into the burette; where it is measured. The acetic acid produced, which is incidentally a rough measure of the number of methyl groups present, is distilled over with steam, and titrated in the usual way. A number of analyses are given of typical substances, including sugars, alcohols, and amino-acids, for the determination of which in biological work the method is particularly adapted, and the results are in good agreement with theory. The method is also suitable for the accurate determination of small concentrations of ethyl alcohol.—G. F. M.

Determination of sulphur in motor spirits. Bradbury and Owen. *See* IIA.

Tests for determining the quality of paper. Lamb. *See* V.

Determination of iodine and bromine in haloid salts by means of telluric acid. Cole. *See* VII.

Determination of cobalt in high-speed steels. Dufty. *See* X.

Determination of small quantites of lead in tinning baths and solders. Breteau and Fleury. *See* X.

Examination of Chinese wood [tung] oil. Ware and Schumann. *See* XII.

Tests of Chinese wood oils [and candlenut oil]. *See* XII.

Report of Committee of American Society for Testing Materials on standard tests for lubricants. *See* XII.

Analysis of white pigments. *See* XIII.

Analysis of red lead. *See* XIII.

Examination of oil of turpentine. *See* XIII.

Analysis of shellac. *See* XIII.

Determination of body and solvent in varnish. Brown. *See* XIII.

Specifications and tests of glue. Linder and Frost. *See* XV.

Production of ω-hydroxy-s-methylfurfural from carbohydrates and its influence on the determination of pentosans and methylpentosans. Cunningham and Dorée. *See* XIXA.

Comparison of the methods used in the various Pharmacopœias for the determination of the active principles of potent drugs and preparations derived therefrom. Dichgans. *See* XX.

Trade Report.

Competition with Germany and Austria-Hungary. Third list of articles in respect of which applications have been received at the Board of Trade. October, 1914.

A THIRD list has now been issued by the Board of Trade, following those issued in August and September (see this J., 1914, 896 and 945); those interested should communicate with the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

A. *List of articles which inquirers desire to purchase:—*

Acetylcellulose; cellulose wadding. Chemicals: Acids, benzoic, carbolic, citric, cresylic, molybdic, salicylic, tannic, tungstic; butyl alcohol; arsenic, white and yellow; Neuburg chalk; white lead; carbon tetrachloride; ammonium chloride; calcium chloride; iron perchloride; cyanides and sulphocyanides; chemicals for dyeing, leather dressing, straw hat manufacture, tanning, and the textile trade; manganese; beta-naphthol; sodium nitrite; silver nitrate; oil, soluble sulphonated; potassium permanganate; sulphates and persulphates; magnesium sulphate; lead sulphide; lead hyposulphite; sodium bisulphite; tartar emetic. Clays: alum earth, kaolin, white earth for metal polishes. Drugs, essences and perfumes: eau-de-Cologne; menthol; perfumery for West African market; pomades; synthetic perfumes. Dyes: alizarin; auramine and similar yellows; eosine, for pigment colours, paper making, soaps, tanning trade, textile trade, tiles; indigo blue; phloxine; synthetic dyestuffs; vegetable dyestuffs. Esparto grass, Fire clay goods (general). Gelatin for straw hat manufacture. Glass and glassware: druggist sundries; for arc lamps; general for electrical lighting; hand-made flint glass; optical; philosophical instruments; sample tubes; surgical and chemical appliances; test tubes; vessels for electrical accumulators; water gauge glasses; windows; wire-embedded plate. Grinding materials; powder (substitute for kieselkreide). Lanoline. Lead and lead articles. Leather and leather goods: chamois; cloth; raw hide blanks. Machinery for applying coating composition to wood; for grinding, cutting, and bevelling glass; for making bronze powder, metal foils, starch, sugar, white porcelain enamel. Manures: fish meal, phosphorine; Matches: general (cheap). Metal foil: gold leaf, imitation, tin, metal, waste and scrap: brass, cast iron, copper, gunmetal, heavy iron and steel, iron and steel dust, iron and steel filings; mica. Oils and greases: animal oils; belt paste for machine belting; colza oil; for making "liquid paraffin"; palm kernel oil; tallow. Ores and minerals: basalt, broken; bauxite, crude; syenite stone. Paints, colours, and varnishes: colours, chemical; colours, mineral; colouring powders for high-class inks; for soaps and tiles; grease paints; ultramarine blue; varnish for electrical insulating; water colours (cheap); yellow ochre. Paper and paper articles: adhesive mounting tissue; carbon paper, ordinary; general; glazed transparent; glycerine parchment; insulating. Photographic appliances: baryta-coated paper for post cards; sensitised cardboard for post card photographs. Scientific instruments: balances; X-ray lamps. Skins: kid, for surgical applicanes; tan roan; white sheep. Size, "Sickel." Tungsten wire. Vinegar. Waterproofing materials, unimpregnated paper felt for waxes. Wire and wire working: lead tin and lead-antimony (alloy wire); brass; gauze, unspecified; iron, annealed and galvanised; lead; metallic filament; nickelled and bright soft iron. Wood wool. Zinc and zinc ware: dust; glazing plates for paper making; nickel-plated sheets; "preparation"; powder; rods; rolls; sheets; spelter; strips for boot eyelets; unspecified; vessels for douches; wire.

B. *List of articles which inquirers desire to sell:—*

Acetylene generators and lighting plant; alizarin oils; boilers, tanks, and metal receptacles; candles; capsules: metal; ceresine. Chemicals: acids; acetates; alcohols; arsenic and arsenites; carbonates; carbides; carbon; coal tar products; cyanides or prussiates; formaldehyde; formates; hydrates; iodides; nitrates; oxides; phosphates; radium and radio-active materials; sulphates; sulphides; sulphites; tartrates; thorium, (probably a salt); urea; zinc salts. Cochineal; collodion; fireclay goods; slag wool; stearine.

Applications in respect of German patents. Ch. of Comm. J., Oct., 1914.

THERE have been a certain number of applications made already under the Patents, Designs and Trade Marks Temporary Rules (Amendment) Act, 1914, for the avoidance or suspension of German patents in this country, and it is believed that at the present time nearly 30 other applications are waiting. They are made in the first instance to the Comptroller-General, who has been sitting with his predecessor for this purpose. These gentlemen do not give any decision, but make recommendations to the Board of Trade. However, they have laid down certain principles which are probably those which will be adopted. These are that it would not be fair to confiscate the property of German patentees; but that in all probability some kind of licence will be given to manufacture the articles in question, and that if a licence is continued after the war it will be subject to a royalty to be paid to the patentee, which may be settled in default of agreement by arbitration. They have also intimated that even if a licence is given only during the continuance of the war it will probably be fair that some royalty shall be payable to the State or to the patentee.

Imperial Institute. Technical Information Bureau. Times, Oct. 19, 1914.

This Bureau has been opened to deal with the steady increase of inquiries as to sources of supply of raw materials, methods of utilising new products from the Colonies and India, and new or little known processes and machinery for industrial purposes.

A statement is being prepared as to sources of potash which will include some hitherto untouched for industrial purposes. It is hoped to issue this by the end of the present year.

An equally important matter is that of finding markets for the immense quantities of raw materials from India and the Colonies formerly sent to Germany, such as palm kernels and copra. A statement giving full information regarding the German palm kernel industry has just appeared in the "Bulletin of the Imperial Institute." The Bureau will place manufacturers interested in these substances in communication with merchants who deal in them.

There is also a scarcity of thymol, because all the ajowan seeds from which it is extracted go to Germany from India. The preparation of thymol presents no difficulty.

Inquiries for the Technical Information Bureau should be addressed to the Director, Imperial Institute, S.W.

Development of U.S. natural resources. Oil, Paint, and Drug Rept., Oct. 5, 1914.

The Bureau of Foreign Trade Advisers in the State Department has been so much engaged with efforts to open up transportation facilities between the United States and Holland and other North European ports, that the possibility of obtaining mercury and other products through Italian ports, being possible reshipments from Austria and Servia, has not been seriously considered. Every effort is being made by the executive departments to help representatives of industries by ways and means to obtain materials in the United States. The facilities of the Geological Survey are being drawn upon for information in regard to increased mercury output in this country and also supplies of carbonate of magnesia, fluorspar, tin, and kindred commodities, important quantities of which are annually sent to this country from Europe. It is believed that American ships will be furnished to bring out of Germany through the ports of Holland supplies of fertiliser, chemicals products, and medicines, and efforts will be made to ascertain other openings for procuring necessary supplies in Europe.

Trading with the Enemy Act. First application under Sect. 3. Times, Oct. 21, 1914.

The first application to the Courts under Section 3 of the Trading with the Enemy Act, 1914, was made to Mr. Justice Warrington on October 20th. The Board of Trade, in accordance with the provisions of the Act, prayed that a controller might be appointed in the public interest to carry on the business of Meister, Lucius, and Brüning, Ltd., of Ellesmere, Lancs. The company was registered under the English Companies Acts, but all except 12 shares were held by German subjects resident in Germany. On the outbreak of war the secretary of the company received instructions from the directors to close the factory. The case raised some important points of procedure. His Lordship held (1) that applications under the Act might be made by motion; (2) that the Court should require evidence that the information on which the Board of Trade based its applications had reasonable foundation; (3) that the controller appointed should be ordered to give the usual security demanded from a receiver; (4) that the Court should reserve the power to require the controller to render and vouch his own accounts in addition to those of the company; and (5) that the controller should make periodical reports upon the company's business.

Prohibited exports and imports. Board of Trade Journal, Oct. 22, 1914.

The Privy Council approved on October 19th, a recommendation from the Board of Trade, to make certain alterations in the list of Prohibited Exports.

(1.) The prohibition of the export of molasses, invert sugar, and all sugar and extracts from sugar which cannot be completely tested by the polariscope, is withdrawn.

(2.) The prohibition of export of unrefined sugar and of refined sugar and candy is withdrawn as regards the Channel Islands, Malta, Gibraltar, Falkland Islands, St. Helena, East Africa Protectorate, and British West African Colonies and Protectorates.

(3.) The prohibition of the export of graphite (see this J., 1914, 988) is limited to "graphite suitable for the manufacture of crucibles."

In a Proclamation published in the "London Gazette" of October 26th, the Proclamation of September 30th is revoked as from October 26th, and the following provisions are substituted:—

The importation into the United Kingdom of all sugar is hereby prohibited provided that the foregoing prohibition shall not extend to sugar (not being raw or refined sugar made or produced by an enemy or in an enemy country, or refined sugar made or produced from raw sugar made or produced by an enemy or in an enemy country):—(*a*) Cleared from the port of shipment to this country on or before October 26th, 1914; (*b*) imported under contract made prior to August 4th, 1914.

Nothing in this Proclamation shall be taken to prohibit anything which shall be expressly permitted by our licence, or by the licence given on our behalf by a Secretary of State or the Board of Trade.

Book Received.

Chemical Technology and Analysis of Oils, Fats and Waxes. By Dr. J. Lewkowitsch, M.A., F.I.C. Fifth Edition, entirely rewritten and enlarged. In three volumes. Vol. II. Edited by G. H. Warburton. Macmillan and Co., Ltd., St. Martin's Street, London. 1914. Price 25s. net.

Volume, $8\frac{3}{4}$ by $6\frac{3}{8}$ ins., containing 936 pages of subject matter, with 19 illustrations, and also alphabetical indexes of botanical and zoological names. For Vol. I., see this J., 1913, 963. Vol. II. contains chapters on: XIII. Commercial preparation of the raw materials used in the oils, fats, and waxes industries. XIV. Technology of the natural oils, fats and waxes: methods of preparing, refining, and examining them, and detecting adulterations. A. Oils and fats (glycerides): vegetable drying oils, vegetable semi-drying oils, vegetable non-drying oils, marine animal oils, terrestrial animal oils, vegetable fats, animal fats. B. Waxes: Liquid waxes, solid vegetable waxes, solid animal waxes. Numerous hitherto unpublished observations are given under the headings of the individual oils and fats.

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Lecture.

THE PRESENT CONDITION OF THE CHEMISTRY OF ANTHRAQUINONE.

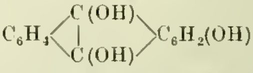
BY R. E. SCHMIDT.

Before the Société Chimique de France, December 6, 1913 (*Abstract*).

Bull. Soc. Chim., 1914, **15**, [12], 1—40.

During the twenty years following the synthesis of anthraquinone by Graebe and Liebermann, only a comparatively small number of anthracene dyestuffs was introduced; these were, in addition to Alizarin itself, Flavopurpurin, Anthrapurpurin, sulphonated Alizarin, Alizarin Blue, β-Nitro-alizarin, and Anthragallol, the last named, however, being obtained by condensing benzoic acid with gallic acid. To this number may be added synthetic Purpurin, which has not been applied in the dyeing industry. On the other hand, the last 25 years has witnessed a remarkable activity in researches on this class of dyestuff, which has resulted in the introduction of the Alizarin Cyanines, Anthracene Blues, Alizarin Green, and a large number of other dyestuffs, yellow, orange, red, violet, blue, and green, and all distinguished by a high degree of fastness. A systematic study of these dyestuffs has led to the formulation of certain rules as to the influence of the substituent groups on colour. Considering first the α-monosubstituted anthraquinones, it is seen that the nitro group and the halogens have practically no effect, though the α-bromo-derivative is slightly yellower than the α-chloro compound. α-Hydroxyanthraquinone is an intense yellow when in a finely divided condition, but the effect of the hydroxyl is neutralised by etherification or esterification, *e.g.*, the α-methoxy- and α-phenoxy-compounds are almost colourless. The SH group is similar to the hydroxyl group, but its effect is more pronounced. The amino group also increases the colour to brick-red, but in this case if the amino group is substituted by alkyl or aryl, the colour becomes bluish-red, whilst the introduction of acidic groups produces yellow compounds. The same remarks apply to the β-monosubstitution products, but here the colour changes are less marked. Among the disubstituted anthraquinones, the dihalogen and dinitro compounds have no tinctorial value. Of the dihydroxy derivatives, the ββ-compounds (2.3, 2.6, and 2.7) are the least coloured, then come the 1.5- and 1.6-compounds, and then the 1.2-, 1.3-, 1.6-, and 1.7-derivatives, whilst Quinizarin (1.4) is the most highly coloured. Again, the diaminoanthraquinones, 1.3, 1.5, 1.8, 2.6, and 2.7, are yellowish-red to brick-red, 1.2 is bluish red, and 1.4 is intense violet. The introduction of alkyl and aryl groups changes the shade towards blue and green, whilst acidic groups tend to produce lighter and yellower products. Many of the acidylaminoanthraquinones are valuable vat colours, unlike the aminoanthraquinones themselves; thus, 1.5-dibenzoyldiaminoanthraquinone (Algol Yellow R) dyes cotton very fast, deep yellow shades from the vat, and the 1.4-dibenzoyldiamino compound (Algol Red 5 G) dyes red shades. From the foregoing facts it is possible to determine the colour of the disubstituted anthraquinones in which the substituents are different: thus, α-aminoanthraquinone and its *p*-chloro, *p*-nitro, and *p*-methoxy derivatives are orange or brick red, whilst 1.4-aminohydroxyanthraquinone is bluish red, 1-amino-4-methylamino is bluish violet, 1-amino-4-tolylamino is blue, and 1.4-ditolyldiaminoanthraquinone is green. The same rules apply to the polysubstituted anthraquinones. Anthrachrysone (1.3.5.7-tetrahydroxyanthraquinone) is yellow, hydroxyflavopurpurin (1.2.4.6) orange, Alizarin Bordeaux (1.2.5.8) orange-red, and the 1.4.5.8-compound bluish-red. Of the isomeric dihydroxyditoluido compounds, 1.5-dihydroxy-4.8-ditoluidoanthraquinone is blue, the 1.2.5.8-compound (Alizarin Viridine) is green, and 1.4.5.8 is yellowish green. Two of the diaminodihydroxyanthraquinones, namely NH : NH : OH : OH = 1.5.4.8 and 1.8.4.5, are blue compounds, which, when sulphonated, are known as Alizarin Saphirol, and dye cotton very pure blue shades.

Introduction of substituent groups into anthraquinone and its derivatives. The nitro group is introduced by the usual methods. When anthraquinone is treated with very strong nitric acid, or with a mixture of nitric and sulphuric acids, α-nitroanthraquinone is first produced, and by more energetic treatment, the 1.5- and 1.8-dinitro derivatives in about equal amounts, accompanied by small quantities of the β- and αβ-compounds, such as 1.6, 1.7, 2.6, and 2.7. The nitration of anthraquinone derivatives generally produces α-nitro compounds; for example, anthraquinone-1- and 2-sulphonic acids are both converted into the 5- and 8-nitro derivatives. The secondary reactions liable to occur in the nitration of hydroxy or amino derivatives, can be prevented in the usual way, *e.g.*, by etherification or acidylation, respectively. The sulphonation of anthraquinone with acid alone necessitates the use of fuming acid at temperatures about 100° C.; this gives the β-monosulphonic acid and 2.6- and 2.7-disulphonic acids. The α-sulphonic acids 1, 1.5, and 1.8, are readily obtained by sulphonation in presence of small quantities of mercury. The introduction of chlorine or bromine into amino- or hydroxy-anthraquinones is effected by the usual methods, but anthraquinone itself resists these processes. Until recently, the only known methods of producing halogen-anthraquinones were to heat anthraquinone with bromine in sealed tubes, or to oxidise the polyhalogen-anthracenes. The present method consists in replacing the sulphonic group of anthraquinonesulphonic acids or their nitro-derivatives, by treatment in dilute aqueous solution with nascent bromine or chlorine, *e.g.*, with a mixture of sodium chlorate and hydrochloric acid: by this method it is possible to produce any desired halogen- or halogen-nitro-anthraquinone, in almost theoretical yield. It is also possible to introduce chlorine into anthraquinone and certain of its sulphonic acids by passing chlorine through their solutions in fuming sulphuric acid at a high temperature: thus anthraquinone may be converted into the 1.4.5.8-tetrachloro-compound, whilst anthraquinone-β-sulphonic acid gives the 1.4-dichloro-7-sulphonic acid. Several methods are known for introducing the hydroxyl group into the anthraquinone nucleus. The first consists in heating anthraquinone-β-sulphonic acids with caustic soda in presence of an oxidising agent, and is used for the preparation of Alizarin and Flavopurpurin. The sulphonic acids can be converted into the hydroxy compounds directly, without oxidation, by heating under pressure with alkaline earths; this method serves for the production of 1-mono and 1.5- and 1.8-dihydroxyanthraquinones. In the course of a study of the sulphonation of Alizarin under various conditions, the author found that a large excess of fuming acid (70—80% free SO_3) at 20°—40° C. did not sulphonate the Alizarin, but produced a high yield of 1.2.5.8-tetrahydroxyanthraquinone (Alizarin Bordeaux), in the form of its sulphuric ester; a more prolonged reaction resulted in the formation of the 1.2.4.5.6.8-hexahydroxy compound. This reaction is general for hydroxyanthraquinones containing at least one α-hydroxy group, but it has not yet been possible to forecast the exact progress of the reaction. Quinizarin, like Alizarin, is converted into the 1.2.5.8-compound; 1-hydroxyanthraquinone gives at first the 1.5-dihydroxy derivative, and later the hexahydroxy compound, whilst Chrysazine is converted rapidly and Anthrachrysone almost instantaneously into the same hexahydroxy compound. The presence of boric acid in this process retards the reaction considerably, probably owing to the formation of boric esters; this affords a method of controlling the reaction to produce intermediate hydroxy compounds, such as the 1.2.5-trihydroxy derivative from Alizarin and the 1.4.8-compound from Chrysazine. The boric esters are also of value in that they are very resistant to decomposition by sulphuric acid at high temperatures. By the use of pure sulphuric anhydride it is possible to introduce hydroxyl groups into anthraquinone itself, producing the 1.2.4.5.6.8-hexahydroxy derivative, though the yield is unsatisfactory. A number of hydroxyanthraquinones can be hydroxylated by means of ordinary sulphuric acid (66° B.) at a high temperature, *e.g.*, 160°—200° C. : by this method, Alizarin Bordeaux is converted into the 1.2.4.5.6.8-hexahydroxy-compound, together with small quantities of the 1.2.4.5.7.8-compound. Whilst studying this reaction, it was found that selenium and mercury are very active oxidation catalysts. Interesting results are obtained in presence of substances which are not catalysts, but actual oxidising agents, such as arsenic acid and nitrous acid. Anthragallol is converted into 1.2.3.4-tetrahydroxyanthraquinone and anthraquinone into Quinizarin by heating with sulphuric acid, boric acid, and sodium nitrite ; when pure sulphuric acid is used, no reaction takes place, but an energetic reaction is induced by traces of mercury. During this process an intermediate compound is formed, 1.4-diazohydroxyanthraquinone, which is stable towards boiling sulphuric acid of 60° B., but reacts with alcohol forming α-hydroxyanthraquinone. Lalande's method (treatment with manganese dioxide and sulphuric acid) is also an important hydroxylation process ; Alizarin is converted into Purpurin, and Alizarin Bordeaux into 1.2.4.5.8-penta- and two hexahydroxyanthraquinones, known as Alizarin Cyanine R, R extra, WRR, and Anthracene Blue WR. This method can be used to introduce further hydroxyl groups into any anthraquinone derivative which contains at least one hydroxyl in each benzene nucleus ; thus, β-nitroanthrapurpurin furnishes 3-nitro-1.2.4.5.7.8-hexahydroxyanthraquinone, Alizarin Cyanine Black G. Quite recently (see this J., 1913, 593 ; 1914, 545) this method has been used to prepare 1.2.4-purpurin-3-carboxylic acid, which gives a valuable alumina lake. The polyhydroxyanthraquinones are not formed immediately during this oxidation process ; true quinonoid compounds, called "anthradiquinones," are formed at first, which resemble benzoquinone, and these are converted into the corresponding hydroxy compounds by means of weak reducing agents. Among the other methods for introducing the hydroxyl group may be mentioned the replacement of bromine or nitro groups by heating with sulphuric and boric acids. The aminoanthraquinones are obtained by reducing the corresponding nitro compounds. When alkaline reducing agents are used, hydroxylamino compounds are obtained under certain conditions ; the 1.5-dihydroxylamino compound cannot be converted into diaminoanthraquinone by reduction, but on treatment with sulphuric acid it undergoes intramolecular transformation into the 1.5-diamino-4.8-dihydroxy compound. One of the most important methods of preparing aminoanthraquinones is by treating negatively-substituted anthraquinones with ammonia ; the hydroxyl group is readily replaced in this manner, *e.g.*, when Purpurin is evaporated with aqueous ammonia, 1-amino-2.4-dihydroxyanthraquinone is produced. By careful treatment of 1.5-dinitroanthraquinone with sulphur sesquioxide (sulphur dissolved in fuming sulphuric acid) it is possible to obtain the same diaminodihydroxy compound as described above, produced by intramolecular transformation of the dihydroxylamino compound ; it is therefore concluded that these hydroxylamino compounds are also intermediate products of the sulphur sesquioxide treatment, and the author has actually isolated the dihydroxylamino derivative corresponding to dinitrochrysazinedisulphonic acid. Treatment of the nitroanthraquinones with 40% fuming sulphuric acid alone produces finally hexahydroxy compounds and their sulphonic acids, whilst if 10—15% fuming acid is used, soluble colouring matters are obtained directly, which appear to consist chiefly of monosulphonic acids of diaminodihydroxyanthraquinones. The introduction of substituted amino groups into the anthraquinone nucleus is effected by treating negatively-substituted anthraquinones with methylamine, piperidine, etc. The preparation of the arylaminoanthraquinones from the hydroxy compounds is greatly facilitated by condensing agents such as boric acid. The condensation product of Purpurin with aniline is known as Alizarin Blue Black B, and the product from Quinizarin and two mols. of *p*-toluidine, in the form of its sulphonic acid, dyes wool fast green shades ; in the latter case, however, the yield is only 30—35%, owing to secondary reactions, including oxidation. A good yield of the dyestuff can be obtained by condensing *p*-toluidine with the reduction product of Quinizarin,



$$C_6H_4\left<\begin{matrix}C(OH)\\ |\\ C(OH)\end{matrix}\right>C_6H_2(OH)_2$$

and oxidising the product. Among the other dyestuffs of this series may be mentioned Alizarin Viridine, 1.4-di-*p*-tolylamino-7.8-dihydroxyanthraquinone, and Brilliant Alizarin Viridin, the corresponding 8-monohydroxy compound ; these form fast chrome lakes and are therefore of interest in calico printing. The formation of acridine compounds, which occurs when halogen-anthraquinones are heated with aromatic amines, is avoided by adding small quantities of sodium acetate or potassium carbonate to combine with the acid liberated. Alizarin Sky Blue is the sulphonic acid of 1-amino-2-bromo-4-*p*-tolylaminoanthraquinone, obtained by heating the corresponding dibromo compound with *p*-toluidine ; when this reaction is carried out in presence of copper, an almost insoluble compound is formed, which proved to be a derivative of Indanthrene, whilst Indanthrene itself can be obtained by heating 1-amino-2-bromoanthraquinone in nitrobenzene or naphthalene, in presence of sodium acetate and traces of copper. The catalytic effect of copper can be utilised generally in the condensation of halogen-anthraquinones with aminoanthraquinones, to produce compounds of the general formulæ, $C_{14}H_7O_2.NH.C_{14}H_7O_2$, and $C_{14}H_7O_2.NH.C_{14}H_6O_2.NH.C_{14}H_7O_2$. A number of these compounds are on the market as vat dyestuffs, such as Algol Orange, Algol Bordeaux, Indanthrene Red, etc.

In conclusion, attention is drawn to two important auxiliaries in the study of the anthraquinone compounds. The first is the spectroscope. Many anthraquinone derivatives present characteristic absorption spectra, which may be utilised for the detection of these compounds and also for controlling and following the progress of certain manufacturing processes, such as the oxidation of Alizarin Bordeaux to pentahydroxy- and hexahydroxyanthraquinone, each step of which is clearly marked by the spectrum. The second auxiliary is boric acid, which, in addition to its uses in manufacturing processes, is also o great value as an analytical reagent ; the boric esters o hydroxyanthraquinones are frequently characteristic, and many substances which exhibit no definite spectrum in sulphuric acid solution, give excellent results when bori acid is added. For example, on addition of boric acid the red-violet solution of Alizarin Blue becomes olive, the violet of Alizarin Bordeaux becomes blue, and the yellow solution of 1.5-diamino-4-hydroxyanthraquinone become red.—T. F. B.

Erratum and Addenda.

This Journal, 1914, page 775, col. 2, l. 29 from bottom *for* "W. Watson Gody" *read* "G. Watson Gray;" an references are as follow :—this J., 1901, pages 538 an 1027 ; also 1904, page 324.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

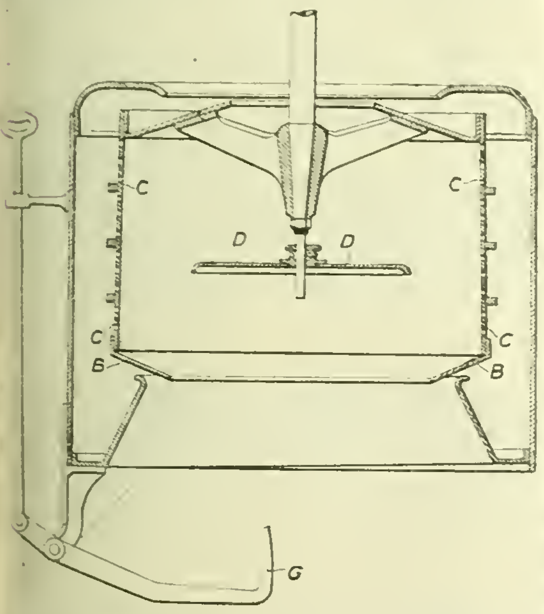
Patents.

Hydro-extractors and like centrifugal machines. T. K. Irwin, London. Eng. Pat. 13,508, June 11, 1913.

The liquid expelled from the cage of the machine impinges directly on the vanes of a turbine or rotor surrounding the cage, the power generated being utilised either directly or by means of gearing to drive a second centrifugal machine.—W. H. C.

Centrifugal machines. A. R. Robertson, Glasgow. Eng. Pat. 26,303, Nov. 17, 1913.

The fixed portion, B, of the bottom of the machine has an angle greater than the angle of repose of the dried material, so that when the movable bottom, D, is raised, he dried material falls out by its own weight. The asket, C, has the shape of an inverted frustum of a cone, o that when discharge takes place, the material comes way easily from the sides. An externally operated craper, G, may be used to assist in the discharge.—W.H.C.



ashing clinker, gravel or other granular material; Apparatus for ——. C. W. Marks, Wokingham, Berks. Eng. Pat. 21,135, Sept. 18, 1913.

he material receives a preliminary soaking in a rotary, nclined conical barrel provided with lifting and conveying lades and a perforated water-supply pipe, and is then elivered into a co-axial rotary screen or trommel. —W. H. C.

alp-washing machine. J. Schneible, Chicago, Ill. U.S. Pat. 1,111,408, Sept. 22, 1914; date of appl., June 5, 1913.

TNK having a conical bottom with a central discharge provided with a perforated inner bottom plate and a rotatable frame carrying agitator blades and a base-plate, the latter being parallel to the perforated bottom and serving to prevent the agitator from forcing the pulp through the perforations.—W. H. C.

Recuperator furnace. W. A. Stubblebine, Allentown, Pa. U.S. Pat. 1,111,414, Sept. 22, 1914; date of appl., Oct. 31, 1913.

A chequer-work air preheater is arranged in the hollow front wall of the fire-place of a reverberatory furnace and the heated air is delivered to various parts of the working hearth, beyond the bridge, through ducts formed in the side walls.—W. H. C.

Kiln. E. P. Stevens, Chicago, Ill. U.S. Pat. 1,111,871, Sept. 29, 1914; date of appl., Nov. 21, 1912.

The kiln has two heating chambers, arranged back to back and separated by a wall enclosing a series of vertical flues. Upon the inside of the front wall of each chamber is a fire-box from which heating flues extend upwards to the roof, across the latter, down the dividing wall, across the floor to the front wall, and thence to the vertical flues in the dividing wall.—W. E. F. P.

Device for measuring temperature. Eng. Pat. 5460. *See* XXIII.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Sulphur compounds of coal; Oxidation of —— and of nitrogen, in the bomb calorimeter, and the correction to be applied in determining the heating value of coal. S. H. Regester. J. Ind. Eng. Chem., 1914, **6**, 812—822.

The results of the experiments indicate that the relative amounts of sulphur trioxide and dioxide in the bomb gases after combustion depend chiefly upon the amount of nitrogen oxides formed in the bomb, which promote the formation of the trioxide just as in the manufacture of sulphuric acid by the chamber process; the ash of the fuel does not appear to exert any appreciable catalytic action. The formation of nitrogen oxides takes place much more readily from the nitrogen of coal than from the nitrogen present in the bomb gases, and increases with increasing pressure and with the heat of combustion of the fuel. The usual correction applied to the heating value of a fuel, according to the sulphur content, based on the assumption that the sulphur is converted completely into sulphur trioxide in the calorimeter, is satisfactory in the case of coal with less than 2% S, burnt in a bomb calorimeter from which the initial charge of air is not removed by rinsing out with oxygen; in the case of coals high in sulphur, a material amount of sulphur may be left as sulphide in the ash and as sulphur dioxide in the gas. If the air in the bomb be blown out with oxygen of high purity so that the concentration of nitrogen in the bomb is only a fraction of 1%, then with a fuel free from nitrogen, only a part of the sulphur will be converted into sulphur trioxide. With a non-nitrogenous fuel containing less than 0·08 grm. of sulphur in the sample burned, approximately quantitative formation of sulphur trioxide is obtained at 20 atmospheres pressure if the nitrogen concentration of the bomb gases be 6%. The heat of combustion (to SO_3) of the sulphur of pyrites was found to be about 4975 calories per grm.—A. S.

Coking process; Theory of the ——. E. Donath. Stahl u. Eisen, 1914, **34**, 60—61.

A SAMPLE of coal from Rossitz, near Brünn, containing ash 4·64, H_2O 9·66, N 1·32, H 4·86, C 82·88, total S 3·35, S in ash 0·32, combustible S 3·03%, when heated in an experimental coke-oven gave a molten product sufficiently fluid to flow from a small opening at the base of the oven. This product quickly solidified to a shining black mass, containing ash 10·47, H_2O 0·50, N 0·14, H 2·99, C 76·86, total S 3·63, S in ash 2·18, combustible S 1·45, O 7·59%. The whole of the organic constituents were volatilised when the product was heated in a covered crucible, leaving only the ash. This behaviour resembles that of tallow, wax and paraffin and some resins, and the author concludes that during the coking of a coal of this type, a mixture of compounds consisting of the degradation products of the resinous and fatty constituents of the original coal-forming materials and also the pitch-like polymerised products of distillation under pressure, is completely melted and decomposes on further heating without leaving any carbon residue. The decomposition products react chemically with the degradation products of the cellulose and protein constituents of the coal-forming material, cementing them into a carbon-like compound or mixture of compounds. At higher temperatures, the protein degradation products in the coal soften and during the complete gasification of the coal, stable compounds are formed containing sulphur and nitrogen, and these compounds are present in the coke.—A. T. L.

Coke; Blast-furnace ——. O. Simmersbach. Stahl u. Eisen, 1914, **34**, 108—110.

THE effect of modifying the conditions of coking, such as the size of the retort, and the temperature, is discussed. The formation of cracks may be diminished by the admixture of lean coal or powdered coke. Coking at too low a temperature may leave cores of uncoked coal containing up to 20% of volatile matter, and yielding for example, on distillation, tar 1·85%, CO_2 0·8, H_2S 0·1, H_2O 2·59, NH_3 0·31, C_6H_6 0·25, gases (CH_4, H_2, CO) 6·35; total volatile matter 12·25%. Incomplete coking is shown by the presence of more than 0·6% H_2. Experiments supporting Bone's view (this J., 1908, 886) showed that compact, hard carbon is obtained by passing methane through a hot tube, while ethylene yields a sooty mass. These varieties of carbon are found in coke. In quenching, the appearance of the coke depends upon the use of clean water. In addition to its appearance, the behaviour of a coke when dropped upon a hard surface gives an indication of its quality.—O. E. M.

Blast-furnace coke. H. Koppers. Stahl u. Eisen, 1914, **34**, 585—587.

RAPIDITY and uniformity of combustion of blast-furnace coke in the blast-furnace, have an important effect on the results obtained, and are promoted by restricting the water-content of the coal, which should be of uniform composition, to 9%, by coking rapidly in uniformly heated ovens, by not allowing the charge to stand in the oven when coking is complete, and by breaking and screening the coke into pieces between 12 and 90 mm. in diameter. Ovens are best built of lime-bound silica brick.—O. E. M.

Tar-formation temperatures of American coals. J. Gas Lighting, 1914, **128**, 134—135.

SAMPLES of coal were heated in a small resistance furnace, under conditions which resembled those of large scale practice but permitted of accurate measurement. With any grade of bituminous coal or lignite, tar began to distil at about 300° C., the maximum evolution was between 375° and 475° C., and the tar was all liberated at 550° C. or in a few cases 600° C. The temperatures did not depend upon the geological age of the coal, the amount of volatile matter, or the C : H ratio, and there was no relation between the amounts of volatile matter and of tar. The C : H ratio is a guide to the amount of tar, the greatest amount of thick tar being obtained from coals having this ratio from 13·5 to 18.—A. T. L.

Oil-tar separation, recovery, and disposal. R. E. Wyant. J. Gas Lighting, 1914, **128**, 131—132. (See also Beardsley, this J., 1912, 422.)

TAR partly separates in the form of an emulsion, and when the whole is mixed, the water-content is not excessive. When tar is accumulated in a tank, pumped off from the bottom, there was a further separation of tar and water. The proportion of water at different depths was:—at 18 in. from bottom, 2—3%; at 2 ft., 46%; at 4 ft. 6 in., 80%, and at 12 ft. 90%. The tar can be recovered from the emulsion by using the emulsion in place of water in the scrubbers. For use on roads, the tar is distilled preferably by heating it to 212° F. (100° C.) and blowing live steam through until the sp. gr. reaches 1·1 at 60° F. (15·5° C.), and the flash-point 145° F. (63° C.) if the tar is used for dust-laying. For road-surfacing the distillation is carried further. The tar is superior to petroleum oil for use on roads.—A. T. L.

[Coal gas] purification. Experiments at Montreal. H Mann. J. Gas Lighting, 1914, **128**, 84.

PURIFIERS filled with a single layer of oxide, 48 in. deep, were worked in sets of four, the gas passing downwards through the oxide, and each set of four purifiers passing 1¼ million cb. ft. of gas per day, containing 450 grain H_2S per 100 cb. ft. Air was admitted at the exhauste outlet in order to revivify the oxide in the foul box whic was placed last in the series. The oxide was not capabl of being revivified after the purifier had been operate continuously for two or three weeks, but by changing th connections so as to place the foul box last every 3 days the plant was worked for a year without renewing th oxide. In changing the order, *e.g.* from 1—2—3—4 t 2—3—4—1, the purifiers were worked for an hour in th order 4—1—2—3, so as to prevent foul gas in No. passing direct to the holder. The oxide became ver hard and the back-pressure increased, so that it wa decided to refill every 6 months. The oxygen admitte for revivification was not absorbed in the first and secon boxes where the gas still contained hydrogen sulphide The rearrangement of the purifiers with clean-box firs and foul-box last doubled their working capacity.—A. T. I

De Beque petroleum field in Colorado. G. R. De Beque Eng. and Min. J., 1914, **98**, 652—653.

A GENERAL resumé is given of the geology of the distric and the history of the oil development. The importan oil strata occur in the Mesaverde (Cretaceous) formatio A well, 2010 ft. deep, yields 100 barrels per day (b pumping) and is capable of a larger output. The oil golden brown in colour, extremely viscous, and solidifie quickly on exposure to air; it has a "32% paraffin base. —W. E. F. P.

Petroleum in Assam. E. H. Pascoe. Mem. Geol. Sur India, 1912, **40**, Pt. 2. Bull. Imp. Inst., 1914, 1 474—475.

THE petroleum deposits of Assam are similar to those Burma, being in rocks of Tertiary age. They are confin to a curved belt of country along the basins of t Brahmaputra and Surma, over some 800 miles from N. Assam through Kachar and Chittagong to the Arak coast. Only two fields of commercial importance a worked, at Digboi and Bappa Pung, about one mile apa in N.E. Assam, but comparatively little exploration h been done.—R. G. P.

Paraffin wax industry of Austria; Application of c in the ——. P. Porges. Z. angew. Chem., 1914, III., 41.

To enable Austrian lubricating oils to compete wi Russian and American oil the paraffin wax is separat as completely as possible. About 95% of the Austri works use the patented apparatus of Porges, Sing and Steinschneider, and produce 6500 wagon-loads purified wax per annum. The oils are gradually chill by passing them through a series of connected crystallising chambers surrounded by coils through which brine is pumped. The semi-solid mass from the chambers is pressed, usually in filter-presses, and the filtrate again partially chilled before being suitable for lubricants. The residue in the press, termed "*gatsch*" is usually submitted to dry sweating to expel the oil. A recent improvement has been the introduction of Pejzel's apparatus, in which the sweating vessels are mounted on trolleys which pass through a ventilated passage. After leaving the sweating vessels the wax is decolorised with sulphuric acid and "silicate." The system of moist sweating, which is little used, aims at utilising the hot liquor from the crystallising chambers. Fractional crystallisation of the wax is effected by chilling the chambers in stages. One part of the apparatus works at 0° C., a second at —5° to —7° C. and a third at —10° to —18° C.; and in a patent process of Pejzel and Porges each chamber is chilled so as to yield a paraffin wax of a definite m. pt.—C. A. M.

Hydrocarbons of Utah—A correction. C. Bardwell, B. A. Berryman, T. B. Brighton and K. D. Kuhre. J. Ind. Eng. Chem., 1914, **6**, 865—866.

Attention is called to certain inaccuracies in the original paper, chiefly in connection with the composition of the different products, but not affecting the abstract (this J., 1914, 15).—A. S.

Apparatus for the analysis of complex gas mixtures. Taylor. *See* XXIII.

Patents.

Coal-washing apparatus. E. G. Burks and N. Hayes, Birmingham, Ala. U.S. Pat. 1,112,976, Oct. 6, 1914; date of appl., Oct. 15, 1913.

The mud from coal-washing is discharged from a sluice into a filtering vessel having inner and outer perforated vertical walls with an intermediate filling of granular material. This vessel is placed in a tank having an overflow, and the overflow water is withdrawn from the tank by a pump and delivered to the sluice. A conveyor is provided for removing the material collected in the filtering vessel.—A. T. L.

Fuel-briquette composition. W. Loesch, Assignor to G. B. Storer, Chicago, Ill. U.S. Pat. 1,111,800, Sept. 29, 1914; date of appl., April 14, 1913.

A mixture of finely divided fuel, 100, cement, 25, finely divided clay, 5, potassium nitrate, 0·5, and water, 25 parts by volume, and if desired, coal oil 2 parts.—A. T. L.

Briquettes [of carbonaceous material]; Process for making —— using waste sulphite lye treated with sulphuric acid as binding agent. A. Richter. Ger. Pat. 275,832, Aug. 2, 1910.

Coal dust or other carbonaceous substance is mixed with a binding agent composed of waste sulphite liquor, sulphuric acid, and tar oils or similar oils, briquetted, and heated to 250°—270° C. to carbonise the binding agent.—T. F. B.

Gas retorts; Means for controlling the operation of ——. H. A. Carpenter and A. W. Warner, Sewickley, Pa., Assignors to Riter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pat. 1,112,978, Oct. 6, 1914; date of appl., June 2, 1914.

In a retort which is charged and discharged at opposite nds, the charging and discharging tool is driven by an lectric motor controlled by circuit-closing devices at pposite ends of the retort.—A. T. L.

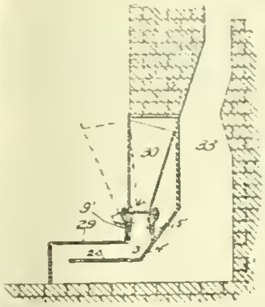
Producer gas generators. T. R. Wollaston, Manchester. Eng. Pat. 29,089, Dec. 17, 1913.

The roof of the producer chamber is formed by a boiler r vaporiser having Field tubes which project into the hot fuel. This boiler is slowly rotated or oscillated so as to stir the fuel and to promote the heating of the Field tubes. The steam passes with air through the jacketed casing of the producer and thence to the bottom of the fuel column. The steam may pass through an injector nozzle so as to force the air through the producer, or a blower may be used. The fuel is fed through a shoot passing through the gas-outlet pipe.—A. T. L.

Gas or vapour producers. F. C. L. Biddlecombe, Luton, Beds. Eng. Pat. 10,681 of 1914; date of appl., Oct. 20, 1913.

In apparatus in which partial combustion of liquid fuel is effected in order to convert the remainder of the fuel into a combustible gas or vapour, as described for example in Eng. Pat. 10,305 of 1913 (this J., 1914, 740) the capacity of the combustion chamber is varied, according to the rate at which gas is made, by means of a loose-fitting piston, which permits the flow of gas to the outlet but prevents the passage of the flame.—A. T. L.

Wood-gas generator and burner. W. L. Boxall, Perry, Cal. U.S. Pat. 1,111,129, Sept. 22, 1914; date of appl., Aug. 10, 1909.



The apparatus, which is fitted into a fire-place opening for heating purposes comprises a combustion chamber, 3′, having a radiating front, 29, and divided by a horizontal partition, 20, into upper and lower passages, the lower passage leading to the flue, 33. Air is admitted through openings at 9′, in a pivoted throat-piece, 15′, which carries the feeding hopper, 30, and rests normally on the sloping wall, 4′, of the combustion chamber, so as to prevent the escape of smoke. For charging, the hopper is tilted forwards as shown in broken lines.—A. T. L.

Gas producer apparatus. J. A. Herrick, Newark, N.J. U.S. Pat. 1,112,534, Oct. 6, 1914; date of appl., Dec. 30, 1912.

The producer has a rotatable body portion, and a heavy inclined poker projecting through an universal joint in the side wall of the fixed upper portion. The lower end of the poker fits into any one of a number of recesses in a central support within the producer, and mechanism is provided for adjusting the poker to any desired position. —A. T. L.

Gas producer. E. A. W. Jefferies and G. H. Isley, Assignors to The Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,112,702, Oct. 6, 1914; date of appl., Aug. 23, 1909.

The producer has a water-sealed ash-pit, which carries a vertical central tuyère with hollow radial arms arranged in a horizontal plane and presenting vertical surfaces to the fuel column. The air enters the fuel column through orifices at the upper edges of the radial arms. The tuyère and arms are rotated to stir the fuel, and horizontal bars are arranged in the producer, at a higher level than the stirring arms, to prevent rotation of the fuel.—A. T. L.

Gas washer. J. F. M. Patitz, Milwaukee, Wis., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,112,381, Sept. 29, 1914; date of appl., Feb. 10, 1912.

The washer comprises a casing containing superposed sets of rotating fan blades, carried by a vertical shaft, the gas being directed outwards through each set of blades. Washing liquid is sprayed into the casing towards the fan blades and is caused to flow outwards and then inwards as a continuous film enclosing the discharge of the rotating fans, so that the gas passes along and through the film of liquid.—A. T. L.

Petroleum hydrocarbons; Converting higher boiling into lower boiling ——. G. W. Gray, Houston, Texas, U.S.A. Eng. Pats. (a) 17,838 and (b) 17,839, Aug. 5, 1913. Under Int. Conv., Jan. 23, 1913.

(a) The oil is heated in the presence of anhydrous aluminium or ferric chloride to not substantially above the "end-boiling-point" of naphtha, and the vapours are condensed. A petroleum distillate free from naphtha products, when heated with 5% of aluminium chloride at 325°—350° F. (163°—177° C.) yields 70—80% of naphtha suitable for motors. If the temperature be raised to 550°—600° F. (288°—316° C.) the distillate consists of naphtha and burning oil which can be afterwards separated. The process may also be used for obtaining light oils from burning and lubricating oils and from crude oil. (b) The distillation is carried out between 400° and 600° F. (204° and 316° C.), and the vapours are passed through a cooling chamber where the burning oil is condensed, the naphtha vapours passing on to a separate condenser. The burning oil may be returned to the still.—A. T. L.

Oil distillation. S. M. Herber, Inza, Mo. U.S. Pat. 1,111,580, Sept. 22, 1914; date of appl., Feb. 9, 1914.

To increase the yield of lower-boiling fractions, the oil is mixed with about one-seventh its bulk of lime and distilled in a current of air or in the presence of water or steam, with or without air.—A. T. L.

Oxygeniser in connection with combustibles; Composition of matter to be used as an ——. A. Morin, L. Hamon, and E. Hess, Montreal. U.S. Pat. 1,112,547, Oct. 6, 1914. Date of appl., Nov. 22, 1913.

See Eng. Pat. 27,648 of 1913; this J., 1914, 635.—T. F. B.

Gases; Apparatus for purifying ——. K. Bomhard, Berlin. U.S. Pat. 1,112,970, Oct. 6, 1914. Date of appl., Sept. 19, 1911.

See Fr. Pat. 433,801 of 1911; this J., 1912, 220.—T.F.B.

Mineral oils; Process of treating ——. J. Dehnst, Halensee, Germany. U.S. Pat. 1,112,602, Oct. 6, 1914. Date of appl., April 17, 1906.

See Ger. Pat. 178,771 of 1905; this J., 1907, 863.—T. F. B.

Means in combination with hydrogen producing plant for regulating fluid pressures therein. Eng. Pat. 16,893. *See* VII.

Carbon dioxide gauge. U.S. Pat. 1,111,565. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Hardwood distillation; Possibilities of —— on the Pacific Coast. R. C. Palmer. Met. and Chem. Eng., 1914, **12**, 623—626. (See also this J., 1914, 345.)

The yields of charcoal, acetate of lime and crude wood alcohol obtained in the laboratory from tanbark oak and California black oak (the most promising of the hardwoods available on the Pacific coast) compared very favourably with those from the hardwoods (beech, birch and maple) used in other localities; the results of large-scale tests were less satisfactory, but still favourable to commercial operation. Under present market conditions it would not be advisable to establish more than one or two small plants in California.—W. E. F. P

Carbons for electric lighting. Board of Trade Bulletin No. 82.

Can be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, London, E.C.

Patent.

Arc-light electrode. I. Ladoff, Cleveland, Ohio, Assignor to W. D. Edmonds, Boonville, N.Y. U.S. Pat. 1,112,458, Oct. 6, 1914. Date of appl., June 1, 1911.

Electrodes for producing flaming arcs are made principally of carbon together with calcium titanate and an organic salt of titanium, a titanium-halogen compound, or an alkali titanofluoride.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Guyot tar. Petkow. *See* XX.

Patents.

Pitch compositions; Toughened ——. E. L. Manhayfer, St. Louis. U.S. Pat. 1,112,817, Oct. 6, 1914. Date of appl., Dec. 13, 1910.

Pitch is mixed with kieselguhr in sufficient quantity to raise its melting point considerably, without destroying its plasticity at normal temperatures. The melting point of the pitch may be raised 20°—25° F. (11°—14° C.) by addition of 15% of kieselguhr.—T. F. B.

1.2-Dihydroxybenzene-4.6-disulphonic acid; Process for preparing ——. Saccharinfabr. A.-G. vorm. Fahlberg, List und Co. Ger. Pat. 276,273, June 3, 1913.

op-Phenoldisulphonic acid is treated with chlorine or bromine in acid solution, and the *o*-halogen-phenoldisulphonic acid is heated with dilute alkali under pressure, below 200° C., to convert it into 1.2- dihydroxybenzene-4.6-disulphonic acid.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Colours and dyestuffs; Export of ——. *Issue of special licences.* Board of Trade J., Oct. 29, 1914. [T.R.]

With reference to the Order of Council dated 8th September, 1914, which prohibited the exportation from the United Kingdom of dyes and dyestuffs obtained from coal tar, the Board of Trade announce that, on their recommendation, licences have been granted to certain firms to export some or all of the colours and dyestuffs specified in the appended schedule, on the express condition that the reasonable requirements of consumers in the United Kingdom in respect of such colours and dyestuffs are first supplied. Any British consumers of these colours and dyestuffs who are unable to obtain the supplies they require should communicate with the Board of Trade.

Cross Dye Blacks, FG, 70823, T Extra 20% strong, BF, BX 20% strong, RX 20% strong and TF; Sulphur Bronze 136; Sulphur Browns 4R, 2D, 2R and 731; Sulphur Yellows Y and R; Sulphur Drab N; Methyl Violets ST and Base 2B; Methyl Blue 2B; Magenta Powder FA and Crystals FA; Methylene Blue ZF; Auramine O and O Conc.; Cerise FDA; Green Crystals A and Y; Bismarck Brown R 100s, Y 100s, Concentrated, and R Concentrated; Chrysoidine R Powder, Y Powder, and Crystals; Nigrosine D, G, and P; Soluble Nigrosine X; Nigrosine 32391; Induline A and B; Soluble Blue A, B, and C; Spirit Blue and Spirit Blue 2B; Thionol Yellow G; Thionol Orange L; Thionol Brown G conc.; Thionol Khaki I; Thionol Browns O and R; Thionol Dark Green; Thionol Brilliant Greens 6GX conc., 4GX conc., and GX; Thionol Green 3B; Thionol Purple B conc.; Thionol Corinth GX and BLX; Thionol Brilliant Corinth RX; Cachou R, 2R, and OX; Thionol Blues and Blacks, Leather Brown LX; Dianol Fast Yellow AR; Dianol Brilliant Red X; Dianol Dark Green N; New Coccine; Phosphine; Leather Orange F; Wool Scarlets 390 and

285; Dianol Oranges; Prune 516; Wool Black 3015; Fast Milling Black B; Era Chrome Blacks; Era Crome Browns M and B; Chrome Red Brown; Chromotrope M; Archelline 2B; Ponceau R and 2R; Orange 4GB; Chrome Green Y; Alizarin Yellow 3G; Crumpsall Yellow YYFP.

Patents.

Vat dyestuffs of the naphthalene series; Preparation of ——. M. Kardos. Ger. Pats. (A) 276,357, June 14, 1913, and (B) 276,358, June 26, 1913.

(A) Naphthalene-1.8-dicarboxylic acid imine, or the condensation product from acenaphthenequinone and hydroxylamine, is fused with an alkali hydroxide. The products are claret or red vat dyestuffs. (B) The dyestuffs described above are treated with fuming nitric acid, and the nitro compounds are dissolved in sodium hydroxide or carbonate solution and reduced with alkaline reducing agents. The resulting compounds dye cotton blue, blue-violet, and grey-violet shades.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silk in Madagascar. J. d'Agric. trop., 1914, 14, 89. Bull. Imp. Inst., 1914, 12, 487.

Both the native silkworm or "landibe" (*Borocera Madagascariensis*) and the mulberry silkworm (*Bombyx mori*) are used by the natives of the centre of the island. The "landibe" lives in natural forests of *Uapaca clusiacea* or in plantations of *Dodonea Madagascariensis* and *Cajanus ndicus*, and produces two harvests a year of brown or grey cocoons. The silk, which is comparable with tussah silk, cannot be reeled, but is carded and spun. The rearing of the mulberry silkworm is increasing. The ilk is used locally and is not yet exported. A station for he study of the silkworm and production of disease-free seed has been established at Nanisana.—R. G. P.

Textile industry; Application of low temperatures in the ——. F. Erban. Z. angew. Chem., 1914, 27, III., 41.

In the preparation of flax for spinning, the "straw" is dried for 50 to 80 hours in the sun, then cooled to —4° C., and the bast fibres separated while in a frozen condition (see this J., 1911, 18). In Ahnert's mercerisaion process the yarns are impregnated with hot lye (25° B., sp. gr., 1·21) and then chilled (see Kirchbacher, his J., 1911, 20). Artificial cold is employed in Schultze's process of obtaining solid alkali hydrosulphites from solutions. In finishing fabrics various machines for applying low temperatures are in use to shorten processes, and to increase the amount of moisture fixed by the fibres. —C. A. M.

Textile machinery. Board of Trade Bulletin. No. 86.

This Bulletin can be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Patents.

Celluloid or like substitutes; Manufacture of ——. L. L. T. Labbé, Asnieres, France. U.S. Pat. 1,112,297, Sept. 29, 1914. Date of appl., June 16, 1911.

See Fr. Pat. 430,035 of 1911; this J., 1911, 1308.—T.F.B.

Pulp from waste papers; Process for the recovery of ——. J. M. Burby, Astoria, Assignor to The Pembee Co., New York. U.S. Pat. 1,112,887, Oct. 6, 1914. Date of appl., June 15, 1911.

See Fr. Pat. 444,703 of 1912; this J., 1912, 1075.—T.F.B.

Process for making briquettes [of carbonaceous material], using waste sulphite lye treated with sulphuric acid as binding agent. Ger. Pat. 275,832. *See* IIa.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Application of low temperatures in the textile industry. Erban. *See* V.

Hydrosulphites and formaldehyde-sulphoxylates. Wild. *See* VII.

Patents.

Silk; Process for weighting —— by means of zirconium compounds. E. Stern. Ger. Pat. 276,423, Feb. 9, 1913.

The tetrahydrate of zirconium sulphate, $Zr(SO_4)_2.4H_2O$, is used for weighting silk, either alone or in conjunction with other weighting substances.—T. F. B.

Colours; Method and means of recording, matching, or devising new shades of ——. G. and W. Parsons, London, and A. W. Coker, Sutton, Surrey. Eng. Pats. 20,093 and 30,096, Sept. 5 and Dec. 31, 1913.

A machine of the rotating disc type, the turntable being operated by an electric motor and the coloured discs being slotted to enable them to fit adjustably over one another. A modification consists in the use of a single colour disc over which is placed a heart-shaped cam (of white for instance) which combination when rotated shows the mixed shade in gradually increasing strength from the centre outwards. Holes are provided in the turntable which during rotation set up suction, thus keeping the coloured discs flat. Convenient means of measuring the areas are provided.—J. B.

[*Fireproofing.*] *Treatment of cotton and cotton goods and other combustible substances to render them permanently less inflammable.* W. H. Perkin, Oxford, S. Bradbury, Ashton-on-Mersey, and Whipp Bros. and Tod, Ltd., Manchester. Eng. Pats. (A) 17,814, 20,971, and 24,088, Aug. 5, Sept. 17, and Oct. 24, 1913, and (B) 17,815 and 20,972, Aug. 5 and Sept. 17, 1913.

(A) The goods are impregnated with a soluble salt of a metal, the oxide or hydroxide of which is capable of acting as an acid, and, after drying, the deposited salt is fixed by treatment with a prepared atmosphere containing a gas (*e.g.*, carbon dioxide or sulphur dioxide) which is capable of rendering the deposited salt insoluble. The fixing atmosphere is preferably moist and the temperature is preferably high, *e.g.*, the fixing gas may be admitted into an ordinary ager. (B) The use of an alkali aluminate as impregnating salt and of carbon dioxide as the fixing gas is specially claimed. Good results are obtained on flannelette by impregnating with a solution of sodium aluminate of 30° Tw. (sp. gr. 1·15) and ageing in an atmosphere containing 10% or more of carbon dioxide and sufficient steam to leave the goods slightly wet on emerging. (See also Eng. Pats. 8509 and 9620 of 1902 and 24,222 of 1903; this J., 1903, 623, 551; 1904, 981.)—J. B.

Waterproof fabric and the like; Manufacture of —— and means for use therein. T. W. Jacobs, jun., London. Eng. Pat. 26,172, Nov. 14, 1913.

The fabric is passed over and under guide rollers through a tank containing the waterproofing liquid, such as a mixture of vaseline, 100; paraffin wax, 100; naphthalene, 4; carbolic acid, 12; and vegetable black, 3 parts, and then between steam-heated squeezing rollers which remove the excess of liquid, and bring about a thorough impregnation of the fabric. The pressure and the temperature of the rollers should be kept approximately constant. —E. W. L.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Phosphoric acid and phosphates; Alcohol in the manufacture of ——. P. J. Fox. J. Ind. Eng. Chem., 1914, **6**, 828—829.

To extract phosphoric acid from phosphate rock it is suggested that treatment with the requisite quantity of sulphuric acid of 50° B. (sp. gr. 1·53) be followed by leaching with denatured alcohol, the residue being filter-pressed. A relatively pure alcoholic solution of phosphoric acid would thus be obtained. In laboratory tests with calcium phosphate, an extraction of 99·2% of the phosphoric acid was obtained with 95% alcohol and 98·7% with 50% alcohol.—A. S.

Potash; Waste of ——. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5**, 374—375.

Co-operation is suggested for the collection and incineration of many waste marine and land plants such as furze, hedge-clippings, bracken, etc., as a source of potassium salts. The following figures give the potash content of the ashes: *Fucus vesiculosus*, *F. serratus*, 4—5%; *F. nodosus*, 13%; oarweed, *Laminaria saccharina*, 15%; *Enteromorpha intestinalis*, 7%; *E. compressa*, 10%; *Ulva latissima*, 4%; *Zostera marina*, 9·5%; bracken, 60%; *Boletus edulis*, 50—57%; *Agaricus velutipes*, 78%; the heath mosses *Hypnum Schreberi* and *H. splendens* 28—30%; hop bine, 25%; groundsel, *Senecio vulgaris*, 43·5%; common broom, 33%; willow bark, 24%; sweet chestnut bark, 20%; common furze, 28%; *Euphorbia amygdaloides*, 39%; Virginian creeper leaves 25%.—F. Shdn.

Clay filters and certain salt solutions; The action between ——. W. B. Hicks. J. Ind. Eng. Chem., 1914, **6**, 829—831.

Various saline solutions were filtered through 8-in. Pasteur-Chamberland water filters. Little or no change was produced in the boric acid content of borate solutions; there was a decrease of 0·2—0·5% in the concentration of alkali sulphate and chloride solutions, of 0·5% in *N*/10 and 8% in *N*/1000 alkali carbonate solutions. The filters were dissolved appreciably by ammonium chloride solutions.—A. S.

Hydrosulphites and formaldehyde-sulphoxylates. E. Wild. Chem.-Zeit., 1914, **38**, 928.

The iodine method of Baumann, Thesmar and Frossard is recommended for the estimation of the sulphoxylate, but in the author's opinion a quick and simple method of analysing hydrosulphites is still lacking. (See Bosshard and Grob; this J., 1913, 485.)—J. B.

Ozone; Action of —— *on inorganic sulphur compounds.* E. H. Riesenfeld and T. F. Egidius. Z. anorg. Chem., 1914, **85**, 217—246.

The action of a stream of strongly ozonised oxygen on solutions of sulphur compounds was investigated. Alkali sulphides, normal or acid, gave thiosulphate and sulphite, with some hydrosulphite; thiosulphate, neutral or alkaline, gave sulphate, dithionate and sulphate, with small quantities of polythionate; sulphite gave principally sulphate, with some dithionate. The end-product in all cases was sulphate. Whilst sulphur compounds at a low stage of oxidation (sulphites, &c.) take up ozone as a whole, analogous metallic compounds (ferrous, manganous, and like salts) take up 1 atom of oxygen, a molecule of oxygen escaping.—O. E. M.

Lead acetate, lead oxide, water; Equilibrium in the system ——. R. F. Jackson. J. Franklin Inst., 1914, **178**, 492—493.

To obtain a basis for investigating the clarification of raw sugar, a study was made of the basic acetates of lead from the standpoint of the phase rule. The analyses were made by measuring the volume of standard acid neutralised by the basic lead, and the volume of acid or of sodium oxalate required for total precipitation of the lead. The basic acetates were prepared by the interaction of normal lead acetate and lead hydroxide. The solid phases capable of existence were found to be three. Normal lead acetate, $Pb(C_2H_3O_2)_2,3H_2O$, consists of monoclinic prisms; it is stable in equilibrium with its own solutions, and its solubility increases rapidly in solutions of increasing basicity. Its solubility in neutral solutions is 35·5%. Tetra-lead monoxyhexa-acetate, $3Pb(C_2H_3O_2)_2,PbO,3H_2O$, crystallises in minute needles, is very soluble in water, and forms highly refracting solutions of sp. gr. 1·93—2·28. It is unstable in contact with its own solution. Its solutions contain at the extremes of saturation 15·89% PbO, 48·95% $Pb(C_2H_3O_2)_2$, and 24·74% PbO, 49·21% $Pb(C_2H_3O_2)_2$. Tri-lead dioxy-diacetate, $Pb(C_2H_3O_2)_2,2PbO,4H_2O$, consists of minute imperfect needles; it is capable of existing in contact with its own solutions, in which case its solubility is 13·3%. Its saturation curve is very long. The extremes of solubility are 7·4% PbO, 4·8% $Pb(C_2H_3O_2)_2$, and 24·74% PbO, 49·21% $Pb(C_2H_3O_2)_2$.—J. H. J.

Manganese sulphide; Heat of formation of ——. S. Wologdine and B. Penkiewitsch. Comptes rend., 1914, **158**, 498—499.

The oxidation of manganous sulphide resulting in the formation of Mn_3O_4 and sulphurous and sulphuric acids gave as a mean value of somewhat varying results 70·535 cals. for the molecular heat of formation of the sulphide. A second method consisted in the ignition of a compressed pastille of manganese and sulphur in a calorimetric bomb in an atmosphere of nitrogen by means of a mixture of aluminium and potassium chlorate and a fuse of guncotton. It gave a value of 62·901 cals. per mol. as the mean of a number of concordant results.—G. F. M.

Felspar supply of the United States. Watts. *See* VIII.

Use of washers and coolers with sulphur ovens, and [*determination of*] *the sulphuric acid content of the oven gases.* Pellet. *See* XVII.

Chief cause of the loss of sulphuric anhydride and chlorine by incineration of substances containing these constituents. O'Sullivan. *See* XXIII.

Barytes in Canada. Oil, Paint, and Drug Rep, Oct. 12 1914. [T.R.]

The barytes mines in Cape Breton will shortly be able to supply the needs of Canada, whilst other sources will produce sufficient quantities for export.

Fluorspar in the United States. Oil, Paint, and Drug Rep., Oct. 12, 1914. [T.R.]

The increase in the home production and the imposition of a tariff on fluorspar in 1909 have resulted in a decrease in the American imports to 22,682 short tons in 1913 compared with the 115,580 tons produced. The imports came almost entirely from Great Britain and amount to over 55% of the total English production. The open-hearth steel process absorbs about 80% of the amount produced.

Patents.

Hydrogen producing plant; Means in combination with —— *for regulating fluid pressures therein.* J. Dempster, Manchester. Eng. Pat. 16,893, July 16, 1914.

In the production of hydrogen by the action of steam on oxidisable material, with alternate de-oxidation by a current of reducing gas (water-gas), a pressure-regulating device is provided to prevent leakage of reducing gas into the hydrogen or steam connections by ensuring a higher pressure in these than in the reducing gas mains. A vessel is divided into two intercommunicating compartments which contain water; one compartment is

in connection with the water-gas inlet main and is provided with an overflow passage, whilst, in the other compartment, water forms a seal between the hydrogen outlet main and the hydrogen scrubber. Any increase of pressure in the water-gas inlet main, acting upon the surface of the water in the first compartment, increases the depth of seal in the second compartment and necessitates therefore a corresponding increase of pressure in the hydrogen outlet main, and in the supply of steam.
—F. Sodn.

Catalysts; Manufacture of ——. A. Schwarcman, Assignor to Spencer, Kellogg and Sons, Inc., Buffalo, N.Y. U.S. Pat. 1,111,502, Sept. 22, 1914; date of appl., Feb. 4, 1914.

A hydrated sesquioxide, *e.g.* $Al_2(OH)_6$, is precipitated by an alkali, washed free from soluble matter and treated with a dilute solution of a compound of a metal of the platinum group (preferably palladium) containing as much metal as will be absorbed by the $Al_2(OH)_6$. The precipitate is collected and dried.—W. H. C.

Sulphuric acid; Chamber used in the manufacture of ——. W. G. Mills and C. T. Packard, Assignors to E. Packard and Co., Ltd., Ipswich. U.S. Pat. 1,112,546, Oct. 6, 1914. Date of appl., March 21, 1914.

See Eng. Pat. 12,067 of 1913; this J., 1914, 692.—T. F. B.

Nitrate of lime; Process of effecting solidification of fluid ——. M. Scharff, Ludwigshafen, Germany, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,112,722, Oct. 6, 1914. Date of appl., July 3, 1912.

See Fr. Pat. 445,826 of 1912; this J., 1912, 1179.—T. F. B.

Hydrogen; Process of producing ——. C. Bosch and W. Wild, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S Pats. 1,113,096 and 1,113,097, Oct. 6, 1914. Dates of appl., Oct. 29, 1913.

See Fr. Pat. 459,918 of 1913; this J., 1914, 24.—T. F. B.

VIII.—GLASS; CERAMICS.

Refractories; Needs of the glass manufacturer in the way of ——. C. W. Berry. Trans. Amer. Ceram. Soc., 1914, **16,** 101—108.

Resistance of tank blocks and glass-pots to the action of fluxes depends more upon physical structure than on chemical composition. A block should possess sufficient density to prevent the penetration of fluxes. It should dissolve slowly in the glass without causing "stones" and the wearing surface should remain smooth. Pure non-plastic clays which are attacked only slightly by fluxes must be introduced in a very fine condition, as otherwise the plastic binding clay will dissolve, allowing the refractory clay to enter the glass and form "stones." Blocks high in silica, *e.g.*, where free silica has been added to obtain 77% SiO_2 in the finished product, are quickly destroyed, as also are mixings high in alumina. High silica also tends to increase porosity. It is not advisable to introduce "grog" made from used pots, as the material has absorbed fluxes which will cause a honeycombed surface. The greatest wear on a pot occurs during the first four melts; after the fifth, the action diminishes as the pot becomes nearly vitrified. A pot which is suitable in composition for plate glass may not answer for lead and other glasses made in closed pots.—H. H. S.

Soda-lime glasses; The limits of proportions of ——. F. Gelstharp and J. C. Parkinson. Trans. Amer. Ceram. Soc., 1914, **16,** 109—116.

Soda ash glasses can only be made successfully with a limited proportion of lime, *e.g.*, $1CaO:2Na_2O$. To obtain satisfactory glasses containing more than 8% CaO, sodium sulphate must be used. Glasses containing soda in excess of 22% of the silica content are not likely to be strong and durable; for plate glass, the soda content should be much lower. The whole field of soda lime silicates may be divided into: (1) opaque basic slags and infusible mixtures of silicates and bases; (2) mixtures giving transparent glasses only on very rapid cooling, otherwise opaque crystalline masses; (3) transparent glasses proper, including those of technical importance; (4) mixtures giving opalescent opaque glasses on slow cooling. The authors made glasses of the definite silicates $2Na_2O,SiO_2$; Na_2O,SiO_2; $Na_2O,2SiO_2$; but a mixture of the composition, $Na_2O,3SiO_2$, gave a melt containing suspended silica which dissolved slowly, to form probably a solid solution of silica in the bisilicate.—H. H. S.

Ruby colour in glass; Notes on the development of ——. A. E. Williams. Trans. Amer. Ceram. Soc., 1914, **16,** 284—306.

Ruby glass is obtained by using as colouring agent copper, gold, selenium, or flowers of sulphur; the metals being usually found to be in suspension as colloids. Recipes culled from the literature of the subject are given for gold, selenium and sulphur rubies, but the author's own experiments refer to copper ruby glass. This was formerly made by the process of flashing, which consists of placing a very thin layer of coloured glass on a surface of colourless glass of normal thickness; special skill being required to blow the layer to uniform thickness in order to obtain uniform colour. At present, however, ruby glass is made by pressing in moulds and reheating. The colour should not be developed till the glass is reheated. Highly fluid glasses are found to "colour out" quickly, viscous glasses slowly. Substitution of lead or soda for lime increases rapidity of colour development, lead more so than soda. High silica content (4—4·5 mols.) is necessary to give sufficient viscosity, and to obtain good colour; low silica tends to produce brown or black colours and opacity. With high silica in lime-potash glasses there is a tendency to streakiness, which can be reduced by small quantities of lead oxide, and by re-melting. Iron and manganese are detrimental to a good red colour. Density of colour is apparently increased by increase in temperature. The following formulæ were found to be most suitable for a good ruby glass, 1% of cream of tartar being added:—

Equivalents.					
Na_2O	0·102	—	—	0·100	0·100
PbO	0·627	—	—	—	—
K_2O	0·202	0·536	0·536	0·536	0·536
SiO_2	2·33	4·57	4·00	4·00	4·57
CuO	0·067	0·023	0·023	0·023	0·023
SnO_2	0·018	0·041	0·041	0·041	0·041
B_2O_3	0·073	—	—	—	—
CaO	—	0·44	0·44	0·34	0·34

—H. H. S.

Glass. Similarity between aqueous and glass solutions of gold. Effects of various temperatures on coloured glass. A. Silverman. Trans. Amer. Ceram. Soc., 1914, **16,** 547—550.

The colour-changes from yellow gold chloride solution to red colloidal solution of gold, and then to brown precipitate and blue supernatant colloidal solution, which occur on addition of potassium carbonate and formaldehyde and subsequent boiling with oxalic acid, may be reproduced in solid solution in glass. Gold chloride solution was sprinkled on sand which was then added to the batch mixing of a Pb-Na-K silicate glass. Stannous oxide served as reducing agent, and the third stage was effected by re-heating.

As certain coloured glasses were found to be much darker at high than at the ordinary temperature, the effect of immersion in liquid air was observed. Selenium ruby, black at high temperatures, was yellow to orange in liquid air. No perceptible change took place with blue and green glasses, but most red and yellow glasses and also potassium bichromate and sulphur became lighter in colour. Return to the ordinary temperature restored the original colour.—H. H. S.

Fluorides as opacifiers [*clouding agents for glass and enamels*]. J. B. Shaw. Trans. Amer. Ceram. Soc., 1914, **16**, 577—579.

Opacity may be produced in glass by fluorides without the presence of alumina. Different heat treatment will modify the products from any given fluoride mixing. —H. H. S.

Clay; Effect of some electrolytes on ——. R. Back. Trans. Amer. Ceram. Soc., 1914. **16**, 515—546.

The clays were used in the physical conditions of plastic mass, thick paste, creamy slip, and 5% aqueous suspension. The effect of added electrolytes was studied with regard to volume shrinkage in drying of the plastic mass, water content of pastes just fluid enough to flow, and viscosity, flocculation and volume shrinkage of slips. Great precautions were found necessary to eliminate error in drying the clay, making it plastic and moulding into briquettes, especially with regard to the time factor. The ratio of volume shrinkages of a ball clay and a kaolin in their best working consistence bore no relation to the ratio of the percentages of water used. These varying shrinkage and pore-water volume relations are attributed to an arrangement of the clay particles effected by the reagents, or to a change in their power of retaining water at 110° C. Some electrolytes, *e.g.*, $Ca(OH)_2$ and $Ba(OH)_2$, in small quantities (0·05—0·075%) act as deflocculators, but greater concentrations produce distinct flocculation. The cause of such dual behaviour is to be sought in dissociation phenomena and changes in surface tension of the liquid medium. Caustic soda and potash are vigorous deflocculating agents at all concentrations, although a temporary thickening may be caused by the presence of lime. The coagulating power of neutral salts ($NaCl$, $CaCl_2$, $AlCl_3$) and the rapidity of coagulation increases with the valency of the cation; neutral salts, as well as acids and alkalis, have a decided influence on the shrinkage and viscosity of clays. The smallest quantities of electrolytes used showed an effect on the fluidity or stiffening of clay paste. Electrolytes that cause flocculation in a clay system may be employed to reduce cracking and excessive shrinkage in the drying of troublesome clays. For casting slips, caustic soda or potash or sodium silicate or carbonate may be used, the volume shrinkage being reduced by one-third. The structure of a cast piece seems more compact and stronger when the correct quantity of electrolyte is used, but excess weakens the ware. As lime and alkalis affect the "malachite green" used in the dye-absorption method of estimating colloids, the Rodenwald-Mitscherlich hygroscopicity method is preferable.—H. H. S.

Weathering of fireclays in the manufacture of face brick and paving block. L. B. Rainey. Trans. Amer. Ceram. Soc., 1914, **16**, 405—408.

The practice of causing clay to "weather" for about four weeks after being mined is regarded as unnecessary, because insufficiently prolonged to bring about any real mineralogical change. Blocks made from the "green" clay tended at first to crack in drying, a difficulty which was overcome by addition of ¼ lb. of salt to each wheel-barrow of clay as it was fed to the pans. The fired ware required longer cooling, *viz.*, 6 days instead of 5. Its resistance to disintegration by the "rattler" test was only 1% inferior (18 : 19) to that of ware made from weathered clay, whilst the colour was brighter.—H. H. S.

Clay; Data on effect of varying compression loads applied to —— *in the plastic condition.* C. W. Parmelee. Trans. Amer. Ceram. Soc., 1914, **16**, 194—200.

In view of the divergence of opinion between Seger and some later writers (see Rept. N.J. Geol. Surv., VI, 260; Missouri G.S., XI, 459; G.S. of Iowa, XIV, 206) as to the effect of re-pressing clay, trial pieces were subjected to compression in a cylindrical die, 15 cm. long and 5·3 cm. in diameter, the pressures ranging up to 50,000 lb. on the whole surface. The results uphold Seger's contention that re-pressing has little, if any, effect upon the density of plastic clay. There is certainly no relation between the magnitude of the compression load and porosity. Any variation in volume of pores is to be attributed to lack of homogeneity in preparing the plastic mass. It follows that in the repressing of brick, pressure used in excess of what is necessary to cause the clay mass to fill the die is wasted energy, and may have the undesirable tendency of weakening resistance to crushing.—H. H. S.

Clays; The compression, tensile and transverse strength of some —— *in the dried state.* A. V. Bleininger and W. L. Howat. Trans. Amer. Ceram. Soc., 1914, **16**, 273—283.

Any strength test of dried clay is regarded as constituting, at best, but a rough and indirect estimate of plasticity. On the other hand, such tests have a practical value in connection with the drying of clays and their bonding power on sand. Tests with mixtures of clay and standard sand are not comparable with those without sand, on account of this bonding power and the change in drying conditions. The clay-sand trials are preferred, particularly with ball clays and plastic fireclays. The transverse test is regarded as more reliable than the tensile test, which is in turn better than the compression test. In all cases, variations from the average are so great that no meaning can be attached to the results until 20 specimens have been broken.—H. H. S.

Clay; The plasticity of ——. N. B. Davis. Trans. Amer. Ceram. Soc., 1914, **16**, 65—79.

Plasticity in clay has been variously attributed to the structure of the particles, to the presence of aluminium silicates containing chemically combined water of hydration, to molecular attraction between particles (Grout, 1905), and to the influence of colloidal matter (Schloesing, 1874). The colloidal theory is regarded as the most probable, and as capable of embracing the others. Organic colloids are very numerous; thirty-four, resulting from decomposition of vegetable and animal organisms, have been identified in soils (see U.S. Bureau of Soils, Bulls. 53, 74, 75). They are present as emulsion-colloids, and protect inorganic colloids—silicic acid, and aluminium and iron hydroxides—from mutual coagulation. The process of decomposition of a mineral such as orthoclase is considered to be essentially one of hydration, with a loss of silicic acid sols at each step, thus: $KAlSi_3O_8+HOH=KOH+HAlSi_3O_8$; $HAlSi_3O_8-SiO_2=HAlSi_2O_6$, pyrophyllite; which by further loss of silica becomes kaolinite and then diaspore. Apart from their protective influence, organic colloids and adsorbed salts increase plasticity by raising the viscosity of the water-film round the particles. The finer the grain of clay, the more chance for colloidal material to form. The longer the clay is subjected to the solvent action of water, the more colloids are formed. Binding power and shrinkage depend on the structure of the grain and on the nature of the emulsion colloids. —H. H. S.

Plasticity method; A study of the Atterberg ——. C. S. Kinnison. Trans. Amer. Ceram. Soc., 1914, **16**, 472—486.

Atterberg's method for measuring plasticity (see International Reports on Pedology, 1911; also this J., 1910, 629) is based upon the varying physical behaviour of clays with different water contents. He classifies the condition of a clay mixed with varying (progressively decreasing) amounts of water into five different states as follows: (1) The upper limit of fluidity, or the point where the clay slip flows as water; (2) the lower limit of fluidity, or flow, where two portions of the clay mass can barely be made to flow together when placed in a shallow dish and sharply rapped; (3) normal consistence, when clay is most workable, is no longer sticky and will not adhere to metal; (4) the rolling limit, at which clay can no longer be rolled into so-called threads between the hands and the surface on which it may rest, and which is the lower limit of the workable condition; (5) the point at which damp clay will no longer hold together when subjected to pressure. The second and third of these conditions define the working range of clay, and it is Atterberg's contention that the wider this range the more plastic is the clay. If the water content corresponding to each of these conditions be expressed as a percentage of the weight of dry clay, the "plasticity number" is the difference between the resulting figures; the higher its value the more plastic is the clay. It is found, however, in the case of loams and of clays rich in humus that normal consistence (3) is higher than flow-limit (2), and therefore two types of plasticity must be recognised, viz., sticky and non-sticky plasticity. Failure to appreciate this distinction is considered by Atterberg to be the cause of failure of many older methods for determining plasticity. The method was tried by the author on twenty American clays of various types, and was judged from practical experience to be no more accurate than that based on volume shrinkage. No method yet known entirely coincides in its results with those of practical experience, but a collation of the best reveals the facts with fair accuracy.—H. H. S.

Pottery scrap clay; Note on the restoration of plasticity to ——. J. Minneman. Trans. Amer. Ceram. Soc., 1914, **16**, 96—97.

Unfired scrap clay, found to be less plastic when re-blunged and re-pressed, may be restored by the addition of electrolytes which coagulate clay slips. Hydrochloric acid, magnesium sulphate, calcium sulphate and vinegar were used on a commercial scale, in amounts varying from 0·05 to 0·1%, the addition being made in the blunger. Magnesium sulphate (0·07%) was found to be most satisfactory, and has been used for several years. The restored plasticity is equal to the original.—H. H. S.

Viscosity of some shales at furnace temperatures. G. H. Brown. Trans. Amer. Ceram. Soc., 1914, **16**, 571—576. (See also Bleininger and Teetor, this J., 1914, 79.)

Test pieces burned to 850° C. were suspended vertically from fireclay grids in the kiln, and loads were applied by hanging to the lower ends fireclay weights equivalent to a tension of 5 lb. per sq. inch of cross-sectional area. Reference marks four inches apart were made on each piece. Seven burns were conducted, the finishing temperatures being 1020°, 1050°, 1090°, 1100°, 1130°, 1150 and 1170° C. respectively. A striking difference in the viscosities of shales during vitrification was evident. As a general rule, a shale or clay maintaining a high viscosity during vitrification is to be preferred to one which is subject to a sudden drop in viscosity: except when, as is found in very silicious samples, the former produces a ware of inferior strength and toughness.—H. H. S.

Felspar supply of the United States. A. S. Watts. Trans. Amer. Ceram. Soc., 1914, **16**, 80—95.

The demand for pure felspar being greater than European sources can supply, the author recounts the location and extent of felspar deposits (apparently pegmatite) in the United States east of the Mississippi River. The influence of the methods of mining and grinding upon the quality of the finished product is shown by the good reputation of Maine felspars, which are not naturally very pure on account of a quartz content which cannot be eliminated. Analyses given of American spars show variations in alkali content from 8 to 16%. The chief states concerned are Maine, Connecticut, New York, and Pennsylvania. In the last-named, the largest deposit of soda felspar in the world was found, but is almost exhausted. Maryland is expected to supply soda felspar in the future; the soda pegmatites contain 6% Na_2O and 4% K_2O. In Virginia and North Carolina, felspar has been subsidiary to mica mining hitherto. In Georgia the production of felspar has not yet been attempted.—H. H. S.

Plaster; Note on the transverse test applied to pottery ——. F. B. Allen. Trans. Amer. Ceram. Soc., 1914, **16**, 98—100.

The transverse, as an alternative to the tensile, test was carried out by suspending plaster bars on knife edges and breaking them by means of a load applied at the middle. The load consisted of a bucket into which water was poured until rupture occurred. The formula used is $S = \frac{3}{2} \cdot \frac{Pl}{bd^2}$, where S is the modulus of rupture in lb. per sq. inch, P the load, l the length in inches, and b and d, the width and depth respectively of the cross-section. The average of tests on good material was found to be 608. A good tensile standard is about 600 lb. per sq. inch. —H. H. S.

Potash-soda felspars; Use of mixed —— in porcelain. A. S. Watts. Trans. Amer. Ceram. Soc., 1914, **16**, 212—215.

The introduction of soda felspar into felspathic porcelain is found to cause warpage when equal parts of soda- and potash-spar are used, if the ware is not fired above cone 8 (1290° C.). Above this temperature, warpage increases with the content of soda-spar, until it constitutes 83% of the total felspar present; then warpage decreases up to 100% soda-spar, indicating that pure soda felspar would cause less warpage than any natural mixture of the two spars. Shrinkage increases with the content of soda spar, but only slightly after the ratio equals 1 : 1. If the firing temperature exceed cone 8, shrinkage increases up to the ratio 62 potash- : 38 soda-felspar, and with additional soda-spar decreases slightly. Translucency increases with the content of soda-spar, but above cone 8 decreases in all cases.—H. H. S.

Porcelain body; The influence of calcium and iron chlorides precipitated in a ——. B. S. Radcliffe. Trans. Amer. Ceram. Soc., 1194, **16**, 127—130.

As clays that naturally burn red have a high absorption, and as the colours are not always uniform, porcelain slips were mixed with solutions of iron and calcium chlorides, which were then precipitated by addition of ammonia and ammonium carbonate. Bodies high in iron were more plastic than those high in lime, and the dried tiles were stronger. All the bodies were completely vitrified at cone 9. Suitable uniform gray colours can be obtained by precipitating 0—2% Fe in a porcelain body, and uniform red colours by 4—6% Fe. The porosity in the latter case need not be more than 3—4%.—H. H. S.

Ferric oxide [as colouring agent in pottery]; A note on the reduction of ——. C. S. Kinnison. Trans. Amer. Ceram. Soc., 1914, **16**, 136—143.

Ferric oxide at atmospheric pressure cannot exist above 1350° C.; it dissociates into oxygen and magnetic oxide, which in presence of silica, as in clay, forms ferrous silicates dark brown to black in colour. This colour-change was taken as criterion of reduction of ferric oxide when added to the extent of 5% to various mixtures of kaolin, flint and felspar. The results show that the temperature of formation of ferrous silicate is qualified by the $Al_2O_3 : SiO_2$ ratio of the body mixture; the smaller the ratio (which varied from 1 : 2 to 1 : 9), the lower the temperature. Seger's statement that the lower the $Al_2O_3 : Fe_2O_3$ ratio, the lighter are the colours developed, is confirmed. Fluxes influence the colouring properties of iron oxide in opposite ways; at low temperatures where the amount of fused material is small, the colour is intensified by suspension of iron particles: but with more fused material present, iron is taken into solution and the colour then depends on composition and temperature. In acid clays reduction of Fe_2O_3 takes place at lower temperatures than in more aluminous bodies: 1320° as compared with 1390° C. When fluxes are present the dissociation temperature is 1210—1220° C.—H. H. S.

Soluble salts in clay; Influence of —— upon behaviour of slip and glaze. M. A. Coats. Trans. Amer. Ceram. Soc., 1914, **16**, 162—168.

A TERRA-COTTA clay containing 0·356% of soluble sulphates was used for the body, and amounts up to 5% $CaSO_4$, 5% NaCl, 4·5% $MgSO_4$, 5·0% $CaCl_2$, and 3·5% $FeSO_4$, were further added separately. The presence of soluble salts in the body caused peeling of slip or glaze, the amount present not being material. Application of the glaze to the "leather-hard" body did not eliminate the trouble. Fixation of the sulphates by addition of barium carbonate was an effective remedy.—H. H. S.

Terracotta bodies, slips, and glazes. G. D. Phillips. Trans. Amer. Ceram. Soc., 1914, **16**, 169—178.

In attempts to produce a satisfactory combination of body, slip and glaze to mature at cone 6—7 for architectural terracotta, the trials were pressed in plaster moulds, removed as soon as possible, and tooled to a finished surface. The body selected had the composition: Stoneware clay 79·5, grog (12—45 mesh) 20, barium carbonate 0·5%. The slip was made from the mixing: china clay 25, Tennessee ball clay 6, Cornwall stone 45, German ball clay 6, flint 20, sodium carbonate 1 part by weight. A bright white glaze was made from the formula: 0·16 K_2O, 0·40 CaO, 0·35 BaO, 0·09 ZnO, 0·41 Al_2O_3, 3·7 SiO_2; and a matt white from the formula: 0·16 K_2O, 0·44 CaO, 0·35 BaO, 0·05 ZnO, 0·37 Al_2O_3, 1·9 SiO_2. The ware was fired to cone 6 in a 50 hour burn, with slow cooling. —H. H. S.

Roofing tile slips and glazes. E. T. Montgomery and C. F. Tefft. Trans. Amer. Ceram. Soc., 1914, **16**, 144—150.

The composition of slips and glazes depends on whether the tile is to be burnt in one fire, at cone 02, or in two fires of which the second is at cone 010—07 (see Ohio Geol. Survey, Bull. 11, "Manuf. of Roofing Tiles"). The use of a dull glaze or one which is matt owing to immaturity is recommended instead of a slip. At cone 02, a glaze of this kind may be made from the formula: 0·6 PbO, 0·25 CaO, 0·15 K_2O, 0·35 Al_2O_3, 1·3 SiO_2, with the addition of the usual colouring agents. At cone 010—07, a dull glaze of the following composition may be used: 0·1 K_2O, 0·5 PbO, 0·25 CaO, 0·15 BaO, 0·15—0·3 Al_2O_3, 1·5—3·0 SiO_2; or a matt glaze of composition: 0·8PbO, 0·1 CaO, 0·1 K_2O, 0·21 Al_2O_3, 1·4 SiO_2.—H. H. S.

Underglaze colours; Production of —— by use of soluble metallic salts. R. M. Howe. Trans. Amer. Ceram. Soc., 1914, **16**, 487—496.

The salts used, viz., nitrates of cobalt, uranium and nickel, sulphates of iron and manganese, and chromium chloride, were deposited by evaporation from solution on bases such as aluminium hydroxide, kaolin, silica, bone ash and zinc aluminate, and calcined at cone 7. The colours were then ground and applied to biscuit ware with ball clay and glycerin, and fired to 600° C. in order to render them firm for dipping into glaze. Earthenware trials were fired to cone 07 in 6 hours, stoneware to cone 7 in 24 hours, and porcelain to cone 10 in 36 hours. Good results were obtained by this method of introducing very small quantities of colouring agents by means of their solutions. Cobalt on alumina yielded good colours at all temperatures; cobalt on zinc aluminate was good at the higher temperatures, but greenish at cone 07; cobalt on flint also behaved well. Uranium on alumina gave nice yellows under oxidising, and pretty grays and blacks under reducing, conditions; uranium on kaolin was not so easily influenced by the atmosphere. Iron on kaolin gave good yellows at cone 07, and browns at the higher cones; iron on bone ash was useless. Chrome-alumina pink was successful at cones 7 and 10, and a better pink was obtained from chrome on zinc aluminate; but the latter destroyed all green colours. Manganese on aluminium hydroxide gave exceptionally good pinks with low Mn content at the higher cones, but with increasing content of stain blistered badly.—H. H. S.

Chromium oxide as colouring agent; Effect of variation of RO elements upon —— in a matt glaze. R. H. Minton. Trans. Amer. Ceram. Soc., 1914, **16**, 248—263. (See also Pence, this J., 1914, 80.)

Experiments were made to determine the effect of CaO, BaO, MgO, and ZnO, separately and in combination, upon Cr_2O_3 in a matt glaze in which K_2O, Al_2O_3, and SiO_2 were kept constant at 0·2, 0·35, and 2·25 equivalents respectively, and Cr_2O_3 at 1·75%. The effect of the above bases on chromium colours is summarised as follows: CaO singly, fine green; CaO and ZnO together, pink to brown in increasing quantities; CaO and BaO, very dark green; CaO and MgO, brown; CaO and PbO, fine bright green; ZnO alone, light fawn; ZnO and BaO, brown; ZnO and MgO, pinkish brown; ZnO and PbO, brown and strong pink; BaO alone, yellow or apple green; BaO and MgO, gray; MgO alone, fawn, stronger than ZnO in effect. In fluxing power, CaO alone is superior to either BaO, MgO or ZnO alone; CaO and ZnO together are superior to any other dual combination; CaO and MgO together do not flux in any proportion (cone 4 down). The uncertain action of zinc in chromium glazes is due to atmospheric conditions in the kiln, the tendency of zinc being to form chromate; both yellow and green and their variations may be found on the same piece. The introduction of chromium as a prepared stain rather than as the raw oxide is recommended. The two following, containing zinc and chromium, and calcined at cone 5, are stable in glazes containing no zinc: (*a*) 1 part of ZnO, 1 of Cr_2O_3, 1 of flowers of sulphur, and 0·01 of Co_3O_4, produce a dark green; (*b*) 40 parts of Cr_2O_3, 20 of ZnO, 5 of Co_3O_4, 20 of SiO_2, and 15 of borax, produce a dark blue green.—H. H. S.

Cobalt-uranium colours [for pottery glazes]; Some ——. B. S. Radcliffe. Trans. Amer. Ceram. Soc., 1914, **16**, 209—211.

In addition to the four oxides, of copper, chromium, nickel and iron, which singly produce green colours, a blend of cobalt blue and uranium yellow is found to be green when fired as when physically mixed. The proportions recommended are 4 or 5 parts of uranium nitrate to one of cobalt nitrate.—H. H. S.

Porcelain glazes; Deformation temperatures of some ——. R. T. Stull and W. L. Howat. Trans. Amer. Ceram. Soc., 1914, **16**, 454—460.

Cones were made of glaze mixtures and their deformation temperatures were determined in a platinum resistance furnace. RO was kept constant in all glazes at $0{\cdot}3K_2O$, 0·7CaO; Al_2O_3 was varied between 0·4 and 0·85 equiv., and SiO_2 between 2·0—6·5. The difference between maximum and minimum deformation temperatures was 57° C.; the softest, deforming at 1220° C. (Seger cone 4 = 1212° C.) having the formula $RO,0{\cdot}6Al_2O_3,4{\cdot}0SiO_2$; and the two hardest, deforming at 1277° C. (approximately cone 7) the formulæ $RO,0{\cdot}85Al_2O_3,2SiO_2$, and $RO,0{\cdot}4Al_2O_3,6{\cdot}5SiO_2$. The glazes were also fired on bisque tiles at cone 9, and the best results found to be obtained from the formulæ, with deformation temperatures of the cones of the same composition: (*a*) $RO,0{\cdot}6Al_2O_3,4{\cdot}0SiO_2$ (1220° C.); (*b*) $RO,0{\cdot}55Al_2O_3,3{\cdot}5SiO_2$ (1227° C.); (*c*) $RO,0{\cdot}55Al_2O_3,4{\cdot}0SiO_2$ (1230° C.); (*d*) $RO,0{\cdot}6Al_2O_3,3{\cdot}5SiO_2$ (1222° C.). The difference between their deformation temperature and their best firing temperature is 80°—90° C., a difference of 4—4½ Seger cones. The best glazes in any group are found in close proximity to the group eutectic.—H. H. S.

Crystalline glaze; A type of —— at cone 3. C. C. Rand and H. G. Schurecht. Trans. Amer. Ceram. Soc., 1914, **16**, 342—346.

The glaze selected had the formula: $0{\cdot}3Na_2O,0{\cdot}65ZnO,0{\cdot}05CoO,0{\cdot}05Al_2O_3,0{\cdot}3B_2O_3,1{\cdot}8SiO_2,0{\cdot}2TiO_2$. Slight variations of Na_2O and ZnO did not appear to affect crystallisation or colour. Increase of TiO_2 caused crystals to become smaller and more numerous, and deteriorated the cobalt blue, owing perhaps to iron impurities in the rutile. Trials were drawn from the kiln as cooling progressed; crystallisation increased steadily from 1170° C. downwards, till at 1030° C. the glaze was a mass of crystals, suggesting crystallisation of an eutectic. A thick coating of glaze applied to the ware was found to give the best result.—H. H. S.

Coloured porcelain glazes at cone 10. E. T. Montgomery and I. A. Kruson. Trans. Amer. Ceram. Soc., 1914, **16**, 317—363.

The colourless glaze used as base varied in composition, the extremes being: (1) $0{\cdot}3K_2O,0{\cdot}7CaO,0{\cdot}4Al_2O_3,3{\cdot}8SiO_2$; and (4) $0{\cdot}25K_2O,0{\cdot}55CaO,0{\cdot}1Na_2O,0{\cdot}1ZnO,0{\cdot}3Al_2O_3,3{\cdot}0SiO_2,0{\cdot}2B_2O_3$. Borax, when used, was introduced raw in amounts up to 10% without difficulty. All glazes were raw, and applied to the dry "green" ware and fired in one burn to cone 10. The minimum and maximum amounts of the usual colouring oxides, employed singly, necessary to produce satisfactory colours were as follows, in equivalents: CoO 0·025—0·10, CuO 0·125—0·2 (volatilisation occurs), MnO_2 0·1—0·25, Cr_2O_3 (Zn absent) 0·015—0·15, Fe_2O_3 0·025—0·1, U_2O_3 (introduced as $Na_2U_2O_7,6H_2O$) 0·01—0·02, NiO 0·05—0·15. Some 21 recipes are given as batch weights for the production of commercially desirable colours, blacks, greens, browns and slate-colours. Experiments were also made on the production of less usual colours in a porcelain glaze by rare elements, fritted stains, and calcined colour bodies. Rutile in amounts from 5—10% gave light to deeper yellow. A solution of platinum chloride 0·5 part, cobalt nitrate 0·14, with glycerin 1·9 and dextrin 1·0, yielded black; and from 0·04—0·06 equiv. of U_2O_3 black was obtained under reducing conditions. Pinks were produced by chrome-tin, chrome-alumina and manganese-alumina stains, and by gold chloride solution. At these high temperatures tin oxide must not be used when chromium oxide greens are desired. A large variety of colours can be obtained at cone 10.—H. H. S.

Vitrification; The legal definition of ——. E. Orton, jun. Trans. Amer. Ceram. Soc., 1914, **16**, 497—511.

As clay products which are visibly glassy are practically certain to be overburned and worthless, and as all clay products whether much or little vitrified show some portions of glassy matrix under magnification, the author proposes a quantitative absorption test in order to ascertain "vitrification." The definition he suggests for a legal standard is as follows: "Where the word vitrified is used in a contract or agreement as an adjective in describing the properties of a clay product, without further definition in such contract, it shall mean that the product shall have attained in the firing process such a degree of structural density that its mean absorption of pure water will not exceed 3% of its own initial weight, when subjected to absorption tests of 48 hours' complete immersion in cold water or 3 hours' immersion in boiling water. Not less than three tests shall be made in determining the mean absorption, and no single test may exceed the mean by more than 0·5%. Neither the possession of the visual properties or appearance of a glass, nor any definite degree of physical strength, hardness, colour, or specific gravity, shall be implied as an attribute of vitrification." —H. H. S.

Producer gas-fired continuous [*pottery*] *kiln; Present status of* —— *in America.* R. H. McElroy and G. R. Mumma. Trans. Amer. Ceram. Soc., 1914, **16**, 585—605.

An 18-chamber kiln at Toronto is described as representing the most recent advance in efficiency and economy. Three 6 ft. water-sealed producers are fed with Yohoghany coal, three-quarters lump, together with slack and nuts, at a cost of $4 a ton delivered. The temperature of the gas is 850°—900° F. (about 450°—480° C.) in the necks of the producers. The steam pressure on the producer fuel bed is 60 lb. Stock bricks are made from a gray-burning calcareous glacial drift and a red-burning sandy weathered plain deposit. The chamber holds 58,000 bricks, weighing, after burning, 5½ lb. each, their size before fire being 9″×4″ and after, 8¾″×3⅞″. The fuel consumption is 285 lb. per 1000 bricks, and the time of burning 25¾ hours. The draught one chamber ahead of the fire is 0·5—0 in.; 3 chambers ahead, 2·0—1·5 in. A kiln is operated by two men on a shift.—H. H. S.

[*Pyrometers.*] *The Veritas firing rings.* A. V. Bleininger and G. H. Brown. Trans. Amer. Ceram. Soc., 1914, **16**, 222—231.

The principle involved in the use of these rings, invented by M. Solon, is the same as in the pyrometer devised by Josiah Wedgwood: that of shrinkage in fire. A clay body similar in composition to white ware (roughly, clay 52, flint 33, felspar 15%), is formed into rings 2·5 inches in diameter with a hole 0·85 inch diam. Progress of firing is followed by withdrawal of rings from various parts of the kiln. The rings share the properties and defects of Seger cones, but are more useful in the early stages of the fire as they swell up before dehydration, whereas a cone shows nothing until incipient softening by fusion occurs. Rings of a former batch should be preserved in order to check the behaviour of the next batch. —H. H. S.

IX.—BUILDING MATERIALS.

Lime mortars; Effect of consistency and amount of sand on the properties of ——. W. E. Emley. Trans. Amer. Ceram. Soc., 1914, **16**, 151—161.

To measure consistency, three different instruments were used: (1) Chapman's (Proc. Amer. Soc. Testing Materials, 1913); (2) the plunger instrument described in Trans. Natl. Lime Manuf. Assoc., 1911; (3) the Clark viscosimeter (Trans. Amer. Ceram. Soc., 1913). Chapman's instrument gave good results, covering the whole field and being sensitive to small changes of composition. Cylindrical plungers are sensitive and may be used for most of the mortars in practice. The Clark viscosimeter is acutely sensitive for lime paste, but useless for mortars. The strength of a mortar is influenced more by its consistency than by its composition; sand settles out when the paste becomes too thin. The mortars were finally moulded into two-inch cubes and after 60 days were measured for shrinkage and their crushing strength determined. The following three, out of seven, had crushing strengths of over 200 lb. per sq. inch: (*a*) lime 20, water 20, sand 60; (*b*) lime 25, water 20, sand 55; (*c*) lime 20, water 15, sand 65% by weight.—H. H. S.

Lime mortar; Method of indicating the rate of set of ——. W. E. Emley. Trans. Amer. Ceram. Soc., 1914, **16**, 117—119.

The final hardening of mortar, due to the reaction between lime and atmospheric carbon dioxide, begins at the surface and proceeds to the interior at a rate dependent on the porosity of the mortar and other factors influencing the circulation of air within the mass. The proportion of water originally present in the mortar is also of importance, as a certain amount is necessary to promote chemical action, and excess requires to be evaporated. To ascertain the influence of the penetration of carbon dioxide on setting, bars of mortar were made up with an aqueous 0·1% solution of Wool Blue R, which is rendered colourless in presence of lime and restored to dark blue by carbon dioxide. The line of demarcation was sufficiently distinct for the extent of carbonate formation to be measured when the bar was sawn through. With bars 1 sq. inch in section, exposed to the action of air in a room, the penetration of the carbon dioxide was complete in about four months.—H. H. S.

Mortars; The use of fine earth in ——. H. K. Benson and J. S. Herrick. J. Ind. Eng. Chem., 1914, **6**, 796—797.

Samples of fine earth of various kinds were mixed with lime or with Portland cement, and with water, kept in moist air for 24 hours, formed into blocks under a hydraulic pressure of 2000 lb. per sq. in., air-dried for 24 hours, and treated with live steam at 80 lb. pressure for 8—16 hours. With suitable proportions of the binding agent (lime or cement) it was possible to obtain from all the samples of earth blocks having a crushing strength of about 3000 lb. per sq. in. and upwards. Some of the blocks had crushing strengths ranging from 6200 to 9750 lb. per sq. in. In presence of soluble organic matter (straw infusion or tannin), strong blocks could not be obtained from earths of sandy texture, but loamy earths gave blocks having a crushing strength of over 3000 lb. per sq. in.—A. S.

Portland cement; Hydration of ——. A. A. Klein and A. J. Phillips. Trans. Amer. Ceram. Soc., 1914, **16,** 313—341.

THE binary compounds known to be present in Portland cement, viz., three aluminates: $CaO.Al_2O_3$, $5CaO.3Al_2O_3$, and $3CaO,Al_2O_3$; and four silicates: $CaO.SiO_2$, $\gamma 2CaO.SiO_2$, $\beta 2CaO,SiO_2$, and $3CaO,SiO_2$, were prepared in as pure and homogeneous a condition as possible. Lime was also burned at different temperatures. Tests were also made on high-silica, low-silica, and high-iron cements. Samples were hydrated on microscope slides with excess of water under conditions precluding evaporation and action of carbon dioxide. They were also hydrated in a cylinder with superheated steam at atmospheric pressure (Bied's method. Proc. Int. Assoc. Testing Materials, **2,** [9], 8), and in an autoclave with steam at various temperatures and pressures. Finally, they were moulded with limited quantities of water approximating to those used to obtain normal consistence. In addition to water, lime-water and calcium sulphate solution were employed as hydrating agents. Examination of changes produced was conducted by petrographic methods. No evidence was obtained of abnormal hydration reactions in the autoclave, except in the changing of optical properties of gypsum and hydrated $3CaO.Al_2O_3$, due to dehydration, which was overcome by use of more water in the autoclave. At very high steam pressures (600 lb. for 2 hours), there were observed large growths of calcium hydroxide crystals; but with lower pressures, the conditions of the autoclave approximated to 28 days normal hardening. The process of hydration is considered to be as follows. Amorphous hydrated $3CaO.Al_2O_3$ is formed, with or without amorphous alumina, and later crystallises. At the same time sulphoaluminate crystals are formed, and lime, if low burned or finely ground, is hydrated. These reactions begin within a few hours after the cement is gauged. The next compound to react is $3CaO.SiO_2$: its hydration may begin within 24 hours, and is generally complete within seven days. Between a week and a month, the amorphous aluminate commences to crystallise, and hydration of $\beta 2CaO.SiO_2$ begins. Although the last-named compound is the chief constituent of American Portland cements it is the slowest to react. The early strength of cements (after 24 hours) is due to hydration of lime and aluminates. Increase in strength between one and seven days depends upon hydration of $3CaO.SiO_2$, though further hydration of aluminates may contribute. Increase between 7 and 28 days is due to hydration of $\beta 2CaO.SiO_2$, but is counteracted by hydration of high-burnt free lime and crystallisation of aluminates, which may cause a decrease in strength during this period. Finally, iron compounds in cement resist hydration and occur as a rust-like material. The disintegrating action attributed to crystallisation of $3CaO,Al_2O_3,3CaSO_4,xH_2O$ is said to have been greatly exaggerated, as such crystals are extremely small, and they begin to form before the cement mass has assumed any great rigidity.—H. H. S.

White Portland cement; Some properties of ——. P. H. Bates. Trans. Amer. Ceram. Soc., 1914, **16,** 551—570.

WHITE cement sets more quickly than gray cement, owing to the absence of iron oxide, which, contrary to the old idea, cannot be compensated by higher alumina content. The difficulty is enhanced by the finer grinding required to obtain a product of good colour. White Portland cement may be readily produced in a rotary kiln at a temperature but little above that used for ordinary cement, if the silica content of the latter be raised, and the alumina decreased, while the lime is kept the same. A lower alumina content is necessary because, while it is not shown that high alumina makes quick-setting cement, the temperature of softening is materially reduced with such increase, and the clinker "rings up" the kiln. High silica necessarily follows, as high lime would cause difficulty in reaching a temperature high enough to produce a sound cement (see this J., 1914, 81). The calcium sulphate content which produced the best time of set, viz., 2%, is not the same as that which produced the best strength, 4%; strength therefore is accompanied by quicker setting. Petrographic analyses of the clinkers showed that in all cases βcalcium orthosilicate was the most important constituent, followed by $3CaO,SiO_2$. The only aluminate present was $3CaO,Al_2O_3$. The composition of the best clinker was: SiO_2 25·94, Al_2O_3 6·55, Fe_2O_3 0·44, CaO 65·50, MgO 1·35, Na_2O 0·07, K_2O 0·12, loss on ignition 0·36%. A mixture of flint, alumina and limestone, gives better results than one of clay and limestone, and this in turn is better than one of felspar and limestone.—H. H. S.

Portland cement; Note on a rare anomaly in the setting properties of ——. F. Ferrari. Annali Chim. Appl., 1914, **2,** 68—74.

TWO samples of Portland cement set almost instantaneously, with considerable evolution of heat, about 1 hour after gauging. The clinker from which the cement was made was found to consist of two distinct products—one, of a greenish yellow colour, not completely sintered, free from puzzuolanic substances but rich in free lime and containing free calcium aluminates; the other, of a brown colour, nearly fused, rich in puzzuolanic substances, and containing no free lime. These two products when ground separately both gave slow-setting cements. It is considered that when the cement from the two products together was gauged, the free lime dissolved rapidly and prevented the hydration of the calcium aluminates. The puzzuolanic substances present in the nearly fused product were in sufficient quantity to fix the whole of the free lime, and when this had taken place hydration of the aluminates became possible and these exhibited their known quick-setting properties. The abnormal cement could be made slow-setting by addition of a small quantity (1%) of lime.—A. S.

Cement: Influence of organic admixtures on the setting of ——. H. K. Benson, C. A. Newhall, and B. Tremper. J. Ind. Eng. Chem., 1914, **6,** 795—796.

SAMPLES of Portland cement, with and without addition of gypsum, were mixed with various organic compounds typical of the classes of substances that might be expected to be present in soil or sand deposits, and the effect on the setting properties of the cement observed. The results are given chiefly in curve-diagrams. Certain substances, *e.g.*, tannin, straw infusion, oxalic acid, quinoline, and soap, which produced a precipitate with the cement and also with calcium chloride solution, greatly accelerated the initial set and greatly retarded the final set. Other organic substances, however, also exerted a retarding effect on the final set and the action cannot be attributed to any particular class of compounds. No evidence of catalytic action was obtained.—A. S.

Refractories; Relative thermal conductivities of silica and clay ——. G. H. Brown. Trans. Amer. Ceram. Soc., 1914, **16,** 382—385.

THE composition of the three sample bricks tested was:—Silica brick: SiO_2 95·48, Al_2O_3 1·92, Fe_2O_3 1·42, %; quartzite brick: SiO_2 83·36, Al_2O_3 11·79, Fe_2O_3 1·69, %; clay brick: SiO_2 63·24, Al_2O_3 32·97, Fe_2O_3 1·33, %. Readings were taken up to 1300° C. The relative thermal conductivities of the bodies, silica, quartzite, and clay, were found to be as 1017 : 986 : 933, silica brick thus having a conductivity 9·0%, and quartzite 5·7%, greater than that of clay.—H. H. S.

Building brick; Absorption of water by ——. H. W. Mahr. J. Ind. Eng. Chem., 1914, 6, 800—803.

Bricks of various characters were subjected to absorption tests (48 hours total immersion and the boiling test recently proposed in the Proc. Amer. Soc. for Testing Materials, 1913, 13, 287) in a 2 % solution of potassium ferrocyanide, then split by means of a chisel, dried, soaked in ferric chloride solution, dried and washed. The degree and character of the penetration of the solution was clearly revealed by the blue precipitate formed. A series of photographs is reproduced, and it is concluded that whilst in the boiling test water is forced into cores not penetrated in the 48 hours total immersion test, the latter gives results which are more concordant and more in conformity with the behaviour of the brick under natural conditions.—A. S.

Magnesite; The effect of steam upon magnesite brick or calcined ——. R. H. Youngman. Met. and Chem. Eng., 1914, 12, 620.

Attention is drawn to the hydration of calcined magnesite (pure and impure) by steam, more particularly in connection with the practice of laying magnesite brick upon moist, refractory material, as in the preparation of furnace bottoms.—W. E. F. P.

Zinc in treated wood; New method for the determination of ——. M. H. Bedford and R. Pfanstiel. J. Ind. Eng. Chem., 1914, 6, 811.

To destroy the organic matter, 3 grms. of the finely-divided wood are mixed with 35 grms. of sodium peroxide and burnt in an iron bomb. Water is afterwards introduced through an opening in the side of the bomb, closed by a screw plug, and the zinc is determined as described by Bateman (this J., 1914, 138). The method gave satisfactory results with red oak sawdust impregnated with zinc chloride.—A. S.

Note on the transverse test applied to pottery plaster. Allen. *See* VIII.

Patents.

[*Asphaltic*] *Paving material.* E. J. Lovegrove and N. G. Crompton, London. Eng. Pats. 5989 and 7539, March 9 and 25, 1914.

A mixture of finely divided clinker or the like (preferably from a dust destructor) with 10—20 % of its weight of bituminous material, or a mixture of gritty material, such as sand or small stone particles, with 10—20 % of bituminous material and a filling of clinker or ash in impalpable powder. The hot clinker is preferably pulverised immediately after withdrawal from the furnace and further drying or heating effected by the destructor gases. The ingredients may be mixed at 275°—375° F. (135°—191° C.) and the mixture laid at 250 —350° F. (121°—177° C.).—F. Sodn.

Wood preservative. J. C. Fitzsimmons, San Francisco, Cal. U.S. Pat. 1,111,302, Sept. 22, 1914; date of appl., June 23, 1913.

A mixture of heavy mineral oil and cresol, each preferably of sp. gr. about 0·98. For example, a mixture of oil of asphaltum base, of 14° B. (sp. gr. 0·98), with 10 % of cresol and having a b.pt. of about 200° C.—F. Sodn.

Concrete structures; Process of hardening ——. S. W. Flesheim, Assignor to Master Builders Co., Cleveland, Ohio. U.S. Pat. 1,113,112, Oct. 6, 1914. Date of appl., Aug. 11, 1913.

See Eng. Pat. 24,420 of 1913; this J., 1914, 422.—T. F. B.

Producing indurated articles. U.S. Pat. 1,111,286. *See* XIII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Bog iron ores; Treatment of —— by Kjeldahl's method for the destruction of organic matter. L. Brandt. Stahl u. Eisen, 1914, 34, 630—631.

To complete the oxidation of organic matter after 1 grm. of the ore has been heated with 20 c.c. of strong sulphuric acid, 0·35—0·45 grm. of hydrated manganese dioxide is added.—O. E. M.

Iron; Solubility of hydrogen and of nitrogen in ——. E. Jurisch. Stahl und Eisen, 1914, 34, 252.

Above 400° C. equilibrium between iron and hydrogen is quickly established. In experiments at atmospheric pressure with 100 grms. of iron wire, containing 0·04 % C, the results were :—

Temp., °C.	Hydrogen absorbed, mgrms.	Temp., C.	Hydrogen absorbed, mgrms.	Temp., C.	Hydrogen absorbed, mgrms.
416	0·035	852	0·264	1033	0·526
518	0·075	878	0·315	1136	0·632
620	0·118	899	0·390	1250	0·776
724	0·178	904	0·383	1350	0·949
775	0·210	930	0·431	1450	1·079
827	0·242	981	0·480		

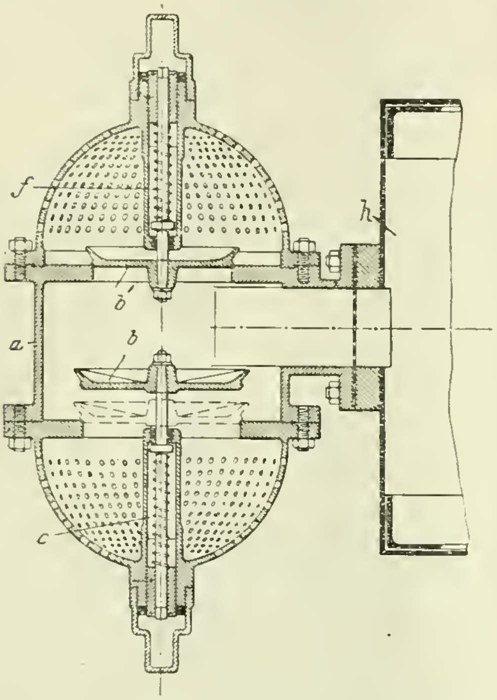
The steep ascent in the curve between 850° and 900° C. is attributed to the allotropic change in the metal. After slow cooling only 0·01 mgrm. of hydrogen remained absorbed. Between 600° and 930° C. an appreciable formation of methane occurred, especially with specimens containing higher amounts of carbon. At pressures ranging from 750 to 23 mm. and at 620° (α-iron), 775° (change of α-iron to β-iron) and 930° C. (γ-iron), the amounts of hydrogen absorbed were proportional to the square root of the pressure. The amounts of nitrogen at 760 mm. pressure, absorbed by 100 grms. of reduced iron in powder were :—878°, 1·58; 930°, 21·65; 981°, 21·03; 1033°, 20·22; 1084°, 19·73; and 1136° C., 18·85 mgrms. Absorption commenced at about 850° C.; and, after slow cooling, in two experiments quantities of 2·63 c.c. and 3·67 c.c. remained absorbed. The amount of nitrogen absorbed was proportional to the square root of the pressure.—J. B.

Carbon in steel; Determination of —— by the direct combustion method. W. Brady. J. Ind. Eng. Chem., 1914, 6, 843—846.

A description of the process and apparatus in use in the laboratory of the Illinois Steel Co. (compare Cain, this J., 1914, 696). Fine drillings of the steel are sifted and the portion passing a 10-mesh sieve in the case of medium- or high-carbon steel, or a 20-mesh sieve in the case of low-carbon steel, and remaining on a 40-mesh sieve, is used as sample. Combustion is effected in a nickel or platinum boat lined with alundum and placed in a quartz tube, 24 ins. long by ¾ in. diameter. Platinised asbestos mixed with broken pieces of quartz tubing is used as a catalyser in the hot part of the combustion tube and the space from the catalyser to the end of the tube is filled with pieces of quartz: the forward part of the tube is left empty. The furnace, heated by gas, or electrically, is kept at 960°—1000° C. The carbon dioxide is absorbed in excess of standard barium hydroxide solution in an Erlenmeyer flask and a nine-bulb tube, and the excess is titrated with hydrochloric acid in presence of phenolphthalein, without filtering. A bubble tube containing granulated zinc is interposed between the combustion tube and the absorption apparatus to retain sulphuric acid, most of which, however, condenses in the exit end of the combustion tube from which it is removed, after about 50 determinations, by moving this end into the furnace and drawing a slow current of oxygen through. —A. S.

Cupola furnaces; Explosions in —— and a safety-device for avoiding them. F. Osswald. Stahl u. Eisen, 1914, 34, 349—352.

EXPLOSIONS in cupola furnaces are due to the passage of carbon monoxide from the furnace back into the blast conduits when the blast is interrupted, the gaseous mixture igniting when the blast is re-started. A device for automatically preventing the accumulation of gas in the blast passages when the blast is interrupted, comprises a valve-box, *a*, attached to the blast chamber, *h*, of the furnace, and fitted with two lift-valves, *b*, *b′*. The upper valve, *b′*, is loaded by the spring, *f*, and opens only when the pressure exceeds the maximum blast pressure used. When the blast is interrupted the lower valve, *b*, is forced upwards by the spring, *c*, and an up-draught is maintained through the furnace. On re-starting the blast, the air or gas passes freely from the blast-chamber, *h*, through valve, *b*, to the atmosphere until the pressure has increased sufficiently to close the valve.—A. T. L.



Vanadium; Determination of —— in ferro-vanadium and steel. O. Wilms and P. Fischbach. Stahl u. Eisen, 1914, 34, 417—418. (See also König, this J., 1914, 315.)

CAMPAGNE's method, in which a solution of the metal in nitric acid is evaporated with hydrochloric acid, and the oxychloride titrated with potassium permanganate at 80°—85° C. in the presence of phosphoric acid, gives low results owing to the volatility of the oxychloride. If sulphuric acid be added, the solution evaporated until sulphuric acid fumes escape, cooled and diluted, before adding hydrochloric acid, then during the subsequent evaporation, the non-volatile oxysulphate is formed: $V_2O_2Cl_4+2H_2SO_4=V_2O_2(SO_4)_2+4HCl$.—A. T. L.

Platinum ore in S. Nevada. F. A. Hale, jun. Eng. and Min. J., 1914, 98, 641—642.

ORE recently discovered at the Boss Mine, 10 miles W. of Goodsprings, contained Pt 0·5—1, and Au 0·75—1·5, oz. per ton, with some silver and small amounts of base metals. The deposit occurs in limestone, in a crushed fault-zone which also traverses a batholithic intrusion of acid porphyry; the ore is oxidised, the platinum and gold being present in metallic form but "alloyed."
—W. E. F. P.

Copper refining; Cathode potential in ——. K. S. Guiterman. Eng. and Min. J., 1914, 98, 601—603. (See also this J., 1914, 923.)

IN laboratory experiments, results confirming those of the previous investigation were obtained as regards current efficiency, the slight variations in which were accompanied by concurrent changes in cathode potential. The latter was slightly increased by the presence of glue; practically unaffected by salt, arsenic, ferrous iron or nickel; temporarily decreased by ferric iron, although gradually restored as the iron became reduced to the ferrous state; but was never lower than that necessary for the deposition of copper. The equilibrium potential of hydrogen was only exceeded under extreme conditions of high current density and low temperature of electrolyte.—W. E. F. P.

Copper; Commercial classification of refined ——. L. Addicks. Amer. Inst. of Metals, Chicago, Sept., 1914. Met. and Chem. Eng., 1914, 12, 641—643.

THE sources and methods of production and purification of copper are considered in relation to the uses of the metal. Furnace refining is restricted to relatively pure crude copper; otherwise a low-grade refined metal is obtained. Electrolytic cathodes generally contain about 0·05% of impurity, of which 0·02 is metallic and the remainder probably hydrogen; but, in the absence of special precautions, the metal is contaminated on melting. The conductivity of perfectly pure, soft copper is probably about 103% of the Matthiessen standard in common use; a representative sample of electrolytic copper of 100% conductivity (annealed) contained Cu 99·93, O 0·04, Ni 0·004, Fe 0·0035, S 0·003, Sb 0·003, As 0·002, Pb 0·002, Al 0·001, Ag 0·001, Se 0·0005, Te 0·0005, Au 0·00001%, and P and Bi traces. Only high-conductivity Lake, and electrolytic, coppers are used for electrical purposes; the former (from surface ores) is indistinguishable from the latter, the conductivity of each being 99—101%; electrolytically-refined, arsenical Lake copper (from increasing mine depths) is also classed as high-conductivity Lake. For brass making a content of not less than 99·88% Cu is usually specified. Casting copper is of indefinite composition and not amenable to specification at the present time, being best purchased on the basis of known brands.
—W. E. F. P.

Converter gases; Cottrell plant for —— at Garfield, Utah. W. H. Howard. Bull. Amer. Inst. Min. Eng., Aug., 1914. Eng. and Min. J., 1914, 98, 653—654.

THE gases (from which lead fume, etc., is to be recovered by electrostatic treatment), are cooled, passed through a steel flue, 1000 ft. long and 210 sq. ft. in cross-section, in which part of the suspended matter is precipitated, and then delivered to the electrical precipitator. This has a total capacity of 250,000 cub. ft. of gas per min., and consists of seven units, each containing 360 vertical tube-electrodes, 10 ft. long and 5 in. in diameter, within each of which is a central No. 14 steel wire electrode; a regular flow is maintained through the tubes (at a velocity of 12 cub. ft. per sec. for full capacity), the gases being delivered to the lower, and conducted from the upper, chambers of each unit through three 36 in. pipes. The electrical equipment for each unit consists of a 30-h.p., 250-volt, direct-current motor, connected direct to a 20-kilowatt, 4-pole, 60-cycle, 220-volt, single-phase, alternating-current generator; the current (220 volts) is stepped up to 20,000—30,000 volts by means of a 20-kilowatt transformer, and rectified before being passed to the precipitator. The present tube and single wire electrodes were adopted (in place of the original plate and pubescent electrodes) as the result of experiments made with the Garfield gases in 1913, when 95—100% of the non-gaseous constituents were removed from the gases by maintaining the precipitator below 100° C., and the possibility of fractional precipitation of these constituents was demonstrated.
—W. E. F. P.

Tin resources of Australia, South Africa and Nigeria. Bull. Imp. Inst., 1914, 12, 442—458.

INFORMATION is given as to the localities in the above countries where tin occurs, with descriptions of the deposits and methods of working and statistics of production.—R. G. P.

Plating of non-metallic objects. E. Werner. Elektrochem. Zeits., 1913, **20**, 57—59.

Glass, stone, porcelain, etc., are given two or three coats of slow-drying copal varnish, dusted with copper or graphite powder before the last coat is dry, stoved for 24 hours, brush-polished, and plated in a slightly acid copper sulphate bath. Leather, rubber, and similar materials are washed with weak caustic soda, and soaked in hot paraffin wax solution before being coated. If the object cannot be covered with graphite, it is coated with gutta-percha solution, then with shellac in spirit, dipped in a silver solution, exposed to hydrogen sulphide, and copper plated. Animal and vegetable objects are soaked in ammonia, dipped in caustic alkali and in a weak acid bath, and washed, before treatment with silver solution. —O. E. M.

Nickel coatings; Black ——. E. Werner. Elektrochem. Zeits., 1913, **20**, 25—26.

The bath consists, for example, of: H_2O 100 litres, $(NH_4)_2SO_4,NiSO_4,6H_2O$ 8505 grms., $CuCO_3,Cu(OH)_2$ 1417, KCNS 2125, and H_3AsO_3 1417 grms. Among the conditions to be observed are: maximum density of bath, which must be neutral; large, old, anodes; potential difference not exceeding 1 volt; regular working; thin plating, as shown by attainment of a deep black, to avoid scaling. Alternative methods and details are given. —O. E. M.

Metals; Action of —— on water. W. P. Jorissen. Comptes rend., Inter. Pharm. Congress, 1913. Engineering, Oct. 23, 1914, 512.

The order of the metals when arranged according to their potential (referred to the hydrogen electrode) in normal solutions of their salts, is: Mg, Al, Mn, Zn, Cd, Fe, Co, Ni, Sn, Pb, H, Cu, Bi, Sb, Hg, Ag, Pt, Au; those preceding hydrogen being positive, and those following it being negative. The position of aluminium refers to the amalgamated metal; the position of the ordinary form is uncertain owing to its superficial coating of oxide. Aluminium keeps well in dry air, but oxidises superficially in moist air. Distilled water has little action upon it, but ordinary water may pit the surface; sea-water corrodes it strongly. Amalgamated aluminium decomposes dilute sulphuric acid, a contrast to amalgamated zinc. Zinc remains bright in distilled water free from gases, but in the presence of oxygen some hydroxide is formed which is sparingly soluble; rain-water dissolves it. Nickel is hardly attacked by air, moisture, sea-water and dilute hydrochloric and sulphuric acids. Pure tin is not attacked by water and dilute sulphuric acid so long as air is absent, but sea-water corrodes it in presence of air. The chloride and sulphate of lead being much more soluble than the carbonate, the presence of chlorides and sulphates in water increases the danger of lead poisoning. The action of a potable water on lead and zinc cannot be predicted from the composition of the water.—J. H. J.

Scheelite concentrates; Determination of phosphorus in ——. E. W. Hagmaier. Met. and Chem. Eng., 1914, **12**, 620. (See also this J., 1914, 923.)

One grm. is heated with hydrochloric acid and potassium chlorate, or with *aqua regia*, and evaporated to dryness, the residue treated with dilute hydrochloric acid (1 : 2), 15—20 c.c. of cinchonine solution and some paper pulp added, the mixture allowed to stand for ½ hour, filtered, and the residue washed with dilute hydrochloric acid containing cinchonine. The filtrate is treated with 10 c.c. of cerium chloride solution (1 grm. $CeCl_3$, 25 c.c. HCl and 250 c.c. H_2O) neutralised with ammonia, boiled for 5—10 mins. and filtered. The precipitate is dissolved in hot, dilute nitric acid (1 : 1), and the phosphoric acid precipitated with molybdate, as usual. With synthetic mixtures containing WO_3 65—70, Fe_2O_3 4—5, and P (a) 0·1, (b) 0·15, (c) 0·2, (d) 0·3%, the maximum and minimum results obtained for phosphorus were (a) 0·096 and 0·083, (b) 0·152 and 0·144, (c) 0·203 and 0·193, (d) 0·303 and 0·293%.—W. E. F. P

Radio-active minerals from W. Australia. Bull. 48, 1913, Geol. Surv. W. Australia; Bull. Imp. Inst., 1914, **12**, 501.

Hydrated silicates of uranium, thorium, and lead described under the names of mackintoshite, thorogummite, and pilbarite occur as constituents of the "main tantalite lode" at Wodgina.—R. G. P.

Pitchblende in Bengal. R. C. Burton. Rec. Geol. Surv. India, 1914, **44**, Pt. 1. Bull. Imp. Inst., 1914, **12**, 501—502.

Pitchblende occurs as rounded nodules in the pegmatite which is intrusive in mica schists at the mica mines at Singar, Gaya district Bengal. Triplite is so persistently associated with pitchblende and uranium ochre that it is taken as an indication of their presence. As yet not much pitchblende has been obtained, but one pit has yielded 4 cwts.; one nodule weighing 36 lb. has been obtained.—R. G. P.

Monazite. E. S. Simpson. Misc. Repts., Bull. 48, 1913. Geol. Surv. W. Australia. Bull. Imp. Inst., 1914, **12**, 500.

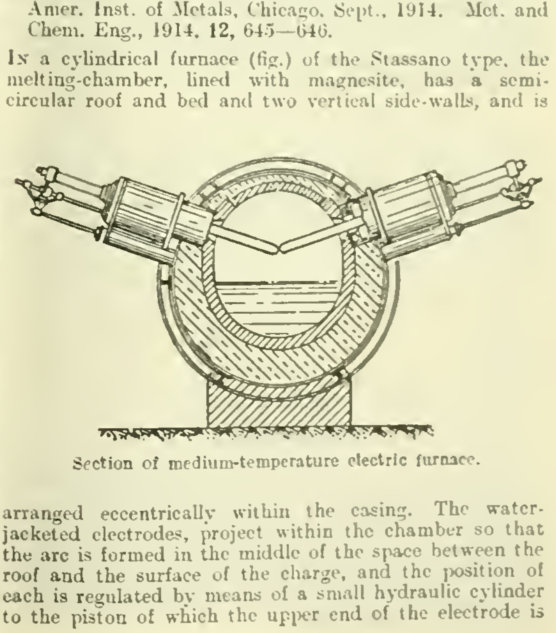
Monazite occurs associated with cassiterite and columbite in alluvial deposits at Cooglegong and Moolyella. The Moolyella material was obtained by re-sluicing low-grade tin gravels, yielding high-grade tin ore and a product consisting of 26·2% monazite, 26·3% cassiterite, 46·5% columbite and 1% garnet. Picked monazite from Cooglegong contained 3·8% and from Moolyella 5·03% ThO_2.—R. G. P.

Core-sand; Choice and treatment of ——. K. Irresberger. Stahl u. Eisen, 1914, **34**, 915—918.

The value of oil and flour as binders for core-sand is described, the sand in these cases being preferably free from lime, and also, with oil, from alumina. The sand grains should be of uniform size. To obtain the best results, test-cores should be prepared from different sands, and using different oils and drying temperatures. Representative samples in each case are withdrawn from the drying oven at measured intervals and the tensile strengths determined.—T. St.

Electric furnace for medium temperature. E. M. Schmelz. Amer. Inst. of Metals, Chicago, Sept., 1914. Met. and Chem. Eng., 1914, **12**, 645—646.

In a cylindrical furnace (fig.) of the Stassano type, the melting-chamber, lined with magnesite, has a semi-circular roof and bed and two vertical side-walls, and is arranged eccentrically within the casing. The water-jacketed electrodes, project within the chamber so that the arc is formed in the middle of the space between the roof and the surface of the charge, and the position of each is regulated by means of a small hydraulic cylinder to the piston of which the upper end of the electrode is



Section of medium-temperature electric furnace.

fixed. The charge is introduced at either or both ends of the furnace, the doors and also the electrode-holders and stuffing-boxes being gas-tight. The power factor of the furnace is over 90% ; no special transformers or starters are required ; and the furnace can be operated with direct or alternating current (single or 3-phase). In an experimental (120 kilowatt) furnace of this type, 1000 lb. of red copper were melted in less than 2 hrs., the power consumption being 240 kilowatt-hours per ton (2000 lb.) of metal.—W. E. F. P.

Gaseous metallic compounds. H. v. Wartenberg. Z. Elektrochem, 1914, **20**, 443—449.

A CONSIDERATION of Nernst's heat theorem and Trouton's rule showed that gaseous alloys are in general stable only at low temperatures and pressures. A determination of its heat of formation showed that $MgZn_2$ exists at 600° C., and vapour density determinations that it is dissociated at 1300° C. The vapour tensions of sodium and of Na_3Hg were measured at 444° C., and the stability of Na_3Hg at 380° and 444° C. demonstrated by distillation.—O. E. M.

Zinc output of the world. Engineering, Oct. 23, 1914. [T.R.]

THE production of zinc in Europe in 1913 amounted to 720,000 tons. The United States produced 346,670 tons, of which 51,300 tons was available for export. The only other sources of supply are Australia and Japan, whose combined output in 1913 was 11,300 tons. As regards the distribution of the European output, Germany in 1913 produced 289,870 tons, Belgium 217,920 tons, Great Britain 65,190 tons, France about 60,000 tons, and Spain 78,280 tons. The French smelters are outside the war area. A deficiency in the world's output of over 400,000 tons during the next 12 months is therefore probable. In 1913 Great Britain imported 64,670 tons of zinc ore and 145,000 tons of crude zinc ; 64,179 tons of the crude came from Germany.

Mercury and the war. Engineering, November 6, 1914, 570. [T.R.]

TRADING interests in mercury are attracting attention on account of its very extensive use in the preparation of fulminate for explosives, the present and probable future consumption of which must have an important bearing on the market for the metal, the withdrawal of available supplies, and the future demand.

The world's production is increasing ; the average for the last decade has been 3728 tons. The output during recent years has been as follows, in tons :—

1913.	1911.	1909.	1907	1905.
4171	3419	3233	3307	3336

The world's supply is obtained from only six countries, the main source being Spain ; the Almaden mines of that country produce nearly a third of the entire quantity. Recent outputs have been as follows, in tons :—

——	1913.	1911.	1909.
Spain	1490	1055	1000
United States	688	742	717
Italy	888	815	700
Austria	855	685	609

Ten years ago the United States' output of mercury was the largest in the world, exceeding 1000 tons for several successive years, but since then it has been declining ; the main American supply is obtained in California, and mostly from one mine. Great Britain's trade in mercury is peculiar, in so far as none is produced in the country ; it is purchased and distributed, and, in effect, controls the world's markets in the metal. The following schedule shows the imports, exports, and British consumption, in flasks, during recent years :—

——	Imports.	Exports.	Consumption.
1913	45,348	26,815	18,533
1912	47,262	32,240	15,022
1911	46,547	31,438	15,109
1910	44,595	24,748	19,847
1909	43,163	22,051	21,112
1908	43,605	22,348	21,257

Each flask contains 75 lb. In Austria the mercury deposits occur in Idria, Western Carniola, and in Italy, at Monte Amiata, Tuscany. The Mexican and Russian outputs are on a very limited scale ; four years ago the Russian output was only 4 tons. The price of mercury has risen enormously since the war commenced ; the Austrian supply, controlled by the Government, is definitely cut off from the world's markets, and the Italian supply is uncertain. The Spanish supply is controlled mainly in London, and very little may be obtainable for export. American supplies can scarcely be obtainable for export to Europe, as the consumption appears to have overtaken the production in the States. In fact, we have been exporting mercury to the United States in small quantities for some years—during 1913, 154,500 lb., to the value of £14,960.

Mercury imported was worth £7 9s. 3d. per flask last year, compared with £8 12s. 3d. during 1911. The war has had a marked effect on our mercury imports, as shown by the following figures :—

Imports for August.

1914.	1913.	1912.
1792 lb.	67,196 lb.	101,779 lb.
24 flasks	896 flasks	1357 flasks

Imports for September.

18,240 lb.	61,851 lb.	32,818 lb.
243 flasks	824 flasks	437 flasks

Mineral industry in South Africa in 1913. Board of Trade J., Oct. 29, 1914. [T.R.]

THE Report of the South African Mines Department for 1913 states that the total value of the mineral output of the Union for the year was £52,924,990, as compared with £52,711,761 in 1912. The following table shows the production of the chief minerals :—

	1912.	1913.
	£	£
Gold	38,691,688	37,374,553
Silver*	124,374	115,822
Diamonds	10,061,489	11,389,807
Coal	1,999,378	2,240,458
Coke	11,980	15,862
Copper	556,978	507,856
Tin	367,699	436,550
Asbestos	18,882	16,028
Graphite	1,155	1,257
Magnesite	1,673	1.194
Lead	8,654	1,199
Salt	63,059	77.142
Lime	129,470	118,984
Flint	9,395	3,789

* Contained in gold bullion and base metal ores.

The industrial disturbances of July, 1913, which resulted in a diminution in the number of natives employed on the Witwatersrand for the remaining six months of the year, were responsible for the decreased output of gold and silver. The slight falling off in the copper exported will probably be continued in future years as the Namaqualand mines become worked out ; the output of the northern Transvaal will, however, tend to meet the deficiency in Namaqualand.

Pig iron production in Germany in July and August, 1914. Board of Trade J., Oct. 29, 1914. [T.R.]

The Union of German Iron and Steel Workers has published the following figures of pig-iron production in Germany :—

	July, 1914.	Aug., 1914.
	Metric tons.	Metric tons.
Foundry iron	259,912	97,788
Bessemer iron	19,076	23,162
Thomas iron	1,045,586	390,658
Steel iron and spiegeleisen	203,968	100 305
Puddled iron	35,773	14,014
	1,564,315	625,927

Ferro-alloys from France; Supplies of ——. Board of Trade J., Oct. 22, 1914. [T.R.]

H.M. Embassy in France reports that, in view of the export and transport difficulties occasioned in France by the war, British firms desirous of obtaining the assistance of the Embassy in facilitating the despatch of supplies of ferro-alloys from the Republic are recommended to communicate in the first place with the Under Secretary of State for Foreign Affairs, Foreign Office, London, S.W., in order that H.M. Embassy may be instructed to intervene in cases where such action may appear desirable.

Lead, tin, and the war. Engineering, Oct. 30, 1914. [T.R.]

In consequence of the war, considerable disturbance has arisen in the markets of these metals. The world's production of lead and tin during recent years has been as follows, in tons :—

	1910.	1911.	1912.	1913.
Lead	1,127,000	1,136,000	1,181,800	1,186,700
Tin	114,800	117,600	124,700	128,900

The world's production of raw lead has been obtained from the United States, Mexico, and Canada, 487,000 tons ; Australia, 116,000 tons ; Spain, 203,000 tons ; Germany, 181,000 tons ; Austria, 24,000 tons ; Belgium, 50,800 tons ; Great Britain, 30,500 tons ; France, 28,000 tons ; and Italy, 21,700 tons. The consumption has been as follows : United States, 401,300 tons ; Germany and Austria, 259,000 tons ; Great Britain, 191,400 tons ; France, 107,600 tons. The German-Austrian production is 54,000 tons less than their consumption, and there may consequently be a shortage in those countries during the war, which may, however, be neutralised by Germany acquiring the Belgian and Italian output. Of tin, half the world's production is obtained from the Straits Settlements, 65,640 tons ; the tin produced in Europe is essentially derived from imported ores, the bulk of which is exported from Bolivia, and smelted in England and Germany. One-sixth of the world's output of tin is produced in Great Britain. It is possible that the war may curtail the world's lead output by more than 200,000 tons. The export of lead from the United States is an important factor ; it would appear that unless the output there can be increased, we cannot expect to receive much larger supplies from America, as the home consumption there is steadily increasing. British imports of lead ore and lead have been as follow during recent years :—

	Lead ore.		Pig and sheet lead.	
	Tons.	£	Tons.	£
1909	15,542	120,540	207,660	2,705,000
1911	17,259	135,010	213,707	2,902,000
1913	18,453	184,930	204,136	3,718,000

The pig lead during 1913 was imported chiefly from Spain and Australia.

Our imports of tin ore during recent years have been :—

	Tons.	£
1909	24,086	1,621,000
1911	28,837	2,306,000
1913	34,592	3,308,000

About two-thirds came from Bolivia. The Bolivian output has increased from 29,400 tons in 1908 to 37,700 tons last year. Our imports of tin blocks, ingots, bars, and slabs have been as follow :—

	Tons.	£
1909	41,725	5,603,000
1911	45,906	8,739,000
1913	45,682	9,252,000

These came mainly from the United States, Russia, and the Straits Settlements.

Blast-furnace coke. Simmersbach. *See* IIa.

Blast-furnace coke. Koppers. *See* IIa.

Talbot slag. Dafert. *See* XVI.

Patents.

Steel alloy. S. S. Wales, Munhall, Assignor to Carnegie Steel Co., Pittsburgh, Pa. U.S. Pats. (A) 1,111,710 and (B) 1,111,711, Sept. 22, 1914 ; date of appl., Dec. 27, 1909.

An alloy-steel containing (A) Mn and % Ni 4, Cr 2, and Ti 2 ; (B) C, Mn, Cr, and % Ni 0·99 and V 0·15.—W. E. F. P.

Armour-plate. S. S. Wales, Munhall, Assignor to Carnegie Steel Co., Pittsburgh, Pa. U.S. Pat. 1,111,709, Sept. 22, 1914 ; date of appl., Aug. 1, 1906.

An alloy-steel containing Ni 5—12, Cr 0·15—0·25, W 0·5—0·7, Si up to 0·15, and Mn up to 0·35%.—W. E. F. P.

[*Steel*]. *Method of hardening and tempering.* J. Patten, Baltimore, Md. U.S. Pat. 1,112,087, Sept. 29, 1914 ; date of appl., Aug. 15, 1912.

A stream of cold fluid is directed upon the surface of the metal while the latter is traversed by an electric arc. —W. E. F. P

Steel or malleable iron; Process of converting cast-iron into ——. J. A. Hunter, Philadelphia, Pa. U.S. Pat. 1,112,909, Oct. 6, 1914 ; date of appl., June 3, 1913.

Cast-iron, at a high temperature but below the melting-point, is subjected to the action of nitric acid, and then cooled, " in a suitable mechanical device."—W. E. F. P.

Metals [*gold and silver*]; *Extraction of* —— *from ores.* E. C. R. Marks, London. From J. Caldwell, Mexico. Eng. Pat. 15,711, July 8, 1913.

The ore is crushed and ground in a solution of common salt or sea water, then mixed with more salt solution, agitated by compressed air, and subjected in a closed vessel to the action of an electric current to generate chlorine, which converts the gold and silver present into soluble compounds. During this treatment the gases evolved are led to a compressor and then returned and used to agitate the charge.—A. S.

Ores of silver and gold; Treating complex refractory —— C. C. Titus, Assignor to Montana Metallurgical Co., Helena, Mont. U.S. Pat. 1,111,976, Sept. 29, 1914 ; date of appl., Dec. 14, 1910.

The ore, containing iron, another metal, and a metalloid, is agitated and heated, and treated with a gaseous mixture of chlorine and oxygen at a gradually increasing temperature, not exceeding 250° C., which is insufficient to cause fusion and agglomeration. The iron is oxidised and the second metal and metalloid converted into chlorides, the metalloid chloride being vaporised.—B. N.

Amalgamator. C. R. Dennison, Youngstown, Ohio. U.S. Pat. 1,111,251, Sept. 22, 1914; date of appl., June 4, 1913.

Between a shaft and a cylinder mounted thereon is a helical blade the edge of which engages with the shaft and with the inner surface of the cylinder to form a continuous spiral passage. The cylinder and the helical blade are of foraminous material, and the whole is rotated in a cylindrical casing containing mercury in its lower part. Ore is fed in at one end of the spiral passage and tailings discharged at the other end. Amalgam is drawn off from the bottom of the casing and mercury fed in at the top and distributed over the rotating cylinder.—A. S.

Vacuum-filters for cyanide process; Leaf of ——. Y. Ohtsuka, Tokyo, Japan. U.S. Pat. 1,111,609, Sept. 22, 1914; date of appl., Feb. 4, 1914.

A supporting bar carries depending rods of bamboo spaced apart, and horizontal strips are arranged on both sides of the rods to form perforated mats, leaving clear vertical passages between the rods. A U-shaped suction pipe carried by the supporting bar has openings in the upper side of its lower horizontal portion communicating with the vertical passages, and the mats and suction pipe are covered by filter-cloths.—A. S.

Zinc; Separation of —— from sulphide ores. H. T. Durant, and The Metals Extraction Corporation, Ltd., London. Eng. Pats. 21,581, Sept. 24, and 22,761, Oct. 8, 1913.

Sulphide ore is roasted to produce as much sulphate as possible, and leached several times, in a filter-press, with a solution of sulphur dioxide, the liquid from the first leaching being oxidised by aeration, treated with zinc dust to remove copper, evaporated to precipitate zinc sulphate, and the mother-liquor from the latter, together with the relatively weak zinc solutions from the second and subsequent leachings, oxidised, diluted if necessary, saturated with sulphur dioxide from the furnace gases, and used for leaching a further quantity of ore.—W.E.F.P.

Zinc; Process of extracting —— from its ores or compounds. E. E. Watts, Kingston, Ontario. U.S. Pat. 1,111,201, Sept. 22, 1914; date of appl., Nov. 20, 1913.

The material is mixed to a thin paste with a solution of zinc sulphate substantially free from iron and placed in the anode compartment of an electrolytic cell. The zinc is then deposited electrolytically using as electrolyte zinc sulphate solution (12% Zn) to which an organic substance is added to render the deposit dense and compact. —A. S.

Zinc residues; Treatment of ——. A. Jones, Bartlesville, Okla., Assignor to Bartlesville Zinc Co., New York. U.S. Pat. 1,112,010, Sept. 29, 1914; date of appl., July 5, 1911.

The zinc residue is arranged in a pile in the open air, and concentrated by combustion of its carbon content, the volatilised zinc being caught in the outer layer of the pile. The operation is conducted under conditions which cause the concentrated mass to sinter.—B. N.

Rabbling appliances for mechanical ore roasting furnaces. J. Harris, Sheffield. Eng. Pat. 21,897, Sept. 29, 1913.

The rabble arms are fixed in hollow lugs on the hollow shaft. Cooling water is led from a tank to the rabble arms, through pipes passing through the shaft; each feed pipe is divided, the upper portion being fixed to the tank, and entering the lower portion loosely above or about the top of the shaft, *e.g.*, by dipping into a funnel-like enlargement. The tank may be annular in form, and surround the top part of the shaft, over which is a removable casing connected with a means for sucking or forcing air through the shaft. A removable bend from each feed pipe leads through the shaft to the loose joint, and the water pipes inside the shaft are extended to a point higher than the level of liquid in the tank.—B. N.

Roasting furnaces; Rabble arms for ——. H. H. Stout, New York. Eng. Pat. 15,643, June 30, 1914. Under Int. Conv., Dec. 4, 1913.

The rabble arm consists of an outer and an inner tube connected by telescopic joints with the outer and inner walls respectively of the vertical double-wall rotary shaft. The free end of the outer tube is closed; that of the inner tube is open and prevented from abutting on the former by a stop.—W. E. F. P.

Screening apparatus for ores and the like. H. A. Megraw, New York. Eng. Pat. 9986, Apr. 22, 1914. Under Int. Conv., May 1, 1913.

A horizontal, rotary, tubular screen, open at both ends and having narrow radial shelves disposed along the inside. Ore pulp is fed to the lower part, the over-size being carried upwards upon the shelves and discharged into a central, inclined launder.—W. E. F. P.

Reducing ores; Method of ——. R. S. Wile, Pittsburgh, Pa. U.S. Pat. 1,111,049, Sept. 22, 1914; date of appl., Dec. 2, 1913.

The ore is fed into the upper part of a deep bath of slag through the central portion of which an electric current is passed vertically. The bath is kept at a substantially constant depth and is of sufficiently high density to support the superincumbent charge of ore until any volatilisable materials therein are expelled.—A. S.

Reducing ores; Apparatus for and method of ——. R. S. Wile, Pittsburgh, Pa. U.S. Pats. 1,111,050 and 1,111,341, Sept. 22, 1914; dates of appl., Feb. 3, 1914, and Dec. 15, 1913.

The furnace comprises a shaft opening at the bottom into an enlarged crucible of greater depth than the diameter of the opening. The crucible is provided with one bottom electrode and two upper ones, movable vertically, one on either side of the shaft. A bath of slag is maintained in the crucible and surrounds and protects the exposed ends of the upper electrodes. Ore is fed in through the shaft, and the electrodes are connected with the conductors of a multiphase circuit and are kept at a substantially equal distance apart so as to maintain an uniform temperature throughout the bath.—A. S.

[*Tungsten.*] *High-fusing metals and alloys of the same; Process for the manufacture of ductile bodies of ——.* A. J. Liebmann, Assignor to N. Hofheimer, New York. U.S. Pat. 1,111,698, Sept. 22, 1914; date of appl., June 3, 1914.

A highly compressed mixture of metallic tungsten powder with 1% WO_3 is subjected to a combined reducing and sintering operation.—W. E. F. P.

Copper ores [*argentiferous*]; *Process for the treatment of ——, and the recovery of their values.* C. S. Vadner, Salt Lake City, Utah. U.S. Pat. 1,111,874, Sept. 29, 1914; date of appl., Dec. 9, 1913.

The oxidised ore is agitated with a hot solution of sodium chloride saturated with sulphur dioxide; the excess of the latter removed from the solution by aeration; finely divided calcium carbonate added to the hot liquid to precipitate iron and arsenic; and the cold filtrate treated with calcium carbonate and compressed air. The precipitated basic copper carbonate (containing silver) is treated with dilute sulphurous acid, and the solution passed over metallic iron after the removal of sulphur dioxide by aeration.—W. E. F. P.

Copper extraction; Recovery of values from the leach-water of ——. C. A. Hall, Mount Airy, Assignor to Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. U.S. Pat. 1,112,608, Oct. 6, 1914; date of appl., Oct. 14, 1912.

In the treatment of "cinders" by successive leachings with a solvent, the first solution is treated for the recovery of copper and other salts, and subsequent solutions for copper alone.—W. E. F. P.

Heat-treating apparatus [for metals, etc.]. J. J. Lichter, St. Louis, Mo. U.S. Pat. 1,112,074, Sept. 29, 1914; date of appl., May 7, 1914.

The heating chamber is situated above a dipping tank and has a movable floor, supported by a cradle within the liquid, and adapted to be immersed in the latter by lowering the cradle down an inclined track within the tank.—W. E. F. P.

Annealing-furnaces. J. A. and J. C. Swindell, Pittsburgh, Pa. U.S. Pats. (A) 1,112,236 and (B) 1,112,237, Sept. 29, 1914; date of appl., Dec. 12, 1913.

(A). Flues for air, gas and waste gases are arranged longitudinally beneath the floor of the heating chamber, along the middle of which a low wall extends in the same direction as the flues; inlet ports (communicating with the air and gas passages) are situated along each side of the middle wall, and outlet ports (communicating with the waste-gas flues) along the opposite outer walls of the chamber. (B.) The middle wall is hollow, forming a preheating chamber the lower part of which communicates with air and gas flues, and the upper part—by lateral openings along each side—with the interior of the chamber.—W. E. F P.

Fume-concentrator for smelters. S. W. Smith, San Jose, Cal. U.S. Pat. 1,112,860, Oct. 6, 1914; date of appl. March 9, 1912.

The fumes are passed through a horizontal chamber having a series of hollow, water-cooled, baffles extending from the floor and roof alternately; the chamber is connected at one end with the smelter and at the other with a small chamber containing rotating paddles upon which a stream of water or "reagent" is directed. A spray of reagent is also directed upon the face of each baffle and into the conduit leading from the smelter to the first chamber.—W. E. F. P.

Iron and steel; Process of producing —— directly from the ore. K. A. F. Hiorth, Christiania. U.S. Pat. 1,112,007, Sept. 29, 1914. Date of appl., June 13, 1912.

See Fr. Pat. 449,212 of 1912; this J., 1913, 492.—T. F. B.

Cupola-furnace. E. Schürmann, Koetzschenbroda, Germany. U.S. Pat. 1,112,846, Oct. 6, 1914. Date of appl., March 8, 1913.

See Fr. Pat. 458,242 of 1913; this J., 1913, 1074.—T. F. B.

Alkali metal alloys; Production of —— by the electrolysis of alkali hydroxide in the molten state, and the obtainment therefrom of alkali metals and alkali metal compounds. E. A. Ashcroft, London. Eng. Pat. 25,144, Nov. 4, 1913.

See Fr. Pat. 464,951 of 1913; this J., 1914, 489.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Accumulator; The alkaline ——. E. Friederich. Elektrochem. Zeits., 1913, 20, 6—10, 31—34.

Attempts to make plates by reducing nickel oxide or by gniting pastes of nickel or iron powder and tar failed. A atisfactory nickel peroxide plate was produced by nickelplating linen fabric carbonised at 1400° C. and extracted with hydrochloric acid. As an anode, such a plate lost carbon in continually diminishing quantities. It was "formed" by covering it with dry nickel oxide, binding it upon a nickel sheet, and charging it in caustic potash solution, using a zinc cathode.—O. E. M.

Distribution of the overhead electrical discharge employed in recent agricultural experiments. Jorgensen and Priestley. *See* XVI.

Water purification by ozone. Pryer. *See* XIXB.

Patents.

Electrolytic apparatus. J. T. Niblett, Denmark Hill, Surrey. Eng. Pat. 24,560, Oct. 29, 1913.

The element comprises a straight vertical casing, which may be divided into two or more compartments, each containing a pair of electrodes. The ends of the casing are perforated at the bottom and top, for the admission of electrolyte and the escape of air respectively. The electrodes may be sheathed in a porous covering, which does not interfere with the electrolytic action, *e.g.*, infusorial earth or asbestos.—B. N.

Cell; Electrolytic ——. C. C. Titus, Assignor to Montana Metallurgical Co., Helena, Mont. U.S. Pat. 1,111,977, Sept. 29, 1914; date of appl., Dec. 14, 1910.

The cell is separated by a diaphragm and a perforated cathode into two compartments, with a gas-tight chamber at the upper end of the anode compartment, and means for maintaining a partial vacuum in it. An overflow pipe, extending from the chamber downwards into the outer compartment, is sealed by the liquid therein.—B. N.

Furnaces; Electric resistance ——. J. Davies and A. Gallenkamp and Co., Ltd., London. Eng. Pat. 10,415, April 27, 1914.

Two opposing walls of refractory material are coupled together and maintained in fixed relationship by a number of metallic tie rods, and a combustion tube, muffle, or similar receptacle is supported in suitable recesses in the walls. The remaining walls are formed by several removable lagging blocks. A heating coil is carried upon the combustion tube, and is connected electrically with some of the rods, with means for short-circuiting the whole or a part of the current when a certain temperature is attained.—B. N.

Condenser; Electrical ——. J. W. Aylsworth, East Orange, N.J., Assignor to Halogen Products Co., Glen Ridge, N.J. U.S. Pat 1,111,289, Sept. 22, 1914; date of appl., Nov. 8, 1913.

Electrically-conducting members are separated by insulating dielectric members, the latter consisting of a solid halogen product of a hydrocarbon, such as naphthalene, mixed with a small percentage of a miscible phenolic resin.—B. N.

[Electrical] Condenser. P. Thomas, Wilkinsburg, Pa., Assignor to Westinghouse Electric and Manufacturing Co U.S. Pat. 1,112,397, Sept. 29, 1914; date of appl., Dec. 4, 1913.

The condenser has a dielectric comprising a halogen derivative of a fatty acid, such as a chlorine-substitution product of stearic acid, the chlorine being generated electrically.—B. N

Furnace; Induction electric ——. W. S. Moody, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,113,134, Oct. 6, 1914. Date of appl., Oct. 18, 1906.

See Eng. Pat. 26,867 of 1906; this J., 1907, 1054.—T. F. B.

XII.—FATS; OILS; WAXES.

Palm kernels; The trade in ——. Bull. Imp. Inst., 1914, 12, 458—464.

Attention is called to the importance of the trade in palm kernels, particularly in Germany where 241,961 tons valued at £5,233,252 were imported to Hamburg in 1913; the oil is extracted or expressed and used for the same purposes as coconut oil, viz., in the manufacture of soaps and candles and of various edible fats, while the meal is much used as cattle food. The possibility of this trade being diverted to the United Kingdom is discussed; no difficulty should be experienced in finding a market for the oil, but the conservative attitude of British farmers might render the disposal of the residual meal somewhat difficult. Manufacturers would probably have to depend at first on its utilisation in compound cakes, although its high reputation in Germany should cause it to become popular; while the fact that over 400,000 tons of various feeding cakes valued at £2,539,892 were imported to the United Kingdom in 1913 shows that there is room for expansion. —R. G. P.

Coconuts in Zanzibar. F. C. McClellan. Bull. Imp. Inst., 1914, 12, 420—422.

The planting of coconuts has increased of late years and there are probably about 2½ million trees on an area of 45,000 acres. Zanzibar copra is not generally of good quality owing to careless preparation, but a small consignment of sun-dried copra prepared on Government plantations compared favourably with Malabar coast copra. In 1913, 7412 tons of copra were exported from Zanzibar and Pemba principally to Marseilles. Conditions are very favourable for coconut planting and considerable areas of land await development.—R. G. P.

Cottonseed products; Changes in official methods of analysis of ——. Chemists' Committee of Interstate Cottonseed Crushers' Assoc.; Oil, Paint, and Drug Rep., 1914, 33.

At a meeting on Aug. 10 and 11, the Committee adopted the following as official methods of analysis:—*Moisture:*—Two to 5 grms. are dried for 3 hours in a covered aluminium dish (of special form, obtainable from American Can Co., Atlanta, Ga.) in an oven at 100° C. *Oil:*—Two to 5 grms. are extracted for 3 hours, in a Soxhlet extractor with short siphon, with petroleum spirit (b. pt. less than 65° C.). *Nitrogen:*—1·7034 grms. are digested and heated with about 0·5 grm. of mercury or 0·7 grm. of mercuric oxide, 10 grms. of sodium or potassium sulphate, and 25 c.c. of sulphuric acid (sp. gr. 1·84) until the solution is colourless. It is then diluted with 300 c.c. of water (fragments of zinc added to prevent bumping), and treated with 25 c.c. of 4% potassium sulphide and 60 c.c. of sodium hydroxide solution (sp. gr. 1·50), the flask connected with a tin condenser, and the ammonia distilled into standard sulphuric acid. *Fat in cottonseed meal:*—The official methods of the Amer. Assoc. Off. Agric. Chemists must be used. *Total fatty acids:*—8 to 10 grms. of soap stock or 4 to 5 grms. of black grease are saponified with alcoholic alkali, the soap solution evaporated to expel alcohol, dissolved in 200 to 250 c.c. of water, and the fatty acids liberated with dilute hydrochloric acid (1 : 1), cooled, separated, washed on the filter with cold water, dried (preferably overnight), and dissolved in 125 c.c. of warm petroleum spirit, the solution evaporated, and the residue dried at 100° C. until constant in weight. A correction is made for oil subsequently recovered from the melted soap stock. *Moisture and meal in crude cottonseed oil:*—10 grms. are heated in a basin over a direct flame until the oil begins to smoke, and the loss in weight taken as moisture. The residue is transferred to a Gooch crucible, washed with petroleum spirit until free from oil, and the final residue of meal, etc., dried until constant in weight. *Free fatty acids in crude cottonseed oil:*—About 50 c.c. of neutral sodium chloride solution (20° B., sp. gr. 1·1612) are placed in a 4 oz. bottle, 1 c.c. of phenolphthalein solution added, and 7·05 grms. of the oil introduced with a standard pipette (obtainable from G. C. Hulbert, Augusta, Ga.), and the mixture shaken and titrated with *N*/4 sodium hydroxide solution. *Laboratory refining test for prime crude cottonseed oil:*—500 grms. are brought to 24° to 27° C. in a weighed enamelled basin about 4½ in. by 4 in., sodium hydroxide solution of the required strength (see table below) added, the mixture mechanically stirred for 5 mins., warmed gradually (in not less than 15 mins.) to 34° C. on the water-bath, with continual stirring, until the oil separates from the soap-stock. If necessary the temperature is raised to 52° C. The basin is then placed in water at 43° C. for 3 hours, and allowed to cool until the soap-stock is hard. The loss in weight due to evaporation is determined, the oil decanted into a weighed basin, and oil and soap-stock separately weighed. The quantity of sodium hydroxide used for refining prime oil must not exceed 1·097%. The following table gives the corresponding quantities of the different strengths of solution which can be used:—

° B.	Sp. gr.	NaOH %	Amounts. %
10	1·0745	6·55	16·8
12	1·0909	8·00	13·7
14	1·1076	9·42	11·6
16	1 1249	10·97	10·0
18	1·1427	12·62	8·7
20	1·1612	14·37	7·6

Tests with 3 or more solutions of the strengths in this table must be made before rejecting a sample; no claim for excessive refining loss is to be allowed if it can be proved that the colour can be obtained with smaller loss than that produced with the maximum permissible amount of sodium hydroxide; and no claim for deficiency in colour is established if it can be proved that the colour can be obtained without exceeding 9% refining loss with the maximum permissible amount of sodium hydroxide. *Refining loss:*—This equals (1) weight of crude oil less weight of refined oil; (2) weight of soap stock, less weight of alkali solution used, plus loss in evaporation. The two results should agree within 0·25%. *Laboratory refining test for "off" (acid) crude cottonseed oil:*—The following table shows the maximum amount of sodium hydroxide that can be used with oils containing the indicated amounts of free fatty acids:—

Free fatty acids. %	Sodium hydroxide. grms.	Excess. grms.	10° B. %	12° B. %	14° B. %	16 °B. %	18° B. %	20° B. %	22° B. %	24° B. %
3·0	0·4245	1·0970	16·8	13·7	11·5	(10·0)	8·7	—	—	—
3·5	0·4963	1·1679	17·8	14·6	12·4	10·7	9·3	—	—	—
4·0	0·5672	1·2388	18·9	15·5	13·1	11·3	9·8	—	—	—
4·5	0·6381	1·3097	—	16·4	13·9	11·9	10·4	9·1	—	—
5·0	0·7090	1·3806	—	17·3	14·7	12·6	10·9	9·6	—	—
Weight of solution required with plus 0·750% excess NaOH.										
5·5	0·7799	1·5299	—	19·1	16·2	13·9	12·1	10·6	—	—
6·0	0·8508	1·6008	—	20·0	17·0	14·6	12·7	11·1	—	—
6·5	0·9217	1·6717	—	—	17·8	15·2	13·2	11·6	—	—
7·0	0·9926	1·7426	—	—	18·5	15·9	13·8	12·1	—	—
7·5	1·0635	1·8135	—	—	19·2	16·5	14·3	12·6	—	—

Free fatty acids. %	Sodium hydroxide. grms.	Excess. grms.	10° B. %	12° B. %	14° B. %	16° B. %	18° B. %	20° B. %	22° B. %	24° B. %
Weight of solution required with plus 0·875% excess NaOH.										
8·0	1·1341	2·0094	—	—	21·3	18·2	15·8	13·9	—	—
8·5	1·2053	2·0803	—	—	22·1	19·0	16·5	14·5	—	—
9·0	1·2762	2·1512	—	—	22·8	19·6	17·0	15·0	—	—
10·0	1·4180	2·2930	—	—	24·3	20·9	18·4	16·0	—	—
Weight of solution required with plus 1·0% excess NaOH.										
10·5	1·4889	2·4889	—	—	—	22·7	19·7	17·3	15·6	14·1
11·0	1·5598	2·5598	—	—	—	23·3	20·3	17·8	16·1	14·5
11·5	1·6307	2·6307	—	—	—	24·0	20·9	18·3	16·5	14·9
12·0	1·7016	2·7016	—	—	—	24·6	21·4	18·8	17·0	15·3
12·5	1·7725	2·7725	—	—	—	25·3	22·0	19·3	17·4	15·7
Weight of solution required with plus 1·125% excess NaOH.										
13·0	1·8434	2·9684	—	—	—	27·0	23·5	20·6	18·6	16·8
13·5	1·9143	3·0393	—	—	—	27·7	24·1	21·1	19·1	17·2
14·0	1·9852	3·1102	—	—	—	28·4	24·7	21·7	19·5	17·6
14·5	2·0561	3·1811	—	—	—	29·0	25·2	22·1	20·0	18·0
15·0	2·1270	3·2520	—	—	—	29·7	25·8	22·6	20·4	18·4
Weight of solution required with plus 1·25% excess NaOH.										
15·5	2·1979	3·4472	—	—	—	31·4	27·3	24·0	21·7	19·5
16·0	2·2688	3·5188	—	—	—	32·1	27·9	24·5	22·1	19·9
16·5	2·3399	3·5899	—	—	—	32·7	28·4	25·0	22·5	20·3
17·0	2·4106	3·6606	—	—	—	33·4	29·0	25·5	23·0	20·7
17·5	2·4815	3·7315	—	—	—	34·0	29·6	26·0	23·5	21·1
Weight of solution required with plus 1·375% excess NaOH.										
18·0	2·5524	3·9274	—	—	—	35·8	31·1	27·3	24·7	22·2
18·5	2·6233	3·9983	—	—	—	36·4	31·7	27·8	25·1	22·6
19·0	2·6942	4·0692	—	—	—	37·1	32·3	28·3	25·6	23·0
19·5	2·7651	4·1401	—	—	—	37·8	32·8	28·8	26·0	23·5
20·0	2·8360	4·2110	—	—	—	38·4	33·4	29·3	26·5	23·9

Oils containing less than 3% free fatty acids may be refined with any amount of sodium hydroxide solution containing up to 1·007 grms. *Process* :—Free fatty acids are determined by the official method and the oil treated as described above with sodium hydroxide solution at 24° to 27° C., with the exception that the temperaturo is brought to 60° C. and eventually to 65° C. Three tests must be made with different strengths of alkali, one of them with the maximum permissible amount. *Bleaching refined cottonseed oil* :—30 grms. of oil are agitated for 5 mins. at 120° C. with 6% of standard English fuller's earth, to be obtained from R. Hulme, Phœnix Cotton Co., Memphis, Tenn., and filtered, and a reading taken with 5¼ in. of the clear oil at 21° C. *Hull analysis* :—5 grm. of the hulls freed by hand-picking from whole seeds) are extracted for 4 hours in a Soxhlet apparatus with petroleum spirit boiling below 65° C., as described above. Whole seed is calculated into oil % by use of the factor 0·20.—C. A. M.

Cottonseed oil ; Ethyl ester of linolic tetrabromide as a product in the analysis of ——. L. S. Palmer and P. A. Wright. J. Ind. Eng. Chem., 1914, **6**, 822—823.

N attempts to isolate linolic acid as the tetrabromide rom cottonseed oil, in which the unsaturated acids were eparated by the lead soap-ether method of Tortelli and Ruggeri (Lewkowitsch, " Oils, Fats and Waxes (1909), Vol. I, 447), in some cases large clustering needles, m. pt. 58—58·5° C., were obtained instead of linolic tetrabromide of m. pt. 113°—115° C. Analysis of the new product howed it to be the ethyl ester of linolic tetrabromide, $C_{17}H_{31}Br_4CO_2C_2H_5$, and this was confirmed by its preparation from linolic tetrabromide by esterification with alcohol and hydrochloric acid gas. The formation of the ethyl ester was probably due to prolonged contact of the ead soaps with ether ; with varying periods of contact, mixtures of linolic tetrabromide and its ethyl ester in varying proportions were obtained. The authors have also prepared methyl bromolinolate (white plates, m. pt. 50°—56° C.) and the methyl and ethyl esters of oleic dibromide, yellow oils very soluble in most solvents. The sters of linolic tetrabromide are very soluble, whereas hose of oleic dibromide are very sparingly soluble, in their orresponding alcohols saturated with hydrochloric acid, but attempts to utilise this difference in properties to separate oleic and linolic acids proved unsuccessful.—A. S.

Kapok seed from Zanzibar. Bull. Imp. Inst., 1914, **12**, 347.

THE seeds contained a normal amount of oil, viz., 21% and would be saleable at current market prices. The principal European market is Rotterdam where the seeds fetch about £6 10s. per ton —R. G. P.

Moringa pterygosperma seed from Zanzibar. Bull. Imp. Inst., 1914, **12**, 348—349.

THE seed contained only 28·6% ofoil, while a previous sample from N. Nigeria contained 35%. The seeds would be saleable if exported in quantity but the market value is uncertain owing to the presence of traces of alkaloids and of much non-albuminoid nitrogenous substances which might render impossible the use of the cake as cattle-food.—R. G. P.

Marine animal oils ; Specific reaction of —— *and of their products of hydrogenation.* M. Tortelli and E. Jaffe. Annali Chim. Appl., 1914, **2**, 80—98.

ONE c.c. of the oil is dissolved in 6 c.c. of chloroform and 1 c.c. of glacial acetic acid and shaken vigorously with 40 drops of a 10% solution of bromine in chloroform. In the case of marine animal oils a characteristic reaction is obtained within 1 minute, comprising a transient pink colour changing to a clear green which persists for more than 1 hour. With other oils either no reaction or a yellow colour is obtained. The reaction is also given by hardened oils obtained by hydrogenation of marine animal oils. 5 c.c. of the melted fat are dissolved in 10 c.c. of chloroform and 1 c.c. of glacial acetic acid and shaken with 2·5 c.c. of a 10% solution of bromine in chloroform : a yellowish pink colour changing quickly to green is produced.—A. S.

Hydrogenated fats ; Industrial production of ——. G. Verona-Rinati. Annali Chim. Appl., 1914, **2**, 99—105.

AN apparatus is described for the hydrogenation of oils, using palladium precipitated on small pieces of coke as catalyst. The catalyst is placed in a movable support kept in motion by a rotating spindle connected by gearing with a pulley outside the reaction chamber. The preheated oil is sprayed into the upper part of the chamber by means of hydrogen under pressure, and a pressure of about 2 atmospheres is maintained inside the chamber. Three reaction chambers are provided and the oil may be withdrawn after one, two, or three treatments in presence of the catalyst, according to the degree of hydrogenation desired. The hydrogen is obtained from water-gas by the Frank-Caro-Linde process of refrigeration, and the excess coming from the reaction chambers is returned to the refrigerating apparatus for purification. When the catalyst loses its activity, it is washed in the apparatus with an inert solvent (petroleum spirit), the last traces of the latter are expelled by a current of steam, and the palladium is again rendered active by treatment with hydrogen at not above 150° C. Palladium possesses the advantage of being active at a considerably lower temperature than nickel (*e.g.*, at 80°—90° C.). According to Karl it loses its activity when deposited on lead, iron, aluminium or zinc, but remains active on finely-divided nickel or on magnesium. —A. S.

Fixed oils of the British Pharmacopœia, 1914. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5**, 380—381.

In the new Pharmacopœia limits for acid, saponification and iodine values of the fixed oils are given, as well as special tests for common adulterants. The figures are summarised in the following table :—

Oleum.	Sp. gr.*	Ref. ind. (40°).	Sapon. value.	Iodine value.	Maximum acid value.
Amygdalæ	0·915—0·920	1·4624—1·4640	188—196	93—100	6
Arachis	0·916—0·921	1·4628—1·4645	190—196	83—101	6
Lini	0·930—0·940	1·4725—1·4748	187—195	Not less than 170	3
Olivæ	0·915—0·918	1·4605—1·4635	188—197	79—87	6
Sesami	0·921—0·924	1·4650—1·4675	189—193	103—114	8
Theobromatis	0·990—0·998	1·4565—1·4575	188—195	35·5—37·5	2

* Temperature not stated.

—F. Sidn.

Sterols; Isolation of —— from fats by means of digitonin. P. Berg and J. Angerhausen. Chem.-Zeit., Aug. 4, 1914. Pharm. J., 1914, **93**, 525.

Since Windaus (Ber., 1909, **42**, 244) showed the possibility of isolating sterols from fats by means of digitonin many authors have tried to adapt this discovery for practical analysis. The method used by the present authors is as follows :—The melted and filtered fat is shaken for a quarter of an hour with a 1% alcoholic solution of digitonin, the temperature of the mixture being 60°—70° C. Chloroform is then added, and after some time (care being taken that the temperature remains 60°—70° C.), the chloroform-fat solution is filtered and the filter freed from fat by chloroform. Through the same filter, the alcohol, containing most of the digitonide, is passed, and the digitonide washed with ether and dried. It is then converted into sterol acetate by boiling with acetic anhydride. After being cooled, the liquid deposits crystals of sterol-acetate. The crystals are dissolved in ether, the solution is filtered, the ether evaporated, and the acetate is recrystallised from alcohol. The melting-point of the sterol-acetate is used as a means to identify cholesterol and phytosterol. The following melting-points were found :—

Cholesteryl acetate from lard (after one crystallisation) = 113·5° C.
Cholesteryl acetate from tallow („ „ „) = 113° C.
Phytosteryl acetate from Oleum Cocois („ „ „) = 127° C.
Phytosteryl acetate from cotton-seed oil („ „ „) = 123° C.

A similar method is used to free the unsaponifiable matter of a fat from sterols. The fat is dissolved in absolute alcohol and an alcoholic solution of digitonin is then added, and after adding a few c.c. of water the digitonide is deposited as flocks, which become crystalline after some time. (See also this J., 1913, 1118.)

Silicates in soap; New qualitative test for ——. H. W. Leitch. J. Ind. Eng. Chem., 1914, **6**, 811—812.

A solution of the soap is heated with excess of hydrochloric acid, the fatty and other insoluble matter filtered off, the filtrate neutralised, boiled with alcoholic potash, filtered and the filtrate (10 c.c.) poured into a mixture of 10 c.c. of acetone and 1 c.c. of a solution containing 10 grms. of sodium aluminate and 2 grms. of sodium chloride per litre : the formation of a precipitate of aluminium silicate indicates the presence of silicates (water-glass). Dextrin or starch also give a precipitate and, if present, should be removed, before boiling with alcoholic potash, by treatment with " Diastafor " at 35° C. for ½ hour.—A. S.

Patents.

Lard substitute [hydrogenised oil]; Apparatus for making ——. J. C. Chisholm, Assignor to The Chisholm Process Oil Refining Co., Dallas, Tex. U.S. Pat. 1,113,151, Oct. 6, 1914; date of appl., Oct. 8, 1912.

Oil and hydrogen are admitted into the opposite ends of a rotating perforated drum around which is wound spiral layers of wire, " having its engaging surface of a catalytic agent." The drum is enclosed in a casing. —W. P. S.

Fullers' earth [from oil refining]; Process of treating ——. C. L. Parsons, Durham, N.H. U.S. Pat. 1,112,650, Oct. 6, 1914; date of appl., Aug. 29, 1906.

Spent fullers' earth from oil-refining works is treated first with a solvent which will dissolve the residual oil but not the absorbed colouring matters, and then with a solvent for the extraction of the colouring matters. —W. P. S.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Isoprene from commercial turpentines. Herty and Graham. *See* XX.

Patents.

Woods; Process for extracting from —— their solubl contents. I. S. Clope, Wilkinsburg, Pa., Assignor t Empire Chemical Co., Atlanta, Ga. U.S. Pat. 1,112.359 Sept. 29, 1914. Date of appl., Oct. 22, 1913.

Coniferous woods are treated under reduced pressur with the vapour of trichloroethylene, the vapours ar allowed to condense, and the resulting solution i fractionated to obtain acetone, methyl alcohol, turpentine pine oil, and resin.—T. F. B.

[Rosin] extractor. J. H. Castona, Moss Point, Miss. Assignor to Castona Improved Process Co., Gulfport Miss. U.S. Pat. 1,112,980, Oct. 6, 1914; date of appl. May 7, 1912.

The material (wood) to be treated is supported in perforated cage within a closed vertical cylinder. vertical perforated steam pipe extends from the cove to the bottom of the cage, there is a steam coil immediatel beneath the cage, and the base of the cylinder is hollo for the passage of steam. The vapours are led awa from the top of the cylinder and rosin collects on the steam-heated base.—A. T. L.

Phenolic condensation product and method of forming the same. J. W. Aylsworth, East Orange, N.J., Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,111,285, Sept. 22, 1914; date of appl., June 2, 1911.

The product comprises an infusible, insoluble, condensation product of phenol and formaldehyde, containing a non-volatile nitronaphthalene derivative, which dissolves in and renders the product plastic at 350° F. (177° C.) The condensation product is free from any halogen acid, and is infusible and insoluble in alcohol and water. The naphthalene derivative melts substantially below its boiling point, and is of such character and proportion, and so united with the product, as to be incapable of removal from thin masses, or by washing the body in a finely divided form with water.—B. N.

Indurated articles; Producing ——. J. W. Aylsworth, East Orange, N.J., Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,111,286, Sept. 22, 1914; date of appl., July 14, 1911.

The porous structure (*e.g.*, wood) is soaked in a solution of a hardening agent (*e.g.*, hexamethylenetetramine) of strength so as to leave approximately the desired predetermined amount of the agent within the pores on drying. The material is then dried, soaked in a solution of a predetermined quantity of a fusible, soluble, phenol resin at not above 210° F. (99° C.) and then heated to cause a reaction between the two substances, thus forming an infusible hard insoluble product in the pores of the wood.—B. N.

Cresolic varnish composition. J. W. Aylsworth, East Orange, N.J., Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,111,287, Sept. 22, 1914; date of appl., June 12, 1912.

The compound comprises a fusible cresol formaldehyde condensation product, formed from a fusible cresol resin and a methylene-containing hardening agent, and having a melting point from 140° to 170° F. (60°—77° C.). It is unchangeable into an infusible product at any temperature less than that of its decomposition, and is soluble in all proportions in turpentine oil, benzene, linseed oil, Chinese wood oil, and monochloronaphthalene.—B. N.

Plastic substances; Production of ——. J. W. Aylsworth, East Orange, N.J., Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,111,288, Sept. 22, 1914; date of appl., Aug. 4, 1913.

The plastic substance, which comprises a water-soluble product containing phenol alcohols, is formed by the reaction between phenol and a methylene-containing substance such as formaldehyde, in the presence of a substantial amount of an alkaline earth hydroxide, such as calcium hydroxide. The solution is neutralised by a mineral acid, such as carbonic acid, the calcium carbonate filtered off, and the mass dried.—B. N.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Para (Hevea) rubber from the Gold Coast. Bull. Imp. Inst., 1914, **12**, 370—371.

The cultivation of *Hevea* has been very successful at Government experimental stations, notably at Aburi and Tarquah; European plantations are already producing rubber while natives also are cultivating the tree. Smoked biscuits from 13 year old trees at Aburi were clean and well prepared and would find ready sale at current market prices. They gave a washing loss of 0·8%; the dry washed rubber contained: caoutchouc, 94·1; resins, 2·9; proteins, 2·7; ash, 0·3%; comparing favourably with Eastern plantation Para rubber.—R. G. P.

Ceara rubber from Papua. Bull. Imp. Inst., 1914, **12**, 373—374.

One sample of sheet and one of scrap rubber stated to be the first produced in Papua were examined. The sheet rubber was clean, well prepared and of normal composition. It would be readily saleable at about 2s. 0d. per lb. (July, 1914). The scrap rubber was slightly tacky and probably worth about 1s. 8d. per lb.—R. G. P.

Rubber in Zanzibar. J. C. McClellan. Bull. Imp. Inst., 1914, **12**, 422.

Two trees are indigenous, *Landolphia Kirkii* and *Mascarenhasia elastica*; the majority of the small quantity of rubber exported (1 ton in 1913) is derived from the former. Ceara trees planted in 1907 in the north of Pemba were healthy, but labour and transport difficulties have prevented further experiments.—R. G. P.

Rubber wares (other than machinery belting, tyres for cycles, motor cycles, and motor cars, and toys). Board of Trade Bulletin No. 81.

Can be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Isoprene from commercial turpentines. Herty and Graham. *See* XX.

Patents.

Rubber or rubber compounds; Apparatus for waterproofing or applying —— to canvas and other fabrics. W. A. Higham, Cheshunt, and H. Skelton, London. Eng. Pat. 20,471, Sept. 10, 1913.

The fabric is passed over two guide rollers, and under a gauge, or spreading knife, provided with side cheeks, which is placed between them. Rubber solution in the trough thus formed in front of the gauge is forced by the action of the latter right through the fabric, and a further coating can then be applied by means of the ordinary gauge and roller, using ordinary "dough."—E. W. L.

Caoutchouc and the like; Manufacture of synthetic ——. F. E. Matthews and E. H. Strange, London. Eng. Pat. 22,137, Oct. 1, 1913.

A mixture of a hydrocarbon containing a conjugated double linkage (divinyl, isoprene, etc.) with sodium or other alkali metal or alloy thereof is ground during the polymerisation. The process may be accelerated by heat. The grinding is advantageous if impurities be present which would cause a deposit on the metal and so retard the reaction. (See Eng. Pat. 24,790 of 1910; this J., 1911, 1398.)—T. F. B.

Rubbers: Process for the improvement of inferior-grade ——. D. Spence and W. F. Russell, Akron, Ohio, Assignors to The B. F. Goodrich Co., New York. U.S. Pat. 1,112,938, Oct. 6, 1914. Date of appl., Feb. 12, 1912.

See Fr. Pat. 448,974 of 1912; this J., 1913, 499.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Colour reactions of ——. H. G. Bennett. J. Amer. Leather Chem. Assoc., 1914, **9**, 436—442.

Characteristic colours are obtained when dilute infusions of different tanning materials are mixed with hydrogen peroxide and treated with an alkaline solution of cobalt nitrate. 6 or 7 c.c. of the infusion containing 0·1% of tannin (which need not be filtered) are treated with an equal volume of 16 vol. hydrogen peroxide and then with 3 or 4 drops of a cobalt solution, prepared by adding a concentrated solution of 2·5 grms. of cobalt nitrate to 25 grms. of ammonium carbonate in 150 c.c. of water. Characteristic colours are also obtained when a little dilute tannin infusion is largely diluted with 400 or 500 c.c. of hard water, or a very dilute solution of an alkaline salt, and 2 c.c. of a 1% solution of iodine in potassium iodide or a crystal of potassium ferricyanide in a little 10% ammonia added. By means of these colour reactions pyrogallol and catechol tannins may be differentiated and the former group subdivided into two distinct classes. The colour reactions obtained with the commoner tanning materials are :—

	Cobalt test.	Iodine test.	Ferri-cyanide test.
Pyrogallol tannins (I)			
Valonia, chestnut extract, oakwood extract	purple	dark blue	purple
Pyrojallol tannins (II)			
Gallic and gallotannic acids, sumach, myrobalans, algarobilla ..	orange	purple-red	orange
Pyrogallol-catechol tannin			
Mimosa bark	bright red	purple-red	orange
Catechol tannins			
Quebracho, gambier	bright red	no colour	orange

—T. C.

Guara ; a new tanning material. W. Eitner. Gerber, 1914, **40**, 85—86.

THE newly introduced tanning material, *guara*, is identical with a tanning material introduced 25 years ago and again at intervals under the name, *Cascalotte*. It consists of the ground fruits of a variety of divi native to South and Central America, freed from seeds and woody husks. It contains from 44 to 54% of a mixture of pyrogallol- and catechol-tannins and gives a very light-coloured, full leather. Guara is also sold as a solid extract. An analysis of this extract gave : tanning matters 41·8, non-tanning matters 30·9, insoluble matters (chiefly ellagic acid) 15·4%. The high percentage of non-tanning matters and the low percentage of tannins compared with the original material, as well as the presence of ellagic acid indicate that considerable decomposition has taken place during the manufacture of the extract or else it has been manufactured from residues containing seeds and woody husks. The extract gives a dark red-brown "empty" leather very similar to mangrove-tanned leather and is considerably inferior to the natural product.—T. C.

Tanning and tanning extracts ; Review of recent progress in ——. G. Baldracco. Annali Chim. Appl., 1914, **2**, 158—171.

ACCORDING to Armand decolorised chestnut extract gives a greater relative yield of leather than an extract which has been merely clarified.

A commission appointed by the Italian Association of the Leather Industry and Trade recommends the following limits for water, ash, and soluble organic matter in leather :—Water, determined by drying at 105° C., not above 20% ; ash, not above 2% ; soluble organic matter, not above 12%, of which saccharine substances must not be responsible for more than 2%. The soluble organic matter is determined in Koch's apparatus, 20 grms. of finely-divided leather being left in contact with water for 12 hours and then extracted for 1½—2 hours so as to obtain 1000 c.c. of solution : if the last portion of the extract still gives a precipitate with gelatin, the extraction must be continued, and the final washings concentrated. —A. S.

Dextrose in leather ; Determination of ——. F. P. Veitch and J. S. Rogers. J. Amer. Leather Chem. Assoc., 1914, **9**, 421—436.

To obtain accurate results with the von Schroeder method of clarification of leather extracts (using basic lead acetate solution), prior to determining dextrose with Fehling's solution, it is necessary to know the amount of soluble matters present other than dextrose and magnesium sulphate, as too large an excess of basic lead acetate solution removes dextrose. The method of clarification adopted by the American Leather Chemists Association (25 c.c. of saturated normal lead acetate solution to 200 c.c. of leather extract containing the soluble matters from 3 grms. of leather) gives accurate results with leathers in which the total soluble matters vary within wide limits, no dextrose being removed even if a large excess of normal lead acetate solution be used.—T. C.

Upholstery leathers ; Method of preparing washable ——. J. G. Ritter. Gerber, 1914, **40**, 58—59 and 71—73.

VEGETABLE-TANNED hides are partially de-tannised by drumming with weak alkaline solutions and then retanned with a mixture of sumach, gambier and myrobalans and aluminium sulphate, salt and magnesium sulphate, together with fish oil. They are next treated with a soap solution, set out and dried. The enamelling is carried out with linseed oil boiled with driers, and formulæ are given for preparing the ground coat, various colour coats and the final varnish (bright or matt) coat.—T. C.

PATENT.

Leather ; Method for producing a non-slip, waterproof, chrome ——. J. L. Allen, Gloucester. Eng. Pat. 21,998, Sept. 30, 1913.

DRY, chrome-tanned hides are either soaked in, or have their "flesh" surfaces brushed with, a solution consisting of shoemaker's wax (resin, tallow and Stockholm or other tar), 4, and paraffin wax, 1 lb., in benzine 4 lb. The hides are lightly washed over with benzine after this treatment, and are then dried in a current of air. (Reference is directed to Eng. Pat. 17,228 of 1912 ; this J., 1913, 38.) —E. W. L.

XVI.—SOILS ; FERTILISERS.

Soil solution and the mineral constituents of the soil. A. D. Hall, W. E. Brenchley, and L. M. Underwood. Phil. Trans., 1913, B. 204. J. Agric. Sci., 1914, **6**, 278—301.

SOLUTIONS were made by extracting the soils from certain of the Rothamsted plots on which wheat and barley had been grown for 60 years. Wheat and barley were grown in these solutions which were renewed fortnightly. The comparative growth in the solutions was closely parallel to the growth of the crops in the field, and corresponded to the composition of the solutions. The phosphoric acid- and potash-contents of the solutions corresponded to the past manurial treatment and present composition of the soils, and were of the same order as those of the natural drainage waters from the corresponding plots. Growth in the soil solutions agreed with that in artificial culture solutions containing equivalent amounts of phosphoric acid and potash. Growth in the solutions from imperfectly manured plots was brought up to the level of that in the solutions from completely manured plots by making up their deficiencies of phosphoric acid and potash. Wheat grew as well as barley in the solutions of the wheat soils, and *vice versa*. In a similar set of solutions from the same soils the growth of buckwheat, white lupins and sunflowers corresponded with that of wheat and barley. Boiling effected no alteration in the nutritive value of the soil solutions. In nutritive solutions of various degrees of dilution the growth of the plants varied directly, but not proportionally, with the concentration of the solution, though the total plant food present was in excess of the requirements of the plant. When the nutrient solution was diffused as a film over sand or soil particles, as in nature, there was no retardation of growth due to slowness of diffusion of the nutrients to the points in the liquid which had been exhausted by contact with the roots. Growth in such sand cultures was much superior to that in water cultures with the same solution, but in the latter case growth was similarly increased by the continuous passage of air through the liquid. The conclusions drawn are :—The composition of the natural soil solution as regards phosphoric acid and potash varies significantly with the composition of the soil and its past manurial history. Within wide limits the rate of growth of a plant varies with the concentration of the nutritive solution, irrespective of the total amount of food available. When other conditions, such as the supply of nitrogen, water and air, are equal, the growth of a crop will be determined by the concentration of the soil solution in phosphoric acid and potash, which in its turn will be determined by the amount of these substances in the soil, their state of combination, and the fertiliser supplied. On normal cultivated soils the growth of crops like wheat and barley, even when repeated for 60 years in succession, does not leave behind in the soil specific toxic substances which have an injurious effect upon the growth of the same or other plants in that soil. The net result of these investigations is to restore the earlier theory of the direct nutrition of the plant by fertilisers (Cp. Dyer, this J., 1894, 288; Cameron, this J., 1910, 774).—J. H. L.

Crop; The effect of one —— on another. Duke of Bedford and S. U. Pickering. J. Agric. Sci., 1914, **6**, 136—151.

The effects of growing grass over the roots of fruit and other trees has been under investigation at the Woburn Experimental Farm since 1895. The principal conclusions arrived at are:—Every growing crop results in the formation of a substance toxic to other plants, and still more so to itself. The toxin oxidises and loses its toxicity and then enhances the fertility of the soil; plants previously poisoned outgrow those not subjected to the toxin unless the toxic effect has been sufficient to produce permanent stunting. The toxic effect varies considerably, according to the nature of the soil, the plant affected and the vigour of the plant producing the toxin. The toxin is probably formed from the debris of the roots and does not appear to be excreted. Heating a soil produces a greater quantity of toxic matter from organic substances than is produced by the growth of a crop, and in this case also the oxidised toxin increases fertility.—R. G. P.

Soil; Improved electrical method of determining salt in ——. W. Beam and G. A. Freak. Cairo Scient. J., 1914, **8**, 130—133.

The most rapid method for the determination of soluble salts in soils is that based on the electrical conductivity of the extract. A convenient form of apparatus is a circular slide-wire bridge, in which, for use in dry climates, the wooden circle supporting the wire should be replaced by ebonite. Instead of saturating the soil with water for the measurement of the resistance, the authors prefer to shake with a measured excess of water and determine the resistance of the liquid; the influence of the texture of the soil is thus eliminated. The results are influenced by the temperature and by the presence of sodium carbonate and organic matter; errors due to the composition of the soluble extract in this respect must be dealt with by the use of special tables based on actual observations. For sodium sulphate the same tables as for chloride may be employed without appreciable error. On the other hand, the presence of calcium salts, particularly calcium sulphate, must be allowed for: calcium sulphate is not only harmless in itself, but neutralises to a large extent the effects of other soluble salts inimical to vegetation. Calcium sulphate may be excluded by employing, instead of water, aqueous alcohol (*e.g.*, 40% by volume) for the extraction of the salts from the soil. Further, from the difference between determinations made with aqueous and dilute alcoholic extracts of the soil, the amount of calcium sulphate may be approximately estimated. In carrying out the tests, a quantity of soil roughly equivalent to 20 grms. of dry substance is shaken in a stoppered bottle with 100 c.c. of water or 40% alcohol, preferably for 10—15 mins., and the resistance of the liquid measured without filtration. The results are calculated from tables or curves constructed from determinations made on solutions of sodium chloride in water and in 40% alcohol and of calcium sulphate in water. —J. F. B.

[*Soils.*] *Scouring lands of Somerset and Warwickshire.* C. T. Gimingham. J. Agric. Sci., 1914, **6**, 328—336.

Various "teart" pasture lands in Somerset and Warwickshire cause scouring of cattle at certain times of the year. All these lands are on the Lower Lias. The soil from "teart" land does not differ markedly from that of adjacent sound land in chemical composition or in the size of the particles, but it possesses a higher soil density, is less loose in texture, less dark in colour and contains less organic matter. Herbage from "teart" land appears less mature, softer and less fibrous than that from sound land, and contains more water and less fibre. Scouring is probably due to the physiological action of one or more constituents of the herbage which are not normally present but occur under special soil (and weather) conditions which appear to be determined by the texture of the soil and which can be removed when the texture is appropriately changed.—J. H. L.

Soil carbonates; Determination of ——. H. B. Hutchinson and K. MacLennan. J. Agric. Sci., 1914, **6**, 323—327.

Two round-bottomed bolt-head flasks of Jena glass, holding 100 and 1000 c.c. respectively, are fitted with double-bored rubber stoppers and connected by a stout bulbed tube. Through the remaining hole of the stopper of the large flask passes the stem of a separating funnel, and through that of the small flask a separating funnel of 50—70 c.c. capacity provided with a three-way tap so that the interior of the flask can be connected with a pump. The material, *e.g.*, 10 grms. of soil, is placed in the small flask. Into the funnels of the small and large flasks are introduced respectively 50 c.c. of 2% hydrochloric acid and 50 c.c. of $N/10$ sodium hydroxide, and then the apparatus is exhausted by a pump capable of giving an internal pressure of 60—100 mm. of mercury. The alkali is next run into the large flask, leaving a few c.c. in the funnel to absorb any traces of carbon dioxide which may escape through the tap. The acid is run into the small flask, which is carefully shaken after the first vigorous evolution of carbon dioxide has ceased. When all the carbon dioxide is evolved (usually after about 20 mins.) air free from carbon dioxide is drawn through the liquid in the small flask and it is again shaken occasionally. About 20—60 mins. after the admission of air, absorption is complete, the large flask is disconnected and the interior of the funnel rinsed into it with water free from carbon dioxide. The best method of titrating the liquid is to add excess of barium chloride to remove carbonates from solution, and then to titrate the free alkali alone with phenolphthalein if $N/10$ sodium hydroxide has been used for absorption. This, deducted from the reading for free alkali in the solution in a blank experiment, may be taken alone for calculation, or the barium carbonate precipitate may be further titrated against acid after the addition of methyl orange. The barium chloride solution should be added immediately before titration, since on prolonged standing the precipitate tends to form larger aggregates with a consequent slowing down of the last stage of the titration with methyl orange indicator; where this occurs a slight excess of acid may be added and titrated back with $N/10$ sodium hydroxide. The method, tested with calcium and sodium carbonates gave accurate results.—J. H. L

Soils; Relative effect of lime as oxide and carbonate on certain ——. H. B. Hutchinson and K. MacLennan. J. Agric. Sci., 1914, **6**, 302—322.

Caustic lime effects a partial sterilisation of the soil and a chemical decomposition of some of the organic matter present (see Hutchinson, this J., 1911, 471; 1913, 761; Russell and Hutchinson, this J., 1913, 501). Five different soils were analysed, treated with various amounts of lime and calcium carbonate up to 1%, and examined monthly for the quantities of ammonia and nitrate and the number of bacteria present, and pot experiments were carried out with barley and mustard. The amount of caustic lime necessary to induce specific changes in the flora and fauna of the soils was found to depend largely on the character of the soils. Light sandy Millbrook soil (from the Woburn Exptl. Fruit Farm) poor in organic matter and carbonate, reacted sharply with 0·2—0·3%; Rothamsted clay soil, poor in organic matter but rich in carbonate, reacted with 0·3—0·4%; Woburn soil (Exptl.

Station, Royal Agric. Soc.), consisting of open sandy loam rendered distinctly acid by annual applications of ammonium sulphate for 37 years, required 0·5—1%, as did also rich garden soil (Physic Gardens, Chelsea) which already contained carbonate; Craibstone soil (Exptl. Farm, North of Scotland College of Agric.) with a high organic- and low carbonate-content failed to react with 1% of lime. Each soil appeared to absorb directly a definite amount of caustic lime, and until this requirement was fulfilled the partial sterilisation phenomena did not set in. These phenomena included a sudden initial decrease and subsequent increase in the number of bacteria, the extinction of the larger forms of protozoa and the inhibition of nitrate production. Smaller doses than those required for partial sterilisation induced a temporary suspension of nitrification, and a consequent accumulation of ammonia for periods varying with the amount of lime and the character of the soil; there was also a temporary increase in the number of bacteria capable of growing on gelatin plates, but the number afterwards fell to the level of the untreated soil. The decomposing action of caustic lime on the organic matter of the soil was shown by the production of ammonia when the bacteria were quiescent; when bacterial growth commenced the production of ammonia was largely increased. The return in nitrogen (as ammonia and nitrate) for each increment of lime applied varied with the character and reaction of the soil and the carbonate-content; on the average over a period of 250 days, it amounted to 1% of the weight of lime applied. Calcium carbonate gave lower returns, apparently because of its lesser action on organic matter. The pot experiments showed amounts of available nitrogen comparable with the amounts of ammonia and nitrate produced in the laboratory experiments. In some cases the quantity of lime added was sufficient to check the growth of bacteria and to depress plant growth in the first crop; in the case of the Chelsea soil the bacteria were active but plant growth was depressed. Inhibition of nitrification resulting from the application of lime led to a higher nitrogen-content in the plants, possibly due to assimilation of nitrogenous compounds other than nitrates, an uneconomic utilisation of soil nitrogen if occurring to any extent. Where the amount of lime applied did not check nitrification the nitrogen-content of the plants was about normal.—J. H. L.

Lime requirement of soils; Determination of the —— by means of the hydroxide of the alkaline earths. C. R. Moulton and P. F. Trowbridge. J. Ind. Eng. Chem., 1914, **6**, 835—837.

THE method proposed by Bizzell and Lyon (this J., 1914, 34) for determining the lime requirement of a soil is shown to give very variable results according to the quantity of barium hydroxide used, the duration of the distillation, and the volume of the distillate.—A. S.

Soil sterility in Java. F. Ledeboer and A. E. Berkhout. Archief Suikerind. Nederl.-Indië, 1914, **22**, 653—672; Intern. Sugar J., 1914, **16**, 486.

"BLACK ALKALI" accumulations, probably originating from flooded craters, have been found to be the cause of the unproductiveness of parcels of soil in the Petaroekan district, Java. A light dressing of caustic lime, or better still gypsum, produced a remarkable improvement, but the addition of a large amount changed the structure of the soil, the lime displacing the soda in the colloidal compounds, causing flocculation.—J. P. O.

Manuring in Germany; Present position of the science of ——. M. Hoffmann. Bull. Agric. Intell. and Plant Diseases, 1914, **5**, 976—984.

EXPERIMENTS have been made regarding the temperature, concentration and duration of influence of the carbonic acid solution in soil. A regular relation was found to exist between the quantities present in the solution and those recovered in the crop. The results of the action of bacteria, yeasts and enzymes in bringing into solution the compounds of potassium and phosphoric acid are most readily investigated if the soil is previously steamed under pressure. Soils, of which the potash content rendered soluble by steaming amounts only to 5%, will benefit by a potash dressing, whereas if the amount reaches 8%, no potash is required. Soils with less than 4% of soluble phosphoric acid, will profit by a dressing of phosphates. A meadow requires manuring the more widely the content of the air-dried crop of hay differs from the standard of 2% K_2O, 0·7% P_2O_5 and 1% CaO. The ratio between the plant foods found in normal plants is about 100 N : 50 P_2O_5 : 150 K_2O : 80 CaO. The use of this ratio, in conjunction with the results of a soil analysis, gives a rough idea of the manure which a piece of land will require before the next crop is sown. Plants in glass houses flower better after applications of carbon dioxide (injected into the soil from a cylinder, or produced by the action of hydrochloric acid on marble), but it has not been shown that the same holds in the field. Trials have been made to determine whether home-produced manures can be replaced completely by commercial manures, but the results have not been favourable. A direct nutritive effect of sodium has been proved.—J. H. J.

Talbot slag. O. Dafert. Z. Landwirtschaft. Versuchsw. in Oesterreich, 1914, 301—302. Stahl u. Eisen, 1914, **34**, 1135.

SAMPLES of Talbot slag from an Austrian works contained: SiO_2, 8·86—10·04; FeO, 5·45—9·23; Fe_2O_3, 2·75—7·35; MnO, 3·50—6·46; Al_2O_3, 3·58—7·48; CaO, 45·70—50·42; MgO, 3·75—4·60; P_2O_5, 14·01—17·90; S, 0·22—0·88; SO_3, traces, up to 0·16%. The slag resembles Thomas slag and should be equally valuable as a fertiliser.—A. T. L.

Fish manure. Bull. Imp. Inst., 1914, **12**, 429—442.

THE methods and machinery employed for the manufacture of fertilisers from fish of various kinds, from fish waste, and from *Crustacea*, are briefly described, with estimates of the cost of installations. Analyses of fish meals used as cattle food and of different fish manures are given and the use is discussed.—R. G. P.

Seaweed from Zanzibar [for use as fertiliser]. Bull Imp. Inst., 1914, **12**, 351—352.

THE seaweed, which is plentiful on the north coast of Zanzibar Island, contained H_2O 20·7%, N 0·76%, ash (much sand) 30·3%, K_2O 0·55%, P_2O_5 0·11%. It was thus poorer in fertilising constituents than certain species of *Fucus* and *Laminaria*, but would be useful for manuring coconuts if potassium compounds were also applied. —R. G. P.

Agricultural experiments; Distribution of the overhead electrical discharge employed in recent ——. I. Jørgensen and J. H. Priestley. J. Agric. Sci., 1914, **6**, 337—348.

THE strength of the discharge from an overhead wire network at a high potential varies according to the mobility of the carriers of the electricity and the velocity of the wind. The discharge is not limited to the area under the wires, and an equipotential curve around such an area is irregular in form and extended in the direction towards which the wind blows. This is of importance, as control and electrified areas have usually been placed close together in field experiments. Descriptions are given of the distribution of the discharge under various weather conditions. The effect of the discharge upon plant growth may possibly be complicated by the presence of radio-active disintegration products. The maximum current density of the discharge in some experimental stations, where the apparatus is constructed after the pattern of the Agricultural Electric Discharge Co., is of the order 10^{-n} amp./cm^2. Methods are discussed by which the influence of the overhead discharge wires on control areas may be minimised.—J. H. L.

Alcohol in the manufacture of phosphoric acid and phosphates. Fox. *See* VII.

PATENTS.

Manures and fertilisers containing phosphate compounds ; Manufacture of ——. A. Dickson, Dublin. Eng. Pat. 18,999, Aug. 21, 1913.

SEWAGE sludge is mixed with insoluble phosphate, such as phosphate rock, and dried, preferably between 200° and 315° C., to convert the phosphate into the available form. About 3 cwt. of finely ground phosphate may be added to each ton of sludge containing 80% moisture. The lry product may be enriched by adding sulphate of potassium, sodium, or magnesium.—T. F. B.

Fertiliser and process of producing the same from rock minerals. J. Perino, Boston, Mass. U.S. Pat. 1,111,490, Sept. 22, 1914 ; date of appl., March 20, 1914.

FINELY-GROUND rock containing fertilising elements (*e.g.*, mixture of potash-bearing silicate rock and rock phos-hate) is disintegrated by incorporating with a salt of a trong mineral acid, capable of dissociating into its acid nd base below 800° C., and heating gradually to a high emperature, preferably in the presence of steam at tmospheric pressure. The product is treated with water, hereby it is cooled and hydrated and falls to a dry owder.—F. SODN.

eed grain ; Treatment of ——. C. E. de Wolf, London, and H. E. Fry, Dorchester. Eng. Pat. 22,151, Oct. 1, 1913.

EE U.S. Pat. 1,106,039 of 1914 ; this J., 1914, 938. The itric acid may be replaced by a solution of a fertiliser, ich as sodium nitrate or ammonium sulphate.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

eet sugar production. E. R. Taylor. Chem. News, 1914, **110,** 209—210. (See also Courthope and Chadwin, this J., 1912, 451 ; Ling, this J., 1912, 452 ; Collins and Hall, this J., 1913, 929.)

N view of the very promising results obtained recently the cultivation of sugar beet in England, it should now e possible to establish the beet growing industry in this untry, since Germany and Austria together supplied 5% of our sugar in 1912. The soil is well suited and the eld per acre is in most cases as great as at Continental ntres and frequently greater. The land is enriched by e cultivation of beets, so that other rotation crops ield better results after it. A considerable portion of e English farming land which has gone out of cultivation om various causes, could profitably be put under beet. n important feature of the beet industry is the number by-products, viz., the pulp finds a ready market, the aves are an excellent cattle food and the saturation lime good fertiliser. In the United States the area under et has trebled in ten years, the yield per acre has nearly ubled and the price per ton of beets has risen by nearly 0%. The roots are grown on a contract basis, the farmer greeing with the factory to plant a certain acreage for given number of years.—J. H. L.

ugar] *Cane crushing ; Notes on* ——, *in the United Provinces, India.* G. Clarke, N. Hussain, S. C. Banerjee, and L. Shanker. Bull. 42, 1—12, Agric. Research Inst., Pusa, 1914.

PERIMENTS have been made at Patabgarh and Shakja-npur during the last three seasons in regard to the haviour of cane on crushing, quantity of cane crushed r hour and extraction. The cane was crushed simul-neously in five 3 roller bullock-driven mills with 8-inch llers, slightly over two tons of each variety of cane amined being used. The juice was weighed and its crose content determined, and the sucrose was also termined in samples of the bagasse withdrawn from each ll at intervals of one hour. With Reora of Benares, indigenous variety very popular in the eastern districts. l Ashy Mauritius, an imported variety, the average results were respectively: juice 61·3 and 74·0, with sucrose 9·6% and 15·4%, bagasse 38·7 and 26·0, with sucrose 5·4% and 6·4%, consequently extraction 73·8 and 87·2 per 100 of sugar in the cane. Results are given in detail for a great number of varieties of cane.—L. J. DE W.

Sulphur ovens ; Use of washers and coolers with —— [*in cane sugar manufacture*], *and* [*determination of*] *the sulphuric acid content of the oven gases.* H. Pellet. Bull. Soc. Chim. Maurice, **3,** 108—110 ; Intern. Sugar J., 1914, **16,** 465.

THE use of washers is unnecessary, since the few mgrms. of sulphuric acid that may be present in the oven gases combine with the organic salts in the juice to form sulphates, which have no inverting action upon sucrose. Coolers, however, must be used to prevent entrainment of sulphur, which might otherwise deposit in the gas exit pipes. To prevent trouble due to condensation of sulphuric acid, the cooler should be made of lead, or two coolers may be worked alternately, one being in use while the other is being cleaned. To determine the sulphuric acid content of the gases a known volume is passed through two wash-bottles, each containing 100 c.c. of recently boiled cold distilled water and 10 c.c. of concentrated hydrochloric acid, in which liquid sulphur dioxide is sparingly soluble. After passing say 10 litres of the gas, the contents of the bottles are transferred to separate beakers, and the sulphuric acid determined by precipitation with barium chloride in the customary manner. The amount of sulphuric acid found in the second wash-bottle (due to oxidation of sulphur dioxide) is deducted from that found in the first, the difference giving the sulphuric acid in the oven gases.
—J. P. O.

Solidified molasses ; Manufacture of —— [*Use for alcohol manufacture*]. H. C. Prinsen Geerligs. La. Planter, 1914, **53,** No. 11, 173—174.

SOLIDIFIED molasses is being made in considerable quantities in Java, and exported to British India for spirit manufacture. The molasses is treated with direct steam, and after separation of suspended impurities, is boiled in a vacuum pan in the ordinary way, concentration being continued until a small sample becomes as brittle as glass when dropped into cold water. A high and uniform vacuum must be maintained to avoid over-heating and decomposition, and boiling should be as short as possible, not lasting more than three hours. The concentrated mass is cooled rapidly, and run into bamboo baskets lined with palm mats, in which containers it may readily be transported.
—J. P. O.

Carbohydrates ; Methods of determination of ——. *III. Cupric-reducing power of the pentoses — xylose and arabinose.* A. J. Daish. J. Agric. Sci., 1914, **6,** 255—262. (See also Davis and Daish, this J., 1913, 1021.)

THE accompanying table gives divisors (obtained from "smoothed out" curves) for use in determining xylose and arabinose under the conditions of working described by Brown, Morris and Millar (this J., 1897, 165, 166). The two xylose preparations used gave $[\alpha]_{D}^{20} = +18·76$ ($c = 5·142$) and $+18·78°$ ($c = 5·0755$), and the two arabinose preparations $+102·14°$ ($c = 6·8064$) and $+102·33$ ($c = 4·669$). Both sugars were dried to constant weight at 96° C. *in vacuo* over phosphoric anhydride.

Pentose, mgrms.	$\frac{\text{CuO}}{\text{Xylose}}$	$\frac{\text{CuO}}{\text{Arabinose}}$	Pentose, mgrms.	$\frac{\text{CuO}}{\text{Xylose}}$	$\frac{\text{CuO}}{\text{Arabinose}}$
10	2·656	2·669	110	2·471	2·521
20	2·638	2·654	120	2·453	2·507
30	2·620	2·640	130	2·433	2·492
40	2·602	2·625	140	2·415	2·477
50	2·581	2·610	150	2·397	2·461
60	2·563	2·595	160	2·378	2·447
70	2·545	2·581	170	2·360	2·432
80	2·526	2·566	180	2·341	2·417
90	2·508	2·551	190	2·322	2·403
100	2·490	2·536	200	2·304	2·389

—J. H. L.

Starches ; Diverse nature of ——. C. Tanret. Comptes rend., 1914, **159**, 530—532. (See also this J., 1914, 607.)

Starches from 16 different plants were heated with water from 35° to 100° C. and the quantities of amylose dissolved at various temperatures were compared colorimetrically by means of iodine, after the liquids had been allowed to stand overnight to allow suspended matters to subside. Wide differences were observed in the quantities of amylose dissolved from different starches at the same temperature, and in the relative quantities dissolved at different temperatures. The solubility curves were neither regular nor similar to one another in form. There may be in each starch a mixture of homologous amyloses of different solubilities, or one principle in different stages of condensation.—J. H. L.

Equilibrium in the system : lead acetate, lead oxide, water. Jackson. *See* VII.

Use of sweet jowar (*sorghum sp.*) *as a source of commercial sugar or as fodder.* Annett. *See* XIXa.

Patent.

Maple-sugar evaporator. R. H. and H. K. Ober, Fort Jackson, N.Y. U.S. Pat. 1,112,380, Sept. 29, 1914 ; date of appl., June 28, 1912.

The evaporating pan is divided into a number of longitudinal parallel compartments ; the outer compartments communicate with the intermediate compartments at one end whilst the intermediate compartments communicate with each other at the opposite end. Longitudinal heating flues are fitted in the intermediate compartments. The syrup is supplied to a heating pan at one end, and then flows through the compartments of the evaporator, the rate of flow being controlled by a valve operated by a float fitted on the supply pipe.—W. P. S.

XVIII.—FERMENTATION INDUSTRIES.

Enzymes of Aspergillus oryzæ and the application of its amyloclastic enzyme to the fermentation industry. J. Takamine. J. Ind. Eng. Chem., 1914, **6**, 824—828.

By using fungus acclimatised to an antiseptic (U.S. Pat. 1,054,626 ; this J., 1913, 444), it has become possible to prepare Taka-koji in a rotating drum and hence at a considerably lower cost than by the older process (this J., 1898, 118). A large iron cylinder which can be rotated at the rate of once per minute, has an inlet and outlet on opposite sides for air, drawn through by means of a suction fan, and is fitted with an independent central iron pipe provided with radial branches through which water or steam can be sprayed. The drum is charged with wheat bran, the necessary quantity of water and steam introduced, and the drum set in rotation. When the bran is thoroughly steamed, it is cooled to 45° C. by moist air, and an aqueous solution of an antiseptic and a suspension of spores of the fungus are successively introduced in the form of spray. After about 12 hours, the temperature begins to rise, and the drum is set in motion and a slow current of air drawn through. The temperature must not fall below 30° C., and from the 18th to the 24th hour, when the temperature tends to rise rapidly, the air current is increased so that it does not rise above 38°—40° C. The process is complete in 48 hours. The Taka-koji made in this way forms an efficient substitute for malt in alcoholic fermentation (see Ortved, this J., 1913, 708). The properties of Taka-diastase, separated from the Taka-koji, are also described. It possesses the great advantage over malt diastase as a medicinal agent of retaining its activity almost unchanged for several years.—A. S.

Beer yeast for industrial and therapeutic purposes. E. Carlinfanti. Annali Chim. Appl., 1914, **2**, 121—128.

In determining the activity of yeast by a fermentation test, considerably higher results are obtained if the carbon dioxide be removed continuously by a current of air during the test. Freshly prepared dried yeast shows a considerably lower fermenting power than fresh yeast in the first 12 hours of the test, but its activity subsequently increases. When dried yeast is kept, its fermenting power diminishes and may almost completely disappear. A number of commercial preparations of dried yeast for pharmaceutical use were examined. In all cases hardly any fermentation occurred in the first 12 hours, and the fermenting power was very low even after 24 hours.—A. S.

Yeasts : Supposed assimilation of sugars by —— *in the absence of fermentation.* W. A. Davis. Chem. World, 1914, **3**, 271—273.

Kahlbaum's "pure" maltose contains not only traces of nitrogenous matter (see Kluyver, this J., 1913, 803) but also 5—15% of dextrin and small quantities of dextrose, and all commercial preparations of pure maltose examined by the author have contained impurities. This fact explains many of the anomalous results obtained by Lindner's "*Kleingärmethode*" (see this J., 1910, 1221 ; 1911, 301, 1465), such as the assimilation of maltose by maltase-free yeasts which are incapable of fermenting it, and the greate assimilability of maltose as compared with dextrose and sucrose. Experiments with pure cultures of the maltase-free yeasts, *S. Marxianus*, *S. Exiguus* and *S. anomalus* showed that when incubated with solutions containin highly purified maltose and dextrose or sucrose, thes yeasts ferment every trace of the latter sugars, wherea the maltose can be quantitatively recovered even afte 3—6 weeks (cp. Davis and Daish, this J., 1913, 1024) The "*Kleingärmethode*" is a very imperfect means o investigating yeasts and many of the conclusions to whic it has given rise, where not already disproved, are highl improbable. Hayduck's nutrient solution (asparagin an salts) is not a suitable medium for all yeasts since som do not assimilate asparagin readily ; yeast water is a muc better source of nitrogen.—J. H. L.

Manufacture of solidified molasses. Prinsen-Geerlig *See* XVII.

Critical temperatures of solution, and haemolytic properties *alcohols.* Vandevelde. *See* XX.

Patent.

Yeast ; Process for eliminating bitterness from ——. P. Docherty, Burton-on-Trent. Eng. Pat. 10,774, May 1914.

Washed yeast is treated with a weak alkaline solutio *e.g.*, a solution containing about 7·5 oz. of ammoniu carbonate per cwt., then washed with water and allowe to remain for 12 hours in contact with blocks of wood cha coal.—W. P. S.

XIXa.—FOODS.

Milk ; The cryoscopic method for the detection of add water in ——. J. S. Maclaurin. Forty-Seventh Annu Report of the Dominion Laboratory, New Zealan 1914, 76—80.

Examination of 270 authenticated samples of milk, com prising morning and evening milks, milks from individu cows and the mixed milk of herds, showed that the freezi point of pure fresh milk does not rise above —0·545° C. fall below —0·565° C. ; the average freezing point m be taken as —0·550° C. The addition of water raises t freezing point to some intermediate point between—0·55 C. and 0° C., the rise being proportional to the amount water added. —W. P. S.

Milk ; Detection of added water in ——. J. W. Leath Analyst, 1914, **39**, 432.

The freezing point of the milks from 25 individual co varied from —0·529° to —0·577° C., whilst for the mix milks it ranged from —0·537° to —0·555° C. In the case of a milk freezing at —0·555° C., the addition of 5% and 10% of water raised this point to —0·519° C. and —0·490 C. respectively.—W. P. S.

Flour ; On the presence of sulphates in ——. R. A. Cripps and A. G. Wright. Analyst, 1914, 39, 429.

The quantity of sulphuric acid found in the ash of flours is very small (usually below 0·02% of the weight of the ash) owing to the fact that acid phosphates, the chief constituents of the ash of flour, decompose sulphates on ignition and cause the loss of the sulphuric acid. Larger quantities of sulphuric acid are found when the determination is made directly on the flour. One hundred grms. of flour are shaken for 1 hour with 1000 c.c. of 1% acetic acid, and allowed to stand for about 12 hours; 500 c.c. of the solution are then decanted, boiled after the addition of a small quantity of hydrochloric acid, nearly neutralised, the proteins precipitated with Almén's tannin reagent, the precipitate removed by filtration, and the sulphuric acid determined in the filtrate by precipitation with barium chloride. In this way, from 0·0069 to 0·0084% SO_3 was found in various flours; a whole-meal flour yielded 0·0103%.—W. P. S.

[*Sorghum Sp.*] *; Use of sweet jowar* —— *as a source of commercial sugar or as fodder and the variation in composition of the crop during growth.* H. E. Annett. Bull. No. 4, Agric. Research Inst., Pusa. (See also Bryan, this J., 1912, 696).

Saccharine sorghum was grown on experimental plots at Lyallpur and Gurdaspur in the Punjab. As a source of sugar the plant is not worth growing in India, for the high proportion of dextrose in the juice (cp. Bryan, *loc. cit.*) prevents the production of good crystalline gur, and the yield of sugar would be only about 1/3 of that from ordinary sugar cane crops. The plant appears valuable as a source of fodder. It grows fairly quickly (within three months), and from one of the experimental plots 13 tons of total green matter were obtained per acre. It should be cut when the seed is at the thin milk stage (see *loc. cit.*), the total weight of the plant and the nutritive value being then at their maximum and the total sugar almost at its maximum. —J. H. L.

Hydrocyanic acid in feeding-stuffs ; Determination of ——*, and its occurrence in millet and Guinea corn.* J. R. Furlong. Analyst, 1914, 39, 430—432.

One hundred grms. of the ground material are extracted with 90% alcohol for 3 hours in a Soxhlet apparatus, and the extract, after expelling the alcohol, is distilled with 150 c.c. of 10% sulphuric acid, the distillate being collected in 5 c.c. of 10% potassium hydroxide solution. At the end of 1 hour, the receiver is changed, water is added to the distillation flask, and the distillation continued. These operations are repeated until evolution of hydrocyanic acid ceases. The distillate is concentrated to 15 c.c., boiled for 10 mins., after the addition of 1 c.c. of a 20% solution of ferrous sulphate containing also 1% of ferric chloride, cooled, acidified with hydrochloric acid, and 10 c.c. of glycerol added. After standing for about 18 hours, the mixture is transferred to a graduated cylinder, diluted to 50 c.c. with water, and the blue coloration compared in tubes of 1 in. diam. with standards prepared rom known quantities of hydrocyanic acid. When the amount of hydrocyanic acid present is not less than 0·001 grm. the standards may be made up directly, but with smaller quantities it is necessary to dilute to 150 c.c. and hen concentrate as in the preparation of the solution rom the plant material. From determinations of hydrocyanic acid in millet and Guinea corn plants of various ages, t was found that all the young plants contained a cyanogenetic glucoside, whilst the full grown plants were free rom this substance. In the case of Guinea corn, the yield of hydrocyanic acid reached a maximum (0·01%) in the 12 in. plants, and decreased as growth proceeded. With millet, the maximum amount of hydrocyanic acid (0·045%) was found in the 24-in. plants.—W. P. S.

Changes in official methods of analysis of cottonseed products. *See* XII.

Determination of carbohydrates. III. Cupric reducing power of xylose and arabinose. Daish. *See* XVII.

Patents.

Flour and flour stock ; Treatment of —— *and appliances therefor.* B. I. Levin, Manchester. Eng. Pats. 20,627, Sept. 12, and 22,366, Oct. 4, 1913.

The material is fed uniformly on to a rotating roller, travelling belt, or the like, which is maintained in a moist condition, and the product is removed by a scraper. Moisture may be supplied by means of a wick and the material may be removed from the roller by a rotary brush which also ensures intimate contact between the roller and the material.—F. Sodn.

Cream ; Method or process of homogenizing. H. N. Brawner, jun., Washington, D.C. U.S. Pat. 1,112,594, Oct. 6, 1914 ; date of appl., Aug. 28, 1912.

Cream is heated, submitted twice to a process for rendering it homogeneous, and then cooled.—W. P. S.

Food preparations or extracts ; Manufacture of ——. F. Krause, Steglitz, Germany. U.S. Pat. 1,113,021, Oct. 6, 1914. Date of appl., Jan. 24, 1914.

See Eng. Pat. 541 of 1914 ; this J., 1914, 937.—T. F. B.

Apparatus for making lard substitute [*hydrogenised oil*]. U.S. Pat. 1,113,151. *See* XII.

XIXb.—WATER PURIFICATION ; SANITATION.

Water ; Action of protozoa in the purification of stored ——. P. T. Müller. Arch. Hyg., 1912, 75, 321—352 ; Wasser u. Gas, 1914, 4, 208.

During the storage of water, the number of "foreign" bacteria present decreases, whilst the ordinary water bacteria are not affected. This is due to the activity of the protozoa. The disappearance of the bacteria is accompanied by a decided increase in the protozoa and infusoria, and this increase is proportional to the decrease of the bacteria. When the development of the protozoa is inhibited by the addition of potassium cyanide and saponin, the bacteria are no longer destroyed.—W. P. S.

Water purification by ozone—with report of the Ann Arbor plant. R. W. Pryer. J. Ind. Eng. Chem., 1914, 6, 797—800.

A brief description of the installation at Ann Arbor, Mich., U.S.A. The ozonisers are very similar to the Siemens-De Frise type, but an outer aluminium pole is used, mica tubes instead of glass and no water jacket for cooling. The filtered water is treated in wells 8—9 ft. deep, the ozonised air (containing on the average, 0·5 grm. of ozone per cb. metre) being forced upwards under a pressure of 5—8 lb., the ratio of ozonised air to water being about 1 : 2·2. During two years' working at no time was any considerable reduction of the number of bacteria observed ; usually the ozonised water contained more bacteria than before the treatment, and it was proved that *Bac. coli* was able to withstand the action of the ozonised air under the conditions described.—A. S.

Water ; The calcium hypochlorite treatment of ——. Klut. Mitt. K. Landesanst. f. Wasserhyg., 1913, 17, 94—116 ; Wasser u. Gas, 1914, 4, 420—421.

When water has been treated with a quantity of calcium hypochlorite equivalent to 0·67 mgrm. of available chlorine per litre, it has a distinct smell and taste of chlorine; the latter can be detected chemically, but may be removed by addition of an equivalent quantity of sodium thiosulphate. In the water so treated, the ammonia is oxidised to nitric acid, the chlorine is increased by 1 mgrm. per litre, and the oxygen absorption from permanganate is diminished. The treated water does not have any appreciable action on metal pipes, pumps, etc. Since commercial calcium hypochlorite varies somewhat in composition, especially as to its content in available chlorine, attention is directed to the use of liquid chlorine stored under pressure, for the purification of water supplies.—W. P. S.

Microbes suspended in water; Removal and separation of —— by means of a current of air. A. Trillat and M. Fouassier. Comptes rend., 1914, **158**, 518—520.

Microbes can be removed from water by means of a current of air to a greater or lesser degree according to their origin and age. Thus whilst *B. prodigiosus* was readily removed, *B. subtilis* under similar conditions was not carried along by the air, and between these extremes *B. coli* and the typhoid bacillus were partially removed. Experiments showed the possibility of a separation of *B. prodigiosus* and *B. subtilis* suspended in the same medium, the former alone being removed. In experiments with *B. proteus* a four months old culture was more readily carried over than a young 18 hour culture. The dimensions of the microbes and their capability for being moistened are the determining factors in their removal from the aqueous suspension.—G. F. M.

Water bacteria; The decomposing power of —— and a new method for the examination of water. W. Spät. Arch. Hyg., 1911, **74**, 237—288; Wasser u. Gas, 1914, **4**, 208.

The quantity of ammonia formed when water is incubated in a suitable medium affords some evidence of the purity of the sample. The decomposition is not always proportional to the number of bacteria present, since ordinary water bacteria, *B. coli*, and pathogenic organisms generally yield only small quantities of ammonia. When, however, the water contains soil bacteria due to contamination by surface drainage, large quantities of ammonia are produced. The samples of water need not be packed in ice during transit as the decomposing power of the bacteria is not affected by storage.—W. P. S.

Water; Rapid method for the bacteriological examination of —— and its use in the control of water supplies and filters. P. T. Muller. Arch. Hyg., 1912, **75**, 189—223; Wasser u. Gas, 1914, **4**, 186.

Ferric hydroxychloride is added to the water, the mixture is centrifuged, and the bacteria are counted, under the microscope, in a definite quantity of the sediment. The method yields results which agree with those obtained by the usual plate-culture methods.—W. P. S.

Nitric acid in water; Preparation of the hydro-strychnine reagent used for the colorimetric determination of ——. Denigès. Bull. Soc. Pharm., Bordeaux, 1914. Ann. Chim. Analyt., 1914, **19**, 221—222. (See this J., 1911, 827.)

In preparing the reagent the zinc used should be chemically pure, or if impure, it should be amalgamated, as follows: 50 grms. of zinc foil are covered with 50 c.c. of water and 20 c.c. of pure hydrochloric acid (sp. gr. 1·18), shaken, and 10 c.c. of a saturated solution of mercuric chloride added; the mixture is shaken for 2 mins., the liquid poured off and the foil washed by decantation, dried with filter paper and then in the air. The reagent should only be prepared when required. The end point of the reaction is only definite after immersion in a boiling water bath for a few minutes. The test is carried out by diluting 5 c.c. of the water to be examined, ten or more times if necessary, adding 0·3 c.c. of the reagent and mixing; then adding 2·5 c.c. of pure sulphuric acid and heating in a boiling water bath for 5 mins. The red colour produced, if nitrate is present, is compared with that given by a solution of potassium nitrate of known strength.—J. H. J.

Deposits in cast-iron and similar water mains. O. Casagrandi and R. Binaghi. Wasser u. Gas., 1914, **4**, 438.

The water supply of Cagliari, Sardinia, is conducted through iron pipes having a total length of about 18 km.; these pipes become choked periodically with a deposit. A similar deposit is formed in the aqueduct of Sinnai. The freshly formed deposit was found to be free from organisms, whilst the older deposits contained *Cladotrix aeracea*; the same growth took place both in iron and steel pipes. The formation of the deposit is affected by three factors, namely, the presence of carbon and silicon in the iron, the structure of the iron, and the character of the water; the chief factor, however, is the presence of dissolved oxygen in the water.—W. P. S.

Water; Preparation of distilled ——. Basladeau. Münchener med. Woch., 1913, 1601; Wasser u. Gas. 1914, **4**, 341—342.

Attention is directed to the importance of using pure distilled water in the preparation of solutions for subcutaneous injections. Ordinary distilled water frequently contains traces of heavy metals, iron, zinc, and alkalis derived either from the condenser or from the storage vessels, and the presence of these impurities has been noticed to have a distinct biological and physiological effect. For the preparation of pure water a platinum or silica condenser is preferable, but satisfactory results may also be obtained by the use of a condenser of Jena glass. The water must be protected from atmospheric impurities.—W. P. S.

Sewage treatment. R. Hering. J. Franklin Inst., 1914, **178**, 417—433.

Treatment is dependent upon the physical condition of the sewage and whether there is much organic matter in solution. In modern methods of treatment, use is made of those anaerobic bacteria which decompose the sewage without offence. One form of tank for this purpose is the Hampton tank as modified by Imhoff of Emscher. The tank consists of two side portions through which the sewage flows, at a reduced rate, and the solids settle out and pass through slots into a central chamber, which has no direct water outlet, and in which fat or light matter rises up a shaft and is skimmed off. The sludge accumulates at the bottom of the central chamber, and when the sulphur bacteria in it have died off it has no odour. This process of loss of odour takes 3—5 months, after which the sludge is removed automatically. It drains readily in a week, when it is in a fit condition for removal.—J. H. J.

Action of metals on water. Jorissen. *See* X.

Patent.

Air; Process of regenerating [exhaled] ——. H. R. Carveth, Niagara Falls, N.Y., Assignor to The Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 1,111,055, Sept. 22, 1914; date of appl., Aug. 15, 1911.

The air is passed, in a closed circuit, over a series of masses of a regenerating agent, *e.g.*, an alkali peroxide, mixture of alkali peroxides, or mixture of alkali and alkaline-earth peroxides, and a hydrating agent, arranged alternately. —F. Sodn.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Morphine in poppy capsules; Formation and yield of ——. G. Mossler. Pharm. Post, 1914 [53]; Pharm. Zeit., 1914, **59**, 600; Pharm. J., 1914, **93**, 525.

To improve the output of opium, and to elucidate the conditions of the formation of morphine in poppy-capsule latex, the following tests were made: An equal number, 250, poppy capsules, were treated as follows:—(1) After cutting off from the stem, dried in the air. (2) Heated for half an hour in alcohol vapour, under pressure, at 80°—83° C. (3) Crushed, while fresh, in a mortar, and air-dried. (4) Scratched, the exuded latex taken up on cotton-wool; the capsules were then cut off and air-dried together with the juice-soaked wool. (5) The same, except that the wool containing the latex and the capsules were sterilised with alcohol. (6) Capsules allowed to ripen in the ordinary manner. The amount of morphine and allied alkaloids in the material thus prepared was then determined, and, for comparison, calculated into the yield from the material dried at 100° C. In the case of the latex absorbed on wool, the average yield of extractive was found from a given number of capsules, and its alkaloidal value referred to the same source. The whole air-dried capsules gave 0·1369% of morphine, and 0·0605% of allied alkaloids; the whole sterilised capsules, 0·1301% of morphine, and 0·041% of other alkaloids; the crushed capsules, 0·0386 and 0·01443%; the scratched air-dried capsules, 0·12442 and 0·1129; the opium on the wool from the above, 0·1877 and 0·1620; the capsules and opium on the wool together, 0·3121 and 0·2991; the scratched capsules sterilised, 0·1147 and 0·0429; the opium on wool sterilised, 0·153 and 0·1293; the above capsules and opium on wool sterilised together, 0·2677 and 0·15825; the ripe capsules, 0·05327 and 0·01737%, respectively. It is evident that sterilisation with alcohol vapour causes no increase in the amount of morphine. After the exudation of the latex following scarification of the capsules, a notable quantity of morphine remains. The low yield of alkaloids obtained from the crushed capsules is noteworthy. From the point of view of the morphine output, it is evident that the capsules, as well as the opium derived from them, are valuable, and should be worked up.

Nicotine from waste tobacco plants; Improved yield of ——. E. Chuard and R. Mellet. Schweiz. Apoth. Zeit., 1914, **52**, 424, and Pharm. J., 1914, Oct. 24, 561.

At present, in Switzerland, when waste tobacco plants are utilised for the manufacture of nicotine, this is done as soon as the crop of choice leaves has been harvested for tobacco manufacture. Investigation shows this to be a mistake. If the stripped stems with buds and shoots are left in the ground, and the soil is dressed with sodium nitrate, a second growth will take place. This will ensure a much larger yield of nicotine, amounting in the authors' experiments to an increase of 77%. It was found that when the plants were pulled up at once, the average yield of nicotine per plant was 0·725 grm. When they were allowed to grow again, the yield rose to 1·284 grm. per plant. The sodium nitrate used as manure does not act directly in increasing the nicotine content, but indirectly in stimulating growth during which the base is elaborated. Of the separate parts of the plants examined, the shoots and roots contain considerably more alkaloid than the stems. Considerable loss of nicotine occurs on drying the material.

Digitalinum verum. H. Kiliani. Arch. Pharm., 1914, **252**, 26—32.

Crude *Digitalinum verum* can be purified by dissolving pt. in 3 pts. of cold methyl alcohol and adding 6 pts. of water. After two days the white granules are filtered off, washed with 10% methyl alcohol, and dried *in vacuo* and the operation repeated till tests show that not more than % of the dry powder is dissolved by shaking with chloroform for an hour, and that the m. pt. is 212°—214° C. The mother liquors are concentrated at 35°—40° C., any granules which separate are removed, and the liquid finally evaporated to dryness *in vacuo*. The residue is dissolved in 4 pts. of 95% alcohol and 5 pts. of ether gradually added to precipitate the by-products. The clear liquid is concentrated to a syrup and mixed with pts. of 10% methyl alcohol. For hydrolysis, 1 pt. of *Digitalinum verum* is added to 10 pts. of a mixture of 00 c.c. of water, 100 c.c. of 96% alcohol and 20 c.c. of concentrated hydrochloric acid, and heated under a reflux condenser in a vigorously boiling water bath for an hour. After standing for 18—24 hrs. the crystals of digitaligenin are filtered off and washed first with 30% alcohol and then with water till all acid is removed. The alcoholic washings and the first water washing are extracted with chloroform which is dried by means of sodium sulphate, and evaporated. The residue is dissolved in 50% alcohol and sown with a crystal of digitaligenin. The product is dissolved in boiling 85% alcohol, the solution decolorised with animal charcoal, and the solid precipitated by the addition of water, when pure white needles are obtained, m. pt. 212°—213° C. The liquors left after extracting with chloroform are freed from acid by means of silver carbonate, evaporated to dryness *in vacuo*, and the syrup dissolved in 1 pt. of methyl alcohol. The solution is mixed with 1 pt. of absolute ether, and sown with a crystal of dextrose
—F. Shdn.

Hydroxymethylanthraquinones in rhubarb, senna and cascara; Determination of the free and combined ——. Daels. Bull. Acad. med. Belge, 1913, 350. Ann. Chim. Analyt., 1914, **19**, 177—179.

From 2 to 5 grms. of the powdered drug are treated in a flask, with 200 c.c. of chloroform, the whole weighed, and heated under a reflux condenser, for 15 mins. The chloroform solution of the free hydroxymethylanthraquinones is filtered off and the residue washed with chloroform. The insoluble residue is washed off the filter back into the flask and made up to the original weight with chloroform. After adding about 50 c.c. of 25% sulphuric acid the whole is weighed and heated on a water bath under a reflux condenser for 2½ hrs., the powder being kept below the surface of the liquid. When cool the weight is again made up with chloroform which is drawn off and 150 c.c. filtered, and shaken with 50 c.c. of 10% sodium bisulphite solution. The chloroform solution is then filtered through kieselguhr, washed with 100 c.c. of 1% hydrochloric acid, and 100 c.c. filtered into a tared flask, evaporated to small bulk and the residue, representing the combined hydroxymethylanthraquinones of the drug, dried at 60°—70° C. The chloroform solution of the free hydroxymethylanthraquinones is shaken out successively with quantities of 50 c.c. of 5% sodium hydroxide solution till it becomes colourless or slightly yellow. The united alkaline extracts are shaken out once with chloroform, diluted with an equal volume of water, filtered, acidified with hydrochloric acid, and shaken out three times with 25 c.c. of chloroform. The chloroform solution is filtered through kieselguhr into a tared flask and evaporated to dryness. Rhubarb contains 0·10 to 0·28% of free, and 3·18 to 5·53% of combined hydroxymethylanthraquinones. Senna contains 1·98 to 2·12% and cascara 1·32 to 1·44% of combined hydroxymethylanthraquinones.—F. Shdn.

Essential oil industry in Seychelles. Rept. Collector Customs Seychelles for 1913. Bull. Imp. Inst., 1914, **12**, 464—466.

This industry is increasing, and new distillation machinery has been installed. The oils exported are chiefly those from cinnamon and clove leaves and lemon grass. In 1912, 506 galls., value 7700 rupees (1 R. = 1s. 4d.), and in 1913, 924 galls., value 16,482 rupees, of essential oils were exported to France, Germany, and the United Kingdom.—R. G. P.

Essential oils of the new British Pharmacopœia. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5**, 376—379.

The suggestions made by C. A. Hill and J. C. Umney as to the essential oils of the British Pharmacopœia have been nearly all adopted (see this J., 1910, 295). *Oleum pimentae* and *oleum pini* (*pumilionis*) have been omitted, the latter being replaced by *oleum abietis* (*oleum pini Sibiricae*, "oil of pine"). Ajowan, lemongrass and wintergreen oils have been included. Comments on the monographs are given and the principal standards, including the sp. gr., optical rotation, and refractive index at 25° C., are summarised in the following table.

Oleum.	Sp. gr.	Opt. rot.	Ref. ind. (25°).	Other standards.
Abietis	0·900—0·920	—32° to —42°	about 1·474	Esters as bornyl acetate 30—40%.
Ajowan	0·910—0·930	+ 1° to + 2°	—	Thymol at least 40%.
Anethi	0·910—0·915	+70° to +80°	1·483—1·488	Solubility 1 in 3 of 90% alcohol.
Anisi	0·975—0·990 $\left(\text{at } \frac{20^\circ}{15{\cdot}5^\circ}\right)$	— 2° to + 1°	1·552—1·558	80 per cent. distils between 225° and 235°. Congealing about 15·5°. Liquefying not below 17°.
Anthemidis	0 905—0·915	— 1° to + 3°	1·445	Solubility 1 in less than 1 of 90%alcohol.
Cadinum	about 0·990	—	—	Test for absence of pine tar.
Cajuputi	0·919—0·930	Not more than —4°	1·460—1·467	Cineol 45% (phosphoric acid process).
Carui	0·910—0·920	+75° to +82°	1·485—1·497	Not less than 50% distils above 200°.
Caryophylli	1·047—1·065	—	1·528—1·540	Eugenol 85% (soda process)
Cinnamomi	1·000—1·030	—0°·5 to —1°	1·565—1·580	Cinnamic aldehyde 55—65%.
Copaibæ	0·896—0·910	— 7° to —35°	1·494—1·500	Distils between 250° and 275°.
Coriandri	0·870—0·885	+ 8° to +14°	1·463—1·467	Solubitity 1 in 3 of 70% alcohol.
Cubebæ	0·910—0·930	—25° to —40°	1·486—1·500	60% distils between 250° and 280°.
Eucalypti	0·910—0·930	—10° to +10°	—	Cineol 55% (phosphoric acid process). Solubility 1 in 5 of 70% alcohol.
Gaultheriæ	1·180—1·187	0° to — 1° (25°)	1·537—1·539	Esters as methyl salicylate 99%. Solubility 1 in 6 of 70% alcohol at 25°.
Graminis citrati	0·880—0·905	— 3° to + 3°	—	Aldehydes 70% minimum.
Juniper	0·862—0·890 (increasing with age)	— 3° to —15°	1·472—1·488	Soluble in 4 vols. of equal volumes 90% and absolute alcohol, becoming less soluble with age.
Lavandulæ	0·883—0·900	— 3° to —10°	—	Esters 7—11% for English oil and not less than 30% for foreign oil. Solubility 1 in 4 vols. 70% alcohol.
Limonis	0·857—0·860	+58° to +64°	1·473—1·476	Citral not less than 4%.
Menthae piperitæ	0·900—0·920	—20° to —35°	—	Total menthol not less than 50%. Esters as menthyl acetate not less than 5%. Soluble in 4 vols. 70% alcohol.
Menthæ viridis	0·925—0·940	—30° to —50°	—	Solubility 1 in 3 vols. 90% alcohol.
Myristicæ	0·870—0·925	+13° to +30°	1·474—1·484	Solubility 1 in 3 vols. 90% alcohol. Not more than 5% residue when evaporated on a waterbath.
Rosæ	*0·854—0·862	— 2° to — 4°	1·456—1·465	Melting point at 20° to 23°.
Rosmarini	0·895—0·920	— 2° to +15°	1·463—1·473	Total alcohols as borneol not less than 10%. Esters as bornyl acetate not less than 1·8%. Solubility 1 in 5 to 10 vols of equal parts 90% and 70% alcohol.
Santali	0·973—0·985	—13° to —21°	1·498—1·508	Total alcohols as santalol not less than 90%. Solubility 1 in 6 vols. 70% alcohol at 20° C.
Sinapis volatile	1·014—1·025	—	—	Distils between 148° and 156°. Allyl iso-thiocyanate not less than 92 grms in 100 c.c.
Terebinthinæ rectificatum	0·860—0·870	—	1·465—1·480	Distils almost entirely between 156° and 280°, leaving no appreciable residue.

* At $\frac{30^\circ}{15^\circ{\cdot}5}$

F. Shdn.

Oils of the Coniferae. II. The leaf and twig, and bark oils of white fir. A. W. Schorger. J. Ind. Eng. Chem. 1914, **6**, 809—810. (See also this J., 1914, 983.)

The white fir [*Abies concolor* (Gord.) Parry] grows on the mountain slopes from southern Oregon to Lower California and from Nevada, Utah and southern Colorado through Arizona and New Mexico. The oil from the leaves and twigs is usually greenish yellow in colour, with a green fluorescence, but two samples were lemon-yellow with no fluorescence. Six samples (yield 0·029—0·272, mean 0·128%) had the following characters: sp. gr. at 15° C., 0·8720—0·8777; n_D^{15}=1·4781—1·4796; a_D^{25}=—20·11° to —27·94°; acid value, 1·01—1·81; ester value, 12·52—27·34; ester value after acetylation, 47·84—55·51; esters (as bornyl acetate), 4·38—9·57 (mean 6·63)%; free alcohols,7·65—10·57 (9·39)%; total alcohols, 13·39—15·56 (14·59)%. The oil yielded the following fractions: 161°—165°, 15·5; 165°—170°, 42; 170°—180°, 18·5; 180°—195°, 3; 195°—240°, 13; and 240°—310° C. ("green oil"), 3%; and contained: furfural, trace; *l*-α-pinene, 12; *l*-camphene, 8; *l*-β-pinene, 42; *l*-phellandrene, 15; and free borneol, 9·5%. Two samples of the bark oil (yield 0·07 and 0·12% respectively) had the following characters: sp. gr. at 15° C., 0·8767, 0·8702; n_D^{15}=1·4833, 1·4809; a_D^{20}=—20·95°, —20·15°; acid value, 1·22, 0·87; ester value, 6·88, 6·43; ester value after acetylation, 23·34, 20·45; esters (as bornyl acetate), 2·41, 2·25%; free alcohols, 4·58, 3·90%; total alcohols, 6·48, 5·67%. The oil yielded the following fractions: 162·5°—170°, 65; 170°—180°, 14; 180°—192°, 8; 192°—250°, 4; 250°—300° C. ("green oil") 5%; and contained: furfural, trace; *l*-α-pinene, 9; *l*-β-pinene, 60; dipentene, 12—13; and free borneol 4·5%. The "green oil" appears to be similar to that obtained from the leaf oil of Douglas fir (see this J., 1914, 41).—A. S.

Oil of black sage. C. E. Burke and C. C. Scalione. J. Ind Eng. Chem., 1914, **6**, 804—806.

The oil was obtained by the steam-distillation of leave and twigs collected in February: yield 0·9%. It ha the sp. gr. 0·8979 at 15° C., specific optical rotation, 24·4 refractive index, 1·4729; acid value, 2·2; ester value 1·6; was insoluble in 70% alcohol and remained clear o cooling to —20° C. It was separated into its component by fractional distillation and was found to consist of pinene 6, cineol 30, dipentene, terpinene, etc. 25, thujone 8 camphor 25 and resinous material 5%. A sample of oi from material collected about 2 months later in the season contained 22·5% of cineol and 40% of camphor accordin to an analysis of the U.S. Bureau of Plant Industry (se Rabak, this J., 1912, 602).—A. S.

Oil of Artemesia arborescens, L. T. Jona. Annali Chim Appl., 1914, **2**, 63—68.

About 200 kilos. of the dried tops of the plants collecte shortly before flowering, yielded on distillation 1·14 kilos of a deep blue oil of sp. gr. 0·9458 at 15° C., which wa soluble in all proportions in 90% and in 10 vols. of 80% alcohol, and remained clear at —15° C. The oil containe neither sulphur nor nitrogen compounds. It had th saponification value, 29·3; ester value, 19·5, ester valu after acetylation, 50·0; and distilled chiefly between 185 and 310° C. at atmospheric pressure and between 90° an 210° C. at 33 mm. It contained a mixture of high boiling hydrocarbons; formic, acetic, isovaleric, pelargonic palmitic, and stearic acids, partly free and partly as esters about 13% of β-thujone, and 13·94% of alcohols, $C_{10}H_{18}$ (thujol and probably a small quantity of borneol), of whic 8·58% were in the free state and 5·36% as esters.—A. S.

Lantana Camara; An oil from the flowers and leaves of ——. D. D. Kanga. Arch. Pharm., 1914, **252**, 1—2.

The exotic *Lantana Camara* which is very abundant in southern India and is known as "Ghaneri," originally came from Central America. The oil obtained from either the dry or fresh flowers or the leaves had a strong persistent but pleasant odour of sage, the yield being 0·02% from the dry flowers and 0·2% from the leaves. The characters of the oil from the dried flowers were: sp. gr. 0·915 at 26°/15° C., refractive index 1·4987 at 26°—26·75° C., $a_D = +23{\cdot}9°$, saponification value 10, acetyl value 43·6. The oil from the leaves had the sp. gr. 0·92114 at 24°/24° C., $n_D^{27} = 1{\cdot}48933$, $a_D = +1{\cdot}96°$, and was obtained by the steam distillation of an alcoholic extract. (See also this J., 1909, 906.)—F. Shdn.

Perfumery industry; Applications of cold in the ——. C. de Chessin Cherchewsky. Z. angew. Chem., 1914, **27**, III., 42.

Artificial cold is employed in the purification of perfumes by chilling (*glaçage*), cold storage of plants and flowers, in the *enfleurage* process to keep the fat at the proper consistence, and for the condensers in the author's process of distilling flowers with a volatile solvent instead of with steam. In the manufacture of synthetic perfumes artificial cold is used in the extraction of certain constituents of essential oils (*e.g.* cineol from eucalyptus oil, safrol from camphor oil), to inhibit exothermic reactions in synthetic processes, for condensation of alcoholic distillates (heliotropin), in distillation *in vacuo* (methyl anthranilate), and in processes where ozone is used production of vanillin by treatment of eugenol solution with ozone).—C. A. M.

Perfumery and essences; Cuban trade in ——. Perfumery and Essent. Oil Rec., 1914, **5**, 374.

N 1912 the total Cuban imports under this heading amounted to 581,329 kilos. valued at approximately 120,000, and last year the imports totalled 683,179 kilos. worth approximately £125,000. France supplies about three-quarters of these goods, and Great Britain about one-fifth.—F. Shdn.

loves; Cultivation of —— *in Zanzibar.* F. C. McClellan. Bull. Imp. Inst., 1914, **12**, 415—420.

Details of methods of cultivation, fungoid and other pests, etc., are given. Clove cultivation forms the most important industry of Zanzibar and of the island of Pemba. The crop varies considerably from year to year, good crop being obtained once every three to five years. n 1912—13 the total yield was 135,386 frasilas (1 frasila= 5 lb.), of which 104,368 came from Pemba; in 1913—14 he total was 726,621 frasilas, 591,222 from Pemba. Annual market requirements are about 400,000 frasilas. Pemba has more than 2/3 of its total area under cloves, r about 35,000 to 49,000 acres. Large trees may yield 0 to 70 lb. of dry cloves, although the average yield is only about 3½ to 4 lb. per tree per annum. The cloves re picked by hand and dried in the sun; hot-air and ther driers have been tried but have been abandoned. —R. G. P.

hymol; Sources of ——. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5**, 372—373. (See also this J., 1913, 378.)

HE only species of origanum yielding thymol exclusively *Origanum hirtum*, whilst oil from *O. Maru* yields carvacrol only. The oil obtained in the South of France from *Thymus vulgaris* contains both carvacrol and thymol. French thyme grown in Germany yields an oil containing carvacrol only, but German thyme and possibly Spanish thyme give thymol only. Essential oils from the following plants are possible sources of thymol: American horsemint, *Monarda punctata*; dittany, *Cunila mariana*; *Mosla japonica* (indigenous to Japan), and *Satureja thymbra* (a Spanish spice).—F. Shdn.

Cloves from Zanzibar. Bull. Imp. Inst., 1914, **12**, 337—340.

The following samples were examined. (A) Cloves from trees 8 to 9 years old; (B) Stems from (A); (C) Cloves picked just before buds turned pink, about 8 to 10 days before ready; trees about 45 years old; (D) Stems from (C); (E) Cloves picked when buds were pink, ready for picking; trees about 60 years old; (F) Cloves picked when in full flower; trees about 60 years old; (G) "Mother of cloves" (clove fruits) from trees about 60 years old.

	Value per lb. in London	Oil %	Eugenol in oil %
A	6d.	17·8	89
B	2½d.	5·9	—
C	7d.	19·2	88
D	2½d.	6·3	89
E	8d.	18·8	81
F	5d.	17·4	88
G	2½d.	6·5	90

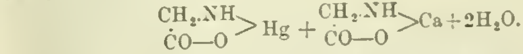
The oil from (C) was the best, having an odour very similar to that of standard commercial clove oil. Next in order were (E), (A) and (F); the odour of oils from (B), (D) and (G) was decidedly inferior. All the samples of cloves, etc. were of good quality and readily saleable in London.—R. G. P.

Isoprene from commercial turpentines. C. H. Herty and J. O. Graham. J. Ind. Eng. Chem., 1914, **6**, 803—804.

The apparatus used was similar to the "isoprene lamp" of Harries and Gottlob (this J., 1911, 1074), except that the platinum wire was wound on a triangular pipe-stem to prevent short-circuiting between the coils: Each experiment was continued until condensation ceased in the receiver for the crude isoprene. The crude isoprene was fractionated, and the portion distilling at 35°—37° C. taken as pure isoprene. From commercial spirits of turpentine in 6 hours a yield of 5·5% (by vol.) of isoprene was obtained. The pinene fraction of turpentine distilling at 155°—156° C. gave in 8 hours, 8% of isoprene, whilst the higher-boiling fractions (from 169° C. upwards), containing dipentene, gave, in 2 hours, only 0·50%; hence the isoprene from spirits of turpentine must be derived from pinene rather than from dipentene as stated by Harries and Gottlob (*loc. cit.*). The volatile oil obtained from the oleoresin of *Pinus serotina*, by distilling under reduced pressure (1 mm.) and which is rich in limonene (see this J., 1908, 589), gave in 9 hours, a yield of 12% of isoprene. Pine oil obtained from resinous pine wood by steam distillation (see Teeple, this J., 1908, 346), gave in 6 hours, a yield of 4% of isoprene. No isoprene could be obtained from refined spruce pine turpentine obtained as a by-product in the manufacture of wood pulp from spruce pine, and consisting chiefly of cymene.—A. S.

Glycocoll; Metallic compounds of ——. A. Bernardi. Gaz. chim. ital., 1914, **44**, II., 257—260.

Mercury glycocollate, $(NH_2.CH_2.CO_2)_2Hg$ (see Ley and Kissel, Ber., 1899, **32**, 1357), when dissolved in water and treated with the calculated quantity of lime water, is converted into a mixture of the mercury and calcium compounds of glycocoll:



$$(NH_2.CH_2.CO_2)_2Hg + Ca(OH)_2 = \begin{matrix} CH_2.NH \\ \dot{C}O—O \end{matrix}\!\!>Hg + \begin{matrix} CH_2.NH \\ \dot{C}O—O \end{matrix}\!\!>Ca + 2H_2O.$$

The mercury compound melts with decomposition at 155° C., is almost insoluble in cold and slightly soluble in hot water, soluble in hot sodium carbonate solution and in cold hydrochloric acid and in ammonia. It is decomposed by potassium hydroxide with separation of yellow oxide of mercury. The calcium compound is a white crystalline substance, slightly soluble in cold and more soluble in hot water; it is precipitated from aqueous solution in an amorphous form by alcohol. In presence of water it is decomposed by carbon dioxide with formation of calcium carbonate and glycocoll. By the interaction of powdered mercuric sulphate and an aqueous solution of glycocoll, a double salt, $(NH_2.CH_2.CO_2)_2Hg,HgSO_4,3H_2O$, is obtained in white crystals, insoluble in the ordinary solvents. It decomposes at 102° C.—A. S.

Alanine and glycocoll; New reactions for ——. Chelle. Bull. Soc. pharm. Bordeaux, March, 1913. Ann. Chim. Analyt., 1914, **19**, 67—68.

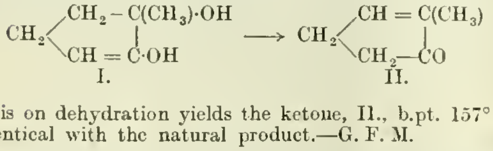
About 2—10 mgrms. of the substance are dissolved in 4 drops of water, 1 c.c. of glacial acetic acid and 0·5 c.c. of 5% sodium nitrite solution are added and the nitrous vapours boiled off. The liquid is boiled with 50—100 mgrms. of hydrazine sulphate and while still hot treated with 2 c.c. of concentrated sulphuric acid. After cooling 2 c.c. more of sulphuric acid are added. Separate portions tested with one drop of a 5% alcoholic solution of the reagent give the following colorations when alanine is present: guaiacol, red; codeine, lemon-yellow; *p*-cresol, orange. With glycocoll, guaiacol gives a reddish violet, codeine a violet, and *p*-cresol a green coloration, but the tints produced with the last two reagents are somewhat transitory.—F. Shdn.

Phenylalanine; Detection of ——. Chelle. Bull. Soc. pharm. Bordeaux, March, 1913. Ann. Chim. Analyt., 1914, **19**, 109.

Formaldehyde added to a solution of phenylalanine in concentrated sulphuric acid gives an orange coloration, rapidly turning brown. An alcoholic solution of paraldehyde added to a similar solution causes a lemon-yellow coloration to develop in a few minutes, followed by a green fluorescence in about an hour. One mgrm. of phenylalanine can be detected in this way.—F. Shdn.

Methylcyclopentenone; Synthesis of a ——. M. Godchot. Comptes rend., 1914, **158**, 506—508.

A cyclic ketone obtained by Looft (this J., 1893, 919) from wood tar, and by Bouveault (Bull. Soc. Chim., 1901, **25**, 435) from wood oils derived from the beech and oak was accorded by them the constitution of a Δ^5-1-methylcyclopentene-2-one. This is now confirmed by its synthesis from Dieckmann's cyclopentanedione-1.2 (Ber., 1897, **30**, 1470), by the action of magnesium methiodide with which it reacts in the ketone-alcohol form giving the glycol, I., b.pt. 79°—81° C. at 15 mm.; $n_D^{16} = 1{\cdot}4734$; sp. gr. at 16° C., 1·051.



I. II.

This on dehydration yields the ketone, II., b.pt. 157° C., identical with the natural product.—G. F. M.

Alcohols; Critical temperatures of solution, and hæmolytic properties of ——. A. J. J. Vandevelde. Bull. Soc. Chim. Belg., 1914, **28**, 149—166.

The physiological hæmolytic method, and Crismer's method of critical temperatures of solution (this J., 1904, 451 and 1907, 32) have been applied to the distillates obtained by the fractionation of commercially pure methyl and isoamyl alcohols, and whilst the latter method was capable of differentiating between them, the hæmolytic process was not sufficiently sensitive for the purpose. From a study of the critical temperatures of solution of mixtures of methyl or isoamyl alcohols with ethyl alcohol, using beef suet, or coconut oil as solutes, the composition of mixtures possessing the same density can be determined, and further a series of alcohols having the same properties as Crismer's "absolute alcohol" (99·072%) can be prepared from less concentrated ethyl alcohol by introducing suitable quantities of isoamyl alcohol. Tables and curves are given from which the composition of alcoholic solutions whose critical temperatures of solution are appreciably raised or lowered can be very accurately determined.—G. F. M.

Tar, Guyot ——. N. Petkow. Z. öffentl. Chem., 1914, 20, 232—233.

Ordinary wood tar (*Pix liquida pini or betulae*) is heated on the water bath for three hours with 6—10% of sodium bicarbonate and two to four times its weight of water. When cold the mixture is decanted, filtered, perfumed and treated with 0·1% of codeine. Three samples were brownish-black and had the characters: sp. gr. 1·0224—1·0254; alkaline reaction; 3·176—4·15% of extract; 1·44—1·936% of ash, the alkalinity of the latter being equivalent to 17·6—19·4 c.c. of *N*/10 acid. They were miscible in all proportions with water and evolved carbon dioxide on acidifying. Tar water prepared from ordinary wood tar is lemon-yellow and acid in reaction, whilst that prepared from the Guyot tar is brownish-yellow and alkaline. As a pharmaceutical speciality Guyot tar is liable to a duty of 100 fr. per 100 kilos. on entry into Bulgaria.—F. Shdn.

Silver in collargol and liquids of animal origin; Determination of ——. P. W. Danckwortt. Arch. Pharm., 1914, **252**, 69—76.

The ash from about 1 grm. of the colloidal silver is warmed twice with 5 c.c. of 25% nitric acid, and the solution transferred to a 100 c.c. flask. The residue of silver chloride is dissolved in 30 c.c. of 10% ammonia, added to the acid solution, and the whole, which should now contain excess of ammonia, is made up to the mark. Standard potassium cyanide solution is added to an aliquot portion with a little potassium iodide as indicator, and the excess titrated back with *N*/10 silver nitrate solution. For smaller amounts, the ammoniacal solution may be treated with hydrogen sulphide solution, acidified with nitric acid and the silver determined colorimetrically. —F. Shdn.

Argentum colloidale; Simple method of valuing —— F. Lehmann. Arch. Pharm., 1914, **252**, 9—12.

About 0·2 grm. of the *Argentum colloidale* is mixed wit 10 c.c. of water and treated successively with 10 c.c of concentrated sulphuric acid and 2 grms. of finel powdered potassium permanganate in small portions After standing for 15 mins. the mixture is boiled, cooled diluted with 50 c.c. of water and excess of ferrous sulphat added. The silver is then titrated with *N*/10 thiocyanat solution.—F. Shdn.

Chemicals and drugs in Canada. Oil, Paint, and Dru Rep., Oct. 19, 1914. [T.R.]

At the present time Canada offers an excellent market fo almost all drugs and chemicals. There is already scarcity in many products, such as carbolic acid, citric oxalic, tartaric, and salicylic acids and their salts, glyceri quinol, menthol, morphine, codeine, castor oil, olive oi potassium chlorate and permanganate, shellac, sodiu benzoate, and santonin. Prices have in many case advanced from 200 to 900%. The National Drug au Chemical Co., which supplies a large part of the market depends on imported goods for many of its supplies, an will soon be unable to meet many of the demands.

Fixed oils of the British Pharmacopœia, 1914. *See* XI

Beer yeast for industrial and therapeutic purpose Carlinfanti. *See* XVIII.

Preparation of distilled water. Basladeau. *See* XIX

Addendum.

Synthetic drugs, etc.

This J., 1914, 1028, l. 22 from top, add references a follow:—

See also Coblentz, this J., 1904, 93; and [illegible], thi J., 1910, 383.

Patents.

Sera for the cure of cancer ; Production of ——. A. P. L. van Langeraad, The Hague, Holland. Eng. Pat. 7978, March 30, 1914.

The animal which is to supply the serum (*e.g.*, a dog or rabbit) is subjected to a preliminary immunising treatment with the milk gland tissue of one or more "domestic" animals (cows, sheep, or goats), and after a few days' interval blood is drawn and the serum prepared in the usual manner.—T. F. B.

Arsenic-antimony compound and process of making same. A. Bertheim and P. Karrer, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,111,821, Sept. 29, 1914. Date of appl., Sept. 24, 1913.

Organic arsenic-antimony compounds are obtained by treating with a strong reducing agent a mixture of an aromatic arsinic acid and an antimony compound in solution. The products are insoluble in water but soluble in dilute hydrochloric acid or dilute caustic soda solution. (See also Eng. Pats. 17,533 and 19,778 of 1913 ; this J., 1913, 1030 ; 1914, 102.)—T. F. B.

Methyl chloride ; Process of manufacturing ——. B. S. Lacy, Perth Amboy, N.J., Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,111,842, Sept. 29, 1914. Date of appl., July 7, 1913.

Methane is mixed with a larger amount of chlorine than is necessary theoretically to form methyl chloride, and the mixture is passed into a suitably heated reaction vessel made of quartz.—T. F. B.

Colloidal solutions of rare metals ; Process for preparing ——. H. Granert. Ger. Pat. 275,704, July 22, 1913.

Stable colloidal solutions of the rare metals are obtained by reducing solutions of the metallic salt with hydrazine hydrate or other reducing agent in presence of serum-albumin.—T. F. B.

Santalol compounds possessing sedative properties ; Preparation of ——. J. D. Riedel A.-G. Ger. Pat. 275,794, Aug. 14, 1913.

The esters of santalol with *a*-bromo derivatives of the higher fatty acids (such as valeric acid or diethylacetic acid) possess sedative and local anæsthetic properties. —T. F. B.

Process for extracting from woods their soluble contents. U.S. Pat. 1,112,359. *See* XIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Aldehyde- and acetone-bisulphites of organic bases and their use as photographic developers. G. Pellizzari. Annali Chim. Appl., 1914, 2, 129—132.

The bisulphites of organic bases such as are used as photographic developers form addition compounds with aldehydes and acetone, which are stable when dry, readily soluble in water, and furnish a developing bath ready for use simply by treating their solutions with sodium carbonate, which decomposes them into their components. p-Aminophenol-acetonebisulphite,

$$HO.C_6H_4.NH_2.H_2SO_3.(CH_3)_2CO,$$

is obtained by suspending 100 grms of the base in 200 c.c. of water, passing in a current of sulphur dioxide and adding gradually 50 c.c. of acetone. When the solution is clear, a further 20 c.c. of acetone is added. The compound separates in minute glistening crystals. The corresponding compound of methyl-*p*-aminophenol (metol) is prepared in a similar manner.—A. S.

XXII.—EXPLOSIVES ; MATCHES.

Permissible explosives [United States] ; Supplementary list of ——. U.S. Bureau of Mines, October, 1914. [T.R.]

The following list contains the names of all permissible explosives tested by the Bureau of Mines between January 1 and August 1, 1914.

Brand	Class	Manufacturer.
Aetna coal powder No. 2	1a	Aetna Powder Co., Chicago, Ill.
Coal special Nos. 1-A and 1-L. F...	4	Keystone National Powder Co., Emporium, Pa.
Mine-ite No. 6-D	1a	Burton Powder Co., Pittsburgh, Pa.
Miners' Friend Nos. 2, 3, 4, 5, and 6	1a	Atlas Powder Co., Wilmington, Del.
Vigorite Nos. 2, 3, 4, and 5	4	Atlas Powder Co., Wilmington, Del.

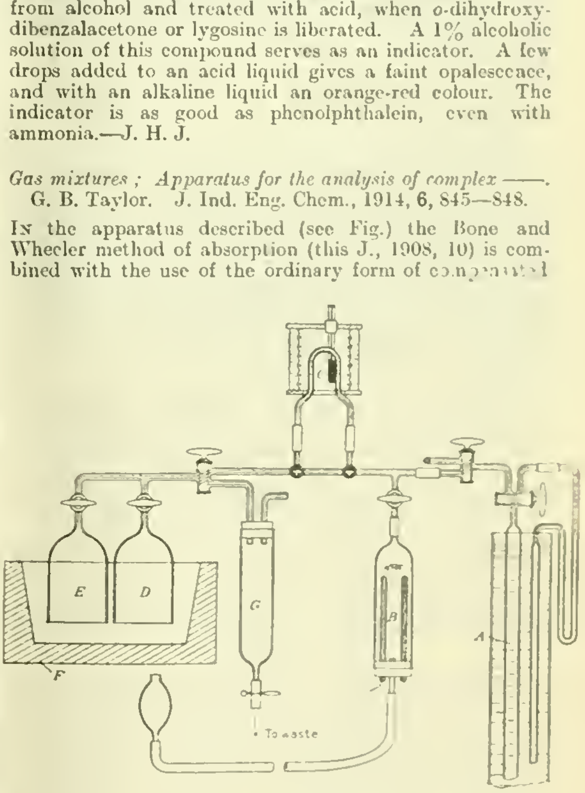
XXIII.—ANALYTICAL PROCESSES.

Indicator ; Dihydroxydibenzalacetone (lygosine) as a new ——. A. Ferencz. Pharm. Post, 1913, 521. Ann. Chim. Analyt., 1914, 19, 232.

Two mols. of salicylic aldehyde and 1 mol. of acetone are condensed in alcoholic solution by means of strong caustic soda. The substance which separates is recrystallised from alcohol and treated with acid, when *o*-dihydroxydibenzalacetone or lygosine is liberated. A 1% alcoholic solution of this compound serves as an indicator. A few drops added to an acid liquid gives a faint opalescence, and with an alkaline liquid an orange-red colour. The indicator is as good as phenolphthalein, even with ammonia.—J. H. J.

Gas mixtures ; Apparatus for the analysis of complex ——. G. B. Taylor. J. Ind. Eng. Chem., 1914, 6, 845—848.

In the apparatus described (see Fig.) the Bone and Wheeler method of absorption (this J., 1908, 10) is combined with the use of the ordinary form of compensated burette (A), an electrically heated, inverted U-tube, C, containing copper oxide for the combustion of hydrogen and carbon monoxide, and a slow-combustion pipette, B, for burning hydrocarbons. Small quantities of fresh absorbing reagents are used and the absorption vessels, D, E, dip into mercury in a wooden trough, F; the spent reagents are discharged through G. In the analysis of coal gas, for example, carbon dioxide is determined by absorption with caustic potash, then "illuminants" with fuming sulphuric acid, oxygen with alkaline pyrogallate, carbon monoxide



and hydrogen by combustion with copper oxide in the tube, C, at about 275° C., and paraffin hydrocarbons in the usual way by slow combustion in B.—A. S.

Sulphuric anhydride and chlorine; Chief cause of the loss of —— by incinerating substances containing these constituents. J. O'Sullivan. Analyst, 1914, **39,** 425—428.

Although chlorides are decomposed and chlorine is lost on incinerating substances containing chlorides, the quantities of calcium, potassium, and sodium sulphates which may be present, are not appreciably reduced. Magnesium sulphate undergoes decomposition on ignition unless a carbonate is present; in the absence of a carbonate, any magnesium sulphate present is converted entirely into magnesium oxide. When present in sufficient quantity in a substance containing chlorides, magnesium sulphate may cause the whole of the chlorine to be lost on ignition.—W. P. S.

Halogen determination in organic compounds. M. Busch and H. Stöve. Z. angew. Chem., 1914, **27,** III., 432.

The substance is dissolved in alcohol, dilute sodium hydroxide solution (containing about 0·2 grm. of $NaOH$) added, and the mixture introduced, with 1—2 grms. of calcium carbonate impregnated with palladium as catalyst (Paal and Karl, this J., 1913, 1089), into a vessel which is filled with hydrogen under pressure and mechanically shaken. Reduction is rapidly effected, and when complete, the solution is filtered and halogen estimated in the usual way. The palladium preparation may be used more than once.—F. Sodn.

Albumin; Colour reaction of —— with triformoxime. L. Lewin. Med. Klinik, 1913, 1122. Ann. Chim. Analyt., 1914, **19,** 281.

A solution of 0·10—0·15 grm. of triformoxime in 100 grms. of sulphuric acid gives a violet colour which is permanent with egg albumin, serum albumin, casein, peptone, papain and other proteins. At the point of contact of the two solutions, coagulation occurs. On shaking the violet colour spreads into the liquid. The violet solution has an absorption line $\lambda=536\ \mu\mu$. The reaction is very delicate; 0·2% albumin can be plainly detected. Selenious acid, arsenious acid and indole give the reaction. A solution of paraformaldehyde in sulphuric acid reacts as triformoxime, but less satisfactorily.—J. H. J.

Oxidation of sulphur compounds of coal, and of nitrogen in the bomb calorimeter, and the correction to be applied to the heating value of coal. Regester. *See* IIa.

Determination of zinc in treated wood. Bedford and Pfanstiel. *See* IX.

Treatment of bog iron ores by Kjeldahl's method for the destruction of organic matter. Brandt. *See* X.

Determination of carbon in steel by the direct combustion method. Brady. *See* X.

Determination of vanadium in ferrovanadium and steel. Wilms and Fischbach. *See* X.

Determination of phosphorus in scheelite concentrates. Hagmaier. *See* X.

Changes in official methods of analysis of cottonseed products. *See* XII.

Specific reaction of marine animal oils and of their products of hydrogenation. Tortelli and Jaffe. *See* XII.

Qualitative test for silicates in soap. Leitch. *See* XII.

Colour reactions of tanning materials. Bennett. *See* XV.

Determination of dextrose in leather. Veitch and Rogers. *See* XV.

Improved electrical method of determining salt in soil. Beam and Freak. *See* XVI.

Determination of soil carbonates. Hutchinson and MacLennan. *See* XVI.

Determination of the lime requirement of soils by means of the hydroxide of the alkaline earths. Moulton and Trowbridge. *See* XVI.

Use of washers and coolers with sulphur ovens, and [determination of] the sulphuric acid content of the oven gases. Pellet. *See* XVII.

Determination of carbohydrates. III. Cupric-reducing power of xylose and arabinose. Daish. *See* XVII.

Cryoscopic method for the detection of added water in milk. Maclaurin. *See* XIXa.

Detection of added water in milk. Leather. *See* XIXa.

Presence of sulphates in flour. Cripps and Wright. *See* XIXa.

Determination of hydrocyanic acid in feeding stuffs. Furlong. *See* XIXa.

Preparation of the hydro-strychnine reagent used for the colorimetric determination of nitric acid in water. Denigès. *See* XIXb.

Determination of the free and combined hydroxymethylanthraquinones in rhubarb, senna, and cascara. Daels. *See* XX.

Detection of phenylalanine. Chelle. *See* XX.

New reactions for alanine and glycocoll. Chelle. *See* XX.

Critical temperatures of solution and hæmolytic properties of alcohols. Vandevelde. *See* XX.

Simple method for the valuation of Argentum colloidale. Lehmann. *See* XX.

Determination of silver in collargol and liquids of animal origin. Danckwortt. *See* XX.

Patents.

Temperature; Devices for measuring ——. M. L. Mellin, London. Eng. Pat. 5460, Sept. 4, 1913.

The movement of a body of mercury or of a Bourdon tube or similar device under the influence of change of temperature is transmitted to a resistance coil apparatus interposed in an electric circuit. The movement causes more or less resistance to be introduced into the circuit and the consequent variation of current is indicated by a galvanometer.—W. H. C.

Carbon dioxide gauge. E. A. Cunningham, Philadelphia, Pa. U.S. Pat. 1,111,565, Sept. 22, 1914; date of appl., Sept. 6, 1913.

Flue-gases are passed through a chamber containing a reagent for absorbing carbon dioxide. Normally the velocity of the gases is sufficiently high to prevent substantial absorption of carbon dioxide, but the flow is interrupted periodically and the fall in pressure due to absorption is indicated by a manometer and recorded automatically.—A. T. L.

Organic analysis ; Apparatus for use in elementary ——. H. Brach, Vienna. U.S. Pat. 1,112,432, Oct. 6, 1914. Date of appl., March 5, 1914.

See Ger. Pat. 263,680 of 1913 ; this J., 1913, 1035.—T.F.B.

Trade Report.

Competition with Germany and Austria-Hungary.

The Board of Trade has now issued a fourth list of articles which inquirers desire (A) to purchase, and (B) to sell. It may be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, London, E.C. The first three lists are referred to in this Journal, 1914, pp. 896, 945, and 1037.

Contraband of war.

A supplement to the London Gazette, dated Oct. 29th, contains a Proclamation making the following articles absolute contraband :—Projectiles, charges, and cartridges and their component parts. Powder and explosives specially prepared for use in war. Sulphuric acid. Armour plates. Hematite iron ore and hematite pig-iron. Iron pyrites. Nickel ore and nickel. Ferrochrome and chrome ore. Unwrought copper. Lead, pig, sheet, or pipe. Aluminium. Ferro-silicon. Mineral oils and motor spirit, except lubricating oils.

The following are made conditional contraband :—Foodstuffs. Forage and feeding stuffs for animals. Fuel, other than mineral oils. Lubricants. Powder and explosives not specially for use in war. Sulphur. Glycerin. Hides, pigskins, and leather.

France ; Exportation of certain articles prohibited from ——. Board of Trade J., Oct. 29, 1914.

The French "Journal Officiel" for the 15th October contains a Presidential Decree which prohibits the exportation and re-exportation of the undermentioned articles from France :—

Acetone : acetic acid and medicinal salts thereof ; carbolic acid ; salicylic acid ; methyl and ethyl alcohol ; anhydrous alumina ; aluminium ; antipyrin ; aspirin ; bauxite ; bismuth and bismuth salts ; bromine and bromides ; caffeine ; indiarubber, balata, gutta-percha, crude or melted down ; chloral ; chloroform ; chloride of lime ; scrap iron and steel ; wood creosote ; coal creosote ; cresol and derivatives thereof ; hydrogen peroxide ; sulphuric ether ; ferro-chrome ; ferro-nickel ; formol ; glycerin ; mineral tar ; iodine ; iodides ; iodoform ; iron filings and forge-scales ; filings and waste of copper, tin, zinc, pure or alloyed ; nickel (ore and metal), pure or alloyed ; sodium nitrite ; potassium, potash and potash salts ; amidopyrine ("*pyramidon*") ; caustic soda ; sulphonal ; theobromine ; trioxymethylene.

Exemptions from the prohibition may be accorded under conditions to be determined by the Ministers of War and Finance.

Netherlands contraband. Times, Nov. 2, 1914.

The latest lists of conditional contraband issued by the Netherlands Government contain the following :—On the French side.—Iron, steel, iron oxide, sulphate, and carbonate, copper, lead, nickel, ferrochrome, glycerin, hides, leather. On the German side.—Crude copper, block lead, lead plates, and lead tubes.

Chemicals and Dyestuffs Committee of the American Chemical Society. Oil, Paint, and Drug Rep., Oct. 19, 1914.

The New York Section of the American Chemical Society, on October 9, voted a committee to examine into the feasibility of expanding the manufacture of chemicals and dyestuffs in the United States and to report to the Section on November 6. This committee is composed of H. A. Metz, I. F. Stone, J. B. F. Herreshoff, David Jayne, J. M. Matthews, Allen Rogers, with B. C. Hesse, chairman. The committee will welcome any suggestions as to specific chemicals or dyestuffs that should be made in America. General suggestions will not be useful. Specific suggestions should be accompanied by a statement of the U.S. consumption, production, and prices, and may be sent to the chairman, B. C. Hesse, 90, William Street, New York City.

Books Received.

Glue and Glue Testing. By S. Rideal, D.Sc. (Lond.). Second Edition, revised and enlarged. Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C 1914. Price 10s. 6d. net.

Volume, 8¾ by 5⅝ ins., containing 179 pages of subject matter, with 14 illustrations, and also an alphabetical index. The text is arranged under the following headings : I. Constitution and properties. II. Raw materials and manufacture. III. Uses of glue. IV. Gelatin. V. Glue testing. VI. Commercial aspects.

Methods of Quantitative Organic Analysis. By P. C. R. Kingscott, D.I.C., A.R.C.Sc., A.I.C., B.Sc. (Lond.), and R. S. G. Knight, D.I.C., A.R.C.Sc., A.I.C., B.Sc. (Lond.). Longmans, Green & Co., 39, Paternoster Row, London ; Fourth Avenue and 30th Street, New York ; Bombay, Calcutta, and Madras. 1914. Price 6s. 6d. net.

Volume (8¾ by 5⅝ ins.), containing 276 pages of subject matter, with 51 illustrations, and also alphabetical indexes of authors' names and of subjects. A table of International atomic weights, 1914, and a list of abbreviations, are followed by Chápters on : I. Determination of molecular weight by physical methods. II. Ultimate analysis. III. Estimation of typical groups. IV. Estimation of some compounds of technical importance. References to the original sources of the methods are given.

Saponi da Toeletta. Del C. Franchi. U. Hoepli, Milan. 1915. Price Lire 5.50.

Volume (6 by 4½ ins.) containing 467 pages of subject matter, including sections on : Raw materials for the manufacture of toilet soaps. Perfumes. Essential oils. Animal perfumes. Artificial perfumes. Perfumes for soaps. Colouring soaps. Filling (loading) soaps. Apparatus for the manufacture of toilet soaps. Processes of manufacture. Lanoline in toilet soaps. Transparent soaps. Soaps for the hair. Liquid soaps. Soap creams and powders. Soaps soluble in sea-water and hard water. There are 59 illustrations.

Catalysis in the Gas Industry. William Young Memorial Lecture delivered before the North British Association of Gas Managers, Glasgow, Sept. 3, 1914. By R. Lessing, Ph.D., F.C.S. Reprinted from Journal of Gas Lighting. W. King, 11, Bolt Court, Fleet Street, London, E.C.

The Chemical Examination of Water, Sewage, Foods, and other Substances. By J. E. Purvis, M.A., and T. R. Hodgson, M.A. Cambridge, at the University Press. 1914. Price 9s. net.

Volume (8¾ by 5⅝ ins) containing 215 pages of subject matter, and an alphabetical index. It forms one of the Cambridge Public Health Series, under the editorship of G. S. Graham-Smith, M.D., and J. E. Purvis, M.A. The text is subdivided as follows :—I. Water ; sewage ; and sewage effluents. II. Milk ; cream ; and condensed milk. III. Butter ; margarine ; lard ; dripping ; suet ; cheese ; cream cheese ; and edible oils. IV. Tea ; coffee ; chicory ; cocoa. V. Wheat flour : self-raising flour : baking powder ; bread ; rice ; starches. VI. Pepper ; cayenne ; mustard ; nutmeg ; cinnamon ; ginger. VII. Cane sugar ; golden syrup and treacle ; honey ; jam. VIII. Alcoholic beverages. IX. Vinegar ; lime and lemon juice. X. Poisonous metals in foods. XI. Preservatives ; Disinfectants. XII. Air ; coal gas ; other gases. XIII. Rag-flock. Urine. A bibliography is given on page 211.

The Electrical Conductivity and Ionization Constants of Organic Compounds. By H. Scudder, B.A., M.D., etc. Constable & Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1914. Price 12s. net.

Volume (9½ by 6¼ ins.), containing 568 pages of subject matter. It is a bibliography of the periodical literature from 1889 to 1910 inclusive, including all important work before 1889 and corrected to the beginning of 1913. It gives numerical data for the ionization constants at all temperatures at which they have been measured; and some numerical data of the electrical conductivity. The text is classified as follows:—I. Abbreviations of words. II. Abbreviations of journal titles. III. Cyclic formulæ. III. Tables (compounds arranged alphabetically, with the ionization constant, some data of conductivity, and all bibliographical references given under each compound). IV. Formula index. V. List of authors (names arranged alphabetically). VI. Subject list. VII. Journal list. VIII. Addenda.

Van Nostrand's Chemical Annual, 1913. A Handbook of Useful Data for Analytical, Manufacturing, and Investigating, Chemists, and Chemical Students. Third Issue. Revised with addition of new tables and a section on Stoichiometry. Edited by John C. Olsen, M.A., Ph.D., Prof. of Analytical Chemistry, Polytechnic Institute, Brooklyn. Assistant Editor, Alfred Melhado, Brooklyn, N.Y. Constable & Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1914. Price 12s. 6d.

Volume (8 by 5 ins.), containing frontispiece (Henri Moissan), 663 pages of subject matter, and an alphabetical index. The text is subdivided as follows:—I. General contents. II. Calculation of volumetric analyses. III. Calculation of gas analyses. IV. Physical constants of chemical compounds. V. Specific gravity tables. VI. Alcohol tables of the Bureau of Standards. VII. Equivalents of Weights and Measures. VIII. Thermochemistry. IX. Stoichiometry. X. New Books. List of the more important ones, published since July, 1909. American and English books. Foreign books, mostly German.

Nutrition. A Guide to Food and Dieting. By Chas. E. Sohn. Henry Kimpton, 263, High Holborn, London, W.C. 1914. Price 3s. 6d. net. Also 40 and 42, University Avenue, Glasgow.

Volume (7½ by 5 ins.), containing 246 pages of subject matter, seven illustrations, and an alphabetical index. The text is classified as follows:—I. General principles. II. Human body structurally regarded, chiefly with respect to the digestive system. III. Human body, chemically considered. IV. Classification of the constituents of foods. V. Digestion; assimilation; metabolism; respiration. VI. The body requirements. VII. Infant feeding. Proprietary infant foods. VIII. Meats, &c. IX. Dairy produce, eggs, &c. X. Bread and cereals generally. XI. Peas, beans, and other leguminous foods. XII. Starchy seeds, nuts, roots, &c. XIII. Oily seeds, nuts, &c. XIV. Fresh roots, &c. Fruits, green vegetables, mushrooms, algæ, &c. XVI. Sugars, jams, confectionery, pastry, &c. XVII. Food adjuncts, drinks, condiments. XVIII. Cooking. XIX. Seasons for foods.

The Purification of Gas by Heat. A Century's Progress and its Lessons. Lecture delivered by Charles Carpenter, D.Sc. M.Inst.C.E., before the Institution of Gas Engineers at Liverpool, June 17th, 1914. South Metropolitan Gas Company, 709, Old Kent Road, London, S.E. 1914.

Volume (8¾ by 5½ ins.), with 49 pages of subject matter, with 7 illustrations.

Thirty-Eighth Annual Report of His Majesty's Inspectors of Explosives; being their Annual Report for the year 1913. [Cd. 7650.] Wyman & Sons, Fetter Lane, E.C. Price 5½d.

This report deals with the work of H.M. Inspectors of Explosives under the Explosives Act of 1875 in connection with the manufacture, storage, packing and conveyance, and importation, etc. of explosives. The appendices to the Report include *inter alia* a list of explosives authorised for manufacture or importation, and details of the importation of explosives during 1913.

Bulletin of the Imperial Institute. Vol. XII. No. 3. July–September, 1914. Price 2s. 6d.

This issue of the Bulletin contains the results of investigations in connection with the quality of rubber from various sources, the economic products of the Zanzibar Protectorate. Sudan wheat, Burma pulse, and timbers from various countries. Information is also given respecting the utilisation of fish and marine animals as fertilisers, the tin resources of Australia, South Africa and Nigeria, the trade in palm kernels, etc.

[*] New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."

I. *Daugherty*, R. L.: Hydraulic turbines; with a chapter on centrifugal pumps. 2nd ed., rev. and enl. N.Y., McGraw-Hill. 190 p. il. 8vo. 1914. $2.

Hinchley, J W.: Chemical Engineering; Notes on Grinding. Sifting. Separating, and Transporting Solids. Reprinted from "The Chemical World." Cr. 8vo, pp. 112. Churchill, London. 1914. Net 2s. 6d.

Ivens, E. M.: Pumping by compressed air. N.Y., Wiley, C. 6 × 244 p. Figs. 8vo. 1914. $3.

IIA. *Petroleum* Year Book, The, 1914. Compiled and arranged by S. H. North. Cr. 8vo, pp.102. Wilkinson, London. 1914. Net 5s.

X. *Beyschlag*. F., and Others: The Deposits of the Useful Minerals and Rocks, their origin, form and content. Vol. 1. 8vo, pp. 542. Macmillan, London. 1914. Net 18s.

Eckel, E. C.: Iron ores; their occurrence, valuation and control. N.Y., McGraw-Hill. 427 pp., il. 8vo. 1914. $4.

Mineral Industry: Vol. 22 (1913); ed. by G. A. Roush. N.Y., McGraw-Hill. 1000 p. 8vo. 1914. $10.

Weed, W. H.: The Copper Handbook; a Manual of the Copper Mining Industry of the World. Vol. XI. 8vo, pp. 1455. W. Wesley, London. 1914. Net 20s.

Jones, E. H.: Smelter construction costs. N.Y., McGraw-Hill. 152 p., il. 8vo. 1914. $2.

XII. *Ellis*, C.: The hydrogenation of oils; catalyzers and catalysis and the generation of hydrogen. 145 illustrations. N.Y., Van Nostrand. c. il. figs. tabs. O. 1914. $4.

XIXB. *Whipple*, G. Ch.: The Microscopy of Drinking Water. Third ed., re-written and enlarged, with colored plates. 409 pages, 6 × 9, 74 figures, 6 full page plates in the text and 19 plates of organisms in colors. Cloth. 1914. Net $4.

XXIII. *Blasdale*, W. C.: Principles of quantitative analysis; an introductory course. 70 illustrations. N.Y., Van Nostrand. c. 10 × 394 p. D. 1914. Net $2.50.

XXIV. *Blanchard*, A. A., and Fk. B. *Wade*: Foundations of Chemistry. N. Y., Am. Book Co. C. 446 p. il. figs. D. 1914. $1.25.

Gattermann, L.: The Practical Methods of Organic Chemistry. 3rd ed. Cr. 8vo., pp. 418. Macmillan, London. 1914. Net 7s. 6d.

North, H. B.: Laboratory experiments in general chemistry; 37 illustrations, 2nd ed., rev. N.Y., Van Nostrand. c. '13, '14. 5 × 205 p. figs. tabs. D. 1914. Net $1.

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[*] Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London. W.C., from whom all the works in the preceding list can be obtained.

Journal of the Society of Chemical Industry.
No. 22, Vol. XXXIII. NOVEMBER 30, 1914. No. 22, Vol. XXXIII

Official Notices.

APPOINTMENT OF NEW EDITOR.

The Council of the Society of Chemical Industry has pointed Mr. Tom F. Burton, B.Sc., of 63, Melbury Gar- West Wimbledon, S.W., to be Editor of the Society's Journal in place of Mr. Watson Smith, who has resigned. Mr. Burton will take up his duties at the new year.

BOARD OF TRADE BULLETINS.

Attention is directed to the notice inserted in this issue of the Journal, relative to the Bulletins on various industries which have recently been issued by the Board of Trade.

Journal and Patent Literature.

TENT SPECIFICATIONS may be obtained by post by remitting as follows :—
English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 05 c. each, as follows : Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.) ; Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

I.—GENERAL PLANT ; MACHINERY.

ler control ; Scientific ——. F. D. Harger. Amer. Brewer's Review, 1914, **28**, 391—392. J. Inst. Brew., 1914, **20**, 557—560.

minimise waste of the heating power of the fuel (see ble I.) continuous records of the temperature of the flue es and of their content of carbon dioxide should be de. The temperature should be the lowest possible th a good draught. An average of more than 7% CO_2 the flue gases is rarely attained without the constant of a carbon dioxide indicator. Carbon dioxide indi- rs are inexpensive to maintain (about 50 cents, or 1d. a month), their life is long, and they give trust- rthy results. The chief factor affecting the percentage carbon dioxide in the flue gases, is the air supply. excess of air over that theoretically required for the plete combustion of the fuel should be kept as low as sible. A draught gauge should be used, especially en working with forced draught. The thickness of the -bed, and the intervals between firing, especially with nd-fired boilers, also exert an influence. The thickness the fire-bed may vary with the draught available, the ty required of the boiler, and the class of fuel used, but eneral it should be as even as possible and free from les through which large volumes of air can enter. cumulations of soot in the tubes diminish the draught, l reduce the conductivity of the boiler plates ; a layer soot ⅛ in. thick will reduce the conductivity by about [illegible]

TABLE I.

g the percentage losses of coal corresponding to rious percentages of carbon dioxide in the flue gases. or different flue gas temperatures. The air entering he furnace is assumed to be at 60° *F.* (15·5° *C.*).

bon dioxide, per cent.	Temperature of flue gases.		
	300° F. 149° C.	420° F. 215·5° C.	540° F. 282° C.
4	39·40	59·00	78·8
5	32·00	48·00	64·0
6	26·30	39·50	52·6
7	22·50	33·75	45·0
8	19·70	29·50	39·4
9	17·52	26·28	35·0
10	15·77	23·65	31·5
11	14·33	21·50	28·6
12	13·14	19·70	26·3
13	12·10	18·15	24·0
14	11·25	16·90	22·5
15	10·50	15·70	21·0

—J. H. L.

Boilers ; Serious corrosion of ——. A. Heinzelmann. Der Klein- u. Mittelbrauer, 1914, 238. Chem.-Techn. Rep., 1914, **38**, 376.

THE feed-water was very soft having a total hardness of only 3·5 degrees (German), the temporary hardness being only 1 degree. It contained 3 grms. SiO_2 and 3 grms. of nitrates per 100,000. Chlorides were present in very small amount. Boilers were worked at about 4 atmospheres pressure for many years without trouble, but when they were replaced by boilers working at 10 to 12 atmospheres, considerable corrosion was produced. After 2 months a hard crust, 6 mm. thick, had formed, and the water blown off was found to be strongly acid. The crust contained 80% Fe_2O_3 and 6% of alkali silicates. On the surface was a layer, 1 mm. thick, of calcium sulphate. The action was due to the decomposition under pressure of the chlorides and nitrates by the silicic acid. The liberated mineral acids attacked the iron, and the resulting salts becoming hydrolysed, a progressive rusting of the boiler took place. The trouble was overcome by adding sufficient sodium hydroxide to the feed water to keep the water in the boilers alkaline to phenolphthalein. This reaction between silicic acid and nitrates in boilers is considered to occur only at a pressure of nearly 10 atmospheres.

—T. St.

Lubrication with oils and with colloidal graphite. C. F. Mabery. J. Ind. Eng. Chem., 1913, **5**, 717—723.

COMPARATIVE tests were made under varying conditions in a Carpenter's machine (this J., 1910, 614) fitted with hard Babbitt metal bearings, run at a speed of 450 revolutions per min., and at a pressure of 200 lb. per sq. in. When the bearings were lubricated with one of the best motor lubricants (8 drops per min.), for 2 hours, and the supply then stopped, the oil film broke in 17 mins., whereas when the oil contained 0·35% of colloidal graphite, an extremely low and even coefficient of friction continued unchanged for 5 hours after lubrication was stopped. Oil containing respectively, 0·1% and 0·5% colloidal graphite did not give satisfactory results. When once established, a suitable surface could be maintained with a smaller proportion of graphite in the oil or a reduced quantity of oil containing the normal proportion. The same lubricating effect was obtained by the use of 1/16th of the quantity of oil required in the absence of colloidal graphite. In one experiment the pressure was supported for nearly 10 hours without the addition of fresh lubricant. This property of colloidal graphite is attributed to its saturating the metallic surfaces to form a "graphoil" surface in contradistinction to the film formed by oil. In all cases the temperature increased with the duration of the test up to a constant value not exceeding 65° F. (18° C.).

In general, the lower the friction coefficient, the lower the temperature. The advantages of the use of colloidal graphite for motor car engines are that it forms a graphoid surface on the bearings, which wears indefinitely, that it eliminates any chance of heating through irregular supply of the lubricant, and that it affords greater protection than an oil-film against sudden variations of strain on the bearings.—C. A. M.

Explosibility of mixtures of air and ammonia (Refrigerators). Schlumberger and Piotrowski. *See* VII.

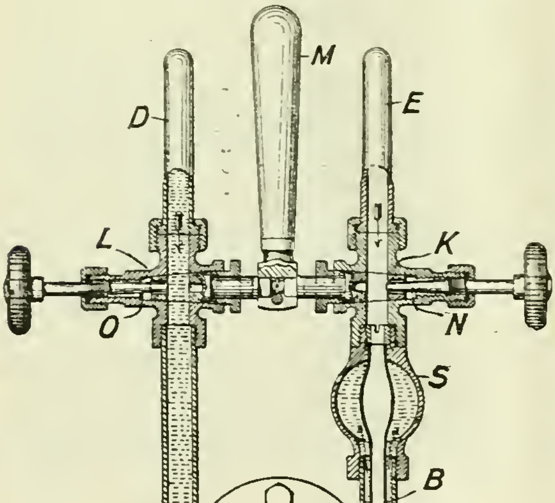
PATENTS.

Discharging compressed gases from storage vessels. J. B. Spurge, London. Eng. Pat. 22,032, Sept. 30, 1913.

To obtain a more regular flow from a cylinder of compressed or liquefied gas a heating coil is interposed between the cylinder and the expansion valve, and to keep back particles of liquid an intermediate vessel is interposed between the cylinder and the heating coil.—W. H. C.

Heating and cooling fluids; Apparatus for ——. W. Adams, Manchester. Eng. Pat. 27,499, Nov. 29, 1913.

A DOUBLE coil is placed in a casing, *U*, and surrounded with non-conducting packing. The liquid to be heated (or cooled) enters through the branch, *D*, passes through the annular space, *C*, between the pipes, to the globular expansion, *S*, and is discharged through a lateral branc not shown. The heating (or cooling) agent ente through the branch, *E*, passes through the inner pipe, . and is discharged through a branch which passes from t lower end, *G*, through the side or bottom of the casin The flow of liquid and heating (or cooling) agent is regulat by the two plug-cocks, *K*, *L*, coupled together and operat by the handle, *M*. Two pin-valves, *N*, *O*, are provid to adjust independently the quantity of liquid flowi through each of the plug-cocks.—W. H. C.



Briquetting-machines. C. Korte, Leeds. Eng. Pa 22,277, Oct. 3, 1913.

THE briquetting press is operated mechanically by a syste of lever devices so arranged that when the desired pressu has been attained, the action of the levers, etc., is aut matically stopped and reversed.—W. H. C.

Steam boilers, surface condensers and the like; Means f preventing formation of hard scale in —— and f removing such scale. G. C. Jones, London. Eng. Pa 22,767, Oct. 9, 1913.

IN using the process described in Eng. Pat. 19,637 1911, in which a current of electricity is passed betwe insulated anodes immersed in the water in the boil and that portion of the boiler which is in contact with t water, the prevention of scale is only effective when t amount of alkali chloride present in the water is equivale to the amount of calcium sulphate present. The cla is for adding a quantity not exceeding 1% of alkali chlori to the water.—W. H. C.

Steam boilers; Prevention of pitting and corrosion in — C. Haythorpe, London. Eng. Pat. 25,893, Nov. 12, 19

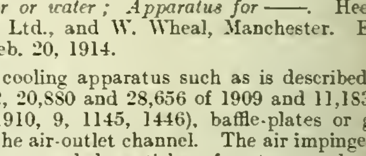
GRAPHITE plugs are inserted into the carbon plates compound zinc-carbon elements which are in meta connection with the boiler shell below the water li A fine deposit of graphite is formed on the boiler pla that come in contact with the heated water.—W. H. C.

Cooling air or water; Apparatus for ——. Heenan a Froude, Ltd., and W. Wheal, Manchester. Eng. P 4369, Feb. 20, 1914.

IN rotary cooling apparatus such as is described in E Pats. 6452, 20,880 and 28,656 of 1909 and 11,183 of 1 (this J., 1910, 9, 1145, 1446), baffle-plates or grids placed in the air-outlet channel. The air impinges agai these and suspended particles of water are deposited —W. H. C

Still. J. A. Ullman, New York. U.S. Pat. 1,113,5 Oct. 13, 1914; date of appl., Dec. 23, 1913.

THE side of the still is formed with a flange, 10, projecti inwards and having on its upper surface a groove, into which the flange, 6, of the still bottom, fits. T joint is made tight by means of angle pieces and bo 13.—W. H. C.

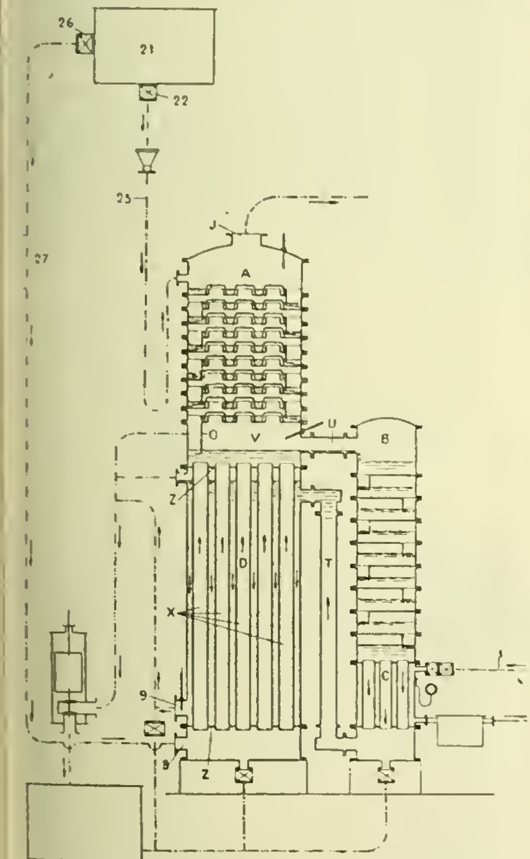


Refrigerating apparatus ; Condensers for ammonia gas ——. J. Dwyer, Montclair, N.J., U.S.A. Eng. Pat. 25,585, Nov. 8, 1913. Under Int. Conv., Dec. 30, 1912.

Groups of "trombone" coils disposed vertically and connected above and below with suitable headers, are arranged in a horizontal series, the bottom header of one group being connected with the top header of the next. The number of coils in each group and hence the condensing capacity is decreased from the inlet to the outlet of the series.—W. H. C.

Stills for the dissociation of chemical solutions by heat ; Continuous ——. R. Fabry, Sheffield. Eng. Pat. 337, Jan. 6, 1914.

The solution to be dissociated, *e.g.* crude ammoniacal liquor, sodium bicarbonate solution, etc., passes from the tank, 21, in regulated quantity, through the cock, 22, nd the pipe, 25, into the upper portion of the dephlegnator, A, where it serves to cool and condense the water apour accompanying the dissociated gases. Another egulated portion of the cold liquid is fed through the ock, 26, and pipe, 27, into the bottom of the tubular reheater, D, through the opening, 8; rises through the ubes, X, and mixes in the chamber, V, with the liquor lowing down the dephlegmator, A. The hot mixed iquid then overflows by the pipe, U, into the dissociator, B, lown which it flows to the tubular superheater, C, where t is heated by steam introduced through the pipe, 1. he liquor is completely dissociated in the vessel, B, nd the spent residue rises through the pipe, T, flows own the pipes, Z, of the preheater, D, parting with its heat o the incoming liquor, and is discharged through the pipe, . By suitably apportioning the flow of liquor between he two directions a nearly pure and dry gas is discharged hrough J, and the liquid is at the same time completely issociated with a minimum amount of steam.—W. H. C.



Distilling apparatus. A. G. Waterhouse, Assignor to Atlas Still Mfg. Co., New York. U.S. Pat. 1,113,521, Oct. 13, 1914 ; date of appl., Oct. 31, 1910.

The supply of liquid to a still is regulated by a valve which is operated by means of a thermal "actuator" (thermostat) placed in the still.—W. H. C.

Centrifugal machine actuated by fluid pressure. A. F. Dunsmore, Glasgow. Eng. Pat. 12,505, May 21, 1914.

The supply of motive fluid is regulated by a spring-controlled valve operated by means of levers by the action of a governor mounted on the spindle of the basket.
—W. H. C.

Separating liquid from solid matter ; Apparatus for ——. H. C. Colburn, Victor, Colo. U.S. Pat. 1,112,119, Sept. 29, 1914 ; date of appl., July 23, 1913.

A horizontal screw conveyor working in the trough-shaped bottom of a containing vessel forces the material against an abutment or projection and thence into an outlet pipe placed in line with the axis of the screw.—W. H. C.

Dehydrating apparatus. I. S. Joseph, Rahway, N.J. U.S. Pat. 1,112,454, Oct. 6, 1914 ; date of appl., Jan. 14, 1914.

The materials to be dehydrated are carried by flat trucks, running on rails, through a shallow dehydrating chamber constructed parallel with and above the longitudinal combustion chamber of a glass furnace, and heated by radiation from the roof thereof.—W. H. C.

Gas-desiccation. J. F. M. Patitz, Milwaukee, Wis., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,113,682, Oct. 13, 1914 ; date of appl., Dec. 21, 1908.

The gas is successively compressed, cooled and expanded, and the condensed moisture removed. The dried gas is then again compressed.—W. H. C.

Dust from exhaust gases ; Apparatus for removing ——. F. Valeur, Gmunden, Austria-Hungary. U.S. Pat. 1,113,848, Oct. 13, 1914 ; date of appl., April 10, 1914.

The gases are passed through a flue which enters tangentially into the base of the chimney. Screens are fixed across the flue at intervals and the cross-section of the flue is contracted at these points to cause a momentary compression and reduction of velocity to allow the dust particles to deposit.—W. H. C.

Filter-press. A. Burger, New Brighton, N.Y. U.S. Pat. 1,112,674, Oct. 6, 1914 ; date of appl., April 8, 1911.

The outlet cocks of the chambers of the filter-press are provided with pneumatic opening and closing devices and are connected by flexible pipes with an apparatus for producing suction or pressure. The pressure or suction causes a piston in the pneumatic device to move in one direction or the other and in doing so to open or close the cock. All the cocks are connected together so that they can be opened or closed simultaneously.—W. H. C.

Distribution of liquids ; Apparatus for the even ——. A. Jonas, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,113,643, Oct. 13, 1914. Date of appl., Dec. 28, 1910.

See Fr. Pat. 421,952 of 1910 ; this J., 1911, 526.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Carbon monoxide in mine air ; Methods of determination and a suggested method of removing it from air. J. Harger. Trans. Inst. Min. Eng., 1914, 533. J. Chem., Met. and Min. Soc., S. Africa, 1914, 15, 59—60.

The determination is based on the reaction $I_2O_5+5CO=5CO_2+I_2$. The sample is collected and measured in the metal cylinder of an apparatus resembling a garden-syringe, the piston-rod of which is graduated to show

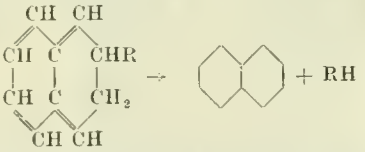
percentages of carbon monoxide. It is passed successively through a solution of bromine, over solid alkali hydroxide, over iodine pentoxide (contained in a coil of glass or silica maintained at about 170° C. in the upper part of a special safety lamp) and (a) through a standard solution of arsenious acid containing sodium bicarbonate and starch, until the latter attains a blue colour, or (b) over metallic copper (to absorb iodine), through a standard solution of alkali hydroxide, and through water containing phenolphthalein tinted by a trace of baryta, until the colour of the last solution is discharged. The volume of the cylinder and the quantity of standard arsenious acid or alkali hydroxide are adjusted so that no indication is obtained unless the air contains more than 0·01% CO; while a dangerous percentage of the latter is indicated within a minute. Carbon monoxide in air is converted into dioxide, at ordinary temperature, by contact with finely divided platinum or palladium; and the use of these or similar catalysts is suggested as the basis for a respirator.
—W. E. F. P.

Firedamp; Electrical detection of ——. G. J. Ralph. Times Eng. Suppl., Oct. 30, 1914, 137.

A PORTABLE apparatus is described for detecting firedamp, and comprises a Wheatstone bridge, of which two of the arms are heated platinum wires, one being in a closed space and the other exposed to the atmosphere. In the presence of firedamp, the resistance of the exposed arm varies. The apparatus can be used with a separate battery or in conjunction with a miner's electric lamp.
—A. T. L.

Coal; The composition of ——. Part II. D. T. Jones and R. V. Wheeler. Chem. Soc. Trans., 1914, **105**, 2562—2565. (See also this J., 1914, 192.)

THE products obtained in the destructive distillation of bituminous coal in a vacuum at not above 350° C. were examined. The occurrence of aromatic hydrocarbons in the oils which were obtained cannot be reconciled with the theory which assumes a breaking off of hydrogen from hydrogenated aromatic nuclei, since this reaction does not take place much below 400° C. An alternative theory according to which complex hydrogenated groups are broken down into a paraffin and naphthalene derivatives, as shown in the equation:—



was supported by the results of the experiments. The neutral oils which were obtained in the distillate were found to consist of mixtures of naphthenes, olefines, and liquid paraffins, such as are obtained by distillation at higher temperatures.—J. N. P.

Briquettes; Rhenish lignite —— in domestic and industrial use. W. Oellerich. Braunkohle, 1913, **11**, 649—655, 665—671, 733—740, 750—755. Chem.-Techn. Rep., 1914, **38**, 193.

LIGNITE in briquettes is found to be as effective as an equal weight of coal, in spite of its lower calorific value, and gives a producer gas better than that from coal, since it contains more carbon monoxide and hydrocarbons, and less nitrogen.—O. E. M.

Bituminous rocks of Estland; Composition of the —— and their decomposition products. Fokin. Gorny Journ. (Russ. Mining J.), 1913, 117. Chem. Techn. Rep., 1914, **38**, 391.

THE bright yellow organic matter of the bituminous rocks of Estland cannot be extracted by organic solvents. It is obtained by leaching out the mineral constituents with different reagents, and contained: H 8·31—9·02, C 72·37—72·82, N 0·56—0·68, O 14·1—16·24, and S 1·6—1·92%; sp. gr. 1·14. The material is slightly hygroscopic, and on dry distillation, yields up to 80% of gas and oil and 20% carbon. Th oil distillate, amounting to about 60%, is readily solubl sp. gr. 0·920—0·945, coefficient of expansion 0·00057 in benzene, but only slightly in petroleum spirit (benzin) It has the viscosity 7·15; and contains: C 80·1—81·85 H 8·71—10·50, O 7·25—8·71, S 0·29—0·40%. Repeate distillation up to 150° C. gives 7·6% petroleum spirit The residues are only suitable for fuel.—J. N. P.

Vaseline oil for internal use. A. Vicario. J. Pharm Chim., 1914, **9**, 149—154.

VASELINE oil or liquid paraffin is obtained from petroleun oils poor in vaseline, and is expressed in the process o preparing solid paraffin. As required by the Frencl Codex it should be of Caucasian origin and consist o hydrocarbons of the series C_nH_{2n}. By comparison of th rate of flow through a fine tube at the ordinary temperatur it should have a viscosity 8—19 times greater than tha of water. The sp. gr. varies between 0·840 and 0·890 Acids and fatty bodies should be absent. American oil which are less pure and limpid than the Russian oils hav a sp. gr. of 0·870—0·945, and give a yellow to a blacl coloration when shaken with concentrated sulphuric acid although they may be satisfactory when tested with 60° acid. The oil can be purified by shaking a litre repeatedl with 50 grms. of concentrated sulphuric acid till the latte ceases to be coloured, then washing with sodium carbonat solution, dehydrating with anhydrous sodium carbonatc and filtering. When subjected to artificial digestio experiments under varying conditions, the oil was un attacked.—F. SHDN.

Lubrication with oils and with colloidal graphite. Maber *See* I.

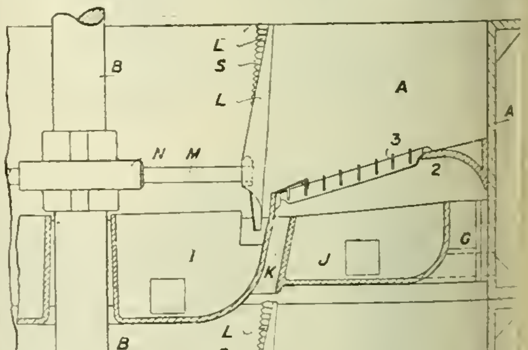
Purifying blast-furnace gases by means of water-spray an cooling. Bayer. *See* X.

Antiseptic properties of petroleum and its derivative Charitschkow. *See* XIXB.

PATENTS.

Washing gases; Apparatus for —— and for analogo purposes. W. B. Davidson, Birmingham and A. Liversedge, Croydon. Eng. Pat. 9302, April 15, 191

THE gas passes up the passages, *G*, *H*, and is deflecte towards the centre of the vessel, *A*, by the curved baffle. It then passes upwards through the spaces between tl



annular plates, 3, and through the spray to the passage, *G*, next above. The washing liquid in the annular trough, *I*, is lifted by the lower ends of the curved spraying devices, *L*, which are attached by the arms, *M*, and the blocks, *N*, to the central rotating shaft, *B*, and is thrown off as spray from the serrations, *S*. The spray is prevented from passing into the gas passage, *G*, by the annular plates, 3, and collects in the outer annular trough, *J*, from which the liquid overflows through passages, *K*, to the inner trough next below.—W. H. C.

Fuel block or briquet. A. F. van Hall, F. Basenau, and R. C. J. van Haagen, Assignors to Naamlooze Vennootschap Briquet Co. (Briket Maatsch.), Amsterdam. U.S. Pat. 1,114,715, Oct. 20, 1914. Date of appl., Aug. 5, 1910.

See Fr. Pat. 428,900 of 1911; this J., 1911, 1243.—T. F. B.

Coking process. L. L. Summers, Chicago. U.S. Pat. 1,114,065, Oct. 20, 1914. Date of appl., May 13, 1913.

See Eng. Pat. 2069 of 1914; this J., 1914, 1001.—T. F. B.

Gas; Apparatus for generating or producing ——. W. R. Degenhardt, Kalgoorlie, Western Australia. Eng. Pat. 22,618, Oct. 7, 1913.

See Fr. Pat. 464,265 of 1913; this J., 1914, 472.—T. F. B.

Gas-producer. A. von Kerpely, Vienna. U.S. Pat. 1,114,072, Oct. 20, 1914. Date of appl., Oct. 11, 1911.

See Fr. Pat. 434,322 of 1911; this J., 1912, 323.—T. F. B.

Manufacture of fireclay gas retorts and the like. Eng. Pat. 25,590. *See* VIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood alcohol. C. Baskerville. J. Ind. Eng. Chem., 1913, 5, 768—772.

Purified wood alcohol is sold in America under the names of "Columbian Spirits," "Colonial Spirits" and "Manhattan Spirits"; in Canada as "Green Wood Spirits" and "Standard Wood Spirits"; and in Germany as "Pro Spirit." Crude commercial methyl alcohol ("wood spirit," "wood naphtha" or "pyroxylic spirit") contains variable proportions of methyl alcohol, acetone, methyl acetate and formate, dimethylacetal, allyl alcohol, aldehyde, methylamine, oil, water, etc. The "tailings" contain furfural, methyl-ethyl ketone, and allyl acetate, with small quantities of paraxanthine. The best commercial wood spirit contains 95% or more methyl alcohol, the common varieties 75 to 95%, and some only 35 to 40%. The crude alcohol as sold usually has a sp. gr. of 0·796 to 0·875 at 15·5° C. In the United States hard woods, especially birch, beech, maple, oak, elm and alder, are preferred for the distillation, though processes for the destructive distillation of sawdust and wood waste have been developed. The wood is seasoned for 1 to 2 years and cut into lengths of 50 in., which are distilled in iron retorts at 400° to 500° F. (200°—260° C.). The volatile products are condensed, the uncondensable portion returned and burned below the retorts. The pyroligneous acid (containing acetic acid, methyl alcohol, acetone, allyl alcohol, phenols, etc.), which separates on the top of the condensed products has a sp. gr. of 1·02 to 1·05. It is used to a small extent in the preparation of an impure iron acetate known as "black iron liquor" or "pyrolignate of iron," but is usually treated to separate the methyl alcohol (about 4%), acetone and acetic acid by neutralisation with lime and fractional distillation. Three stills (2500 galls. each) are commonly used, and the respective distillates contain about 15, 42 and 82% wood alcohol. The residue of gray acetate of lime is exported for the manufacture of acetic acid, whilst the crude wood spirit is sent to a refinery for purification and rectification by distillation from lime or caustic alkalis. Acetone cannot be separated by simple distillation and various methods of separating it have been devised, such as conversion into chloracetones of high b. pt.; conversion into chloroform and distilling the mixture with chloride of lime; crystallisation of the methyl alcohol with calcium chloride; formation of a methyl ester followed by distillation. During 1909—1910 there were in U.S.A. 147 works distilling wood, employing 3039 workmen, and making products (including 8,168,083 galls. of wood alcohol) of the value $9,737,000. In 1913 there were 63 manufacturers of wood alcohol. The exports of wood alcohol (mainly to Germany, Great Britain and Belgium) in 1911 were 2,040,000 galls. valued at $898,000. The crude wood spirit imported into Germany in 1911 amounted to 8,759,300 kilos., of which 4,168,700 kilos. came from Austria, 268,700 kilos. from Sweden, and 4,318,800 kilos. from the United States, whilst in the same year Germany exported 1,739,200 kilos. of purified wood spirit, mainly to France, Italy and Holland. Methyl alcohol is less toxic to lower plants and infusoria but is much more toxic to higher animals and man than ethyl alcohol. Its use should therefore be prohibited in any liquid capable of being taken internally, whilst precautions should be taken to protect workmen from the toxic effects of the vapour.—C. A. M.

Tungsten wire filaments; Preparation of ——. O. Ruff. Z. Ver. deutsch. Ing., 1913, 57, 1615. Chem.-Techn. Rep., 1914, 38, 146.

To prepare a dense, ductile wire suitable for electric lamps, pure tungsten is first obtained by reducing the trioxide in hydrogen, and it is then compressed into rods which are hardened by heating gradually in a current of hydrogen in a tube furnace to 1000° C. for 1 hour. The rods are sintered by heating electrically up to 2850° C., the heating being carried out very carefully and slowly, as the quality of the final product largely depends on this process. The rods are then hammered and rolled at 1200°—1300° C. in a current of hydrogen in a special machine, the operation being repeated until the rods are reduced to the desired diameter. To point the rods before inserting them in the wire-drawing machine the ends of the thicker rods are dipped into molten potassium nitrite, and the thinner ones are made the anode in an electrolytic cell containing potassium cyanide. The finished tungsten wire is silvery white, malleable, tough, ductile and non-magnetic. It is stable in air at ordinary temperatures but oxidises at a red heat so that electric lamps with tungsten filaments have to be exhausted.—T. C.

Coconut and its products, with special reference to Ceylon. Pratt. *See* XII.

Patents.

Coal or other solid material; Apparatus for the distillation of ——. T. Hughes, London. Eng. Pat. 23,418, Oct. 16, 1913.

A vertical metal retort is formed with a central hollow wall containing the heating flues, and intermediate louvred walls arranged so as to support a thin layer of the coal on either side of the central wall, and to provide a collecting chamber for the distillation products adjacent to the outer wall of the retort. The retort may be circular in plan, the walls and chambers being of annular form. The floor of the retort is carried on rails on a base-plate which can be lowered for withdrawing the charge.—A. T. L.

Absorbent or decolorising substance; Manufacture of an ——. Aktiebolaget Kolm. Ger. Pat. 276,343, Oct. 1, 1913.

The bituminous concretions containing uranium, which are found in certain alum shales in Sweden and elsewhere, known as "kolm," are subjected to dry distillation, preceded or followed by extraction with water or acids. The product may be used for decolorising saccharine juices and other liquids.—T. F. B.

Apparatus for the treatment [destructive distillation] of nitrogenous waste, sewage sludge and the like. Eng. Pat. 21,656. *See* XIXb.

Recovery of valuable products [oil and combustible material] from clay and the employment of such products in the manufacture of bricks. Eng. Pat. 28,191. *See* VIII.

III.—TAR AND TAR PRODUCTS.

Benzoic acid ; Quantitative study of the sulphonation of ——. J. Maarse. Rec. Trav. Chim. Pays-Bas. 1914, **33**, 207—238.

Benzoic acid was sulphonated by heating with 4 to 16 times its weight of 93—100% sulphuric acid at from 140° to 209° C. and for from 6 to 91 hours. *o*-Sulphobenzoic acid was not produced under any of the above conditions. The principal product was the *m*-acid together with a small proportion, generally less than 10%, of the *p*-acid. Prolonged heating or high temperatures favoured the formation of the latter. The benzoic acid was incompletely sulphonated when heated to 140° C. with 4 times its weight of 93% acid for not more than 24 hrs. With larger proportions of acid, or more concentrated acid, or at higher temperatures, the whole of the acid was sulphonated.—F. Shdn.

Patent.

Coal-tar or its products ; Treatment of —— *for the removal of the properties therein tending to induce pitch-cancer.* H. W. Robinson, Sedgley. U.S. Pat. 1,114,045, Oct. 20, 1914. Date of appl., Feb. 11, 1914.

See Eng. Pats. 4159 and 10,156 of 1913 ; this J., 1914, 412.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Supply of dyestuffs and colours. Board of Trade Announcement, Nov., 1914.

The Board of Trade has had under consideration the question of the supply of dyestuffs and colours, the deficiency of which at the present time, owing to the cessation of supplies from Germany, is causing great apprehension in the textile trades and in other important British industries. After consultation with the Committee on Chemical Manufactures, appointed in August last under the chairmanship of the Lord Chancellor, it appeared to the Board advisable to take such steps as were possible to develop the immediately available sources of supply, and also to encourage the permanent manufacture of dyestuffs and colours in the United Kingdom on a large scale, so as to guard against any recurrence of the present difficulty. As regards interim steps, arrangements have been made to encourage the immediate expansion of the various existing sources of supply. As regards the permanent supply, after preliminary consultations with representatives of some of the principal bodies of consumers, a meeting was held at the offices of the Board of Trade on Tuesday, November 10, which was attended by representatives of 22 important associations and firms engaged in the colour-using industries. There was laid before the meeting a scheme for the formation of a limited company with a large capital of which the bulk would be subscribed by the consumers of dyestuffs and colours and others interested, the Government indicating their willingness conditionally on this being done to subscribe a certain proportion of the share capital and to guarantee the interest on a large debenture issue for a term of years. Precautions would be taken to preserve the British control of the enterprise and to prevent undue encroachment on other branches of the chemical trades. The meeting was informed that preliminary arrangements had been made enabling the Government to acquire important dye-producing works in this country for the purposes of the new company if established, and that the Government would be prepared to take all necessary steps to secure the acquisition of any other concerns in the United Kingdom whose transfer to the new company might be desirable. The meeting unanimously adopted a resolution approving in principle of a national effort being made by the trade to increase the British supply of synthetic colours and welcoming the assistance of the Government for that purpose. A small committee representing the trades concerned was appointed to confe with the Board of Trade with a view to the elaboration of a scheme on the lines discussed at the meeting.

A further announcement as to the proposed company will be made at an early date.

Phthalein dyestuff of the naphthalene series ; New ——. [*Indicator.*] E. König. Chem.-Zeit., 1914, **38**, 483.

A new dihydroxynaphthophthalein is formed by meltin 2 mols. of 1.6-dihydroxynaphthalene with 1 mol. of phthali anhydride. It forms a scarlet chloride and blue-gree alkali salts. Methylation gives a colourless ether, solubl in sulphuric acid with a scarlet colour and intense fluorescence. It gives dibromo- and di-iodo-compounds and a disulphonic acid, the latter forming a colourless dipotassium salt and a blue-green fluorescent tetra-potassium salt The new phthalein is too sensitive to alkalis to be used in dyeing ; in fact it serves as an indicator and can advantageously replace phenolphthalein in titrating yellow o red solutions.—J. B.

N-Methyl-α-acetylindole. Diels and Dürst. *See* XX

Patents.

Vat dyestuffs of the naphthalene series ; Process for preparin ——. M. Kardos. Ger. Pat. 276,956, Oct. 10, 1913 Addition to Ger. Pat. 276,357 (see this J., 1914, 1045).

Naphthalenedicarboxylic acid imine or acenaphthene quinone oxime, in either of which the NH-group contain an alkyl, aryl, or similar substituent, is fused with a alkali hydroxide, or the dyestuffs obtained according t the principal patent are treated with alkylating or arylatin agents. The dyestuff from N-methylnaphthalenedicar boxylic acid imine dyes cotton pure red shades fast t chlorine and light.—T. F. B.

Azo dyestuff which may be developed on the fibre ; Manufac ture of an ——. C. Müller, Assignor to Kalle und C A.-G., Biebrich on Rhine, Germany. U.S. Pat. 1,113,46 Oct. 13, 1914. Date of appl., Nov. 13, 1913.

See Ger. Pat. 275,660 of 1912 ; this J., 1914, 828.—T. F. B

Azo dyes for wool. P. Hauptmann and A. Rehde, Lever kusen, Germany, Assignors to Synthetic Patents Co. New York. U.S. Pat. 1,113,622, Oct. 13, 1914. Dat of appl., Sept. 4, 1913.

See Ger. Pat. 269,213 of 1912 ; this J., 1914, 247.—T. F.

Sulphur [sulphide] dye ; Green ——. J. Flachsländ Assignor to Farbenfabr. vorm. F. Bayer und C Elberfeld, Germany. U.S. Pat. 1,113,766, Oct. 13, 191 Date of appl., Aug. 9, 1911.

See Eng. Pat. 30,104 of 1910 ; this J., 1912, 66.—T. F.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Cellulose ; The methylation of ——. *Part II. Hydroly of methylated cellulose.* W. S. Denham and H. Woo house. Chem. Soc. Trans., 1914, **105**, 2357—2368.

The formulæ given in the previous paper (this J., 191 974) are not to be taken as representing the compositio of definite homogeneous methylcelluloses. Methylation progressive without definite stages ; the percentage combined methoxyl increases with the number of successi treatments ; after six methylations products containi

23·89 and 25·97% OCH_3 were obtained. All the operations were attended by loss of weight, particularly the sixth methylation which was carried out with more concentrated sodium hydroxide (38·3 grms. per 100 c.c.). The highly methylated preparations were hydrolysed at 0° C. by means of hydrochloric acid saturated with the gas at that temperature (cf. Willstätter and Zechmeister, this J., 1913, 822); solution and hydrolysis took place without evidence of profound decomposition. The products of hydrolysis were resolved by a complex series of fractionations with solvents (ether and acetone) and by distillation of methylglucosides prepared from them, into a mixture of methylhexoses; no disaccharide was detected. The substances actually isolated may be classified as follows:—an amorphous monomethylglucose or mixture of several; an amorphous dimethylglucose or mixture of several; a crystalline trimethylglucose; a trace of a crystalline compound, possibly tetramethylglucose. No dextrose was isolated but strong presumption of the presence of unmethylated hexose was obtained. The presence of small traces of tetramethylglucose may be due to the depolymerisation of the cellulose during the methylation treatments or else to the existence of terminal dextrose residues in the cellulose molecule. Substantially the highest product of the methylation of cellulose is represented by trimethylglucose after hydrolysis, which confirms the existence of three free OH groups in the C_6 unit. As the trimethylglucose crystallised readily and was apparently a homogeneous substance, occurring in the a form, there is a presumption in favour of the symmetrical linkage of the dextrose residues in the cellulose molecule. The trimethylglucose isolated in the crystalline form amounted to 10% of the crude product and a further quantity remained in the mother liquors; it did not yield an osazone, and its constitution has not been definitely determined.—J. F. B.

Coconut and its products, with special reference to Ceylon. Pratt. *See* XII.

Paper, pasteboard, and cardboard. Board of Trade Bulletin No. 90.

May be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Patents.

Paper pulp; Apparatus for straining ——. W. W. Beaumont, London. Eng. Pat. 22,094, Oct. 1, 1913. Addition to Eng. Pat. 23,191, Oct. 10, 1912.

The gradual rotation of the straining drum is produced by the action of vibro-motors applied to the cradle arms in which it is mounted, the vertical and horizontal movements of the vibro-motors being compounded to produce a circular or elliptical motion of the drum.—J. F. B.

Pulp-mixing chests and the like. S. Milne, Edinburgh. Eng. Pat. 10,154, Apr. 24, 1914.

The floor of the chest slopes towards the centre and the corners between floor and side are rounded. At the bottom of the central vertical shaft is fixed an agitator with flat vertical blades arranged to force the pulp outwards only. Higher up on the shaft a propeller is fitted with helical blades arranged to force the pulp downwards into the sphere of action of the agitator.—J. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Adsorption and stabilisation. [*Theory of dyeing.*] J. C. Blucher and E. F. Farnau. J. Phys. Chem., 1914, **18**, 629—640.

To account for certain apparent anomalies in the dyeing of silk, as viewed from the standpoint of the adsorption theory, Bancroft (see this J., 1914, 197, 349, 589) advanced the view that substances when adsorbed may be rendered more stable. Blue hydrous copper oxide, for example, is readily transformed into the black oxide at 100° C., but is stable when adsorbed on wool and also in presence of small quantities of manganous sulphate, and, according to the present investigation, many other salts ($ZnSO_4$, $NiSO_4$, $CoCl_2$, $Al_2(SO_4)_3$, $Cr_2(SO_4)_3$, $MgCl_2$) behave similarly. The stability of blue hydrous cobalt oxide is increased by hydrous nickel oxide (Benedict, J. Amer. Chem. Soc., 1904, **26**, 695) and by adsorbed cobalt sulphate (Hantzsch, Z. anorg. Chem., 1912, **73**, 304); and the effect of the former has been made to serve as a very delicate test for nickel, the rapid change of freshly precipitated blue hydrous cobalt oxide into the normal pink hydroxide being retarded in presence of nickel. The red dyeing of hydrous aluminium oxide from a blue colloidal solution of Congo acid, regarded by Bayliss (this J., 1911, 1093) as evidence of the formation of a red aluminium salt, is considered to be due to the stabilisation by the hydrous aluminium oxide of a red Congo acid unstable in aqueous suspension. Certain anomalies in the dyeing of silk with picric acid dissolved in organic solvents are probably to be accounted for by tautomerism and the slowness with which equilibrium is attained.—A. S.

Patents.

[*Washing*] *Treating textiles, pieces, warps, etc., with liquids; Machine for* ——. J. S. Ainley, Huddersfield. Eng. Pat. 29,928, Dec. 30, 1913. Addition to Eng. Pat. 6970, March 22, 1913 (this J., 1914, 251).

The fabric is cuttled on to an endless apron which travels intermittently over a solid supporting table whereon it is pressed or "possed" by the action of rollers moved intermittently towards and away from the portion of fabric lying on the apron.—J. B.

Cop-dyeing and like machinery. F. Riley and J. H. Riley and Co., Ltd., Bury, Lancs. Eng. Pat. 30,025, Dec. 31, 1913.

The gauze envelope which encloses the cops disposed radially on the outside of a vertical cylinder with deep projecting flanges, top and bottom, and which beds against low projections on the inner faces of the periphery of these flanges, is held in position by rods having reduced shouldered ends passing through holes in the flanges. One of the reduced ends of the rod, considerably longer than the other, is surrounded by a helical spring and the rod may be removed by lifting it against the pressure of the spring.—J. F. B.

Dyeing process. J. J. Fearon, Assignor to C. J. Fox, Philadelphia, Pa. U.S. Pat. 1,113,765, Oct. 13, 1914; date of appl., May 2, 1913.

In dyeing sulphur colours on skein yarn the hanks are first dyed in the usual way and then washed in the same vessel, air being circulated through the mass of yarn during washing, or air may be forced directly into the dye-bath after the dyestuff has been exhausted.—J. B.

Dyeing apparatus and process. A. J. and J. A. Rau, Clifton, N.J., U.S.A. Eng. Pat. 22,595, Oct. 7, 1913. Under Int. Conv., Oct. 17, 1912.

See Fr. Pat. 463,603 of 1913; this J., 1914, 418.—T. F. B.

Dyeing machine. R. D. Booth, Philadelphia, Assignor to The Psarksi Dyeing Machine Co., Cleveland, Ohio. U.S. Pat. 1,113,405, Oct. 13, 1914. Date of appl., Oct. 16, 1911.

See Fr. Pat. 436,936 of 1911; this J., 1912, 430.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Iron, mercury and arsenic ; Determination of —— in sulphuric acid. H. Nisjenson. Chem.-Zeit., Sept. 29, 1914. Pharm. J., Nov. 14, 1914.

In an Erlenmeyer flask 60 grms. of pure zinc are placed, and 100 c.c. of sulphuric acid, freed from HNO_2 by heating, are added by means of a burette. The hydrogen is passed into a small Erlenmeyer flask, containing 1 c.c. of bromine, 100 c.c. of water, and a few drops of sulphuric acid. After about an hour and a half nearly all the zinc will be in solution. The rest of the zinc, which contains mercury, as an amalgam, is filtered, washed and dried. After being mixed with freshly burnt calcium oxide, it is placed in a porcelain crucible, covered with a weighed cover. The upper hollow of the cover is filled with cold water and the crucible is cautiously heated for ten minutes ; the cover is washed with alcohol, dried in a stove, and weighed. The iron will be in the filtrate and is titrated with $N/100$ permanganate. The arsenic is absorbed as AsH_3 by the solution of bromine. The bromine is evaporated by heating the solution. The colourless liquid is reduced by boiling with Na_2SO_3 after which hydrochloric acid is added. The arsenic is titrated with a $N/10$ $KBrO_3$ solution, using indigo as an indicator. One c.c. of $KBrO_3$ solution corresponds with 0·00375 grm. As. This analysis of technical sulphuric acid can be done in about five hours.

Potassium-phosphoric acid-water and ammonia-phosphoric acid-water ; The ternary systems ——. E. G. Parker. J. Phys. Chem., 1914, **18**, 653—661.

Study of the systems mentioned in the title showed that at 25° C. the stable solid phases in contact with solutions containing ortho-phosphoric acid and potassium or ammonium are KH_2PO_4,H_3PO_4 ; KH_2PO_4 ; K_3PO_4 ; $K_3PO_4,3H_2O$; $KOH,2H_2O$; $(NH_4)H_2PO_4$; $(NH_4)_2HPO_4$, and $(NH_4)_3PO_4,3H_2O$. Some experiments were also made with solutions containing both potassium hydroxide and ammonia in addition to phosphoric acid, and the results are tabulated. One of the solutions was allowed to stand over sulphuric acid at 25° C., until both the sulphuric acid and the solution were constant in weight and a solid had separated from the solution. The solution then contained NH_4 1·81, K 4·95 and PO_4 3·96 mols. per 1000 grms., and in the solid which separated, substances having similar optical properties to KH_2PO_4 and K_3PO_4 were recognised ; two double salts, one or both of which was unstable in the air (with liberation of ammonia), or an unstable double salt and a solid solution were also probably present. To obtain a compound containing potassium, ammonia, and phosphoric acid, stable at the ordinary temperature—the chief object of the investigation—it will be necessary to use more acid solutions.—A. S.

Ammonium phosphomolybdate ; Behaviour of —— with ammonium hydroxide. P. B. Sircar. J. Amer. Chem. Soc., 1914, **36**, 2372—2374.

In Woy's method of determining phosphates (Chem.-Zeit., **21**, 442) the phosphoric acid is precipitated as ammonium phosphomolybdate and this is dissolved in ammonia, and the phosphoric acid re-precipitated with magnesia mixture. According to Gibbs (Amer. Chem. J., 1891, **5**, 361, 391) crystals of $2(NH_4)_3PO_4,5MoO_3,7H_2O$, separate when the ammoniacal solution of the phosphomolybdate is allowed to stand. The author finds that when ammonium phosphomolybdate is treated with a moderate quantity of strong ammonia solution, white crystals of $(NH_4)_2Mo_2O_7.3NH_3$, are formed, whilst with a large excess of ammonia the crystals which separate at first, re-dissolve, and subsequently a flocculent precipitate of $(NH_4)_2HPO_4$, is produced, which is very hygroscopic. The compound, $(NH_4)_2Mo_2O_7.3NH_3$, loses ammonia on standing and yields $(NH_4)_2Mo_2O_7$. It sometimes contains 0·1—0·2% of phosphoric acid, probably adsorbed. In a very few cases the salt described by Gibbs (*loc. cit.*) was obtained.—A. S.

Ammonium chloride ; Crystallisation of —— in cubes. A. Dubosc. Bull. Soc. Ind. Rouen, 41, 335. Pharm. J., Nov. 14, 1914.

Cubical crystals of ammonium chloride may be obtained by adding small amounts of copper or iron salts to the crystallising solution. The best results, however, are got by using 1 of ammonium acetate per 1000, added to the solution in the concentration bath at 100° C. The ammonium acetate is probably decomposed to acetamide, and it is to the latter compound that the modification of the crystalline form is due.

Potassium chloride from freshly-cut kelp ; Leaching of ——. A. R. Merz and J. R. Lindemuth. J. Ind. Eng. Chem., 1913, **5**, 729—730.

Large samples of the alga *Macrocystis* were towed through sea-water, and portions subsequently analysed in the wet condition and after drying before and after this treatment. The ash ranged from 2·76 to 3·40 ; KCl 16·97 to 27·87, N 0·79 to 1·07, and I 0·06 to 0·16%. Another sample contained from 16·29 to 32·05% KCl. The stems contained more potassium than the leaves, and the variations were due solely to the difficulty of obtaining an average sample. These results show that freshly-cut kelp does not lose its potassium chloride when immersed in sea-water, at all events for periods up to 135 hours A sample of the rock weed "sea-lettuce" contained 47·41% KCl. Hence its presence in kelp is not detrimental ; but its collection would prove too expensive for it to be an economic source of potash.—C. A. M.

Potassium iodate ; Photolysis of ——. J. H. Mathews and H. A. Curtis. J. Phys. Chem., 1914, **18**, 641—652

A mixture of potassium iodate and iodide in solution is decomposed much more rapidly under the influence of ultra-violet light than is a solution of either salt alone The rate of decomposition of potassium iodate by light decreases slowly when the solution is exposed to the air The decomposition is inhibited when the solution is kept saturated with oxygen, but is greatly accelerated by carbon dioxide. In the photolysis of potassium iodate the two reactions :

$KIO_3=KI+3O$;

$5KI+KIO_3+6CO_2+3H_2O=6KHCO_3+6I$. probably occur, the second with a much higher velocity than the first.—A. S.

Silver nitrate solutions ; The solvent properties of ——. The silver voltameter. III. T. M. Lowry. Roy. Soc Proc., 1914, **A91**, 53—71.

Among impurities which may influence the weight of the deposit in the silver voltameter are substances which although almost insoluble in water dissolve in silver nitrate solutions and are thus precipitated when such solutions become impoverished during electrolysis. The influence of dilution and of temperature upon the solubility of silver chloride, silver bromide and silver sulphide in silver nitrate solutions is indicated in a series of solubility curves.. The solubility of silver chloride in solutions of hydrochloric acid and of sodium chloride is also similarly recorded. Black silver sulphide was permanent in contact with silver nitrate solutions up to 10% strength but with increasing concentration the change to the yellow variety was more and more rapid.—J. R.

Hydrogen peroxide ; Preservation of ——. J. H. Walton jun., and R. C. Judd. Z. physik. Chem., 1913, **83**, 315. Chem.-Techn. Rep., 1914, **38**, 85.

Concentrated solutions of sodium chloride will preserve hydrogen peroxide ; the time required for the decomposition of half the peroxide in a solution is approximately doubled by the addition of 1 mol. NaCl per litre. Sulphuric acid even in a concentration of 0·00066 grm. per litre has a pronounced retarding influence on the decomposition. A still better preservative is acetanilide, which is effective even in solutions containing positive catalytic agents, such as sodium hydroxide, and also soluble matter from glass.—C. A. M.

Sulphur; A new modification of ——. A. H. W. Aten. Z. physik. Chem., 1913, **83**, 442. Chem.-Techn. Rep., 1914, **38**, 247.

The enhanced solubility in sulphur monochloride of sulphur previously heated to 170° C. points to the presence of a maximum of 5% of the new allotrope ($S\pi$), which, however, has not been isolated. Similar solubility relationships hold for carbon bisulphide and toluene; and all the solutions are yellow.—J. R.

Glucinum (beryllium) sulphate and its hydrates. F. Taboury. Compt. rend, 1914, **159**, 180—182. J. Chem. Soc., 1914, **106**, ii., 728.

The progressive dehydration, by heating, of the tetrahydrate of glucinum sulphate confirms the existence of the di- and mono-hydrates, the former being obtained at 55°—60° C. and the latter at 100° C., and indicates the existence of a hemihydrate obtainable at 150°—160° C. The anhydrous salt obtained at 250° is stable up to 530°—540° C., and thus allows of the estimation of glucinum in the form of its sulphate. Glucinum sulphate does not form acid salts even when dissolved in sulphuric acid.

Terbium. C. James and D. W. Bissel. J. Amer. Chem. Soc., 1914, **36**, 2060—2066.

Terbium was rapidly separated from gadolinium by fractional crystallisation of the bromates, about 30 grms. of very pure terbium oxalate, giving a black oxide, being obtained from some kilos. of mixed bromates of gadolinium, terbium, dysprosium, holmium, and, in traces, yttrium and erbium. The absorption spectrum given by a strong solution of terbium nitrate consisted of a single band in the blue, and the authors conclude from their investigation that there is only one terbium. A mixture of air and gas directed upon terbium peroxide or upon gadolinium oxide containing terbium peroxide, heated almost to redness, caused incandescence, the gas usually taking fire.—F. Sodn.

Neoytterbium; Isolation of ——. J. Blumenfeld and G. Urbain. Compt. rend., 1914, **159**, 323—326. J. Chem. Soc., 1914, **106**, ii, 731.

The authors have submitted the earths of the ytterbium group, in the form of their nitrates, to a process of fractional crystallisation (compare Urbain, J. Chem. Soc. (Abs.), 1907, ii, 956; 1908, ii, 108), following the stages in the purification by measuring the coefficients of magnetisation of each fraction. After four thousand crystallisations they have obtained eight successive fractions having the same coefficient, indicating the isolation of a definite compound. The metal of the nitrate corresponding with these fractions they call "neoytterbium." The paramagnetism of its oxide is 33·6, and the atomic weight of the metal is 173·54. The spectra of these fractions show but very feebly the strongest rays of luteeium (compare Urbain, *loc. cit.*), or of thulium (compare Soret, J. Chem. Soc. (Abs.), 1880, 7, and Cleve, *ibid.*). The spectra do not contain the rays of aldebaranium, as indicated by Auer von Welsbach (compare this J., 1914, 21).

Radium: uranium ratio in carnotites. S. C. Lind and C. F. Whittemore. J. Amer. Chem. Soc., 1914, **36**, 2066—2082.

Samples of carnotite representing large quantities (a few hundred pounds to several tons) of ore showed a Ra : U ratio identical with that of pitchblende, $3{\cdot}33 \times 10.^{-7}$ whereas those from a few pounds of ore tended to exhibit abnormal (high or low) ratios. This is explained by supposing that "transposition" of radium has occurred within the ore bed, producing local differences which are equalised in mixing large quantities of ore. Radium was determined by the emanation method in one operation, either by solution or by ignition, and always after attainment of equilibrium in sealed glass tubes, for a month or more; fusion with carbonate or fusion followed by solution gave low results. The "emanating power" of carnotite was found to be 16–50%.—F. Sodn.

Neon and helium; Production of ——, *by the electrical discharge.* J. N. Collie, H. S. Patterson, and I. Masson. Roy. Soc. Proc., 1914, A **91**, 30—45. (See also this J., 1913, 231.)

Various forms of apparatus employed for the passage of the electrical discharge through hydrogen at low pressure are described. With every precaution against atmospheric contamination by leakage the formation of neon and helium was repeatedly observed, although occasionally negative results were obtained. The absolute and relative amounts of neon and helium varied considerably in the different experiments. The possibilities of leakage, permeation, and occlusion are dismissed in favour of the actual production of the inert gases through the agency of the discharge.—J. R.

Charcoal; Absorption of gases by —— *at low temperatures.* G. Claude. Comptes rend., 1914, **158**, 861—864.

Hydrogen forms an exception to the general rule that the absorption of a gas by charcoal at low temperatures depends upon the ease of liquefaction of the gas. In comparative experiments on the absorption of nitrogen, neon, helium and hydrogen by coco-nut charcoal at —195·5° and —182·5° C., using an arrangement similar to that employed by Dewar (Proc. Roy. Inst., 1907, June 7), at the same pressures the absorption of hydrogen was enormously greater than that of either helium or neon, although, in accord with Dewar's observation, not so great as that of nitrogen.—G. F. M.

Air and ammonia; Explosibility of mixtures of ——. E. Schlumberger and W. Piotrowski. J. Gasbel., 1914, **57**, 941—943. J. Gas Lighting, 1914, **128**, 365.

An explosion at an ice-factory by which damage to the factory and injury to the stoker occurred, was investigated by H. Bunte, who found that the explosion must have been one of a mixture of air with ammonia that had escaped from the refrigerator. The authors have further investigated the subject. They find that the chief reason why mixtures of air and ammonia in experimental trials have not exploded hitherto, is that narrow tubes like burettes, etc., have been used, and the cooling effect of their walls is proportionately great in the case of such explosive mixtures. The mode of ignition, too, is known to have an effect in such cases. A spherical vessel is most favourable to complete combustion, and ignition should take place at the centre of the vessel. In the present research, the authors produced a spark of the same strength for all the ignitions by employing a ten-volt accumulator with induction-coil of special construction and a long pendulum contact-breaker. This pendulum, liberated each time from the same position, made contact for precisely the same period through a platinum point attached to its bob, passing over the surface of mercury which was forced from a levelling vessel to the top of a tube slightly over an inch in diameter. The pendulum was connected with one pole and the mercury with the other pole of the coil. The electrodes in the explosion vessel were of 0·3 mm. platinum wire, the ends being 6 mm. apart. It was found that explosion occurred with perfectly dry ammonia, and air dried only by passing it over concentrated sulphuric acid, whereas if the air were further dried by passage over phosphorus pentoxide, no explosion occurred. A state of constant humidity was then secured for the further experiments by passing the air through dilute sulphuric acid of sp. gr. 1·340, having an aqueous vapour tension at 20° C. of 8·494 mm. Using as explosion-vessel a spherical bulb of 110 mm. diam. and with a capacity of about half a litre, it was found that under these conditions the explosive mixtures of air and ammonia ranged from 16·5 to 26·8% by vol. of ammonia in the mixture. In a Bunte burette (19 mm. diam.), with a spark-gap of 2 mm., no explosion could be obtained, but continuous combustion was observed between the limits of about 19 and

25% NH_3. The mixture corresponding with the combining proportions of ammonia and oxygen is 21·9% by vol. of NH_3 with air.

Analysis of silicol (ferrosilicon) and other silicon alloys used for the production of hydrogen. Jaubert. *See* X.

Precise standardisation of hydrochloric acid solutions. Andrews. *See* XXIII.

Patents.

Phosphoric acid; Method of manufacturing ——. I. Hechenbleikner, Charlotte, N.C., Assignor to Southern Electro-Chemical Co., New York. U.S. Pat. 1,112,211, Sept. 29, 1914; date of appl., Feb. 7, 1914.

Natural phosphate rock, silicious material, and carbon are heated so as to produce vapours of phosphorus which are withdrawn with the furnace gases, the current of gases being broken up and mixed with oxygen (*e.g.*, by admitting this gas as a counter-current), and the phosphoric acid absorbed by an aqueous liquid in towers operated on the counter-current system. The spent gases may be passed through a scrubber.—F. Sodn.

Barium oxide; Method of preparing ——. L. E. Saunders, Niagara Falls, N.Y. U.S. Pat. 1,112,721, Oct. 6, 1914; date of appl., Feb. 5, 1912.

Barium sulphate is decomposed by the heat of an electric arc under non-reducing conditions, obtained by maintaining the material out of contact with the arc.—O. R.

Epsom salts; Process of making ——. G. Clarke, Assignor to The Ohio Chemical and Manufacturing Co., Cleveland, Ohio. U.S. Pat. 1,112,770, Oct. 6, 1914; date of appl., Aug. 2, 1913.

A hot solution of ferrous sulphate is partially neutralised with a double oxide of calcium and magnesium, and the neutralisation completed with magnesium oxide. The precipitated ferrous hydroxide is removed, and magnesium and calcium sulphates are recovered from the solution by fractional crystallisation.—F. Sodn.

Zinc oxide; Manufacture of ——, *and apparatus therefor.* J. A. Singmaster, Palmerton, Pa., Assignor to New Jersey Zinc Co., New York. U.S. Pats. 1,112,853 and 1,112,854, Oct. 6, 1914; dates of appl., Jan. 9 and 18, 1912.

A charge of zinc ore and combustible material is carried through a tunnel furnace on a number of perforated grates, each mounted on a truck and provided with its own air supply. Air is forced through the bed, the current being increased as the material passes forward, and the zinc oxide fumes are discharged at successive points through a number of off-takes in the roof of the furnace. —O. R.

Alkali silico-aluminate richer in alkali than felspar [*, and hydrochloric acid*]*; Method for making* ——. A. H. Cowles, Assignor to The Electric Smelting and Aluminium Co., Sewaren, N.J. U.S. Pat. 1,111,881, Sept. 29, 1914; date of appl., Sept. 11, 1913.

Material containing silica, alumina, and carbon, disposed to present a relatively extended surface, is subjected to the action of water vapour and salt vapour in a rotary furnace. For example, a mixture of clay, salt, and finely-divided carbon, agglomerated into small masses, is fed into the converting zone of the furnace, whilst steam, air, and water are blown in at the lower end, the excess of water vapour being sufficient to aid in condensing the hydrogen chloride produced. Portions of the furnace susceptible to attack by the acid are kept at a temperature above the b.pt. of strong hydrochloric acid.—F. Sodn.

Alkali cyanogen compounds; Making of ——. J. C. Clancy, Assignor to Portland Gold Mining Co., Colorado Springs, Colo. U.S. Pat. 1,112,893, Oct. 6, 1914; date of appl., June 22, 1912.

Calcium cyanamide is heated with alkali sulphide or a mixture of this and another alkali salt, *e.g.*, with its own weight of a mixture of equal weights of sodium sulphide and chloride, in presence of carbonaceous material. —F. Sodn.

Sulphuric acid; Apparatus for producing ——. E. H. McFarland, Cincinnati, Ohio, Assignor to General Electric Co., New York. U.S. Pat. 1,112,424, Sept. 29, 1914. Date of appl., May 10, 1913.

See Eng. Pat. 15,293 of 1913; this J., 1914, 482.—T. F. B.

Continuous stills for the dissociation of chemical solutions by heat. Eng. Pat. 337. *See* I.

VIII.—GLASS; CERAMICS.

Ceramic industry; Sanitary conditions in the ——. Leymann. Zentralbl. Gew.-Hyg., 1913, **1**, 94. Chem.-Techn. Rep., 1914, **38**, 190—191.

In 1903, 1672 factories out of 14,000, employing 10,360 workers out of 140,000 used lead compounds. Diseases of the respiratory organs are not more numerous than in other trades. Among 66,000 workers in 429 factories between 1900 and 1903 there were annually 88 cases of lead poisoning (0·13%), on the average. In factories where galena is used no cases were observed.—O. E. M.

Plate and sheet glass. Board of Trade Bulletin No. 92.

May be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Patents.

Tunnel dryers for drying products of clay and the like material. A. R. Stevenson, Glasgow. Eng. Pat. 23,174, Oct. 14, 1913.

Air is heated by passing along pipes arranged in a flue which extends along the base of the tunnel and is heated from any available source. The flue is covered with thin plates, and the heated air is led from the longitudinal heating pipes by means of a number of vertical pipes to the top of the drying chamber. Air and moisture are withdrawn from near the bottom of the drying chamber by vertical downward pipes, arranged in the wall of the tunnel dryer, and pass into a longitudinal flue, below the heating flue, which communicates with the chimney stack.—W. C. H.

Clay or the like; Apparatus for drying products of ——. L. E. Rodgers, Chicago, Ill. U.S. Pat. 1,103,435, July 14, 1914; date of appl., Nov. 18, 1913.

The articles to be dried are run on trucks through a number of non-communicating chambers, arranged side by side. Conduits into which hot and cold air can be forced are arranged transversely across the chambers, and communicate with mixing chambers through openings controlled by valves. Air feeder-ducts are arranged longitudinally beneath the drying chambers and communicate with them through openings in the top walls of the ducts which are connected at one end with the air-mixing chambers. The hot and cold air conduits are placed midway between the ends of the drying chambers in order to supply air to the opposite ends of the chambers. —W. C. H.

Gas retorts and the like; Manufacture of fireclay ——. G. V. Evers, Stourbridge, Worcester. Eng. Pat. 25,590, Nov. 8, 1913.

To avoid handling the retorts or other articles between the processes of shaping and firing, they are shaped in the firing kiln, by means of a machine carried on overhead rails.—A. T. L.

Clay; Recovery of valuable products [oil and combustible material] from —— and the employment of such products in the manufacture of bricks and the like. G. P. Crowden, Peterborough. Eng. Pat. 28,191, Dec. 6, 1913.

A retort is fixed in one of the chambers or hot flues of a brick kiln, and is so arranged that material can be charged into it and products of distillation withdrawn and collected in a hydraulic main. Clay or shale, containing bituminous substances, is thus distilled by the heat of the brick kiln, steam, also superheated by the heat of the kiln, being at the same time blown into the retort to assist distillation, and the residual baked clay may be mixed with other clays for brick manufacture. The liquid and gaseous products of distillation are applicable for heating the kiln itself, for illuminating, power generating, or other purposes.—O. R.

Glass; Manufacture of sheet ——. H. K. Hitchcock, Tarentum, Pa., Assignor to Hitchcock Experiment Co. Reissue No. 13,804, Sept. 29, 1914, of U.S. Pat. 805,064, Nov. 21, 1906. Date of appl., June 18, 1906.

See this J., 1905, 1306.—T. F. B.

Dehydrating apparatus. U.S. Pat. 1,112,454. *See* I.

IX.—BUILDING MATERIALS.

Portland cement; Alterations in Austrian standards for ——. Cement 1914, 14—15, 34—35, 65—66. Chem.-Techn. Rep., 1914, **38**, 270.

The cement must not contain more than 2·5% SO_3 or 5% MgO. For determining the setting time, a needle of 1 sq. mm. cross-section, weighted with 300 grms., is prescribed. The briquettes used for testing the strength of the cement are to be kept in air for the first 24 hours, and then some entirely in water at 15°—18° C. until the test, and others for 6 days in water and afterwards in air at 15°—20° C. The briquettes kept in water only, must have after 7 days a tensile strength of 12 kilos. and a crushing strength of 120 kilos. per sq. cm., and after 28 days 20 and 200 kilos. in the respective cases. The briquettes kept in water and afterwards in air, must have after 28 days, a tensile strength of 25 kilos. and a crushing strength of 250 kilos. per sq. cm. The directions for the preparation and treatment of the briquettes before testing are also altered.—J. H. L.

Plaster; Mixing and setting of ——. A. Astruc and A. Juillet. J. Pharm. Chim., 1914, **9**, 5—19.

A consideration of the qualities of plaster for surgeon's work. For mixing, 60 grms. of water per 100 grms. of plaster are recommended: setting is nearly complete after 20 mins. The time of setting of the plaster is retarded by the presence of mucilaginous substances, such as marsh-mallow, gum arabic, linseed, etc.; powdered marsh mallow in particular, even when only 0·5% is present, more than doubles the time required; setting is accelerated by alum and common salt. The rise in temperature on mixing and the duration of the heat reaction vary with the quality of the ingredients used. When marsh-mallow is present, the duration of the reaction is increased, but the rise of temperature is less. Alum and sodium chloride cause a great increase in the rise of temperature and shorten the time. The relations between rise of temperature and time are shown graphically by means of curves.—J. H. J.

Zinc in treated wood; Determination of ——. F. C. Frary and M. G. Mastin. J. Ind. Eng. Chem., 1913, **5**, 738—739.

American railroad companies buy sleepers specified to contain ½ lb. $ZnCl_2$ per cb. ft.(= about 0·5% Zn). The common method of determination is to heat the sample with sulphuric acid, add nitric acid, and heat till all organic matter is destroyed, when the solution is diluted, iron removed, and zinc precipitated as sulphide and weighed as oxide. This gives satisfactory results with woods other than oak (especially red oak), the organic matter of which is not completely destroyed, while only about half of the zinc is subsequently precipitated. To obviate the difficulty 2 grms. of the dried shavings are fused in a nickel basin with a little water and about 30 grms. of pure potassium hydroxide, with frequent stirring, and minute fragments of potassium nitrate (about 0·5 grm. in all) added from time to time until all organic matter has been oxidised. After cooling, the mass is dissolved in water, 15 to 20 c.c. of bromine water added, the liquid boiled, the nickel oxide separated, and the filtrate and washings rendered faintly acid with hydrochloric acid. Sodium sulphite is then added, the amount of free hydrochloric acid brought to 2 to 6% by vol., the liquid diluted to 400 c.c., heated to boiling, and titrated with potassium ferrocyanide, with uranium nitrate as indicator, whilst a blank determination is made simultaneously. The method gives good results with oak impregnated with both creosote and zinc chloride.—C. A. M.

Patents.

Slates or tiles; Manufacture of artificial ——. J. M. Macdonald and J. J. Keswick, London. Eng. Pat. 21,579, Sept. 24, 1913.

Pulverised material, for example refuse slate, with or without the addition of sand, powdered brick or stone and colouring materials, is mixed with approximately 15% of its weight of Portland cement. The mixture is made into a semi-plastic mass by water or a diluted solution of sodium borosilicate, pressed into the desired shapes, allowed to harden and then immersed in a solution of sodium borosilicate of 35° to 55° Tw. (sp. gr. 1·175—1·275) and finally dried.—W. C. H.

Magnesium cement; Process of making ——. W. Siegmann, Assignor to M. V. Gault, Baltimore, Md. U.S. Pat. 1,102,358, July 7, 1914; date of appl., April 7, 1911.

Magnesium oxide, magnesium sulphate, sodium chloride, kieselguhr and if desired asbestos and colophony are mixed with water to produce a plastic mass to which carbon bisulphide is also added "to increase evaporation of moisture and the dissolution of other ingredients."
—W. C. H.

Cement; Process of, and apparatus for making ——. H. L. Duncan, New York. U.S. Pats. (a) 1,113,606 and (b) 1,113,933, Oct. 13, 1914; dates of appl., Nov. 13, 1903 (renewed March 10, 1914) and June 20, 1910.

(a.) Molten furnace slag is congealed into a sheet of plastic material, which is broken up and piled on a conveyor, where it is annealed and then pulverised and cooled. The material thus obtained containing substantial proportions of active cement material, is mixed with inert cement material, produced by treating furnace slag, and also with Portland cement. (b) The apparatus comprises a pair of adjustable congealing rolls, through which cooling fluids can be circulated; portions of the rolls, on which fluid cooling jets can play, are arranged to work within cooling chambers. Substantially molten furnace slag is supplied to the larger congealing roll by a corrugated, cooled feed roll. The stream of plastic slag thus produced is disengaged from the larger congealing roll by a scraper fixed to the feed roll and fed on to a stationary cooled conveyor, with which a rotating breaker co-operates and disintegrates the slag. Gaseous and liquid cooling jets are directed on to the breaker and stream of slag on the conveyor. A moving conveyor, provided with an adjustable speed device and enclosed in an annealing chamber, receives the slag particles, which when discharged from the conveyor, come in contact with fluid cooling jets and pass to a rotating disintegrator; from this the slag material passes by a shoot to a rotating, ribbed cooling cylinder in which the active slag cement material collects.—W.C.H.

Hardening cementitious materials. A. C. Horn, New York. U.S. Pat. 1,114,140, Oct. 20, 1914 ; date of appl., Oct. 9, 1912.

PORTLAND or other hydraulic cement is mixed with finely divided magnetite, ferrous sulphate and manganese dioxide, worked up into a plastic mass with water and formed into any desired shape.—B. N.

Concrete : Aggregate for ——. F. M. Haldeman. Assignor to The Master Builders' Co., Cleveland, Ohio. U.S. Pat. 1,113,555, Oct. 13, 1914 ; date of appl., May 4, 1914.

THE surface portions of a concrete structure are formed of cement and finely disintegrated partices of metallic iron coated with a thin and substantially uniform film of magnetic oxide.—W. C. H.

Slag ; Process of making articles from ——. M. Chiapponi, Paris. U.S. Pat. 1,114,581. Oct. 20, 1914. Date of appl., Nov. 6, 1913.

SEE Fr. Pat. 455,381 of 1913 ; this J., 1913, 945.—T. F. B.

Composition for coating cement. U.S. Pat. 1,112,059. *See* XIII.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ; Addition of titanium iron alloys to foundry ——. H. Braune. Jernkontorets Annaler, 1913, **68**, 822. Chem.-Techn. Rep., 1914, **38**, 273. (See also Venator, this J., 1910, 570 ; Slocum, this J., 1911, 899.)

EXPERIMENTS at the *Kgl. Technischen Hochschule* of Stockholm indicate that the addition of titanium to foundry iron removes nitrogen more readily than it deoxidises. 0·25% Ti removes as much nitrogen as larger quantities. The transformation point, texture, specific gravity and mechanical characters of the iron are not altered. Resistance to strain is increased by addition of 0·25% of ferrotitanium. The quality of steel appears to be improved by addition of 0·25% Ti. By embedding the iron in 90% titanium and heating in a cementation furnace for 14 days ; the superficial portions absorbed 0·1% Ti.—J. H. L.

Titanium in iron and steel ; Colorimetric determination of ——. C. R. McCabe. J. Ind. Eng. Chem., 1913, **5**, 735—736.

Amounts above 0·02% : Two grms. each of the sample and of steel free from titanium are dissolved in 80 c.c. of sulphuric acid (1 : 3), 4 c.c. of nitric acid (sp. gr. 1·2) added, and the solutions boiled until free from nitrous fumes, and (in the case of cast iron) filtered from silica. The liquids are diluted so that in equal volumes the colours match, and an addition of 2 c.c. of 3% hydrogen peroxide is made to each. Standard titanium solution is then added to the solution of non-titanium steel to match the colour of the test sample. The standard solution is prepared by heating 100 grms. of ferro-titanium with about 50 c.c. of strong hydrochloric acid and (after some moments) 5 c.c. of nitric acid (sp. gr. 1·12). After evaporation of about half of the acid the liquid is diluted with 15 to 20 c.c. of water and the ferro-titanium treated with more of the mixed acids until sufficient has been dissolved (about 12 times). The filtrates are evaporated until titanic acid separates, and then freed from iron by extraction with ether, united, heated with 150 c.c. of sulphuric acid (1 : 3), and filtered. The filtrate is diluted to about 700 c.c., boiled with excess of ammonia, and the precipitated hydrated titanic acid washed free from chlorides by decantation, dissolved in 50 c.c. of sulphuric acid (1 : 1) and diluted to a litre. The strength is determined by precipitation with ammonia, and the solution diluted so as to contain 0·0002 grm. of titanium per c.c. *Amounts below* 0·02% :—The solutions of the sample and of non-titanium steel are evaporated to 10 c.c., transferred to separating funnels (the dishes being rinsed with about 15 c.c. of dilute hydrochloric acid, 2 : 1), and shaken with 50 c.c. of ether (free from alcohol) to extract the iron. The lower layers are drawn off, each diluted with 225 c.c. of hot water, and boiled with ammonia in slight excess, the precipitates washed with hot water, and dissolved in 10 c.c. of sulphuric acid (1 : 3), and filtered into 30 c.c. colorimetric cylinders. The filtrates and washings which should be equal (15 to 18 c.c.) in both cases, are then treated with 3 c.c. of 3% hydrogen peroxide. In the presence of even 0·001% Ti a yellow tint quite distinct from the green tint of the non-titanium solution will be seen, and its amount may be determined as described above. In the case of cast iron the sample is dissolved in hydrochloric acid, the solution filtered, and the residue ignited (and after volatilisation of silica with hydrofluoric acid and a few drops of sulphuric acid) fused with 1 grm. of sodium carbonate. The mass is dissolved in hydrochloric acid, and added to the main solution, which is then extracted with ether, etc.—C. A. M.

Cementation of iron ; Recent developments and researches on the ——. W. Guertler. Intern. Zeits. Metallog., 1914, **6**, 196—199.

CEMENTITE can only be formed by direct synthesis during cementation if the carburising agent (*e.g.*, acetylene, cyanogen) is less stable than cementite. In cementation, the more or less pure γ crystals become saturated with carbon on their surfaces, and the carbon then diffuses from the surface into the interior and then from crystal to crystal. The diffusion from one crystal to another appears to be independent of the carburising agent but increases with the temperature. Since the carburising agent at the steel surface has to be continuously renewed, fluid agents are the best. Fe_3C separates out of the γ-crystals, on the side remote from the carburising agent, when they are saturated with respect to the agent and supersaturated with respect to Fe_3C. If the carburisation is sufficient, free carbon is obtained either by disintegration of cementite or by separation from the supersaturated γ-crystals.

Some results obtained by Hatfield (see also this J., 1911, 427) are given in the following table :—

Original composition of steel.						Carbon content after 7 days' cementation at 950°—1000 C.		
C.	Mn.	Si.	S	P.	Total C.	Free C.	Combined C.	Added C.
%	%	%	%	%	%	%	%	%
3·30	trace	0·074	0·01	0·01	3·30	3·15	0·15	0
0·85	0·26	0·093	0·01	0·01	1·54	0·10	1·44	0·69
1·05	0·31	0·084	0·01	0·01	1·46	0·26	1·20	0·41
1·10	0·27	0·102	0·01	0·01	1·50	0·88	0·62	0·40
1·20	0·31	0·084	0·01	0·01	1·60	1·00	0·60	0·40

—W. F. B.

Steel castings ; Micro-structure of ——. W. Tassin. J. Ind. Eng. Chem., 1913, **5**, 713—717.

STEEL castings in the "green" (*i.e.*, from the mould) show a coarsely crystalline regular network the meshes of which usually intersect at some angle of an octahedron. This structure is termed "ingotism." When the steel is annealed at the right temperature for a sufficient time, the structure becomes finely granular and uniformly distributed. With insufficient time at the right temperature traces of the original structure will be seen, whilst with too long a time the new structure will be much coarser and show irregular areas. These become more pronounced when the temperature is too high. When steel which has been correctly annealed is sensitive to shock and to suddenly applied loads, the microstructure will show the presence of slag, sulphides or other impurities, or even minute cracks following the lines of the impurities. When used in conjunction with a set of standards the metallographic method will give information not easily obtainable in any other way.—C. A. M.

Steel; Production of granular pearlite by heating —— in an electric vacuum furnace. W. P. Ishewsky. Intern. Zeits. Metallog., 1914, **6**, 199—200.

STEEL containing: C 0·83, Mn 0·38, and S 0·03%, was heated in an electric vacuum furnace to 800° C. and then cooled to 680° C. This was repeated eleven times at intervals of 20 mins. During cooling the transition temperature, which had a slight tendency to rise, was 701° C. to 712° C. After treatment the structure was coarser, the granular pearlite had increased, the lamellar was less in amount but composed of larger particles, the cementite had increased, and free ferrite was present. It was shown by treating a second sample containing: C 0·37, Si 0·38, Mn 0·98, P 0·05 and S 0·03%, that this result was not due to the original presence of cementite. The mechanical properties were:—

Sample.	Tensile strength.	Elongation.
	tons per sq. in.	%
(1) 0·83% C., before treatment	48·7	11·8
(1) 0·83% C., after ..	34·2	19·75
(2) 0·37% C., after ..	31·2	21·25

—W. F. B.

Steel; Belaiew's studies on the structure of ——. W. Guertler. Int. Zeits. Metallog., 1914, **6**, 72—89.

THE principal photomicrographs and descriptions published by N. T. Belaiew of the structures which may be developed in steels are given and discussed. *Primary crystallisation* from the molten metal gives rise to a dendritic structure (see this J., 1912, 539). *Segregation structures.* As the steel cools, cementite or ferrite separates, and independent grains of γ-solid solution are formed. If the segregations of cementite or ferrite become forced to the boundaries of the individual crystals the "net-structure" results. The size of the meshes is connected directly with the rate of cooling and the temperature of annealing. The segregates may, on the other hand, be confined within the γ-crystals, when their orientation corresponds to the crystal-structure of each grain, and Widmanstetten figures are formed (see this J., 1910, 954). Normal martensite is an arrested and imperfect Widmanstätten structure. The "net" and Widmanstätten structures may occur together. *Pearlite formation.* The γ-crystals on further cooling are resolved into pearlite. Belaiew distinguishes between streaky, wavy, and onyx-like pearlite. The structure may be apparent only under high magnifications and Belaiew does not agree with the view that troostite is an ultramicroscopic structure and that sorbite represents an intermediate stage between troostite and pearlite. Pearlite is structurally unstable, the constituents tending to segregate. This tendency is considerably increased in the presence of excess of either constituent. In this way cementite boundaries of grains may extend into the grains forming pseudo-dendrites. The author questions Belaiew's view that the characteristic of damascene steel is the complete resolution of pearlite into ferrite and cementite.

—T. ST.

Chrome and tungsten steels; Permanent magnetism of certain ——. M. B. Moir. Phil. Mag., 1914, **28**, 738—748. (See also this J., 1914, 552.)

THE residual magnetism of steels is of varying magnitude and is retained with different degrees of firmness according to the composition, the physical condition as determined by previous heat treatment, and the size and shape of the sample of metal. The retentive power was determined by measuring the strength of negative magnetic field necessary to reduce the residual magnetism to zero: this negative field is equal and opposite to the coercive force of the magnet. The amount of residual magnetism in the alloys investigated was not found to bear any relationship to the permanent magnetism or coercive force. Annealed specimens of chrome steels possessed only a negligibly small quantity of permanent magnetism, while quenched specimens retained sufficient to serve as useful magnets. In a number of chrome steels containing Cr from 1 to 20%, but otherwise similar, the total residual magnetism fell in proportion to the Cr content. The permanent magnetism retained after submitting to repeated mechanical shocks and temperature fluctuations was greatest with 8% Cr, while the coercive force was greatest with 16% Cr. The results vary also according to the dimensions of the magnet: as the ratio of length to breadth is increased, the Cr-content must be diminished to give the same magnetic properties. Tungsten-steels gave a much higher magnetic intensity and permanent magnetism than chrome-steels, yet the coercive force and retentivity were in all cases lower than with the steels containing 8% Cr. With steels containing from 2·9 to 11·6% W, quenched from 900° C., a continuous fall in the total residual magnetism occurred with increase of tungsten, while the permanent magnetism remained approximately constant up to 8·7% W.—I. N. P.

Ferro-nickels; Dilatation of —— over a wide temperature interval. P. Chevenard. Comptes rend., 1914, **159**, 175—178. J. Chem. Soc., 1914, **106**, ii., 708—709.

A STUDY of the dilatation and contraction of alloys of iron and nickel, varying from pure iron to pure nickel, over a temperature range from —195° to 750° C. The difference between the linear dimensions of bars of the alloys before and after heating are a measure of the amplitude of the irreversible transformation. These differences gradually tend towards zero on passing from iron to Fe_2Ni, which is apparently the limit of irreversible alloys. The alloys between Fe_2Ni and FeNi, have abnormal, quasi-reversible properties. For $FeNi_2$, the dilatation takes place according to a parabolic law between 0° and 800° C.

Silicol (ferrosilicon); The analysis of —— and other silicon alloys used for the production of hydrogen. G. F. Jaubert. Rev. gén. Chim. pure et appl., 1913, **16**, 341—347. Chem.-Techn. Rep., 1914, **38**, 380.

FIVE portions (10 grms. each) of the ferrosilicon contained in thin paper thimbles are added successively to 50 c.c. of 40% sodium hydroxide solution in a 2-litre flask and kept at 80° C. The evolved gas is led through 3 wash-bottles containing respectively pure water, bromine water (to oxidise hydrogen phosphide), and 10% sodium hydroxide solution (to remove bromine vapour). To the last wash-bottle, in which a thermometer hangs, is connected a gas receiver. The volume of gas obtained is reduced to 0° C. and 760 mm. 50 grms. of silicol yield 70 to 75 litres of hydrogen. The contents of the bromine water wash-bottle may be used for the determination of phosphorus.—T. ST.

Zinc-gold slime; Notes on treatment of ——. H. A. White. J. Chem., Met., and Min. Soc., S. Africa, 1914, **15**, 50—51.

THE value of the calcined slime is increased by emulsifying any "white precipitate" present before treatment with acid, thus avoiding the formation of difficultly-soluble, "greasy" lumps; and by heating the slime for at least 12 hrs. with excess of acid and then neutralising the excess with part of the coarser zinc shavings: sodium bisulphate is more economical than sulphuric acid and is now generally used. The life of the clay liner (of a pot used for smelting) is prolonged by filling the space between the liner and the pot with powdered graphite (crushed pots): fusion is facilitated and a slag obtained containing less than 10 oz. Au per ton (after panning) by covering (not mixing) the charge of calcined slime with 15—20% of its weight of a mixture of calcined borax 1, and fine sand 1½, parts by weight.—W. E. F. P.

Gold; Method of determining —— in by-products containing platinum and iridium, etc. H. R. Jolly. J. Chem., Met., and Min. Soc., S. Africa, 1914, **15**, 51—52.

THE bead obtained by cupelling the lead button from the pot assay is heated with dilute *aqua regia* (1 : 1) until all the gold is dissolved, the solution filtered, neutralised with sodium hydroxide, warmed, treated with 5—8 c.c. of warm potassium cyanide solution and in 10 mins. with 30 c.c. of sodium sulphite solution (20%), warmed for 10—15 mins., then diluted to about 300 c.c. The following solutions are added in the order given with constant stirring: 8—10 drops of potassium ferrocyanide (10%), 30 c.c. of copper sulphate (20%), 30 c.c. of sulphuric acid (20%), and 10 c.c. of sodium sulphite. The precipitate is allowed to settle, filtered off and treated by the ordinary pot assay process, the resulting bead being parted as usual. In five experiments in which from 5 to 17 mgrms. of check gold were dissolved in *aqua regia*, 99·8—100% of the Au was recovered by this process.—W. E. F. P.

Nickel-copper-gold-silver alloys; Quaternary mixtures with two liquid strata and the quaternary ——. Equilibria in quaternary systems. N. Parravano. Gazz. chim. ital., 1914, **44**, II., 279—349. (See also this J., 1913, 1112, 1158; 1914, 261.)

THE equilibrium which regulates the separation of the pure components, or of binary, ternary, or quaternary solid solutions from quaternary mixtures with two liquid strata is discussed; and such systems are divided into 7 types, for each of which are given the nature of the boundaries of the space which limits the primary separation of a pure component; the surface which limits the secondary separation of a pure component; the curve which defines the tertiary separation of a pure component; and the spaces which define the primary separation of binary, ternary, and quaternary solid solutions respectively. A re-investigation of ternary Cu-Au-Ag alloys gave results agreeing on the whole with those obtained by Jänecke (this J., 1911, 1259). The temperatures of initial separation of one component and of two components, and of complete solidification were determined for 276 quaternary alloys. The zones of coexistence of the solid and liquid phases and the zones of solid miscibility are shown on tetrahedral diagrams. In addition to these, a series of triangular diagrams depict the isotherms in the separation of solid solutions of varying composition, when in each case, the quantity of nickel in the liquid remains constant at a definite percentage. The structure of the alloys obtained was also examined micrographically, and it was possible to recognise crystals of pure metals, solid solutions, and eutectics, also to distinguish primary from secondary constituents.—J. N. P.

Plant of New Jersey Zinc Company. Oil, Paint and Drug Rep., Nov. 2, 1914. [T.R.]

LECLAIRE'S process of making zinc oxide by distilling and burning metallic zinc, started between 1840 and 1850, is still in use in Europe and at the Florence works of the New Jersey Zinc Company of Pennsylvania. In 1848 the New Jersey Zinc Company began experimenting at Newark, and in 1850 built its first works. Originally it intended to make metallic zinc, but found that the Franklin ores contained too much iron and manganese to make this profitable, and therefore turned its attention to the manufacture of oxide. It experimented with various processes, and finally adopted the one which is now in use, which was patented in 1852.

The Palmerton plant occupies a long, narrow strip of land in the Lehigh valley, extending westward from Palmerton about one and three-quarter miles. On this plot the company has a large oxide plant and also plants for the manufacture of spiegeleisen, zinc, lithopone, and sulphuric acid. By 1910 the business had outgrown the location and a second plant was built, to the east of the town.

The ore is all obtained from the mines at Franklin Furnace, N.J., where it is crushed and treated, first by magnetic separators and then by jigs, which separate it into four products. The first, called Franklinite, consists mainly of oxides of zinc, iron, and manganese, with practically no injurious impurities. This ore is worked by itself, making the best qualities of oxide. The residue remaining in the furnaces after removal of the zinc is taken to the blast furnaces for the manufacture of spiegeleisen. The second product contains about the same amount of zinc as Franklinite, but less iron and manganese, and does not make quite as good an oxide. It is used, like Franklinite, for the manufacture of oxide, and the residues are thrown away. The third product is Willemite, or anhydrous zinc silicate, free from cadmium and almost free from lead, which is used for the production of pure commercial zinc. This is used for making brass and other alloys that are to be spun and drawn, as the metal made with it is ductile and not liable to crack when worked; also for galvanising telegraph and telephone wires which have to stand severe bending in making the splices, as it has been found that a coating of pure zinc free from lead and cadimum is less likely to crack and peel off than if a less pure material is used. The fourth product from the ore at Franklin is limestone tailings.

The ores are shipped to Palmerton, where they are received on a high trestle, parallel to the furnace rooms. Here they are dumped in bins or stocked in large piles behind the trestle, from which they can be returned to the bins by a gantry crane. The coal is brought in on the same trestle and placed in bins in line with the ore bins. From the bins the ore and coal are drawn into a car which takes them to the mixers, where they are weighed in proper proportions, mixed by machinery and elevated to bins over the furnaces. From these they are drawn in weighed amounts into hoppers on travelling cranes which deliver them to the different furnaces.

In the west plant at Palmerton there are 34 blocks of furnaces, and in the east plant 20 blocks. Each furnace is a brick chamber with an arched roof and a flat grate, under which is a closed ashpit. The total grate surface of the furnaces is about one-half acre.

A new furnace is first heated and then a thin layer of coal is spread on the grate and ignited. When this is burning well a charge of mixed ore and coal is dropped on it. A blast is blown into the closed ashpit, and passes up through the charge, burning the coal and reducing and volatilising the zinc, which is burned by the excess of air above the charge. The zinc oxide so produced and the products of combustion are drawn from the furnace by large exhaust fans which blow them over to the bag-rooms. The bag-rooms have a system of distributing pipes at the top, from which hang muslin bags about 45 feet long and 6 feet in circumference. The combustion gases pass out through the bags and the oxide is collected in them. The bags are connected with hoppers at the bottom, from which the finished oxide is drawn to be taken to the packing room. The six bag-rooms in the two plants contain nearly 71 miles of bags, with a total surface of 51¼ acres of muslin. The oxide is first bolted through wire screens. Each bolting machine feeds into a packer which forces the oxide into barrels or bags. The barrels are made at the plant and contain 300 lb. of oxide each. The paper bags contain 50 lb. each.

Zinc-silver-lead alloys; Ternary ——. B. Bogitch. Compt. rend., 1914, **159**, 178—180. J. Chem. Soc., 1914, **106**, ii., 729.

ON melting together lead, silver, and zinc, two layers are generally formed, and the author has studied the distribution of the three metals between the two layers at the temperature of solidification of the top layer, this being the poorer in lead, and consequently less fusible. Some twenty fused mixtures were studied, and a curve is given showing the proportions of the three metals which give two layers, and those which can exist without liquation. These results only hold good for temperatures near to the solidification point.

Copper, lead, and nickel; Reduction of the oxides of ——. P. Sabatier and L. Espil. Comptes rend., 1914, **159**, 137—142. J. Chem. Soc., 1914, **106**, ii., 729—730.

COPPER oxide is reduced to metal without the intermediate formation of cuprous oxide, by dry hydrogen at 150° C. The curve showing the rate of reduction is formed by one branch only, the velocity being small at first, then increasing rapidly up to a certain point, after which it diminishes regularly. This oxide is reduced directly to the metal.

The reduction of lead peroxide by a stream of dry hydrogen is first manifest at 150° C., it being reduced to the protoxide without the intermediate formation of red lead (compare Glaser, this J., 1903, 1051). The protoxide, litharge, is first visible at 190° C., it being slowly transformed at this temperature, and more rapidly at 240° C. into the suboxide, Pb_2O, this oxide being, in its turn, slowly reduced to metallic lead at 250°, and rapidly at 300° C.

The authors have repeated their work, already described (this J., 1914, 351), on the reduction of nickel oxide, and maintain their opinion that the unstable, intermediate suboxide formed has the composition Ni_4O, and not Ni_2O as given by Berger (this J., 1914, 752).

[*Copper smelting.*] *Coal-dust firing for reverberatory furnaces.* E. P. Mathewson. Eng. and Min. J., 1914, **98**, 725—727.

As a result of successful trials, all the reverberatory furnaces for smelting copper matte at Garfield and at Anaconda, Mont., U.S.A., will be fitted for firing with coal dust, and at Anaconda a new furnace with an estimated capacity of 800 tons daily is being designed. Coal-dust firing was first used successfully by D. H. Browne at Copper Cliff, Ont., Canada, for smelting basic ore, and preliminary drying and very fine pulverisation of the coal were found to be essential. The plant consisted of a Ruggles-Coles dryer and Raymond pulveriser, Sturtevant fans, a centrifugal separator, and screw conveying machinery for the coal dust. The charge was dropped through holes in the furnace roof along the sides. At Garfield with Western (U.S.A.) ores, according to W. J. Leonard, one furnace, which was not rebuilt, smelted about 400 tons of ore daily, using 14·5% coal. The slag averaged SiO_2 42, FeO 38, and CaO 13%. The coal contained moisture 7, ash 6, volatile combustible matter 46, and fixed carbon 48%, with a calorific value of 13,500 B.T.U. when dry. At Anaconda in a furnace, which was rebuilt and provided with hoppers along both sides, down the middle and across the firing end, 475 tons of ore were smelted daily with a coal consumption of 13·8%. Tables of smelting results are given. With this method of charging, the side walls are protected by the charge, thus rendering fettling unnecessary and there is no appreciable bath of molten matte. The matte is tapped at the front of the furnace instead of at the side.—W. F. F.

Copper and the war. Engineering, Nov. 13, 1914. [T.R.]

The world's production and consumption of copper have been seriously interfered with by the war, and prices are very unreliable. The world's production of copper during recent years has been as follows :—1913, 1,005,900 tons; 1912, 1,018,600 tons; 1911, 893,800 tons; 1910, 891,000 tons. More than 50 per cent. of the total is produced in the United States—last year 589,100 tons out of 1,005,900 tons. Copper was also produced last year in the following countries :—Mexico, 90,000 tons; Japan, 77,200 tons; and Australia, 41,800 tons. As regards Europe, German and Austrian output was 52,100 tons, out of a total European output of 186,500 tons. Great Britain is second, with 41,100 tons; then Russia, 34,300 tons; and Spain with 23,600 tons. European consumption during 1913 reached 643,100 tons; after allowing for the European output, 456,600 tons had to be imported, obviously mainly from America. The European consumption was :—Germany, 259,300 tons; Great Britain, 140,300 tons; France, 103,600 tons; Russia, 40,200 tons; Austria, 37,200 tons; Italy, 31,200 tons. The American consumption was 351,000 tons. Reduced consumption has necessarily resulted in reduced production; the world's copper output, now that curtailment has become effective, has dropped to a basis of about 550,000 tons per annum. At the great Rio Tinto copper mine in Spain operations have been slowing down; its operations are said to have been curtailed to bring it in line with orders issued by other companies. It may be assumed that the leading copper mines of Germany, if not entirely closed down, have also curtailed their production, as the two leading consumers of copper in that country have been idle for some weeks. The Russian output is entirely required by Russian consumers, the Austrian output is unimportant, and the Italian output, 1600 tons, is very insignificant, whilst the Scandinavian output is only 12,000 tons. The Australian output has been reduced 50 per cent., Chili has drastically cut down production, the output last year having been 30,385 tons. The Peruvian output has been cut down 50 per cent., Mexican output is reduced to a nominal quantity, and the Canadian output is also cut down.

Although the output of ore was stopped as soon as possible after the outbreak of war, the output of the smelting and refining works cannot show a similar decrease until the materials in the vats have been withdrawn; ninety days must be allowed for that. After peace has been proclaimed, three months must elapse before normal refinery supplies can again be obtained. The total American exports for October have been estimated at about 16,200 tons, and for September, 16,838 tons and August, 19,676 tons: the average exports from 1910 to 1913 during August and September have been 30,000 and 29,300 tons, respectively.

Towards the end of September the British Government acquired all the stocks of copper in Dutch warehouses, this metal being mostly destined for Germany. Three cargoes of copper afloat for Holland were also taken by the British Government. As a result the export of copper from the United States is restricted, as shipments can only be made with impunity to Great Britain, France, Italy, and Roumania, and not to the Scandinavian countries and Holland. Germany imports annually over 200,000 tons of copper; a prolonged war might result in a copper famine.

The total value of the American copper exports may be taken at £30,000,000, all of which come to European countries, except about £1,458,000 worth, which were sent mainly to Canada.

British exports and imports of copper occur as ore, unwrought bars, blocks, slabs, cakes, and ingots, and copper goods manufactured. Our total copper exports of all varieties are :—

	Tons.	£
1909	40,440	2,745,300
1910	50,210	3,340,000
1911	50,300	3,374,300
1912	43,040	2,901,200
1913	53,200	4,180,400

Our total imports have been :—

	Tons.	£
1909	288,430	11,569,200
1910	237,950	9,295,800
1911	263,740	9,355,300
1912	251,650	11,029,200
1913	257,620	11,312,000

The world's consumption of copper has been as follows, in tons :—

—	1913.	1912.	1911.	1910.
England	140,300	148,877	159,736	148,187
France	103,600	106,753	106,408	92,838
Russia	40,200	38,818	31,830	28,237
Germany	259,300	253,429	234,985	208,826
Austria	37,200	51,574	41,101	37,150
Italy	31,200	34,378	40,949	32,487
United States	351,000	365,922	316,791	334,565

German silver; Metallography of ——. F. C. Thompson. Chem. Soc. Trans., 1914, **105**, 2342—2349.

The preparation of a satisfactory alloy involves the reduction of the cored crystals, which are very persistent in nickeliferous alloys after casting, and which impart brittleness to the metal, to a structure consisting of allotrimorphic crystals. With the help of micrographs, the influence of physical treatment, such as annealing, and of the chemical composition, on the properties of Cu-Zn-Ni alloys was studied. Metal which had been overheated during the annealing was made brittle through the re-formation of the large cored crystals which are obtained after casting. This fault could be rectified by re-annealing at a lower temperature, which caused a transformation in the crystal structure and a removal of all dendritic markings. The improvement in the tensile strength of the metal resulting from the reduction of the crystal grains is attributed to a cementing action of intercrystalline boundaries. Nickel played an important part in reducing the size of the grains, the effect being proportional to the amount present. Any oxygen in the alloy was attributed to finely disseminated zinc oxide. The addition of manganese as a deoxidant caused a notable reduction in the size of the crystals in the case of Muntz metal, and to a smaller extent with German silver. Lead present in German silver separates out as a distinct insoluble component in globular form, and tin combines with the copper and separates in a similar manner.

The properties of German silver show a number of analogies to those of steel, *e.g.*, in regard to the process of annealing, the influence of metals added, and the phenomenon of recrystallisation after cold working.—J. N. P.

Bearing metals; Investigations on ——. E. Heyn and O. Bauer. Verh. Ver. Bef. Gewerbfl. 1914, Beiheft, March 30; Chem.-Techn. Rep., 1914, **38**, 232.

Curves and data are given correlating the composition of Pb-Sn-Sb alloys with the temperature of incipient solidification, somewhat below the pouring temperature, and the temperature of complete solidification, which is the upper limit at which the bearing can be run. In general there is a considerable interval between these temperatures. Alloys containing less than 25% Sb show a tendency to segregation with rising tin-content and require rapid cooling; 2—3% Cu diminishes this, and renders the alloy harder and more brittle. The hardest alloy contains Sn 30, Sb 60, Pb 10%. The hardness of each binary alloy is increased by the addition of the third metal. Hardness is usually accompanied by brittleness, but although alloys rich in tin (up to 84%) and containing less than 25% Sb are hard they are not broken by a sudden blow; their behaviour under compression is normal.—O. E. M.

Lead; Corrosion of ——. R. H. Gaines. J. Ind. Eng. Chem., 1913, **5**, 766—768.

Lead is corroded by lime mortar, lime putty and lime water. Lead immersed in alkaline water that had leaked through concrete lost 0·132% in 8 days. Several cases of the corrosion of lead service pipes in wet concrete were observed, where there was no evidence of leakage of electricity. Samples of manganese bronze, steel, lead, copper and Monel metal were embedded singly and in contact in damp concrete, and the loss in weight determined after 2 months. With the exception of lead (loss=11·99 grms. per sq. ft.) the corrosion loss was very small, and that of Monel metal almost *nil*. The losses of the metals in contact differed but slightly from those observed with the metals alone. The corrosion of lead in soil is not always negligible, even in the absence of stray currents. In some soils lead pipes are destroyed by electrolysis more rapidly than steel pipes. At St. Paul, U.S.A., lead water pipes were damaged by the current escaping from electric railway lines, whilst cast iron pipes in the line of the same current were but little affected by corrosion.—C. A. M.

Alloys; The specific heat of metallic ——. Saposhnikow. Int. Zeits. Metallog., 1914, **6**, 114—115.

The specific heat of the alloys of Bi-Cd, Sb-Sn, Bi-Sb, and Zn-Sb, were determined between 15° and 100° C. in the water calorimeter. The results obtained are in close agreement with the values calculated on the assumption that specific heat is a purely additive property.—T. St.

Nickel; Polymorphic change in ——. Baikow. Int. Zeits. Metallog., 1914, **6**, 115.

A cooling curve of nickel heated in a vertical electric furnace was obtained, temperatures and temperature-differences being simultaneously registered photographically, copper being used as the neutral body. A slight break was obtained on the difference curve at 360° C., agreeing with the known magnetic transformation of nickel at 340° C.—T. St.

Passivity of metals. H. G. Byers and S. C. Langdon. J. Amer. Chem. Soc., 1914, **36**, 2004—2011.

The effect of dissolved oxygen on the time required to induce passivity in iron was studied, and it is concluded that passivity, when not associated with a visible film, is due to the rate of ionisation of the metal being insufficient to carry currents beyond a certain density, so that, in oxygen electrolytes, when such density is exceeded, oxygen electrodes, consisting of occluded oxygen, are formed. The concentration of dissolved oxygen about the anode is regarded as the most important factor in conditioning passivity (compare Byers, this J., 1908, 1160). Non-anodic passivity is likewise due to occlusion of oxygen and consequent protection of the metal from attack. With a sufficient dilution, iron as an anode may be rendered passive even in hydrochloric acid solution, the conditions favouring liberation of oxygen at the anode.—F. Sodn.

Briquetting ores and flue-dust using as binding agent the dust recovered in purifying blast-furnace gases. O. Kippe. Stahl u. Eisen, 1914, **34**, 1164—1165.

The dust recovered in the dry-cleaning of blast-furnace gases forms an excellent binding agent for the manufacture of briquettes from fine ores or flue-dust. The ore or flue-dust is mixed with 5—10% of the filter-dust, formed into briquettes, and hardened by treatment with steam at 7—10 atmospheres pressure for 6—10 hours. Briquettes prepared in this way had a crushing strength of from 93 to 153 kilos. per sq. cm., and yielded little dust when broken by being dropped from a height of 3 m on to a cast-iron plate. The strength of the briquettes was not adversely affected by heating at 300°—400° C. or at 1000°—1100° C. With certain ores, it is advisable to add 0·5—1% of lime to the filter-dust.—A. S.

Blast-furnace gases; Purifying —— *by means of water-spray and cooling.* M. A. Bayer. Rev. gén. Chim. pure et appl., 1913, **16**, 325. Chem. Tech. Rep., 1914, **38**, 79.

After passing through the dust chamber, the gases are led through a chamber in which they are treated with water spray and cooled to 40° C. The steam resulting from the water spray condenses and carries down most of the suspended dust. The gases then pass through another chamber containing water-cooled pipes to condense any aqueous vapour and thereby abstract any remaining dust.—W. F. B.

Blast-furnace slags; The influence of alumina on ——. J. E. Johnson. Ferrum, 1913, **11**, 20—25.

Alumina takes no part in the chemical reactions in a blast-furnace, its action being merely to increase the viscosity of the molten slag. This action becomes marked when the alumina amounts to about 16%, reaches a maximum at 20%, and decreases again at 25 to 30%. Whatever the amount of alumina present, the ratio of lime (lime + magnesia) to silica should be about 1·5 for basic iron and 1·2 to 1·4 for foundry iron. Indirectly, by reason of the greater viscosity of a slag containing alumina, whereby the iron is held up for a longer period and thus becomes heated to a higher temperature, the presence of alumina is favourable to the production of iron high in silicon.—T. St.

Brass, lead, and copper; Industrial diseases among workers in ——. P. M. Grempe. Gürtler-, Bijouterie- u. Metallw.-Ind., 1913, **11**, 157. Chem. Techn. Rep., 1914, **38**, 191.

Brass and lead poisoning are equally dangerous. Green stains on the teeth and blue discoloration of the gums indicate copper and lead poisoning respectively; they are frequently confused, as they have symptoms in common. Preventive measures are best.—O. E. M.

Preparation of tungsten wire filaments. Ruff. *See* IIb.

Over-voltage. Newberry. *See* XI.

Use of hydrofluoric acid in the separation of copper and lead from tin and antimony by means of electric current. McCay. *See* XXIII.

Patents.

Semi-steel; Manufacture of ——. W. Muirhead, Shettleston, Lanark. Eng. Pat 22,263, Oct. 3, 1913.

A mixture of pig-iron and an oxidising agent (hæmatite, scale, etc.), or of pig-iron and steel scrap, is melted in an open-hearth (Siemens) furnace heated by gas, and worked in the furnace till it is converted into semi-steel. (Reference is directed to Eng. Pat. 7946 of 1907; this J., 1908, 451.)—W. E. F. P.

Manganese steel; Manufacture of ——. W. Campbell, New York, J. H. Hall, High Bridge, N.J., and H. M. Howe, Bedford Station, N.Y., Assignors to Taylor-Wharton Iron and Steel Co. U.S. Pat. 1,113,539, Oct. 13, 1914; date of appl., Aug. 10, 1908.

Claim is made for an alloy-steel containing Mn less than 9% and C from "1·075% minus 0·04 of the percentage of manganese" to "1·075% plus ⅓ of the percentage of manganese." The steel is hard and ductile, practically non-magnetic, and has a homogeneous appearance when magnified to 100 diameters.—W. E. F. P.

Electroplating non-metallic objects; Improved substance for use in processes for ——. L. Waltispurger and C. A. Rivoal, Paris. Eng. Pat. 23,741, Oct. 20, 1913.

A solution of colophony in cold "white spirit" (light petroleum) to which a conductive powder, such as copper, is added, is used for producing a conductive coating on non-metallic objects.—B. N.

Metals; Cleaning —— [*electrolytically*]. A. A. Nelson, Assignor to Acme Steel Goods Co., Chicago, Ill. U.S. Pat. 1,114,635, Oct. 20, 1914; date of appl., Feb. 25, 1914.

The iron or steel is made the cathode in a bath of fused alkali hydroxide or alkali salt, and a current passed for the removal of scale or rust, the metal being afterwards cleansed in water.—B. N.

Furnaces; Melting —— *and apparatus for stirring or agitating molten material therein.* I. Hall, Birmingham. Eng. Pats. 28,345, Dec. 9, 1913, and 5197, Feb. 28, 1914.

The stirring device, which is located in the melting pot, is actuated by a lever supported on brackets on the furnace cover, and the movement of the lever is limited by a slot, in the form of an arc of a circle, fixed to the lever, and adapted to engage a stationary pin. A centrally-located valve, for regulating the pouring of the metal, is connected by a valve stem, passing through a stuffing-box in the cover, with a second lever pivoted to a bracket on the cover. The mixing device is fixed to a sleeve or the like on the valve stem, and is attached to its lever by two rods passing through stuffing-boxes disposed one on each side of the valve stem and its operating lever.—B. N.

Furnace; Electric —— [*for melting and refining metals*]. J. H. Gray, New York. U.S. Pat. 1,113,778, Oct. 13, 1914; date of appl., Aug. 21, 1913.

The oblong hearth of the furnace has tapered ends and the electrodes are disposed above the hearth so as to form an arc between each electrode and the metal. The electrodes are arranged in several groups of three each, one group at each end of the hearth, the three electrodes of each group being connected to the respective terminals of a three-phase circuit arranged in delta, so that the current passes successively down through each electrode and up through the other two electrodes of the group. The area covered by one group overlaps that covered by another group, so as to effect a uniform distribution, and permit the operation of the furnace, if desired, with only one group of electrodes.—B. N.

[*Zinc.*] *Ores; Apparatus for smelting* ——. J. A. Potter, Pueblo, Colo. U.S. Pat. 1,113,481, Oct. 13, 1914; date of appl., Dec. 23, 1912.

In the rear wall of the reduction chamber of the apparatus is a central charging opening having, upon each side, an opening communicating with a condensing and regenerating flue, and, immediately beneath, a smaller opening through which gas from an adjacent producer chamber (operated with liquid fuel) is passed so as to permeate the charge. The reduction chamber is provided with an exhaust conduit, a pipe for the supply of air under pressure, and means for connecting either of the condensing and regenerating flues with the pressure, and the other with the exhaust, conduit.—W. E. F. P.

De-tinning; Process of ——. W. Savage, Piedmont, Ala. U.S. Pat. 1,113,491, Oct. 13, 1914; date of appl., Feb. 17, 1914.

A coating of "white tin" is subjected to the action of "a slime containing tin-ammonium chloride and gray tin."—W. E. F. P.

Ores; Agglomerating fine ——. J. H. Payne, Baltimore, Md. U.S. Pats. (A) 1,114,029 and (B) 1,114,030, Oct. 20, 1914; dates of appl., Feb. 21, 1914, and April 10, 1913.

(A) The ore, containing a material amount of sulphur, is introduced continuously into the upper end of a long rotating inclined tube, and a flame of air and gaseous fuel passed into the lower end as a counter current. Sufficient air is employed for combustion of the fuel, but not sufficient for burning material quantities of the sulphur, and the ore is heated to the point of incipient fusion so as to convert the material into nodules. (B) For copper ores, rich in sulphur, silicious material is mixed with the ore to prevent complete fusion under the influence of the heat generated by the oxidation of the sulphur.—B. N.

Electrolyte for use in electrometallurgy. N. H. M. Dekker, Paris. U.S. Pat. 1,113,546, Oct. 13, 1914. Date of appl., Aug. 17, 1912.

See Eng. Pat. 17,836 of 1912; this J., 1913, 662.—T. F. B.

Zinc; Metallurgy of ——. A. L. J. Queneau, Torresdale, Assignor to Queneau Electric Zinc Furnace Co., Philadelphia. U.S. Pat. 1,114,036, Oct. 20, 1914. Date of appl., Dec. 17, 1908.

See Fr. Pat. 403,048 of 1909; this J., 1909, 1318.—T. F. B.

Magnetic separator. G. Ullrich, Assignor to F. Krupp A.-G. Grusonwerk, Magdeburg-Buckau, Germany. U.S. Pat. 1,114,071, Oct. 20, 1914. Date of appl., July 3, 1913.

See Eng. Pat. 14,426 of 1913; this J., 1914, 359.—T. F. B.

Ores; Method of heating —— *in two chambers or retorts arranged behind each other.* E. Menne, Creuzthal, Germany. U.S. Pat. 1,114,502, Oct. 20, 1914. Date of appl., July 1, 1912.

See Ger. Pat. 253,450 of 1911; this J., 1912, 1187.—T. F. B.

Muffle-furnace. E. Curran, Cardiff. U.S. Pat. 1,114,587, Oct. 20, 1914. Date of appl., March 21, 1914.

See Eng. Pat. 6165 of 1913; this J., 1914, 320.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Over-voltage. E. Newbery. Chem. Soc. Trans., 1914, **105**, 2419—2435.

Exhaustive measurements were made of the actual back E.M.F. between electrode and electrolyte during electrolysis, or the voltage which is over and above the stationary potential given by the electrode when at rest. By means of a rapidly rotating commutator, this measurement was made during a very short interval after the interruption of the electrolytic circuit. Evidence was obtained of intermediate reactions such as dehydration of ions, which take place before an ion is liberated at an electrode, and of the selective influence exerted by colloids on the separation of the different ions, thus determining the efficiency with which zinc, for instance, is separated from an acid electrolyte. Up to a certain value, increasing current density caused an increase in overvoltage, but with higher current densities, the overvoltage gradually fell and in some cases actually became negative. This effect was traced to an inductive action of the gas as it escaped in a charged condition. Confirmation was obtained of the view that ions must penetrate to a certain distance in the metal before delivering their charge. If the free element is then gaseous, its escape is hindered by the metal and this leads to the accumulation of high pressures and rupture of the surface. This action was demonstrated by means of microphotographs which show the formation of crater-form pittings on the surface of different metals after liberation of gas by electrolysis. Measurements made on the degree of ionisation of the free gas escaping after electrolysis showed a remarkable inverse relationship to overvoltage. Variation in factors such as time, nature of metal, and temperature, which influenced the overvoltage, produced a change in the inverse sense in the ionisation of the gas. The application of high gaseous pressures—up to 100 atmospheres—was without appreciable influence on the overvoltage. The results show that all earlier formulæ expressing the overvoltage are invalidated through omitting to take into account the different factors which have been traced in this work.—J. N. P.

Solvent properties of silver nitrate solutions. The silver voltameter. III. Lowry. *See* VII.

Production of neon and helium by the electrical discharge. Collie and others. *See* VII.

Patents.

Electrode-making machines. S. L. Casella, New York. Eng. Pat. 14,582, June 17, 1914. Under Int. Conv., July 3, 1913.

A rotating table carries four moulds for the production of electrodes, the movement of the table bringing into operation four plungers as each mould is in register, whereby the following operations are carried out successively: compression of the depolarising material; perforation, axially, of the compressed material; insertion of an electrode in the perforation: and ejection of the completed electrode. The table is rotated a step after each operation, locked, and released for the next forward movement. An intermittent feed device supplies electrode material from a hopper.—B. N.

Batteries; Plates for electrical or secondary —— or accumulators. E. Hancock and D. David, Cardiff, Glamorgan. Eng. Pat. 19,109, Aug. 22, 1913.

An oxide of lead, such as litharge, is mixed to a paste with sulphuric acid and substances rich in carbohydrates or free carbon, such as potatoes. This is moulded into plates, and heated in a receptacle from which air is excluded by surrounding the plates with wood charcoal. The burnt plates are ground and the material mixed with part of the original mixture, or a similar mixture prepared from red lead, then dried and finely powdered and sulphuric acid added to form a paste. The latter is moulded into plates, which are wrapped in paper before being placed in charcoal and heated. The plates are then short-circuited between zinc or iron plates in acid, and afterwards placed between positive electrodes in acid, being then alternately charged and discharged until all impurities are extracted.—B. N.

Cell; Electrolytic ——. H. C. Jenkins, H. F. Pattinson, and R. Wellesley, London. Eng. Pat. 25,415, Nov. 6, 1913.

The liquid is introduced into the bell containing the anode, so as to maintain a concentrated condition at the anode, and liquid is displaced either upwards to a draw-off device within the bell, from which the liquid is passed to a tank with an adjustable weir, or downwards towards the lower edge of the bell. By means of suction, different levels are maintained inside and outside the bell, the liquid being drawn off at the higher level, and returned by a pipe below the level of the liquid. The gas is drawn off under suction from the interior of the bell through a pipe with a valve, the latter closing automatically when the bell is removed from the cell.—B. N.

Conductors; Electrical ——. T. B. Allen and L. B. Coulter, Assignors to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,114,665, Oct. 20, 1914; date of appl., Nov. 21, 1911.

A porous article of silicon carbide is impregnated with a colloidal solution of graphite and heated.—B. N.

Furnace; Electric —— for fixing nitrogen from the air. E. K. Scott, Belvedere. U.S. Pat. 1,113,376, Oct. 13, 1914. Date of appl., June 25, 1913.

See Eng. Pat. 14,871 of 1912; this J., 1913, 872.—T. F. B.

Electrodes for secondary batteries; Process of making ——. J. Apoznanski, Assignor to Stanislaw and Georgij Gaszynski Bros., Apoznanski & Co, Moscow. U.S. Pat. 1,114,667, Oct. 20, 1914. Date of appl., Dec. 14, 1910.

See Ger. Pat. 275,881 of 1910; this J., 1914, 971.—T. F. B.

Thermo-element. Ger. Pat. 276,354. *See* XXIII.

XII.—FATS; OILS; WAXES.

Coconut; The —— and its products, with special reference to Ceylon. D. S. Pratt. Phillip. J. Sci., 1914, **9**, 177—198.

The average palm produces about 40 nuts per annum, or upwards of 60 in well-kept plantations. There are about 750,000 acres of plantations in Ceylon, producing about 1,250 million nuts a year, of which 2 million are used daily for food, and the remainder exported as copra, etc. In 1913 the price of good nuts in Ceylon ranged from 40 to 56 pesos (83s. 4d. to 116s. 8d.) per 1000. In 1911 about 142,774 acres were under cultivation in the Malay States, the yield of copra from which was estimated at 65,600 tons. The value of the coconuts imported into the United States has risen from 1,816,484 pesos (£189,217) in 1903 to 3,562,754 pesos (£371,120) in 1913. The native method of preparing the copra is to cut the nut in two and expose the two halves on dry sandy ground for about 2 days, when the pulp is separated and the drying completed in 4 days. Artificially dried copra is inferior in colour and appearance to the sun-dried product. The method used is to place the copra on a platform of areca palm laths over an earth pit in which is a fire of dry coconut shells. About 50 kilos. of copra are prepared from 170 to 200 nuts (according to the rate of drying). Rapid drying in a current of air (*e.g.* in 10 hours) is attended with considerable loss of oil, about 15% more kernel being required to produce a given weight of copra. It should be possible to complete the drying within 72 hours by means of a slow current of air at 54° to 60° C., and with a minimum loss of oil. Ceylon copra is graded into the four qualities—*kalpentyn* (the best produced,) *estate*, *maravila* (ordinary), and *common* or *cart*, which is bought in lots from various small producers. In 1913 the *kalpentyn* grade fetched 259 pesos (£29 10s.) and *cart* 232 to 253 pesos (£24 3s. to £26 17s.) per ton. In the Phillippines the best quality is known as "Samar sun-dried," the bulk of which is used locally for the production of oil; "Cebu sun-dried," "F.M.M." (fair merchantable Manila); and "Laguna," which is frequently made from green nuts and dried over a smoky fire and readily becomes mouldy. Ceylon copra is quoted at about 20 pesos (41s. 8d.) per ton less than Cochin and Malabar copra. The total exports of copra from Ceylon in 1913 were 57,705 tons, of which 40,314 tons were sent to Germany, 12,094 tons to Russia and 1650 tons to the United Kingdom. The total imports of coconut oil into this country in 1913 were:—Refined oil, 30,087, and unrefined oil 31,559 tons. During 1911—1912 India exported 2,165,103 galls. of coconut oil valued at 2,626,876 pesos (£273,632), of which Germany took 584,251 galls. and the United States 477,487 galls. The total exports for 1912—1913 were much lower. In Ceylon it is estimated that 40 full-grown coconuts will yield 1 gall. of oil. The machinery used is primitive and relatively little oil is now expressed there. The copra is cut up, ground to a coarse bran, and heated in steam-jacketed vessels at a uniform temperature. The warm mass is then gradually pressed in a hydraulic press up to a pressure of 2 tons, until all but about 10% of oil is expelled, when the mass is again ground, rolled, heated and submitted to a pressure of 3 tons, which reduces the oil-content to about 6%. In this way about 66% of oil and 33% of oil-cake (*poonac*) are obtained, the latter being exported as a feeding stuff or ground up with phosphates, nitrates, etc. and used as a fertiliser on the coconut estates.

Desiccated coconut:—The shells of selected nuts are chipped away and the kernels shaved by hand, washed, shredded or granulated by machinery, and dried in a desiccating machine through which is driven a current of air at 82° to 93° C., whereby the moisture is reduced to the allowable maximum of 1·5 to 2%. Finally the product is sifted mechanically into fine, medium and coarse grades, cooled on zinc-covered tables, and packed in lead-lined chests, each holding about 59 kilos. It is estimated that the coconut loses about 50% in weight during desiccation, and 1000 nuts yield about 150 to 173 kilos. (according to the district). Nearly twice as many Malabar coconuts are required to produce the same amount of product as Ceylon nuts, whilst Indian nuts are dearer; hence Southern India has been unable to compete with Ceylon in the industry. The whole of the product is exported, the total exports in 1913 being 15,326 tons, of which the United Kingdom received 6339 tons, Germany 2302 tons, and the United States 3787 tons. The estimated cost of a plant to deal with 90 tons of desiccated coconuts per year is 78,520 pesos (£8179).

Coir fibre.—The best fibre is made by native methods, especially in the Galle district. The husks are placed in bamboo enclosures which are submerged in river or sea water. After about 6 days' softening they are beaten on a block, and the separated fibre hackled with a wooden comb and dried. Two classes of fibre are thus obtained, viz., "*bristle fibre*" (averaging 30 cm. in length) and "*mattress fibre*," which is spun into "coir yarn" about 17 m. long and 40 mm. thick. In the mills the fibre is softened in large tanks, iron rails being used to keep the husks submerged. After 5 days' soaking the material is crushed in a "breaker," and the fibres separated by revolving iron wheels ("drums") studded with spikes. The long coarse fibres are hackled by hand, made into hanks and partially bleached with sulphur fumes. This is made into brushes, etc. The mattress fibre, consisting of torn and broken pieces falling from the spikes of the "drums," is spun into coir yarn, and made into mats and coarse cloths, which are frequently dyed with aniline dye-stuffs. Ceylon coir yarn is sold in the two grades of *Kogalla* and *Colombo*, which are further subdivided into 15 to 24 standards differing in thickness, colour, twist, etc. The exporters' prices range from about 146 to 290 pesos (£15 4s. to £30 4s.) per ton. It is estimated that 1000 coconut husks will produce 30 to 35 kilos. of bristle fibre and about 140 kilos. of mattress fibre and yarn. The amounts of coir yarn and bristle and mattress fibres exported from Ceylon in 1913 were 5762 and 12,852 tons respectively. *Other products.*—The dry shells are burned to charcoal in pits or are destructively distilled to obtain a pyroligneous liquor which is used in coagulating rubber latex. The charcoal is excellent and is in increasing demand.—C. A. M.

Hydrogenated fats. A. E. Sandelin. Teknikern, 1913, 359—361; Chem.-Techn. Rep., 1914, **38**, 321.

Results obtained on the examination of hydrogenated products prepared from whale oil at a factory in Kaipiais, Finland, and also of hydrogenated whale oil, made in Germany and offered to a Finnish margarine factory, were:—

	M. pt. ° C.	Solidifying pt. ° C.	Refractometer reading at 40° C.	Saponification value.	Acid value.	Iodine value (Wijs).	Reichert Meissl value.	Polenske value.	Mol. wt. of insoluble acids.	M. pt. of the arachidic acid.	Nickel reaction*
Original whale oil ..	fluid	fluid	64·1	192·2	9·50	144·8	0·27	0·69	287·7	—	—
Artificial tallow	47·5	38·1	48·0	183·7	9·88	56·9	0·25	0·49	296·4	75·5	+
,, stearine ..	54·3	47·3	32·4	187·7	7·80	11·7	0·14	0·31	297·0	74·1	+
Hydrogenated whale oil (German)	41·9	31·9	48·2	190·9	5·30	57·8	0·18	0·50	282·0	76·0	+

* With dimethylglyoxime.

—W. P. S.

Chaulmoogra oil: Source of genuine ——. E. E. Francis. J. Pharm. Chim., 1914, **9**, 388—390.

Up to 1900 chaulmoogra oil was supposed to be derived from the seeds of *Gynocardia odorata*, but it was then shown to be derived from the seeds of *Taraktogenos Kurzii*, and this was generally accepted as the source of the genuine oil although the oil was still called *oleum gynocardium*. *Taraktogenos Kurzii* grows in Burmah, the Chittagong Hill Tracts and in Assam. The crop is uncertain and sometimes entirely fails and this has led to the substitution of the oil from the seeds of *Hydnocarpus Wightiana*, a tree of the same family, for the genuine oil. Since 1913 the oil derived from this latter source (also known as kavatel oil) has been fraudulently sold as genuine chaulmoogra oil although it is considerably cheaper and inferior in its dermatological effect. The two oils have a similar appearance and constitution but differ in smell, the genuine oil also containing much more free fatty acids.—T. C.

Oil of manketti nuts. H. Sprinkmeyer and A. Diedrichs. Z. Unters. Nahr. Genussm., 1914, **27**, 113—119.

The kernels of manketti nuts (*Ricinodendron rautanenii*, Schinz) from German South West Africa (8·33% of the fruit) had the following composition:—Water, 4·70; ether extract, 59·40; proteins, 26·95; ash, 3·02; and crude fibre and N-free extractives, 5·93%. The cold-drawn oil had the following characters:—Sp. gr. at 15° C., 0·9306; refraction at 40° C., about 84; at 25° C., about 93; iodine value (Hübl), 128·5; acid value, 1·25; saponif. value, 193·3; Reichert-Meissl value, 0·75; Polenske value, 0·40; Hehner value, 94·85; *Fatty acids*:—m.pt. 39·0° C.; solidif. pt. 35·7° C.; refraction at 40° C., about 69; neutralisation value, 204·5; iodine value

135·7; and mean mol. weight, 281. The oil yielded no insoluble bromide, but the fatty acids yielded linolic tetrabromide (m.pt. 114·2° C.). No destinctive colorations were obtained in the tests of Bellier, Halphen and Baudouin. In Livache's absorption test the increase in weight was 10·05%. Mixed with driers it yielded a varnish which dried more slowly than linseed oil varnish, but was superior in tenacity, freedom from stickiness, and resistance to water and alkaline liquids. The oil is thus well suited for the manufacture of linoleum. The oil-cake is rich in protein and should make a good feeding-stuff, provided no injurious constituents (such as frequently occur in seeds of *Euphorbiaceae*) are present. Physiological experiments with the oil itself were satisfactory (see also this J., 1913, 95, 611).—C. A. M.

Mabula pansa [*owala*] *seeds and oil.* H. Wagner and J. Muesmann. Z. Unters. Nahr. Genussm., 1914, **27**, 124—131.

OWALA or pauco nuts (*Pentaclethira macrophylla*) from German W. Africa contained 81% of kernels, which when air-dried had the following composition:—Water, 7·48; ash, 2·23; phosphoric acid, 0·45; crude fibre, 4·71; nitrogen, 4·68; and fat, 49·8%. The crude oil, which had a pungent taste, had the following characters:—Sp. gr. at 15° C., 0·9164; refractometer reading, 56·6; acid value, 20·4; saponification value, 181·9; iodine value, 99·5; Reichert-Meissl value, 6·5; Polenske value, 0·5; acetyl value, 20·6. *Fatty acids*:—M.pt., 56·5—57·5° C.; solidif. pt., 55·2° C.; neutralisation value, 185·7; iodine value, 106·3; iodine value of liquid fatty acids, 143·5—144·1; and mean mol. weight, 143·5—144·1. After refining with alkali the oil showed an iodine value of 101·2 and acid value, 0·3, but still had a slight bitter taste. The fatty acids contained about 25% (calculated on the oil) of lignoceric acid (m.pt. 80·5° to 81° C.) and about 43% of liquid fatty acids. The unsaponifiable matter (0·62%) contained 0·21% phytosterol (m.pt. 140·8° C.). No colorations were obtained in the tests of Baudouin, Soltsien or Halphen, but Bellier's test gave a greenish-black coloration changing to red-brown. In the elaidin test the oil solidified after some time. No insoluble bromide was obtained. (See also this J., 1906, 893; 1907, 699; 1910, 1019.)—C. A. M.

Seed oils; Characters of certain little-known ——. A. Diedrichs. Z. Unters. Nahr. Genussm., 1914, **27**, 132—141.

(1) *Date stone oil*:—Algerian date stones (11·17% H_2O) yielded 7·98% of a fairly viscous oil with a pungent taste. Bellier's reagent for vegetable oils gave no coloration. The fatty acids yielded linolic tetrabromide. (2) *Orange and lemon pip kernels* yielded 57·31 and 49·67% respectively, of light yellow oils with intense bitter taste. The orange seed oil contained linolic and linolenic acids. (3) *Bassia butyracea seeds* yielded 55·90% of a fat, which gave an insoluble bromide. The extraction-residue, on treatment with water yielded 38·3% (14·90% on original substance) of a resinous extract containing saponin. (4) *Stillingia seed*:—After separation of the fat (*Stillingia tallow*) surrounding the kernels, the latter yielded 62·03% of light yellow oil with a nutty odour and taste. The oil yielded 20·04% of insoluble bromide (m.pt. 147° C.), whereas the tallow gave no precipitate with bromine. (5) *Calotropis* (*akoon*) *seeds* from *Asclepias gigantea* contained 57·68% of kernels, and the whole seed yielded 26·76% of a viscous olive-green oil with a bitter taste and pungent odour. It gave 0·2% of an insoluble bluish-white bromide, and in Livache's test absorbed 3·98% oxygen in 10 days. The plants contained a bitter milky juice, with an odour of opium, which is used medicinally by the natives. The following characters were shown by these oils:—

Oil from.	Oil.										Fatty acids.				
	Sp. gr. at 15° C.	Refractometer reading.		Acid value.	Saponif. value.	Reichert-Meissl value.	Hehner value.	Polenske value.	Iodine value.	Unsaponifiable matter.	M. pt.	Solid. pt.	Neutralisation value.	Iodine value.	Mean mol. weight.
		40°C.	25° C.												
										%	° C.	° C.			
Date stones	—	48·2	56·1	6·15	210·98	0·88	95·23	3·20	52·31	trace	22·4	18·1	220·3	55·26	257·5
Orange pips	0·9251	57·3	65·8	0·53	196·37	0·55	95·60	0·40	97·26	—	39·5	34·0	206·2	100·4	275·1
Lemen pips	—	60·0	68·2	1·75	195·98	0·55	95·57	0·30	107·26	—	—	—	—	—	—
Bassia butyracea, extracted fat (crude)	—	57·6	—	50·10	179·64	3·08	95·95	0·5	47·72	2·22	58·4	56·5	179·45	49·56	313·2
Bassia butyracea, hot-drawn (crude)	—	59·6	—	50·00	170·32	—	96·15	—	50·65	5·30	—	—	—	—	—
Bassia butyracea, hot-drawn (refined)	—	59·3	—	1·00	177·88	—	95·98	—	47·73	2·40	—	—	—	—	—
Stillingia seed, tallow	—	44·6	—	7·03	206·64	0·88	95·33	—	29·78	—	54·3	55·6	212·94	30·74	271·2
,, ,, oil	—	77·4	86·0	1·24	209·44	0·99	95·27	—	154·99	—	—	—	209·54	166·63	273·2
Calotropis seed	—	54·5	63·0	31·05	196·42	0·55	95·56	0·35	84·27	trace	33·8	31·0	199·64	87·64	286·6

—C. A. M.

Chinese or Stillingia-tallow. A. Diedrichs. Z. Unters. Nahr. u. Genussm., Aug. 15, 1914.

STILLINGIA-TALLOW, or "vegetable tallow," is exported from China in large quantity for making soap and candles. It is an interesting peculiarity of this fat that, when congealing, it expands with great force, so that a thin glass is usually ruptured. It is not impossible to use it, when sufficiently purified, for nourishment. The fat is imported as such and not the seed. It is said to be often adulterated by the Chinese. Even in a purified condition it soon becomes bitter in taste, and of a disagreeable odour.

Waste products [*oils and greases*]; *Reclamation of* —— [*from cotton waste, etc. used for cleaning machinery*]. G. H. Ayres. Times Eng. Suppl., Oct. 30, 1914, 128.

OILY waste or rag is placed in a centrifugal separator driven directly by a steam turbine forming an integral part of the machine, the exhaust steam serving to heat and liquefy the oil and grease. The separated oil is purified by settling or filtration. The waste or rag is then washed and dried. Sponge cloths used instead of cotton waste on the Lancashire and Yorkshire Railway yield 1—1¼ gall. oil per gross. Similar methods are employed for the recovery of "cutting oil" from metal screwings and turnings, turpentine and ink from the cleaning materials used in printing works, wax and composition from the short ends and waste in candle and match factories, and fats in cocoa, chocolate and biscuit factories and bakeries.—A. T. L.

Beeswax; Bleaching of ——. K. Heinz. Seifensied Zeit., 1913, **40**, 1140, 1169, 1192. Chem.-Techn. Rep. 1914, **38**, 132.

COMPLETE bleaching of beeswax can only be effected b sunlight, and all chemical methods require supple menting by sun-bleaching for the production o absolutely white wax. Moreover, it is frequently impossible to remove all traces of chemicals from the product Natural bleaching is effected by repeated exposures the wax being melted with water containing sulphuric aci between each exposure. Of chemical agents, oil of turpentine has the drawback of imparting an unpleasant odou to the wax. It is preferable to add to the water, used t prevent overheating of the wax by the sun, potassium chlorate, sodium hypochlorite, or hydrogen peroxide. Another method is to boil 100 kilos. of the melted wax with a solution of 3 kilos. of potassium chlorate in 10 litres of water acidified with sulphuric acid, and after removal of the chemicals, to finish the bleaching in the sun. Permanganate is not effective as a bleaching agent. One of the best methods is to boil the wax with a solution of potassium bichromate and sulphuric acid, and to remove the chromic oxide by washing with water containing lactic or sulphuric acid. Ozone has not proved very effective. Bleaching with fuller's earth, Florida earth, and the like, has the drawback that the powder retains a considerable amount of wax, which can only be recovered by extraction.—C. A. M.

Rosin; Determination of —— in fats and soaps. Leiste and C. Stiepel. Seifensieder-Zeit., 1913, **40**, 1233. Chem. Techn. Rep., 1914, **38**, 213.

The fat or soap is dissolved in alcohol, neutralised with alcoholic soda, and the mass obtained on evaporating the solution in admixture with a quantity of freshly ignited sand is extracted with acetone containing 2% of water. The rosin and unsaponifiable matter are extracted together, but since the latter is present in the ordinary soap-making fats to a slight extent only its amount may be neglected. —J. A.

Candles. Board of Trade Bulletin No. 89.

May be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Lubrication with oils and with colloidal graphite. Mabery. *See* I.

The butter-fat content of margarine. Arnold. *See* XIXa.

Sandalwood oil and its application to perfumery. Mann. *See* XX.

Patents.

Fish and other animal offal, bones and the like; Means for treating [extracting fat from] ——. Eng. Pats. 21,331, Sept. 22, and 29,172, Dec. 18, 1913.

In an apparatus for the extraction of fat from fish offal, bones, etc., the digestion pan is fitted with stirrers and means are provided for treating the material successively with superheated steam, benzene, and hot air. Means are also provided for cooling the steam and hot air, after use, and for recovering the benzene after it has been withdrawn from the pan.—W. P. S.

Oils, fats, and the like; Treatment of ——. N. Testrup, London, Assignor to Lever Bros., Ltd., Port Sunlight. U.S. Pat. 1,114,067, Oct. 20, 1914. Date of appl., March 20, 1911.

See Eng. Pat. 7726 of 1910; this J., 1911, 1022.—T. F. B.

Fat from bones, materials suitable for glue manufacture, and like substances; Process for the extraction of ——. E. Fischer, Charlottenburg, Germany. U.S. Pat. 1,114,598, Oct. 20, 1914. Date of appl., Jan. 16, 1912.

See Fr. Pat. 430,015 of 1911; this J., 1911, 1324.—T.F.B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Enamel paints. O. M. Meissl. Oesterr. Woch. öffentl. Baudienst, 1913, [15]. Chem. Techn. Rep., 1914, **38**, 94.

The chief requisite of a good enamel is durability. The drying medium of ordinary enamels is linseed oil and its substitutes. The addition of rosin oil makes the enamel liable to crack and to become sticky in the sun, whilst mineral oils retard the drying, and driers reduce the stability to the same extent as they accelerate drying. The function of the drying medium does not cease with the drying of the enamel, but promotes subsequent oxidation. For outside work enamels should be as free as possible from driers and diluting liquids such as oil of turpentine, petroleum spirit, etc. Direct sunlight and moisture have a great influence on the stability. Zinc pigments are less durable than iron and lead pigments out-of-doors, but for interior work zinc and iron pigments are preferable to lead. For stations, locomotive sheds, etc., iron oxide pigments are preferable to red lead pigments. The durability of an enamel increases with the fineness of the pigment, whilst lighter shades of colour are less durable than dark shades. The durability of enamels for ordinary purposes increases with the elasticity of the film, whereas enamels for use under water are as a rule more durable in proportion to their hardness. The thinner the layers of pigment and the more numerous the coats, the more durable is the enamel. It ought never to be applied below 4° C. Zinc white is dearer in use than white lead, since it requires more linseed oil. No satisfactory substitute for red lead in enamels for iron work has yet been found; iron oxides have not the same durability.—C. A. M.

Turpentine oil; Detection of hydrocarbons in ——. Utz. Farbenzeit., 1912, **17**, 1208. Z. Unters. Nahr. u Genussm., 1914, **27**, 687.

Mennechet's test, in which 4—5 c.c. of oil are shaken with a little magenta and 2 drops of nitric acid, gives characteristic colorations with turpentine oil and with hydrocarbon substitutes which enable these to be readily distinguished, but is not sufficiently delicate to indicate admixture of hydrocarbons with oil of turpentine unless at least 30% of the former is present.—T. C.

Resinates; Photochemical properties of coloured ——. J. Larguier des Bancels. Compt. rend., 1914, **159**, 316—317. Chem. Soc. J., 1914, **106**, ii., 696. (Compare this J., 1912, 797.)

Coloured resinates when exposed to light slowly lose their solubility in benzene. This process is accelerated by the presence of small quantities of mineral salts. Of the chlorides and nitrates of a large number of metals tried, only those of uranium, zinc, and cadmium exert any marked influence, the effect produced being, within certain limits, proportional to the amount of active salt present. The action of uranium is much more powerful than that of zinc or cadmium, which are of the same order. To produce the same effect in the same time, the concentration of zinc or cadmium nitrates requires to be twenty times that of uranium nitrate. The results obtained with uranium and zinc salts are not due to their hydrolysis in aqueous or alcoholic solution giving an acid solution. Certain salts, such as those of copper, iron, chromium, and thorium entirely modify the properties of the resinates, rendering them insoluble, or producing a precipitation which interferes with the experiment.

Oil of manketti nuts. Sprinkmeyer and Diedrichs. *See* XII.

Patents.

Pigment and paint. O. W. Pickering, Springfield, Mass., Assignor to Pickering Paint and Pigment Co. U.S. Pat. 1,113,907, Oct. 13, 1914; date of appl., Aug. 5, 1913.

The paint comprises lead aluminate, an oil, and a drier. B. N.

Cement; Composition for coating ——. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co. U.S. Pat. 1,112,059, Sept. 29, 1914; date of appl., May 24, 1909.

A composition comprising at least 10% of the free fatty acids of a drying oil, an acid resin, and thinning and "extending" materials.—O. R.

Resinous condensation products ; Manufacture of ——. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 22,544, Oct. 6, 1913.

See U.S. Pat. 1,098,728 of 1914 : this J., 1914, 799. Phthalic acid may be replaced entirely or in part by oleic acid.—T. F. B.

Varnish. W. A. Beatty, Assignor to G. W. Beadle, New York. U.S. Pat. 1,113,926, Oct. 13, 1914. Date of appl., Jan. 3, 1913.

See Fr. Pat. 447,647 of 1912 ; this J., 1913, 244.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

[*Rubber latex*] ; *The tapping interval of* ——. N. C. S. Bosanquet. India-Rubber J., 1914, **48**, 797—798.

Observations, extending over more than a year, on a 94-acre clearing of 7-year old rubber, demonstrated that tapping on alternate days yielded better results than more frequent tapping. The yield per tree with daily tapping varied from 2·32 grms. in October to 3·03 grms. in December, at a cost of 29 to 19 cents (5·8—3·8d.) per lb., whereas when the trees were tapped on alternate days the yield was 4·54 grms. in January and 6·75 grms. in June, the cost being 13 cents (2·6d.) in the former and 11 cents (2·2d.) in the latter month. There is a considerable saving on bark removal, on the alternate day system. —E. W. L.

Rubber ; Packing of plantation ——. P. Schidrowitz. India Rubber J., 1914, **48**, 802.

To avoid contamination with wood splinters, etc., and thus enable plantation rubber to be used without washing other than that carried out on the plantation, it is suggested that the cases should have a loose lining of cloth, of the type used in rubber works for wrapping, etc.—E. W. L.

Coconut and its products, with special reference to Ceylon. Pratt. *See* XII.

Patents.

Rubber solution ; Safety non-inflammable ——. P. Hildebrand, London. Eng. Pat. 22,704, Oct. 8, 1913.

Rubber is dissolved in trichloroethylene, for example, 1 lb. of rubber in 12 pints of solvent.—T. F. B.

Caoutchouc substances ; Coloured —— *and process of making same.* K. Gottlob, Elberfeld, and R. Ditmar, Gratz, Austria-Hungary, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,113,614 and 1,113,759, Oct. 13, 1914. Dates of appl., Oct. 16 and 31, 1912.

See Fr. Pat. 450,567 of 1912 ; this J., 1913, 615.—T. F. B.

Caoutchouc substances ; Production of ——. F. Hofmann and C. Coutelle, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 1,113,630 and 1,113,631, Oct. 13, 1914. Dates of appl., Oct. 3, 1911, and Oct. 29, 1912.

See Eng. Pat. 1124 of 1911 ; this J., 1912, 141.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Notes on plant chemistry. Keegan. *See* XX.

XVI.—SOILS ; FERTILISERS.

Soil ; Studies of an acid —— *in Assam.* A. A. Meggit
Memoirs Dept. Agric. India. Chemical Series, 191
Vol. 3, No. 9, 235—269.

Test crops of oats were grown at Jorhat, Assam, in a
area of 0·26 acre comprising 26 plots, each of whic
received a different manurial treatment, with and withou
liming. From the results obtained it was concluded tha
the highly beneficial effect of lime is due to its action i
neutralising acidity and destroying, or preventing undu
accumulation of, toxic material in the soil.—W. E. F. P.

Soil constituents ; Relative solubility of ——. H. Fische
Intern. Mitt. Bodenkunde, 1913, III., 331. Biede
mann's Zentr., 1914, **43**, 292—294.

The potash of biotite was found to be less soluble tha
that of phonolith in water saturated with carbon dioxid
although in culture experiments by Pfeiffer and Blanck
oats absorbed more potash from biotite than from phon
lith.—R. G. P.

Ammonia ; Volatilisation of —— *from soils.* O. Lemme
mann and L. Fresenius. Landw. Jahrb., 1913, **45**, 12
Biedermann's Zentr., 1914, **43**, 435—437.

A current of air from an air pressure apparatus was le
through three wash-bottles to saturate it with moistur
then through dilute sulphuric acid and dilute ammoni
and finally through an empty flask. It was then passe
over the soil to be tested and subsequently through N/
acid. A similar experiment was done without the soi
The absorption of ammonium salts depended upon a
exchange of the bases of zeolithic origin present in th
soil. In presence of chalk the absorption of ammonia b
the soil was increased or diminished. or remained un
affected, according to the nature and source of the soi
—J. H. J.

Nitrogen ; Absorption of different forms of —— *by plants*
influence of the medium. D. Chouchak. Compt
rend., 1913, **156**, 1784—1787. Biedermann's Zentr
1914, **43**, 409—412.

The influence of various salts upon the adsorption
nitrogen from an ammonium chloride solution by pla
roots was studied. With living plants the adsorption wa
proportional to the time, whilst the rate of diffusio
inside the roots was constant. With dead roots, ma
nesium sulphate prevented any adsorption, and sodiu
sulphate, magnesium chloride, calcium chloride, and ca
cium sulphate markedly decreased the amount in varyin
degrees. With living roots, the influence of the salts, thoug
considerable, was less than with dead roots. When two
more salts were present at the same time in varying propo
tions, the influence of one was in some cases antagonistic t
that of another, and there was a maximum concentratio
with the different mixtures above which adsorption of nitr
gen decreased. In the system, water, root, and dissolve
nitrogenous substance, the last is divided between th
water and the superficial layer of the root in certai
proportions which are easily modified by the presence
other dissolved substances, *e.g.*, the salts mentioned abov
—J. H. J.

Calcium cyanamide [*nitrolim*] *; Behaviour of some moul*
fungi towards ——. A. Kossowicz. Z. Gärungsphysiol
1913, **2**, 154. Biedermann's Zentr., 1914, **43**, 140—14

Nutrient solutions were prepared containing as sol
nitrogenous matter two commercial specimens of calciu
cyanamide previously sterilised by heating at 100°
or by filtering their solutions through a Berkfeld filte
In some of the solutions all the organisms tested, viz.
Botrytis Bassiana, *Penicillium glaucum*, *Mucor Boidi*
Cladosporium herbarum, *Phytophthora infestans*, *Penicilliu*
brevicoule, *Aspergillus glaucus* and *niger*, *Isaria farinosa* an
a red *Fusarium*, exhibited more or less growth, but in other
only the first three or five developed. The results wer
probably influenced by impurities in the calcium cyanamid

and this point may be of importance in the application of calcium cyanamide as a fertiliser.—J. H. L.

Potassium salts ; Occurrence of —— in the salt springs of the United States. J. W. Turrentine. U.S. Dept. Agric., Bureau of Soils, Bull. No. 94, May 8, 1913. Biedermann's Zentr., 1914, **43**, 403.

None of the artificial and natural brines examined was found to contain potassium in sufficient quantity to repay extraction. The mother-liquors in the preparation of salt from sea-water contain sufficient potassium to enable them to be converted into a fertiliser by evaporation. The residue of a dried-up lake in South California contained so much potassium that it would form a valuable source of potash salts on the commercial scale.—J. H. J.

Phosphoric acid in basic slag ; Determination of the —— soluble in citric acid. F. Haussding. Landw. Jahrb., 1913, **45**, 49. Biedermann's Zentr., 1914, **43**, 438—439.

The methods of von Lorenz (compare Neubauer and Lücker, this J., 1912, 259) and Popp (this J., 1912, 831 ; 1913, 953), and the official method were compared. The iron citrate method of Popp gave the highest results, nearly identical with those obtained by the official method and the direct precipitation method of von Lorenz gave rather lower but more accurate results. The adoption of the von Lorenz method would entail a rise in the price of the phosphoric acid.—J. H. J.

Phosphates ; Experiments with crude ——. Prianischnikow. Biedermann's Zentr., 1914, **43**, 395—401.

Russian phosphates used as manure in pot cultures gave increased yields of mustard, lupin, etc. A Russian phosphate containing 26% P_2O_5 was converted into a superphosphate containing 12·5—13·5% of water-soluble, 14—14·5% of citrate-soluble and 14·5—15% of total P_2O_5, at a cost of 40 centimes per kilo. of water-soluble phosphate. Extraction of various phosphates with dilute sulphuric acid showed that for each variety the quantity of phosphoric acid extracted reached a maximum, varying from 46 to 73%, with a definite quantity of acid. Sodium bisulphate may replace sulphuric acid in the preparation of superphosphate. If to the solution, milk of lime is added, the precipitate contains 22—37% P_2O_5. Nitrosuperphosphate prepared with the waste acid from the manufacture of trinitrotoluene contained higher proportions of total and water-soluble P_2O_5 than ordinary superphosphate prepared from the same raw phosphate with sulphuric acid. Small amounts of ferrous and ferric sulphates added to phosphates were beneficial in sand cultures, but larger amounts were harmful. Double phosphates were prepared by the extraction of the acid radical of the phosphate with dilute sulphuric acid or sodium bisulphate, concentrating the solution and mixing with bone meal free from gelatin ; the double phosphate contained about 25% P_2O_5 of which about 95% was soluble in water. That phosphates are assimilated by plants was proved by sand cultures of lupins and buckwheat, in which a certain proportion of the phosphate added was found in the crop.—J. H. J.

Bone-meal ; Action of —— as a phosphoric acid fertiliser in comparison with superphosphate and basic slag. B. Schulze. Landw. Versuchs-stat., 1913, **83**, 101—180. Biedermann's Zentr., 1914, **43**, 441—443.

The experiments continued over three seasons and the comparison was made between the water-soluble phosphate of superphosphate, the citric acid-soluble phosphate of basic slag, and the total phosphate of bone meal. The superphosphate gave the best results ; the basic slag being about 80% as effective, and the bone meal about 60%. Bone meal free from gelatin gave better results than that containing gelatin. The grinding of the bone meal has a great influence upon its effectiveness ; the finer the grinding, the better the manurial results. Coarsely ground meal has only about two-thirds the effect of finely ground meal.—J. H. J.

Manurial experiments with lime. P. Bolin. Meddelanden Nr. 80 fran centralanstalten for jordbruksforsok, Stockholm, 1913. Biedermann's Zentr., 1914, **43**, 112.

In experiments with oats three types of fertilisers were employed with and without lime (1·6—1·9 tons per acre), viz., 1·2 cwt. of potassium nitrate with 4·8 cwt. of basic slag and 1·6 cwt. of 37% potassium sulphate per acre ; 16—32 tons of cow dung per acre ; and 8—12 tons of cow dung with 4·8 cwt. of basic slag and 0·8 cwt. of potassium sulphate per acre. The lime reduced the crop obtained with artificial fertilisers alone, but considerably increased that obtained with the animal manure.—J. H. L.

Sulphur for stimulating plant growth. F. de Castella. J. Dep. Agric. Victoria, 1914, **12**, 289. Pharm. J., 1914, 667.

For some time the attention of agricultural chemists has been directed to the value of sulphur as a manure (this J., 1913, 669 ; 1914, 975). The author confirms the fact that it acts favourably on the growth and yield of the vine. It does not act alone, however ; its beneficial effect is directly proportional to the amount of organic matter present in the soil to which it is added. When the quantity of organic matter diminishes, the effect of sulphur also diminishes and becomes nil in a soil devoid of organic matter. The action of sulphur is greater if it is previously mixed with the organic matter with which it is to act. The use of sulphur in the vineyard caused a very marked increase in the yield of grapes.

Sulphur ; Fertilising action of ——. V. V. Sabaschnikoff. Russ. J. f. exp. Landw., 1912, 821. Biedermann's Zentr., 1914, **43**, 282.

The soil used for the experiments contained 0·082% of sulphuric acid. Flowers of sulphur was applied in the proportion of 10 grms. per sq. metre. The increase in the weight of barley and rye on the sulphur plot over that on an untreated plot (2 sq. metres) was about 1·5 kilo. in each case.—J. H. J.

Plants ; Influence of manganese and aluminium on the growth of ——. T. Pfeiffer and E. Blanck. Landw. Versuchsstat., 1913, **83**, 257—281 ; Chem. Techn. Rep., 1914, **38**, 320.

Manganese salts, when added to soils, favour the growth of plants to a slight extent, but the cheaper manganese compounds are very sparingly soluble, so that large quantities have to be employed, and the actual benefit arising from their use is questionable. The addition of very small quantities of aluminium sulphate and manganese sulphate results in an insignificant stimulating action on the plants.—W. P. S.

Behaviour of ammonium phosphomolybdate with ammonium hydroxide. Sircar. *See* VII.

Patents.

Soil ; Sterilising of ——. P. J. Holmes, Norwich. Eng. Pat. 23,312, Oct. 15, 1913.

Steam is admitted to the space below a shallow cover placed a short distance above the soil, *e.g.*, a metal sheet provided with an outer jacket of insulating material, and with its edges bent downwards so as to rest on the soil.—W. P. S.

Seed grain ; Treatment of —— [with a solution of a manure and then with ultra-violet rays]. C. E. De Wolf, London, and H. E. Fry, Godmanstone, Dorset. Eng. Pat. 23,339, Oct. 15, 1913.

The grain is moistened with water, or a 15% sodium nitrate solution, and then submitted to the action of ultra-violet rays. Wheat, oats, and barley should be submitted to the rays for 5 hours ; maize and cottonseed for 7 hours. The process renders the grains more productive when sown.—W. P. S.

Fertilisers ; Plant ——. J. Keegan, Liverpool. Eng. Pat. 25,365, Nov. 6, 1913.

A fertiliser composed of two powders, solutions of which are applied separately and consecutively to the soil. One powder contains soluble ammonium and magnesium salts, to which potassium and aluminium salts may also be added, whilst the other consists of equivalent quantities of tribasic potassium or sodium phosphate and sodium silicate, or of dibasic potassium or sodium phosphate together with potassium and sodium carbonate.—W. P. S.

Fertiliser. T. L. Willson and M. M. Haff, Ottawa, Assignors to Southern Investment Co. of Canada Ltd., Montreal, Canada. U.S. Pat. 1,112,183, Sept. 29, 1914 ; date of appl., Aug. 17, 1912.

A dry fertiliser, consisting of calcium ammonium phosphate containing at least sufficient ammonia to correspond to the formula, $Ca(NH_4)H_3(PO_4)_2$.—O. R.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar in cane and beet ; Formation of ——. H. Pellet. Bull. Assoc. Chim. Sucr., 1913, **31,** 296, 322. Chem.-Techn. Rep., 1914, **38,** 3.

In the case of beet, intensive cultivation may lead to a daily formation of 1·20—1·25 grms. of organic matter (mostly sugar) ; in the case of cane (Egyptian) the average is only 0·8—0·9 grm. In a ripe cane weighing 1500 grms., the foliage contain 210 grms. of dry matter, of which 12 grms. are ash and 198 grms. organic, the cane itself containing 400 grms. of dry matter, of which 6 grms. are ash and 394 grms. organic.—O. R.

[*Sugar*] *Beet and cane ; Determination of the sucrose and reducing sugars in the foliage of the* ——. H. Pellet. Bull. Assoc. Chim. Sucr., 1914, **31,** 909—920.

Leaves and leaf-stalks are passed separately through a mincing-machine, and the finely divided material pressed two or three times, the pulp being removed and pounded in a mortar after each operation. *Sucrose by double polarisation*—500 c.c. of the filtered juice are treated with normal lead acetate (100 c.c. for the leaves, and 50 c.c. for the leaf-stalks), mixed, and filtered (giving solution A). 50 c.c. of the filtrate (solution A) are treated with 50 c.c. of sulphurous acid solution (sp. gr. 1·035—1·040), treated with 1 grm. of purified animal charcoal, mixed, and filtered, the clear liquid (solution B) being polarised in the 400 mm. tube, and the temperature noted. Another 50 c.c. of solution A are treated with 5 c.c. of hydrochloric acid (sp. gr. 1·19) and 25 c.c. of sulphurous acid solution (sp. gr. 1·035—1·040), and inversion effected according to Herzfeld's method, after which 1 grm. of purified animal charcoal is added, and the liquid filtered and polarised, the temperature again being noted (solution C). *Sucrose and reducing sugars by Fehling's solution.* 20 c.c. of solution B are rendered alkaline with sodium carbonate solution, 40 c.c. of Fehling's solution and sufficient water to bring the volume to 80 c.c. added, and the temperature raised to 65° C. for 10 minutes, the cuprous oxide precipitated being determined by the cyanide method (this J., 1914, 494). 50 c.c. of solution C are rendered alkaline with sodium carbonate solution, and the total reducing sugars determined as before. In calculating the sucrose by the double polarisation method, the factor 142·00 is used instead of 142·66 ; while the factor for converting the results obtained on the juice to those on the original substance is 0·91 for the leaves, and 0·97 for the leaf-stalks. According to the author, the results obtained by double polarisation should agree with those found by Fehling's solution to within 0·1%.—J. P. O.

Pectin substances in [*beet*] *sugar factory products* [*and their influence on the determination of raffinose*]. T. Koydl. Oesterr.-Ungar. Zeits. Zuckerind., 1914, **43,** 208—231. Chem.-Techn. Rep., 1914, **38,** 288.

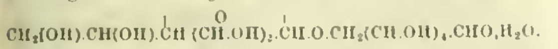
Even when the difference between the values given by direct and double polarisation in the analysis of beet molasses amounts to as much as 3%, this " plus polarisation " is not due wholly to raffinose, of which there may be present only 1%, but is caused by the presence of pectin substances not precipitated by basic lead acetate, the amounts of which are shown to vary considerably throughout the campaign.—J. P. O.

Raffinose [*from cottonseed meal*] *; Preparation of* ——. C. S. Hudson and T. S. Harding. J. Amer. Chem. Soc., 1914, **36,** 2110—2114.

One kilo. of meal is treated with 5 litres of cold water, the mixture quickly filtered by suction, and the filtrate treated with a slight excess (about 200 c.c.) of basic lead acetate solution. The yellow lead precipitate is filtered off, excess of lead removed by hydrogen sulphide, and, after adding about 0·2 grm. of sodium hydrosulphite, the solution concentrated under reduced pressure to a syrup containing about 25% H_2O. Barium hydroxide (2 grms. of octahydrate for each grm. of raffinose) is added, the mixture warmed to not over 80° C., to effect solution, and gradually poured into 1·5 times its volume of commercial anhydrous methyl alcohol, and the granular precipitate ground to a fine powder, filtered off, and washed with methyl alcohol. The barium compound, suspended in about 1500 c.c. of water, is decomposed by gradual addition of 50% phosphoric acid solution until exactly neutral, the precipitate filtered off, and the last traces of barium removed by precipitating with sulphuric acid and again filtering. Fifty grms. of the vegetable carbon, " eponite," are added to the filtrate and filtered off after a few minutes, and the still yellow solution boiled *in vacuo* to a syrup containing 20—25% H_2O. Ethyl alcohol (95%, containing 0·3% HNO_3) is then added, just to saturation (as a rule 10—15 c.c.), and the mixture inoculated with crystals of raffinose hydrate and left overnight at 0° C. to crystallise, the separated crystals being ground with 75% alcohol, filtered off, and washed with alcohol. About 40 grms. of colourless raffinose crystals are obtained, and a further 10 grms. by treating the mother liquor again with barium hydroxide. The proportion of ash (0·5—1%) may be reduced by preparing a 50% aqueous solution, filtering, adding acidified alcohol as above, nearly to the point of cloudiness, and stirring. About 2·5% (referred to the original cottonseed meal) of pure raffinose hydrate, crystallising rapidly at the ordinary temperature, are thus obtained, and a further 0·5% by cooling the mother liquor to 0° C. After washing with 75% and then with 95% alcohol, the product contains less than 0·05% of ash and gives a specific rotation of 123·2° (anhydrous sugar) in 10% aqueous solution at 20° C.—F. Sodn.

Maltose and its oxidation products with alkaline hydrogen peroxide ; Structure of ——. W. L. Lewis and S. A. Buckborough. J. Amer. Chem. Soc., 1914, **36,** 2385—2397.

Maltose is oxidised by alkaline hydrogen peroxide largely without hydrolysis and without formation of saccharinic acids. A larger amount of oxygen is consumed than in oxidation with alkaline copper sulphate (this J., 1909, 1155) and larger amounts of formic and glycollic acids are formed. 100 grms. of anhydrous maltose gave 22·97 grms. of hydrolysed dextrose (24·97 grms. when corrected for decomposition of dextrose under similar conditions), 0·16 grm. of mannonic-lactone, 16·04 grms. of glycollic acid, 0·11 grm. of oxalic acid, 55·37 grms. of formic acid, and 4·44 grms. of carbon dioxide, together with 1·18 grms. of unidentified material, probably containing erythronic and *l*-threonic acids. The proportions and nature of the products are different from those obtained from dextrose (Spoehr, Amer. Chem. J., 1910, **43,** 238 ; Glattfield, Amer. Chem. J., 1913, **50,** 135) and the differences must be due to the glucosido-linkage between the two dextrose residues in the maltose molecule. Maltose is a γ-*d*-glucosido-*d*-glucose and the formation of relatively large quantities of glycollic acid indicates that the terminal (primary alcohol) carbon atom takes part in the glucosido-linkage, the formula hence being :



$$CH_2(OH).CH(OH).\overset{|}{C}H\,(\overset{O}{C}H.OH)_2.\overset{|}{C}H.O.CH_2(CH.OH)_4.CHO,H_2O.$$

Additional evidence in favour of this formula is cited and the mechanism of the oxidation is discussed. (See also Nef, this J., 1914, 366.)—A. S.

Formic acid ; Determination of —— in honey. H. Lührig and F. Doepmann. Jahresber. Chem. Untersuchungsamtes, Breslau, 1912—13, 24—26 ; Z. Unters. Nahr. Genussm., 1914, 27, 477—478.

When honey is mixed with water and submitted to steam-distillation, as in Fincke's method for the determination of formic acid (see this J., 1911, 82, 235 ; 1912, 402 ; 1913, 445), the first portion of the distillate, amounting to 1500 c.c., does not contain all the formic acid present. From 6 to 10 mgrms. of formic acid (or of volatile substances which reduce mercuric chloride) are obtained in each of the three successive quantities (500 c.c.) of distillate collected when the distillation is continued. When a mixture of 100 grms. of sugar, 300 c.c. of water and 1·5 grm. of tartaric acid is distilled with steam, the distillates contain a quantity of reducing substances equivalent to 10 mgrms. of formic acid. Tartaric acid and water alone yield a few mgrms. of reducing substances, and it is pointed out that it is quite possible that a part of these is derived from the rubber connections of the distillation apparatus. In the determination of formic acid in materials containing glyoxylic acid, the distillate should be treated with zinc and dilute sulphuric acid before the mercuric chloride reagent is added ; any basic zinc sulphate precipitated with the mercurous chloride is removed by treating the latter with dilute hydrochloric acid.—W. P. S.

Patent.

Manufacture of an absorbent or decolorising agent. Ger. Pat. 276,343. *See* IIb.

XVIII.—FERMENTATION INDUSTRIES.

Malt ; Purchase of —— on the basis of analysis. H. and J. M. Heron. J. Inst. Brew., 1914, 20, 465—487.

It is a common practice for the maltster to submit to the brewer samples of a run of malt at the beginning of a season, and contract to supply a definite quantity as required, each delivery to correspond approximately with the sample submitted. The suggestions for sampling made by the Committee of the Inst. of Brewing on Malt Analysis (see this J., 1906, 236) may be amplified as follows :—In sampling from sacks, there should be a minimum of five samples for all deliveries, and for large consignments one sample from every ten sacks. The samples should be drawn with a probe or spear and not with the hand, which may be moist. In the case of heaps, at least ten samples should be drawn (from different parts) from bulks up to 100 quarters, and 20—30 from larger bulks. All bins except tall silos, should be probed like heaps. In sampling from tall silos with a conical bottom ending in a spout, two or more sacks should be drawn and samples taken from them. The shaking of larger samples in tins, prior to taking smaller samples, is objectionable since the denser and less modified grains tend to accumulate at the bottom. The best method is to pour backwards and forwards six or more times from one vessel to another. Samples taken immediately after the malt has left the kiln tend to show a lower yield of extract, a higher diastatic activity and a darker colour, than those taken several days later, after the malt has cooled and been screened and brushed. Re-dried malt appears to continue to lose moisture after leaving the kiln, so sampling should be delayed for at least three days. Since the report of the Committee on Malt Analysis various possible sources of error in the determination of extract have been pointed out (see Jones, this J., 1908, 240 ; Day and Amos, this J., 1914, 434 ; Ling and McLaren, this J., 1908, 514 ; Baker and Hulton, this J., 1910, 644 ; Siau, this J., 1912, 197). A difference of ½—¾ lb. of extract between two determinations on the same sample is fair agreement and rather more latitude might be allowed in view of the imperfection of sampling. A consignment of malt, well loaded and dispatched and not unduly delayed in transit, will on an average absorb ½—¾ or even 1% of moisture, so that a maximum of 3% of moisture on delivery is not unreasonable. Siau and Hodson (J. Inst. Brew., 1909, **15**, 67) have pointed out possible sources of error in moisture determinations. In determining the diastatic activity of malt, the reaction of the starch solution is of great importance (see Jones, *loc. cit.*). An alkalinity equivalent to 1 c.c. of N/10 acid per litre, in the distilled water used, lowers the diastatic activity value about 4°. The tube method often gives results 2°—5° higher than the standard method. A difference of ± 5° between sale and delivery samples is reasonable. For colour determinations a difference of ± 1° is not excessive, for the determination is affected by the mode of illumination (see Baker and Hulton, this J., 1906, 552 ; 1907, 268) ; moreover the series "52" glasses do not match the nuance of all malts perfectly, and mild ale and high dried malts often tend to become paler on storage. Tables are given showing, for three different malts, a comparison of the various deliveries, with the sale and bulk samples.—J. H. L.

Yeast ; Some studies on ——. I. Relation of cell reproduction to the supply of free oxygen. II. Metabolism of the yeast cell, with special reference to the thermal phenomena of fermentation. H. T. Brown. Annals of Botany, 1914, 28, 197—226. J. Inst. Brew., 1914, 20, 541—544.

I. When yeast cells are seeded in a liquid containing dissolved oxygen and an excess of nutriment, and the available oxygen is limited to that initially present in the liquid, the total number of cells per unit volume tends to attain a maximum, which is independent of the number of cells seeded but, within certain limits of oxygen supply, is proportional to the initial amount of oxygen, and under these circumstances the rate of reproduction is not logarithmic but is a linear function of the time. The dissolved oxygen does not remain as such in the liquid during reproduction, but is rapidly absorbed by the seed-yeast before cell-budding commences. The author suggests that the "oxygen-charge" absorbed by each cell determines the reproductive power of the cell. If of two equal volumes of liquid, saturated with air, one contains more cells of seed-yeast than the other, and both are deprived of further access of oxygen, the dissolved oxygen will be rapidly absorbed by the cells ; those of the larger seeding will absorb a smaller "oxygen-charge" and therefore will possess a smaller reproductive power than those of the smaller seeding, but this disadvantage will be exactly counterbalanced by their greater number, so that the total number of new cells formed will be the same in both cases. The linear rate of reproduction is explained by the partition of the "oxygen-charge" amongst an increasing number of cells, whereby the rate of subdivision of the individual cells diminishes in inverse ratio as their total number increases. Pasteur first expressed the idea that the oxygen originally absorbed by the yeast from the surrounding medium is the *primum movens* which determines its subsequent power of reproduction. Although a yeast cell can, under favourable conditions, continue to take in oxygen from the medium if this is maintained saturated with air, the cell can only store up a limited amount of oxygen in a form available for subsequent reproduction. All attempts to increase this effective "oxygen-charge" by previously submitting the yeast to strong aeration, or even by passing pure oxygen through the liquid, were unsuccessful ; the yeast under these conditions continues to take up oxygen, but its potentiality of reproduction is not thereby increased. Under favourable conditions, with the yeast cells at a concentration of 1 in 1/4000 cub. mm of nutrient liquid, the volume of oxygen taken up by each cell and constituting the oxygen charge, is about 5 times the volume of the cell itself.

II. Experiments made with large volumes of fermenting wort indicated that the heat of fermentation (including heat of hydrolysis) of 1 grm. of maltose is about 125 calories. Between 14° and 16° C. a yeast cell ferments its own weight of sugar in 8½—9½ hours, and the heat generated in 1 hour, is sufficient to raise the temperature of the cell by 15° or 16° C. The temperature coefficient of fermentation by yeast is high. The following figures, calculated from data given by Slator, represent the relative rates of fermentation of top-fermentation brewery yeasts at temperatures starting from 5° C. and rising by increments of 5° to 40° C. :—1·00, 2·65, 5·59, 10·05, 15·80, 22·59, 30·50, 36·60. The apparently wasteful metabolism of the yeast cell is a necessity imposed by the conditions under which reproduction occurs in nature, *e.g.*, in fruit juices. These conditions are altogether different from those of the fermentation industries, where the fermentative faculty of the cells has been purposely enhanced and their reproductive faculties have been restricted.—J. H. L.

Yeast cells ; Staining of —— by Methylene Blue, etc. C. G. Matthews. J. Inst. Brew., 1914, **20**, 488—496.

The method of staining employed was to prepare an aqueous suspension of the yeast, sufficiently dense to show a just perceptible opalescence, and to treat portions of 3 c.c. with the staining solution, *e.g.*, 0·1 c.c. of a 0·1% solution of Methylene Blue, or 0·2 c.c. $N/10$ solution of iodine diluted twenty-fold. A number of pitching yeasts were investigated in this way. With Methylene Blue, dead and torpid cells assumed a pallid stain, but from 1 to 20% of the cells stained a sapphire colour. The following conclusions are drawn respecting this deeper staining :—It is not confined to *S. Cerevisiae* though shown best by this race. It is independent of the glycogen reaction of the cells, and, in large measure, of staining by other dyes, as Indigo Carmine or Cochineal Carmine. The cells so stained are not necessarily dead or torpid in the ordinary sense. Those likely to stain can be identified by their higher refractive power, showing up brightly when the microscope objective is slightly out of focus, and they usually have smaller or ill-defined vacuoles or none at all. The progeny of a non-staining cell may stain, even to 3 to 4 individuals, though staining cells seldom give rise to non-staining ones. The budding of a staining cell seems frequently to be arrested when a small bud has formed, but sometimes a pair of equal-sized cells, presumably mother and daughter, will stain, and such cells tend to remain attached. In stained cells all parts take the stain. The phenomenon appears to indicate a change of state and possibly of function in the cell, probably a resting stage in which there may be accumulation of reserve nutriment (but not necessarily glycogen, though it may be fat) and a perceptible diminution or temporary arrest of the vegetative activity. It is not necessarily a permanent change, as a fresh fermentation under favourable conditions may entirely alter the condition of the cell.—J. H. L.

Yeasts ; Assimilation of maltose by ——. G. Kita. J. Chem. Ind. Tokyo, 1914, **17**, 274—278. Chem.-Techn. Rep., 1914, **38**, 262.

In solutions containing ammonium nitrate as source of nitrogen, Schuchardt's "pure maltose" was less readily assimilated by yeasts after it had undergone a preliminary extraction with absolute alcohol. The commercial maltose appears therefore to contain besides protein (see Kluyver, this J., 1913, 803 ; Davis, this J., 1914, 1068) some other constituent, similar to oryzanin which increases its assimilability.—J. H. L.

Enzymes of yeast ; Susceptibility of the various —— to thermo-regeneration. G. Bertrand and M. Rosenblatt. Comptes rend., 1914, **158**, 1823—1826.

Unlike the sucrase, neither the maltase nor the catalase of yeast maceration juice exhibited the phenomenon of thermo-regeneration (see this J., 1914, 658). The activity
of both was completely destroyed by heating the ju
to 70° C. for 1 min., and was not restored even partially
higher temperatures.—J. H. L.

Beers ; Chilled bottle ——. A. Hadley. J. Inst. Bre
1914, **20**, 504—533.

There are two main methods of chilling beers, *viz.*, c
storage and quick chilling, and the latter, which is l
costly, provided always that the beer is properly c
ditioned, gives results equal to the slow chilling proce
The beer is run or pumped from the skimming vessels
glass-lined copper or wooden tanks to condition. H
it is dry-hopped if necessary, primed if customary, a
usually partially fined. A conditioning is thus effect
which cannot be attained in casks, whilst there is far l
waste, and the beer is cleaner and brighter after havi
settled for a few days, so that the filters run far long
than when the beer is conditioned in casks. In or
to save time, many brewers have installed a quick-chil
of the counter-current or some similar type betwe
the conditioning and chilling vessels. The beer can th
be cooled to 35° F. (2° C.) before entering the chilli
and carbonating vessels in which its temperature is s
further reduced, *e.g.*, to 28° F. (—2° C.). Continuo
carbonation appears to be working satisfactorily in
number of breweries. The chilling is kept entir
separate from the carbonating, and the chilled beer
pumped through the carbonator which is placed eit
between the chilling plant and the filter or between t
chiller and the filling machines. This arrangement
said to give more uniform results, keeping the beer
quieter condition for bottling. The author gives a num
of practical notes on filters, refrigerating plant, bottli
machines, washing plant and stoppering and labelli
The collection of carbon dioxide from fermentation v
permits of considerable economy. Owing to the dang
of overheating the gas, and thus affecting the flavo
of the carbonated beers, it is not advisable to compr
the carbon dioxide to more than about 100 lb. per sq.
The collection of the gas should be started about 15 ho
after pitching, and is usually continued for 24—30 hou
The average amount produced from a 100-barrel ferment
tion vat is roughly 10 lb. per hour, and the total quant
should be sufficient to carbonate about 400 barrels
beer, or a smaller number if carbon dioxide is used
top-pressure.—J. H. L.

"Mirin" and its turbidity ; Chemistry of ——.
Takahashi, Y. Shimazu and S. Hagiwara. J. Agr
Tokyo, 1913, **5**, 179—187. Z. Unters. Nahr. Genuss
1914, **27**, 604—605.

"*Mirin*" is a rather thick, yellowish brown, strong
alcoholic beverage made from swollen rice, ferment
by cultures of *koji* or *shoyu*. After fermentation h
proceeded for 40—50 days in open vessels, the express
liquid is allowed to stand until clear. With a sp. gr.
about 1·138, it contains 10—12·54% of alcoh
1·86—4·96% of dextrin, 30·1—32·89% of sugar and abo
0·12% of ash. Fermentation is accompanied
saccharification of starch and decomposition of protei
Organic acids are also formed, but if in too large amoun
they promote excessive proteolytic enzyme action and t
amino-acids produced give rise to turbidity in the bevera
To avoid this the acidity of the mash must be kept with
certain limits by addition of sodium carbonate, and ca
should be exercised in the selection of the yeast materi
—J. H. L.

Wine ; Colour reactions of constituents of ——.
Schaffer. Mitt. Lebensm.-Unters. u. Hyg. Schwe
Gesundheitsamt, 1913, **4**, 206—211. Z. Unters. Na
Genussm., 1914, **28**, 120—121.

White wines and raisin wines are almost free fro
tryptophol (β-indole-ethylalcohol), whereas red win
invariably contain it. It may be isolated by shaki
10 c.c. of the wine with a mixture of ether, amyl alcoh
and petroleum spirit (8 : 1 : 3) and treating the resid
left on evaporating the extract with a few crystals

dimethylaminobenzaldehyde, a little alcohol, and a few drops of 25% hydrochloric acid. In the presence of tryptophol (1 : 10,000) a violet coloration is obtained slowly at the ordinary temperature and immediately on heating. In addition to *l*-arabinose, wines may contain another pentose, which yields furfural when the wine is distilled, even without the addition of hydrochloric acid. For the furfural test 10 c.c. of the wine (diluted if necessary) are distilled with 10 c.c. of hydrochloric acid (sp. gr. 1·18), until about 16 c.c. of distillate have been obtained. About 10 c.c. of this are mixed with 6 to 8 c.c. of 85 to 98% alcohol and 1 to 2 c.c. of a cold saturated solution of phloroglucinol in hydrochloric acid (sp. gr. 1·06). Any violet coloration will usually appear in about 4 to 5 hours (sometimes 8 to 9 hours), and generally disappears again in a few hours. Wines containing more than 4 grms. of sugar per litre should be diluted and fermented before testing. Artificial wines (raisin wine and wine from spent grapes) usually give a negative or faintly positive result, whilst natural wines invariably give a distinct reaction. A mixture of wine from spent grapes with 20% of red wine gave the reaction. The violet coloration was faintest with light Spanish wines and French and Spanish red wines.—C. A. M.

Quercetin in wine; Determination of ——. T. v. Fellenberg. Mitt. Lebensm.-Unters. u. Hyg. Schweiz. Gesundheitsamt, 1913, **4**, 1—14. Z. Unters. Nahr. Genussm., 1914, **28**, 118—119.

The colouring matter quercetin can be readily extracted from wine by ether; it is nearly insoluble in water but is soluble in strong alcohol. Wines also contain a water-soluble tannin, probably quercitrin, as the main constituent of their colouring matter. The colouring matter extracted with ether dyes wool mordanted with alumina yellow, and that mordanted with alumina and tin bright yellow in dilute and orange yellow in concentrated solutions. Unmordanted animal and vegetable fibres are not dyed. To determine the yellow colouring matter 10 c.c. of the wine are extracted with cold ether, the ethereal extract distilled, and the residue dissolved in water, and (in the case of red wines) heated for 10 mins. on the water-bath with unmordanted woollen threads 10 cm. in length to remove the foreign dirty-grey colouring matter. The quercetin is then absorbed by 0·01 grm. of mordanted wool (10 mins. in the water-bath), and the dyed fibres washed, dried, and compared with standard fibres dyed with a solution of quercetin (1 mgrm. per litre). White wines seldom contain more than 0·1 mgrm. whilst red wines contain up to 48 mgrms. of quercetin per litre. The yellow colouring matter in the wine is derived from the grape skins, and should a white wine contain about 8 mgrms. thereof it is derived from the spent grapes (*Tresterwein*); wines containing more than 4 mgrms. are suspicious. The colouring matter is first formed during fermentation in contact with the skins. Tea leaves contain a colouring matter resembling but not identical with quercitrin. The yellow colouring matter in wine consists of quercitrin, traces of quercetin, and a decomposition product of chlorophyll.—C. A. M.

Saffron yellow in white wine; Detection of ——. V. Kreps. Arch. Chem. u. Mikrosk., 1912, **5**, 24—31. Z. Unters. Nahr. Genussm., 1914, **28**, 121.

The colouring of white wines with saffron is legal in Hungary though forbidden in Austria. "Saffron yellow" differs from the natural wine colouring matter in not being affected by alkalis. It does not react with strong solutions of organic acids or with strong mineral acids. It is precipitated by lead acetate as a lemon yellow precipitate, whilst the filtrate shows a light yello coloration. It can be largely extracted with amyl alcohol from the wine acidified with hydrochloric or sulphuric acid, but not from an alkaline solution. Fat-free wool will fix the saffron colouring matter, but it can be extracted again practically unchanged by means of 3% ammonia solution. —C. A. M.

Potassium and magnesium; Determination of —— *by physico-chemical volumetric methods. Application to the analysis of wines.* M. Duboux. Comptes rend., 1914, **159**, 320—323. J. Chem. Soc., 1914, **106**, ii., 745—746. (Compare Dutoit and Duboux, this J., 1908, 871, 912.)

Potassium can be estimated in wines by determining the conductivity of the solution after the repeated additions of small amounts of chloro-platinic acid, after the addition of eighteen times its volume of alcohol. A change in the direction of the conductivity curve indicates the end of the precipitation. It is necessary to wait some time for the conductivity to become constant after each addition of the reagent, and also to destroy the organic matter in the wine by evaporation and ignition prior to the estimation. For the estimation of magnesium, the conductivity is measured in a solution containing 0·02% NH_3 and 0·06% NH_4Cl after the addition of measured small quantities of $N/2$-phosphoric acid. Before performing the titration, the organic acids in the wine must be destroyed and the phosphoric acid and lime removed by precipitation. Fifty c.c. of the wine are treated with 3 c.c. of $N/1$-sulphuric acid and 100 c.c. of alcohol. After two hours the calcium sulphate is filtered off, and to the filtrate is added 3·5 c.c. of $N/1$-ammonia and 7 c.c. of a 16% solution of lead nitrate, which precipitates the phosphates. The whole is warmed on the water-bath, filtered, and to the filtrate 5 c.c. of $N/1$-sulphuric acid are added and the lead sulphate filtered off. The solution is evaporated to dryness and calcined, the residue is dissolved in 5 c.c. of $N/10$-HCl, 50 c.c. of $N/10$-ammonia are added, and the liquid titrated with the phosphoric acid.

Products derived from the date palm. Raynaud. *See* XIXa.

Methyl alcohol in corn silage; Occurrence of ——. Hart and Lamb. *See* XIXa.

Patent.

Liquids such as stout, beer and the like; Pasteurising, sterilising and cooling ——. H. S. Gregory, Palmers Green, Middlesex. Eng. Pat. 19,159 of 1913; date of appl., Feb. 23, 1914.

The liquid is pumped under pressure into the upper part of a jacketed conical chamber over the sides of which it is distributed in the form of a film; the supply of heating agent to the jacket and the flow of liquid to the chamber are controlled by a thermostatic device. The sterilised liquid flows through a float-chamber into a cooling chamber, the flow being so regulated by the float that the liquid remains in the float-chamber for from 15 to 20 minutes. The cooled liquid escapes through a pipe into which is also passed the liquid resulting from the condensation of the vapours from the heating vessel. —W. P. S.

XIXa.—FOODS.

Milk samples for analysis; Preservation of ——. J. Tillmans, A. Splittgerber and H. Riffart. Z. Unters. Nahr. Genussm., 1914, **27**, 893—901.

Thymol, phenol, creosote, and sodium fluoride exert only feeble preservative action, the milk coagulating after 24—48 hours. The coloration produced by potassium bichromate interferes with the determination of acidity. Chloroform raises considerably the refractometric value and the (apparent) fat-content, and creosote lowers the specific gravity of the milk. The diphenylamine test for nitrates is rendered worthless by the presence of potassium bichromate, and less sensitive by thymol, creosote, mustard oil and phenol. Mercuric chloride is the only satisfactory preservative. At a concentration of 0·03—0·04% it keeps the milk fresh for 120 hours, with no appreciable increase of acidity; it has no influence on the determination of specific gravity, refractometric value and fat-content, and is the only one of the substances studied which preserves any nitrates in the milk from decomposition so that they can be accurately determined by the diphenylamine method (Tillmans, this J., 1911, 44) even after 120 hours. It is used by the Municipal Hygienic Institute of Frankfort-on-Maine in the official milk control, the samples being treated with 2 c.c. of a 0·5% solution per 250 c.c. Its toxic nature demands certain precautions, *e.g.*, the samples are treated with 0·2 c.c. of a 1% aqueous solution of Congo-red; this colouring matter has no influence on the analytical results, and in the coagulation of proteins by calcium chloride it is completely precipitated, leaving a colourless serum. (Cp. Rocques, this J., 1912, 742; Denigès, this J., 1913, 670.)—J. H. L.

Milk; Titration of —— with alcohol of various strengths. F. Löhnis. Molkerei-Zeit., Hildesheim, 1914, 153. Biedermann's Zentr., 1914, **43**, 496—497.

Two c.c. of milk are run into a beaker so as to form a thin layer over the bottom and titrated with alcohol until the first appearance of coagulation. The number of c.c. used is called the "alcohol number" of the milk. If more than 6 c.c. are required, the end point is uncertain. Alcohol of 70, 80 and 90% strength by volume was used, and it was found that 80% alcohol gave the most reliable results. The alcohol number gives an indication of the number of bacteria in the milk; with a low germ content the milk requires more than 4 c.c., with a medium germ content 2—4 c.c., and with a high germ content less than 2 c.c. The alcohol number indicates also the quality of the milk.—J. H. J.

Margarine; The butter-fat content of ——. W. Arnold. Z. Unters. Nahr. Genussm., 1914, **27**, 379—388.

The following determinations should be made in order to determine the presence or absence of butter-fat in margarine :—saponification value, Reichert-Meissl value, and Polenske value, both of the fat itself and of that portion which is soluble in alcohol; the molecular weight of the water-soluble fatty acids should also be determined. In the case of a margarine free from butter-fat and palm fats the Reichert-Meissl and Polenske values will be not greater than 0·55. The relation between the Reichert-Meisal and Polenske values will be as follows when the margarine consists of animal fats (or vegetabl fats free from volatile fatty acids) and coconut oil :—

Coconut oil %	2	6	10	14	20	25	30	40	5
Reichert-Meissl value	0·9	1·65	2·37	3·2	3·9	4·5	4·84	5·8	6·7
Polenske value	0·05	0·95	1·3	1·65	2·4	3·0	3·65	5·05	6·5

When the Reichert-Meissl value is greater than tha indicated in the table, the presence of butter-fat i indicated; when it is lower, palm-kernel oil is present The presence of palm-kernel oil is also indicated by Polenske value exceeding 0·6, when the molecular weigh of the soluble fatty acids is above 130, and by the characte of the volatile insoluble fatty acids; the latter, bot from the original fat and from the alcohol-soluble fat are solid. In the case of margarine containing butter-fa and free from palm oils, the Reichert-Meissl and Polensk values of the fat and its alcohol-soluble portion will giv the proportion of butter-fat present; the molecula weight of the soluble fatty acids will lie between 97 an 107.—W. P. S.

Butter; Water-content of ——. W. Theopold. Be Nahrungsm. Untersuchungsamtes Bromberg, 1913, 1 Z. Unters. Nahr. Genussm., 1914, **28**, 109—110.

It has been asserted that butter increases in weigh by absorption of water when moistened externally o placed in cold water for 70 hours. This is disproved b experiments cited. A sample of butter containing 22·9 water showed 22·6% after the treatment, whilst anothe sample with 18·8% showed 18·2%.—C. A. M.

Wheat and its products; Composition of ——. H. Kalnin and A. Schleimer. Z. ges. Getreidew., 1913, **5**, 199 Chem.-Techn. Rep., 1914, **38**, 174.

Wheat was separated by milling into various portion the composition of which is shown in the following table :-

	Flour.			Feeding meal. 78·71 to 80·92 %	Fine bran. 80·92 to 89·34 %	Coarse bran. 89·34 to 92·72 %	Husk-bran. 92·72 to 98·47 %	Husk offal 1. 98·47 to 99·78 %	Husk offal, 2. 99·78 to 99·79 %	Germ. 99·79 to 100 %
	0 to 31·48 %	31·48 to 73·46 %	73·46 to 78·71 %							
Total protein	13·24	15·08	19·36	20·35	18·30	17·39	17·39	14·62	14·18	28·50
Fat	1·14	1·86	4·04	4·63	5·38	5·15	5·18	3·52	2·42	6·85
Starch	79·29	74·69	61·13	47·18	15·65	8·74	14·14	24·36	24·56	29·90
Sugar, as dextrose (after hydrolysis)	5·23	7·27	11·13	13·46	8·80	8·60	8·67	8·77	7·83	18·75
Pentosans	2·59	3·37	5·52	11·62	22·52	30·49	29·32	24·96	27·02	12·63
Crude fibre	0·12	0·20	1·09	3·24	9·87	11·60	9·76	19·41	13·36	3·32
Ash	0·49	0·88	2·36	3·32	5·82	7·59	7·54	4·44	4·50	4·72
Phosphoric acid	0·23	0·50	1·27	1·70	2·90	3·44	3·75	0·98	0·75	2·52

—W. P. S.

Rye and its products; Composition of ——. M. F Neumann and H. Kalning. Z. ges. Getreidew., 1913, 5 41; Chem.-Techn. Rep., 1914, **38**, 174.

A normal specimen of rye was, by careful milling, separate into four grades of flour (yield 73%), bran, husk, offal, an germ; these portions had the following composition :—

	Flour.				Bran. 72·82 to 96·22 %	Husk offal, 1. 96·22 to 98·64 %	Husk offal, 2. 96·64 to 98·65 %	Offal. 98·65 to 99·81 %	Germ. 99·81 to 100 %
	0 to 31·05 %	31·05 to 62·10 %	62·10 to 67·28 %	67·28 to 72·82 %					
Total protein	6·70	11·00	14·47	16·58	17·58	21·05	11·14	13·36	44·74
Fat	0·64	1·43	2·49	2·71	3·62	5·98	2·87	3·40	11·95
Starch	81·53	69·44	60·27	55·40	20·49	13·52	11·30	29·41	—
Sugar, as dextrose (after hydrolysis)	5·00	7·54	12·03	14·02	15·08	9·06	4·77	8·31	—
Pentosans	3·55	5·25	7·02	8·13	22·59	24·17	36·35	24·84	7·32
Crude fibre	0·07	0·40	0·93	1·22	5·79	10·85	14·39	10·84	3·94
Ash	0·46	0·94	1·74	2·09	4·83	4·34	3·25	3·84	5·54
Phosphoric acid	0·18	0·42	0·87	1·04	2·42	1·55	0·89	0·98	3·11

—W. P. S.

Feeding-stuffs; Valuation of —— by means of chemical analysis. A. Smetham. J. Roy. Lancashire Agric. Soc., 1914. Analyst, 1914, 39, 481—491.

The results of analyses of a large number of feeding-stuffs are shown in the following table (*cf.* this J., 1910, 39, 40. "Albuminoids" represent total nitrogen, multiplied by 6·25. "Digestible carbohydrates" include all non-nitrogenous organic matter, except woody fibre and fat. The "food units" are calculated on the assumption that oil and albuminoids are of equal value, and together are 2·5 times as valuable as carbohydrates. When a food has been ascertained to have poisonous properties, the fact is stated in the tables, but the absence of such a statement does not necessarily imply that the foods are wholesome:

Name.	Water.	Oil.	Albuminoids.	Digestible carbohydrates.	Woody fibre.	Mineral matters.	Sand and silica.	"Food units."
Wheat, Indian, hard	9·94	1·50	9·81	75·40	1·50	1·85	—	104
,, ,, soft	13·33	1·76	10·50	69·42	2·10	2·89	—	100
Flour patents, American	12·00	1·37	12·75	73·46	0·07	0·35	—	109
,, standard (Rollston)	13·90	1·77	11·88	70·70	0·80	0·95	—	105
,, brown germ,	11·40	2·97	14·25	69·51	0·67	1·20	—	113
Wheat, pollards, La Plata	11·30	4·17	19·13	55·73	5·42	4·25	0·10	113
,, germ (good)	13·30	8·63	31·37	42·00	0·60	4·10	—	142
"Meal seeds" (refuse from oatmeal)	9·10	5·17	10·12	57·78	14·53	3·30	1·70	96
"Oat feed" (refuse from oatmeal)	10·05	5·90	7·63	52·49	19·83	4·10	1·90	86
Rye flour	12·15	1·77	9·75	74·67	0·16	1·50	0·15	103
Millet, Russian	12·00	4·43	10·50	61·65	8·37	3·05	1·60	99
,, Manchurian	12·80	3·83	9·38	70·58	1·71	1·70	0·05	104
American white Kaffir corn	11·90	3·30	10·63	71·44	1·48	1·25	0·05	106
Flaked maize (feeding)	12·90	3·57	9·38	71·28	1·77	1·10	—	104
Maize grits	12·50	1·53	7·50	77·22	0·60	0·65	—	100
Maize bran	13·75	3·10	6·13	62·94	12·93	1·15	—	86
Germ corn flour	11·90	4·40	8·38	73·47	0·40	1·45	—	105
Rice flour, Canadian	12·75	0·93	7·00	78·15	0·17	0·70	—	98
Rice meal or bran:								
Australian	9·15	17·83	13·00	44·29	5·83	9·90	2·75	121
Siam	9·25	16·60	11·75	50·32	3·83	8·25	1·55	121
Demerara	9·00	21·37	12·63	41·35	5·80	9·85	4·65	126
Beans: Chinese, split	13·55	2·17	25·75	48·20	6·88	3·45	0·30	118
Large Japanese haricot (old crop)	14·25	1·80	20·25	56·53	3·67	3·50	—	111
White African (Vigna Catiang)	14·85	1·67	21·75	52·80	2·78	3·15	0·05	119
Rangoon red (sometimes poisonous)	11·75	1·37	20·00	59·16	4·02	23·70	0·10	113
Soya: Manchurian	11·80	17·60	38·13	22·06	5·26	5·15	0·55	161
Korean	10·35	17·30	38·13	22·89	6·93	4·40	—	161
Caucasus	10·25	19·17	31·63	24·27	6·68	5·00	0·10	158
Egyptian	10·05	19·33	35·88	22·72	5·72	6·30	0·15	161
Argentine (from Manchurian seed)	14·05	19·90	32·13	24·34	4·08	5·50	0·05	154
China soya bean cake	17·75	5·00	47·50	18·46	5·49	5·80	0·35	150
English soya bean meal (extracted)	11·82	1·50	44·00	32·08	5·38	5·22	0·44	146
Chinese bean cake (rolled)	8·65	17·60	39·00	25·48	4·42	4·85	0·15	167
,, ,, (crushed)	9·10	10·23	42·75	27·82	4·90	5·20	0·20	160
,, ,, (from Southern ports)	11·65	5·60	46·12	25·46	4·47	6·70	1·20	155
Manchurian bean cake	15·60	8·60	41·37	24·81	4·37	5·25	0·20	150
Peas: Calcutta, green	14·50	1·80	25·75	47·94	7·01	3·00	0·25	117
Chinese, green	12·05	1·13	22·50	51·68	6·89	2·75	0·35	114

Name.	Water.	Oil.	Albuminoids.	Digestible Carbohydrates.	Woody fibre.	Mineral matters.	Sand and silica.	"Food units."
Peas: Russian	17·45	1·83	23·62	48·57	5·53	3·00	0·55	112
Pea hulls, white	12·20	0·73	5·25	31·05	47·92	2·85	0·10	46
,, ,, (from Calcutta white peas)	8·45	0·50	6·63	35·16	46·41	2·85	0·05	51
Tares, Russian	12·90	1·70	23·20	50·67	6·77	4·70	1·30	113
"Bombay tares"—pigeon pea (*Cajanus Indicus*)	12·00	2·07	20·38	55·67	6·38	3·50	0·05	112
Linseed: Calcutta	7·60	38·67	18·50	22·36	8·37	4·50	1·05	165
Manchurian	9·35	37·87	21·88	22·58	4·87	3·45	0·20	172
Morocco	—	40·87	—	—	—	—	—	—
Riga	9·45	35·38	22·69	22·20	5·83	4·45	0·70	167
La Plata	7·92	35·12	22·36	24·82	5·82	3·96	0·11	168
Linseed cake from Riga seed	16·40	12·73	28·50	31·15	5·77	5·45	0·95	134
American	9·95	5·40	31·12	41·22	7·31	5·00	0·05	133
Prime Western Canadian	11·45	7·12	31·81	36·47	8·35	4·80	0·10	134
Bombay	9·60	10·32	30·83	33·86	8·22	7·17	1·92	137
Chinese	9·25	10·93	33·12	29·63	10·87	6·20	1·90	140
Mexican	10·85	11·37	28·09	34·63	9·90	5·16	0·62	133
Spanish	11·45	6·77	32·13	32·08	10·27	7·30	1·80	—
Cottonseed: Egyptian	8·80	23·93	19·56	21·54	21·16	5·01	0·80	30
Brazilian	9·35	23·20	21·09	24·96	17·05	4·35	0·07	136
Bombay	8·46	19·37	17·95	29·88	19·99	4·35	0·44	123
South Russian	9·75	24·12	18·66	26·20	17·62	3·65	0·10	133
Chinese	10·85	13·40	18·63	26·64	26·68	3·80	0·05	91
Sudan	10·50	16·50	21·88	26·89	19·88	4·35	0·05	123
Smyrna	9·75	20·87	17·50	25·73	22·25	3·90	0·15	122
Mersyne (Levant)	9·90	18·47	15·25	29·11	23.77	3·20	0·05	114
,, (decorticated)	7·55	37·23	30·87	17·15	1·85	5·35	0·10	187
Decorticated cotton cake meal:								
North American Gulf ports	7·85	8·70	46·50	25·45	6·25	5·25	0·05	163
*Atlantic ports	7·40	10·16	42·37	25·86	7·00	7·15	0·05	157
Decorticated cotton cake:								
Bombay	7·50	9·97	35·38	32·00	7·75	7·40	0·65	145
Undecorticated cotton cake:								
Calcutta	8·95	4·90	21·00	38·45	22·35	4·35	0·25	103
Bombay	9·97	6·05	22·00	34·98	20·94	6·06	1·20	105
Smyrna	10·97	6·78	24·25	33·26	20·11	4·63	0·05	111
Mersyne	11·31	4·39	18·25	35·58	26·56	3·91	0·20	92
West Indian	10·15	6·59	26·25	33·51	18·80	4·70	0·10	116
Brazilian	11·00	5·37	27·12	27·13	24·93	4·45	0·15	108
Cottonseed pollards	10·55	2·07	8·25	40·88	34·50	3·75	0·55	67
Rape seed Ferozopore	5·70	39·23	22·00	22·45	4·17	6·15	1·65	176
Ravison seed	6·65	23·40	25·50	19·87	10·73	13·85	0·05	142
Brown colza cake, Cawnpore	6·55	6·87	35·63	34·15	6·30	10·50	2·75	140
Mustard seed cake (brown)	12·15	7·73	18·00	39·86	17·61	4·65	0·65	104
"Dodder" cake (Camelina)	8·80	9·43	32·75	27·22	10·20	11·60	4·95	133

* During the past few years an alteration has taken place in the character of decorticated cottonseed cake and meal from the United States. At present, very little cottonseed is being imported into the United Kingdom as cake, the bulk of that arriving here being ground into meal before shipment. More woody fibre is present than formerly. The contracts on which American decorticated cottonseed meals are now usually sold require choice meal to contain at least 40, prime meal at least 38, and good meal at least 35·5% albuminoids, with allowances if the outturn is below the stipulated amount. Texas meal is usually sold on a basis of 52% oil and albuminoids together.

Name.	Water.	Oil.	Albuminoids.	Digestible carbohydrates.	Woody fibre.	Mineral matters	Sand and silica.	"Food units."
"Gold of pleasure" cake (Camelina)	10·25	11·20	35·37	25·64	11·53	6·01	0·80	142
(Copra) South Sea	4·15	67·67	8·25	15·70	2·33	1·90	—	206
,, Malabar	3·60	70·90	7·88	13·62	2·25	1·75	—	211
Coconut cake: Macassar	9·30	16·96	18·75	40·56	8·98	5·45	0·30	130
Poonac cake	8·65	15·93	21·12	36·80	10·60	6·90	1·45	129
Coconut fibre	11·40	0·90	0·94	54·46	27·90	4·40	0·20	59
Palm kernels	4·90	50·35	9·63	26·58	6·64	1·90	0·05	177
"Eaba palm" seeds, Demerara	27·50	0·30	4·25	44·48	21·47	2·00	—	58
Euphorbia classica nuts	8·10	39·07	18·25	14·51	16·97	3·10	0·05	158
Acoomoo beans, Lagos	4·90	63·03	8·62	12·97	8·53	1·95	—	192
Cuajo nuts (*Myristica Surinamensis*)	3·75	65·23	8·75	10·64	9·68	1·95	0·10	196
Toulouconna nuts, African	9·95	39·40	4·00	38·67	6·48	1·50	0·10	147
"Botter bean" acorn, from Africa (*Quercus Ilex var. Ballota*). Husk 21·9 per cent., kernel 78·1 per cent. Kernels yielded	28·15	5·84	5·12	57·59	1·50	1·80	—	85
Dhomba seed (*Calophyllum inophyllum*)	3·10	74·30	6·88	7·01	6·51	2·20	—	210
Dhomba meal (extracted)	10·00	20·23	20·75	29·74	11·53	7·75	2·10	132
Coulby nuts	4·82	61·70	7·82	17·30	5·09	3·27	0·05	191
Lamy nuts	7·87	46·80	4·51	32·85	6·00	1·97	0·10	161
Cohune nuts (kernels)	6·25	69·71	7·50	12·62	2·07	1·85	—	206
Pignolia kernels	7·25	45·50	37·25	4·98	0·47	4·55	0·05	212
Shea nuts, West African	5·65	48·80	7·38	32·74	2·68	2·75	0·05	173
,, ,, ,,	5·80	52·67	9·38	26·15	3·25	2·75	—	181
Shea-nut meal	12·70	4·73	12·37	57·67	6·48	6·05	0·65	100
Sesbania macrocarpus, from Colorado River	10·80	6·03	37·25	31·29	11·08	3·55	0·30	139
Sesame seed, Cyprus	—	53·80	—	—	—	—	—	—
,, cake, Brazilian	6·50	30·72	34·13	16·77	3·68	8·20	0·64	179
,, ,, Egyptian	8·35	8·20	44·75	18·82	5·53	14·35	4·95	151
"Sim-Sim" cake, East Africa (Sesame)	8·55	17·13	38·88	21·22	3·97	10·25	1·25	161
Till cake, Akola (India Central Provinces)	8·40	8·93	38·87	25·50	3·50	14·80	2·75	141
Ground nuts:								
Decorticated Chinese	5·35	45·73	25·88	19·64	1·25	2·15	0·05	199
,, W. African	7·00	44·03	27·63	17·64	1·00	2·70	—	197
Ground-nut cake, decorticated, Rangoon	8·25	5·53	48·00	28·35	1·67	8·20	4·05	162

Name.	Water.	Oil.	Albuminoids.	Digestible carbohydrates.	Woody fibre.	Mineral matters	Sand and silica.	"Food units."
Ground-nut cake, decorticated, River Plate	9·15	16·60	14·25	21·09	4·46	4·45	0·55	173
Ground-nut cake, undecorticated, Burma	10·10	9·33	28·50	25·29	22·47	4·40	1·00	120
Ground-nut cake, undecorticated Macassar	8·85	9·43	31·63	22·94	17·73	9·42	4·92	126
Arichide shells	7·85	5·03	7·38	20·91	54·90	3·90	2·20	52
Sunflower seed cake:								
South Russian, peasant made	7·27	18·47	33·19	19·34	14·83	6·90	1·60	148
Odessa, hydraulic	7·75	8·68	38·38	22·46	16·03	6·70	0·95	140
Marrotty seed meal, extracted (*Hydnocarpus venenatus*), poisonous	7·05	4·30	23·00	27·55	30·70	7·40	1·10	—
Castor-oil seeds, poisonous	7·31	43·96	17·75	7·76	20·20	3·02	—	—
Cottonseed meal (extracted)	11·75	1·10	30·62	13·96	36·52	6·05	—	—
"Nut residue" from mixed Sapotaceæ, South Sea Islands	9·90	7·96	14·57	49·54	14·43	3·60	1·50	106
Cacao, Guayaquil	3·55	47·20	15·38	27·39	2·53	3·95	0·15	183
Hop meal	7·15	9·93	27·50	31·90	16·97	6·55	1·75	125
Arrowront from Formosa (natural condition)	63·00	0·23	2·12	32·33	0·87	1·45	—	38
Sago flour, Borneo	15·70	0·20	1·37	75·61	2·17	4·95	4·25	79
,, ,, 1st quality	11·70	0·13	0·13	87·56	0·13	0·35	0·10	88
,, ,, 2nd quality	16·30	0·17	1·12	76·91	3·30	2·20	1·60	80
Farina middlings	13·55	0·63	1·88	80·21	1·58	2·15	0·10	86
Tapioca flour, Ampas	12·70	0·23	0·88	80·47	4·87	0·85	—	83
,, ,, Penang	11·80	1·27	3·00	78·73	0·60	4·60	3·65	89
,, ,, Low Java	13·80	0·43	1·37	74·08	5·47	4·85	2·10	79
,, -seed pearl	13·50	0·20	0·12	85·96	0·07	0·15	—	87
Manioc-roots meal, Java	11·70	0·70	2·63	81·62	1·65	1·70	0·10	90
Hemp-seed cake, Manchurian	7·40	9·83	30·88	20·32	25·07	6·50	2·20	122
Distillery meal	5·10	23·50	25·19	33·87	11·33	1·01	0·35	156
,, grains	73·98	2·15	5·88	12·35	4·86	0·78	0·26	32
Pressed yeast	71·70	0·85	16·44	8·10	—	2·90	—	51
"Crawtaes" (Achenes of *Ranunculus repens*) poisonous	10·80	13·70	11·30	18·25	36·05	9·70	3·60	—
"Distilled grape seeds"	8·60	10·72	10·06	33·76	31·54	5·32	—	86
"Apple offal"	9·50	5·93	9·50	48·15	19·27	7·65	4·15	87
"Tomato meal"	7·25	15·62	27·00	14·93	30·05	5·15	0·70	121
Beet pulp cake	12·25	2·77	6·88	55·81	18·59	3·70	0·35	80
Dried beet pulp	11·80	0·83	8·75	58·92	16·45	3·25	0·05	83
Beet fodder, Spanish	12·00	0·60	8·87	61·52	10·21	6·80	0·05	85
Peat dust	21·15	2·90	6·50	43·65	22·80	3·00	1·99	—

ye flour; Detection of small amounts of —— in wheat flour. R. Fanto. Z. Unters. Nahr. Genussm., 1914, **28,** 79—83.

en grms. of the flour are mechanically shaken for 2½ hours ith 100 c.c. of water, the mixture centrifuged for 1 hour, nd the efflux velocity at 17° C. of the aqueous extract etermined in Traube's "stalagmometer" (Biochem. eits., 1910, **24,** 341). Extracts of different kinds and rades of wheat flour gave results ranging from 57 to 72 ses. (water 51 secs.), the lower values being given by and-sifted samples, while commercial grades did not fall elow 62. In the case of rye flours of various kinds the alues ranged from 178 to 709 secs. Mixtures of wheat our with 2½% of rye flour of similar colour showed efflux elocities of 98·5 to 112 secs. The constituent to which ye flour owes its viscosity is not a protein, but appears o be the "gum" isolated in impure condition by Ritt-ausen (J. prakt. Chem., 1867, 321) by extracting the our with dilute alcohol and adding strong alcohol to he extract. This substance forms a colloidal suspension n water.—C. A. M.

lour and bread; Determination of fat in ——. M. P. Neumann, H. Kalning and G. Grujic. Z. ges. Getreidewesen, 1912, **4,** 220—226; Z. Unters. Nahr. Genussm., 1914, **27,** 748—749.

he fat present in flour may be extracted completely ith ether, but it is advisable to dry the flour previously or 3 hours at 100° C. The flour may also be dried at 80° C. for a short time (about 30 mins.) without nfluencing the yield of fat, but low results are obtained hen the flour is maintained at 120° C. for 17 hours. at cannot be extracted directly from dried and powered bread; the starch must first be hydrolysed. Five rms. of bread crumbs are placed in a flask, 50 c.c. of ater and 2 c.c. of hydrochloric acid are added and the ixture is heated for 90 mins. in a boiling water-bath nder a reflux condenser. After cooling, the mixture neutralised with sodium hydroxide solution, then cidified with 1 drop of hydrochloric acid, and filtered. he insoluble portion is washed with hot water, dried for hours at 105° C. and extracted with ether in a Soxhlet pparatus.—W. P. S.

ilage formation; Chemical changes during ——. R. E. Neidig. J. Amer. Chem. Soc., 1914, **36,** 2401—2413. (See also this J., 1913, 156.)

he formation of silage takes place within 3 weeks at the most from the filling of the silos and observations on hree types of silo (wooden, hollow tile, and concrete) howed that there is no essential difference in the quality f the silage produced, provided that the corn used is n the proper stage of maturity, that the proper amount f water is added, that the silos are carefully filled, and hat the walls are smooth and air-tight. The maximum emperature attained in the silos was 91° F. (33° C.). arbon dioxide developed very rapidly after filling the ilo and free oxygen disappeared entirely after the second r third day. Non-reducing sugars were rapidly converted into reducing sugars and the latter then decreased n amount but did not entirely disappear. The amounts f volatile acids and of racemic lactic acid increased daily. Small amounts of alcohol were formed.—A. S.

Methyl alcohol in corn silage; Occurrence of ——. E. B. Hart and A. R. Lamb. J. Amer. Chem. Soc., 1914, **36,** 2114—2118.

Normal corn silage is shown to contain a small proportion of methyl alcohol, part at least of which is probably formed by the action of micro-organisms on glycine. —F. Sodn.

Date palm; Products derived from the ——. F. Raynand. J. Pharm. Chim., 1914, **9,** 391—396, 454—458.

Almost every part of the date palm is made use of. The fruit is largely consumed by the Arabs and exported and is also made into a preserve called "Roub." Inferior and damaged dates are fermented and distilled, yielding an alcoholic spirit. The stones after softening in water are used as cattle food. The terminal bud or palm cabbage is eaten and the trunk gives a valued timber. A copious flow of sap is obtained by making incisions in the stem and this is either consumed immediately as a beverage or fermented to give the beverage called "Lagmi." Lagmi is a milky liquid with an insipid taste. The composition varies with the length of time it has been fermented, the alcohol content gradually increasing up to about 5%. Lagmi contains starch grains and yeasts in suspension. The former are both round and oval with distinct rings and hilum. On adding baker's yeast to Lagmi a further energetic fermentation takes place, giving another palm wine "Kiacham," a clear liquid with an acid taste containing 7 to 8% of alcohol. A sample of the spirit obtained by distilling the fermented dates had sp. gr. 0·940 and contained 48% of alcohol. *Roub* prepared by boiling dates for a long time with water is a reddish-brown syrupy liquid with a sweet then astringent taste. An average sample contained: dextrose 50, sucrose 20, pectins 3, tannin 4, mineral matter 2%. The variety of date known as "Ghars" yields a sugary juice which after boiling forms a date syrup or date honey called "Assal."—T. C.

Cassava roots and refuse. M. Kling. Landw. Versuchstat., 1913, **82,** 211—235; Chem.-Techn. Rep., 1914, **38,** 47.

Dry cassava roots or manioc contain: crude protein. 1·40; crude fat, 0·38; non-nitrogenous extractive matters 94·13; crude fibre, 2·12 and ash 1·96%; they are therefore exceptionally poor in protein and fat. The extractive matters consist mainly of starch: sucrose was found to the extent of 0·5%. The refuse from the manufacture is worked up as fodder meal, which possesses similar characters: it is analogous in nature to pressed potatoes. This meal is available for all kinds of stock and especially suitable for calves: it should preferably be mixed with some other fodder richer in protein.—I. F. B.

Salicylic acid; Determination of —— in jams. H. Serger. Z. Unters. Nahr. Genussm., 1914, **27,** 319—322.

Twenty grms. of the jam are heated nearly to boiling with 30 grms. of water, filtered while hot, and 25 grms. of the cooled filtrate shaken with 5 c.c. of dilute sulphuric acid (1 : 3) and 100 c.c. of a mixture of 300 c.c. of petroleum spirit and 200 c.c. of chloroform. Fifty c.c. of the petroleum spirit-chloroform layer are treated with 1 c.c. of dilute ferric chloride solution, then diluted with water to 100 c.c., and shaken for 1 minute. The petroleum spirit-chloroform layer is drawn off, the aqueous portion is diluted to 100 c.c., and the coloration compared with that given by a definite quantity of salicylic acid. For the purpose of comparison, the colorations should not exceed in intensity that of a N/500 potassium permanganate solution; if stronger, the solution must be diluted accordingly. A method described by Heintz and Limprich (this J., 1913, 763) was found to be untrustworthy for the detection of very small quantities of salicylic acid, but the test may be improved by using a larger volume of petroleum spirit, say 30 c.c., for the extraction.—W. P. S.

Coconut and its products, with special reference to Ceylon. Pratt. *See* XII.

Preparation of raffinose [from cottonseed meal]. Hudson and Harding. *See* XVII.

Determination of formic acid in honey. Lührig and Doepmann. *See* XVII.

PATENTS.

Baking preparation. R. A. Holbrook. Assignor to Victor Chemical Works, Chicago, Ill. U.S. Pat. 1,113,632, Oct. 13, 1914; date of appl., Dec. 15, 1913.

A baking powder consisting of a suitable carbonate, monocalcium phosphate, and disodium phosphate.—W.P.S.

Sterilising fluids containing fat globules; Method and apparatus for ——. N. J. Nielsen, Aarhus, Denmark. Eng. Pat. 20,274, Sept. 8, 1913.

See Fr. Pat. 467,373 of 1914; this J., 1914, 882.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Water; Auto-purification of ——. Flamand. Bull. Soc. Chim. Belg., 1914, **28**, 9—10.

Blondiau's draining bricks may be used as a support for the material in a sand filter and extract the water from the sand by capillarity. They are made of a number of folds of earthenware so moulded that each brick consists of 16 draining tubes in parallel, of which half have their opening towards the sand and the other half have their opening towards the well. The tubes are flattened so that their filtering surface may be a minimum. Under a charge of 4 or 5 metres of sand and water, the delivery of each brick is about 100 litres per day. The water leaves the brick slowly, so that only an abundant oozing is seen. Sewage passed through a filter of this kind had all its organic matter oxidised and mineralised.—J. H. J.

Drinking water; Sterilisation of small quantities of ——. H. Langer. Deutsch. Med. Wochenschr., 1913, **39**, 1837. Chem.-Techn. Rep., 1914, **38**, 146.

Pathogenic bacteria can be destroyed even in highly contaminated potable waters, without adversely affecting the taste of the water, by adding 0·5 grm. of bleaching powder (equal to 0·12 grm. of free chlorine) mixed with an equal weight of sodium chloride to each litre of water and subsequently adding the calculated quantity of sodium percarbonate and filtering. (See also Ger. Pat. 260,653; this J., 1913, 840.)—T. C.

Disinfection of drinking water with chlorine; Influence of organic substances on the ——. E. Haïri. Z. Hyg., 1913, **75**, 40. Chem.-Techn. Rep., 1914, **38**, 10.

The chlorine absorption power is best determined by treating the water with an excess of bleaching powder, allowing to stand for one hour, and titrating the excess of chlorine in weakly acid solution.—O. R.

Water; Detection and significance of B. coli in ——. W. Plücker. Z. Unters. Nahr. Genussm, 1914, **27**, 521—543.

A synopsis is given of the large amount of work and investigation which has been carried out regarding this subject and a complete bibliographical list is appended to the paper. *B. coli* consists of short rods, is capable of liquefying gelatin, does not form spores, ferments lactose, and responds more or less completely to certain tests, among which are the Neutral Red and indole reactions; about 50 different types of the bacterium have been described. It occurs in the intestines of all warm-blooded animals, but its presence in cold-blooded animals is open to doubt. The bacterium is also widely distributed in soils, etc., and appears to be capable of surviving therein for a longer period than in water; it lives longer in pure than in dirty water, and in sterile water may survive for more than 50 days. The various tests which have been proposed for the detection of *B. coli* in drinking water are referred to, and the conflicting opinions regarding the significance of the presence of the organism in a water supply are discussed. Much depends on the locality and surroundings of a spring or well as to the relative number of organisms which may be tolerated. Neither the number of colonies per c.c. nor the coli test give definite indication as to the risk of infection unless the geological formation, properties of the soil, manuring, etc., of the neighbourhood from which the water is obtained be taken into account.—W. P. S.

Potassium; The perchloric method of determining ——, *as applied to water analysis*. C. Scholl. J. Amer. Chem. Soc., 1914, **36**, 2085—2089.

An aliquot portion of the water is evaporated to 150 c.c., acidified with 10 c.c. of concentrated hydrochloric acid, precipitated with 10% barium chloride, added drop by drop to the boiling solution, boiled for 15 minutes, filtered, and evaporated to dryness; ammonium salts are expelled by heating, the residue dissolved in 20 c.c. of hot water, 20% perchloric acid solution added, slightly in excess of that required to combine with the bases present, the mixture evaporated to dryness, 10 c.c. of hot water and a little perchloric acid added, the mixture again evaporated, and the evaporation, after treating with water and perchloric acid, repeated until white fumes appear; the perchlorate residue is then exhausted with 25 c.c. of 96—97% alcohol, containing 0·2% of perchloric acid, filtered through a Gooch crucible, washed with the perchloric acid-alcohol mixture, and dried at 120°—130° C. The asbestos packing of the crucible is washed with the solution of perchloric acid in alcohol before using, and is preferably employed repeatedly without disturbing, the perchlorate being removed with hot water. If both sodium and potassium are to be determined, the precipitation with barium chloride is omitted.—F. Sodn.

Nitrites in water; Detection of ——. Bornand. Mitt. Schweiz. Ges.-Amt, 1913, **4**, 285. Chem.-Techn. Rep., 1914, **38**, 146.

Rochaix's Neutral Red reagent is unsuitable for the detection of nitrites in drinking water, as is also Denigès' strychnine sulphate reagent (see this J., 1914, 1070) owing to the case with which it decomposes. The Ilosvay-Lunge reagent (sulphanilic acid) is more suitable for this purpose than those of Barbet and Jandrier (resorcinol sulphuric acid) and Mnoucha Chwilewizky (indole).—T. C

Silica in natural waters, alkaline softened boiler feed waters, and concentrated boiler waters. A. Goldberg. Z. Unters. Nahr. Genussm., 1914, **27**, 265—273.

Twenty-two samples of waters of all kinds contained soluble silica, which was reduced by about 50% on filtration through wood wool, apparently through adsorption of the colloidal silica. After treatment with alkali (caustic soda and sodium carbonate, alkali with aluminium sulphate, the mixed lime process) soft waters relatively rich in silica deposited scarcely any silica, whilst hard waters lost only a fraction of their dissolved silica when boiled. When heated in a boiler under pressure, however, neutral or slightly alkaline softened waters lost practically the whole of their dissolved silica, usually as silicate. The deposit thus formed may cause local overheating and pitting of boilers. The dissolved silica probably also contributes to the acidification of water heated in boilers under pressure. For example, when solutions of 5 grms. of $MgCl_2$, $Mg(NO_3)_2$, KNO_3 and NaCl in 50 c.c. of water, were distilled with 1000 c.c. of an approximately 0·1% solution of colloidal silica, the residue (50 c.c.) showed an acidity (up to $N/10$), whilst the distillates were all acid, especially in the case of $MgCl_2$ and $Mg(NO_3)_2$. The colloidal silica solution was neutral to Methyl Orange, Congo Red, and metanitrophenol, and when distilled alone yielded a neutral distillate. (See also page 1079.)—C. A. M.

Benzine; Accidents caused by —— *in* 1913. Chem. Fabrik Griesheim-Elektron. Chem.-Techn. Rep., 1914, **38**, 89.

During 1913 there were 148 accidents in Germany caused by benzine, resulting in 132 cases of serious injury and 71 deaths. Compared with 1912 the cases of injury showed a decrease of 23·7% and the deaths an increase of 24·5%. The accidents were distributed as follows:—Chemical cleaning works, 6; druggists' stores, etc., 8; in transport, etc., 54; motor driving, 50; illumination, 4; and in the hands of the public, 23. Two workmen were killed by the narcotic action of the vapours.—C. A. M.

Boiler enamel; Dangerous ——. Ber. Sächsisch-Thüring. Dampfkessel-Revisionsvereins zu Halle a. S. Minist. d. Hand. u. Gew. Verw., 1914, 21. Chem.-Techn. Rep., 1914, **38**, 89.

The boiler enamel, "*Siderosthen*," which had caused several workmen to faint in a boiler, had a flash-point of 19·5° C. It was a coal-tar or oil-gas tar product containing considerable quantities of volatile toxic light oil.
—C. A. M.

Eosin; Action of —— on bacteria, ferments, and mould fungi. H. Zeiss. Arch. Hyg., 1913, **79**, 141. Chem.-Techn. Rep., 1914, **38**, 3.

In most cases the addition of as much as 10% of eosin to the cultures was harmless, but in the case of aerobic spore carriers as little as 0·5% stunted their growth without affecting their powers of resistance.—O. R.

Petroleum and its derivatives; The antiseptic properties of ——. K. Charitschkow. Bergingenieur-Ges., 1913, **4**, 14. Chem.-Techn. Rep., 1914, **38**, 391. (See this J., 1914, 763.)

The zinc and copper salts of the naphthenic acids, dissolved in petroleum, have been applied in Russia for the impregnation of timber. An ammoniacal solution of the copper salts of these acids, together with other ingredients, constitute the so-called "Kupriol," a substitute for "Carbolineum."—J. N. P.

Carbon monoxide in mine air; methods of determination. Harger. *See* IIA.

Patents.

Water; Apparatus for softening and purifying ——. G. R. Shankland, Manchester. Eng. Pat. 25,728, Nov. 11, 1913.

Tubes packed with zeolites are arranged vertically in a casing, the upper and lower ends of the tubes entering small chambers at the top and bottom of the casing, respectively. The water to be treated is passed downwards or upwards through these tubes. The spaces between the tubes may also be packed with zeolites and used separately or in conjunction with the tubes. A tank containing revivifying solution is situated above the apparatus and means are provided for cutting out any portion of the apparatus for the purpose of revivifying the zeolites contained therein.—W. P. S.

Nitrogenous waste, sewage sludge and the like; Apparatus for the treatment [*destructive distillation*] *of* ——. W. D. Menzies, Westcliff-on-Sea, Essex, J. Menzies, London, and "S.O.S.," Ltd., London. Eng. Pat. 21,656, Sept. 25, 1913.

The material is delivered into a hopper fitted with heated rollers and thence on to endless travelling conveyors situated one above the other in heating and drying chambers. On leaving the drying chambers the material is delivered by a centrifugal or other charging machine into horizontal retorts where it is heated to 700°—900° F. (371°—482° C.) by means of steam or hot air introduced through perforated pipes. The material is then conducted into inclined retorts where it is distilled, these retorts being heated by a furnace. The oils, ammonia, carbon, etc., resulting from the distillation are collected.
—W. P. S.

Sewage and other mixtures of liquids and solids; Centrifugal treatment of —— and apparatus for use in connection therewith. J. Bromet, F. Thorman, and H. C. Wood, Tadcaster, Yorks. Eng. Pat. 1085, Jan. 15, 1914. Addition to Eng. Pat. 22,836, Oct. 7, 1912 (this J., 1913, 839).

The liquid is passed down a pipe reaching to the bottom of the centrifugal drum and thence passes upwards through the annular separating chamber, the separating process being thus carried out in the reverse direction to that described in the previous patent (*loc. cit.*). The liquid is discharged tangentially from the drum.—W. P. S.

Filter beds for sewage and other waste liquids. I. K. Irwin, London Eng. Pat. 3392, Feb. 9, 1914.

Movable screens are fitted between the distributors and the surface of the filter-bed with the object of intercepting the solids in suspension in the liquid. A layer of coke or sand, to which chemical agents may be added, may be placed on the upper side of the screen.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine-benzene; The T,x-diagram of the system ——. J. W. van Iterson-Rotgans. Z. physik. Chem., 1914, **87**, 305—322.

In extracting cinchona bark with benzene according to van Leersum's method, the solubility of quinine in the boiling solvent was found to be much greater than that stated in the literature (1 part of quinine in 30 of boiling benzene according to Oudemans, Arch. Neerl., 1877, **9**, 285). Experiments were made from which the complete m. pt. curve of mixtures of benzene and quinine was plotted. Vapour pressure determinations were also made, and it is concluded that benzene and quinine form two compounds, $C_{20}H_{24}N_2O_2,C_6H_6$ and $3C_{20}H_{21}N_2O_2.2C_6H_6$, of which the latter forms mixed crystals with quinine. The first-named compound crystallises in two forms, *viz.*, as needles and as rhombohedra (see Oudemans, *loc. cit.*). Over a wide range of the system also, a colloid-like solid phase is formed having a refractive index identical with that of the solution. This behaves as a homogeneous mixed phase and is probably either a colloid or a highly viscous solution. Preliminary determinations of the solubility of quinine in boiling benzene gave varying results higher than corresponded with the curve, and this was found to be due to lag in the formation of the colloid-like solid phase, whereby the compound, $C_{20}H_{24}N_2O_2,C_6H_6$, dissolved to a metastable solution, from which a portion of the dissolved quinine would again separate, but only with extreme slowness, even in contact with the colloid-like solid. By adopting certain precautions to overcome this difficulty, the true solubility was found to be 1 part of quinine in 4·56 parts of boiling benzene, the saturated boiling solution thus containing 18% of quinine. The author is unable to explain the low result of Oudemans (*loc. cit.*); under ordinary conditions results higher than the true values are to be expected.—A. S.

Quinine derivatives; Investigations of certain ——. K. Schroeder. Arch. exp. Pathol. u. Pharmakol., 1913, **72**, 361. Chem.-Techn. Rep., 1914, **38**, 3.

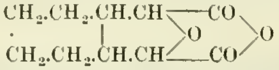
Against infusoria and plasmodia, monobromoquinine and quinine dibromide were twice as effective as quinine, dehydroquinine was only half as effective, and cupreine dibromide was practically inactive. The relative actions towards bacteria were similar but weaker, and towards frog-spawn the differences were even more strongly marked.—O. R.

Isostrychnine; Pharmacodynamic action of ——. M. B. Wiki. L'Union Pharm., 1914, **55**, 341. Pharm. J., 1914, 667.

Isostrychnine was obtained by Bacovescu and Pictet (this J., 1905, 1123) by heating strychnine and water in sealed tubes to 160°—180° C. It has the same ultimate chemical formula as strychnine, $C_{21}H_{22}N_2O_3$; but crystallises in a different form with 3 mols. H_2O and melts at 214·5° C. The author finds it to be much less poisonous than strychnine. In toxicity it approaches brucine. The action on the nervous system more closely resembles that of curare than of strychnine, and doses which kill by arresting respiration do not affect the cardiovascular system. Its tetanising action is slight, and only seen under certain conditions. Pharmacologically, isostrychnine is placed between curare and brucine.

Cantharidin. J. Gadamer. Ver. Ges. deuts. Naturforsh. Aerzt., 1913—1914, II., 494. J. Pharm. Chim., 1914, **10,** 343—344.

The following symmetrical formula is assigned to cantharidin :—



When heated with a solution of hydrobromic acid in acetic acid, compounds of the composition, $C_{10}H_{12}O_3Br_2$ and $C_{10}H_{11}O_3Br$, are produced together with hydrobromocantharic acid, $C_{10}H_{13}O_4Br$. The latter was resolved into optically-active isomerides by means of brucine. The active acid when reconverted into cantharidin gave an inactive product.—F. Shdn.

Gentiacaulin. M. Bridel. J. Pharm. Chim., 1914, **10,** 329—335. (See this J., 1913, 958.)

The roots and leafy twigs of *Gentiana acaulis* were extracted separately, and biochemical tests indicated that both portions of the plant contained the same glucoside hydrolysable by emulsin, the twigs having a greater content than the roots. The actual yields, however of gentiacaulin were 2% for the fresh roots and 1% for the fresh leafy twigs. The glucoside was found to have $[a]_D = -64{\cdot}42°$ instead of $-63{\cdot}84°$ as stated formerly (*loc. cit.*). When hydrolysed by boiling with 2% sulphuric acid gentiacaulein, dextrose, and xylose were formed in equivalent proportions.—F. Shdn.

a-Methyl-glucoside ; Influence of alcoholic strength upon the biochemical synthesis of —— by a-glucosidase. A. Aubry. J. Pharm. Chim., 1914, **9,** 19—23. (See also this J., 1914, 982.)

The fermenting liquid consisted of 20% of filtered yeast maceration juice and 1% of dextrose. The proportion of methyl alcohol in the fermenting liquid varied from nil to 40%. When the alcohol was insufficient to prevent growth of bacteria, 2% of toluene was added. Fermentation was conducted at 18°—20° C., and polarimeter readings were taken every 4 days until the reaction was complete. Even with only 2% of methyl alcohol, 12·4% of the dextrose was combined. The synthesis increased with increase of alcohol up to 16% after which it diminished to zero. At 36% of alcohol, when destruction of the enzyme by the alcohol was immediate, no new synthesis took place. The influence of temperature was important, the destructive influence of the alcohol increasing rapidly at higher temperatures ; its influence was immediate with 16% of alcohol at 40° C. a-Glucosidase is more active than emulsin under the same conditions.—J. H. J.

Plant chemistry ; Notes on ——. P. Q. Keegan. Chem. News, 1914, **110,** 211—212.

An extract of grass of Parnassus (*Parnassia palustria*), made with boiling water, contained a moderate amount of mucilage and no nitrate. It gave reactions of a tannoid, probably rutin, and also of a catechol tannin (2—3%). Butterwort (*Pinguicula vulgaris*) contained no nitrate and no tannin, but considerable quantities of mucilage, sucrose, and a tannoid apparently resembling quercitagenin and associated with a catechin-like substance. Golden saxifrage (*Chrysosplenium*) yielded much mucilage, some gum and sucrose, a little nitrate and tannin (a true catechol without any pyrogallol derivative) but no tannoid ; there was also present a substance with a quinol group (1 : 4). Leaves of mahonia or holly-leaved barberry resembled those of common ivy, in containing caffetannin and a tannoid, probably quercitagenin, and in giving certain reactions, *e.g.*, aqueous extracts, on addition of dilute alkalis, produced a fine green coloration tending to become brown, and reddened by acids—a reaction rare in plant chemistry. The monkey flower (*Mimulus luteus*), an immigrant from Western America, contained nitrate, about 1% of caffetannin, a bitter principle soluble in benzene and in sulphuric acid with purplish colour, an unknown substance yielding a green coloration and precipitate with acetic and hydrochloric acids, but no rhenanthin or tannoid. Very small quantities of caffetannin were detected in the leaves of the day-lily and the turk's head or martagon lily.

Analyses of forest leaves at different stages of growth revealed the fact that in the young leaf tannoids alone are frequently produced, and only later do tannins appear. The tannoids thus seem to be products of alkaline protoplasm, and they are associated with volatile oils, resins and waxes, whilst the tannins are associated with organic acids, especially oxalic acid.—J. H. L.

Cinnamon ; Composition of ——. F. W. Dafert and R. Miklauz. Archiv Chem. u. Mikrosk., 1912, **5,** 117—120 ; Z. Unters. Nahr. Genussm., 1914, **28,** 42.

Ten samples of Ceylon cinnamon (*a*) and 16 samples of cassia-cinnamon (*b*) yielded the following results when dried for 2 hours at 100° C. and then extracted in a Soxhlet apparatus for 10 hours with 90% alcohol :—Loss at 100° C. (water and volatile oil), (*a*) 8·33—11·90% ; (*b*) 8·29—12·23% ; non-volatile alcohol-extract, (*a*) 12·09—17·14% ; (*b*) 6·41—18·66%. In the case of Ceylon cinnamon the sum of these two values lay between 20·42 and 26·07% and with cassia-cinnamon between 17·94 and 29·47%.
—W. P. S.

Sandalwood oil and its application to perfumery. H. Mann. Amer. Perfumer and Essent. Oil Rev., 1914, **9,** 213—214.

Fine scents for soaps are prepared by mixing 5 parts of sandalwood oil with 3 parts of natural or artificial rose oil or Bourbon geranium oil, and 1 part of coumarin. A further addition of ½ part of patchouli oil and 5 parts of concentrated infusion of benzoin can be made. The soap-mass becomes coloured light-brown or dark-gray. The perfume can be fixed by the addition of a small quantity of artificial musk. Cedar-wood oil is substituted for sandalwood oil in some cases. Variations can be obtained by the use of residues from the distillation of orris root and the addition of small quantities of vanillin. Handkerchief perfume can be made with infusion of oil of rose as a base treated with small additions of violet and orange concretes, sandalwood and French geranium oils being then added with oil of bergamot and infusion of genuine musk. Sachets and powders are made from the ground wood mixed with orris and vetiver roots. Amongst other causes of the fluctuating price of sandalwood oil is the fact that the trees suffer at times from a malignant disease.
—F. Shdn.

Cardamoms and cardamom oil. G. M. Beringer. Midl. Drug. and Pharm. Rev., **46**; through Z. Unters. Nahr. Genussm., 1914, **27,** 902—903.

Commercial cardamom oil is derived mainly from the cultivated cardamoms (seeds of *Elettaria Cardamomum* White and Maton) of Ceylon and Malabar, and possesses a sp. gr. of 0·929—0·947, and a rotatory power ranging from +22·2° to +40° at 25° C. Oils of lower density and rotatory power are from other or wild cardamoms, and should be rejected. The pure oil, like most other essential oils, keeps well, and dissolves when fresh in 3 vols. of 70% alcohol, and when somewhat aged, in 4 vols. (See also Reinsch, this J., 1911, 139 ; and this J., 1911, 293.)—J. H. L.

Essential oils ; Constants of various ——. Sci. and Ind. Bull. of Roure-Bertrand Fils. Z. Unters. Nahr. Genussm., 1914, **27,** 686—687.

Essential oil of Nepeta nepetella. Plants collected in September after blooming yielded 0·0598% of a yellow, rather viscous essential oil having the following characters : sp. gr. at 20° C., 1·03984, at 32° C., 1·02536 ; optical rotation +15° 12′ and after acetylation, +17° 20′ ; acid value, 45·5 ; ester value, 245·7 and saponification value, 314·5. The oil is soluble in 2 vols. of 70% alcohol and gives no coloration with ferric chloride. Only a part of the oil combines with sodium bisulphite. *Ylang-ylang oil from Mayotte.* Two samples gave the following characters: sp. gr. at 15° C., 0·9594 and 0·9651; optical rotation, —53° 56′ and —45° 16′; acid value, 1·3 and 1·4; ester value, 129·7 and 131·6; ester content calculated as $C_{10}H_{17}.CO_2CH_3$, 45·4% and 46·0%; saponification value of the acetylated oil, 167·0 and 180·8; total alcohol content, calculated as $C_{10}H_{18}O$, 52·5% and 57·5%. The oils were soluble in one volume of 95% alcohol, the solutions becoming turbid on the addition of more alcohol. A third sample of this oil had an optical rotation of —4° 4′. *Oil of Cape* (see this J., 1912, 149).—T. C.

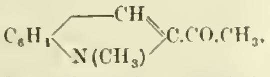
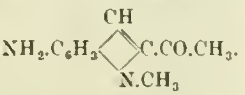
Calycanthus floridus; Volatile oil of ——. E. R. Millor, G. W. Taylor, and M. H. Eskew. J. Amer. Chem. Soc., 1914, **36**, 2182—2187.

Oil of *Calycanthus floridus*, separated from the stem and bark by steam distillation, was found to contain *d*- and *l*-α-pinene, cineol, borneol, bornyl acetate and other esters, salicylic acid, and probably linaloöl. The cineol predominated, 36 and 69% being present in different samples.—F. Sodn.

Essential oils and essential oil products; Hydrogen number of some ——. *I. Oils of sassafras, anise, fennel, clove, and pimento.* A. R. Albright. J. Amer. Chem. Soc., 1914, **36**, 2188—2202.

The method depends on the quantitative hydrogenation of unsaturated compounds in presence of a solution of colloidal palladium as prepared from the commercial dry product or by the process of Paal and Amberger (this J., 1904, 208). The "hydrogen number" of the oil is the number of c.c. of hydrogen, at standard temperature and pressure, absorbed by 1 grm. during the period of primary or most rapid absorption. Dry colloidal palladium (0·02 grm.) and 50 c.c. of 50% alcohol are introduced into an absorption flask of special design, which is filled with hydrogen through an attached gas burette, and the flask is closed and mechanically shaken until hydrogen is no longer absorbed; it is then opened and the substance allowed to drop from a weighing bottle on to a concave "substance table" within the flask, while a current of hydrogen is passed through the apparatus, and finally the flask is again shaken until an abrupt decrease in the rate of absorption, as registered by the burette, is observed (preferably by means of a curve). An appropriate factor converts the burette reading into the % of active constituent (*e.g.*, eugenol) present. The paper deals only with oils of the type that can be completely and very rapidly reduced, and a table is given showing the hydrogen numbers of various samples of sassafras, anise, fennel, clove, and pimenta oils. Oils containing substances "poisonous" to colloidal palladium (*e.g.*, mustard oil) cannot be treated by the process.—F. Sodn.

N-Methyl-α-acetylindole. O. Diels and W. Dürst. Ber., 1914, **47**, 284—290.

N-Methyl-α-acetylindole,  $C_6H_4\begin{matrix}—CH\\N(CH_3)\end{matrix}C.CO.CH_3$, obtained by condensation from diacetylmonomethylphenylhydrazone, $CH_3.CO.C[:N.N(CH_3)(C_6H_5)].CH_3$ (Ber., 1911, **44**, 263), has a physiological action similar to that of morphine, but is only slightly soluble in water. By subjecting the nitro-compound of diacetylmonomethylphenylhydrazone to the indole condensation, 3-nitro-N-methyl-α-acetylindole, was obtained, and this, on reduction with zinc dust in moist ethereal solution, gave the corresponding amino-compound,  $NH_2.C_6H_3\begin{matrix}CH\\N.CH_3\end{matrix}C.CO.CH_3$. The latter formed soluble salts but these were quite devoid of physiological action. The amino-compound when diazotised and combined with R-salt gave a red azo dyestuff.—A. S.

Hydramine-ethers and hydramines; Method for the preparation of —— *and of compounds of the choline series.* J. Houben and K. Führer. Ber., 1914, **47**, 75—82.

The authors have shown previously (Ber., 1907, **40**, 4990) that when dichloro-ethyl ether is brought into contact with ethereal organomagnesium halides, the α-chlorine atom is replaced by an alkyl or aryl group, whilst the β-chlorine atom remains intact:

$$C_2H_5O.CHCl.CH_2Cl + R.Mg.hal. = C_2H_5O.CHR.CH_2Cl + Cl.Mg.hal.$$

The second chlorine atom can be replaced by heating the resulting alkylated glycol chlorhydrin ethers with alkalis or amines. With the fixed alkalis, hydrochloric acid is withdrawn and unsaturated ethers are formed: $C_2H_5.O.CHR.CH_2Cl—HCl = C_2H_5.O.CR:CH_2$. With ammonia or primary amines a mixture of products is obtained. Phenyl-glycolchlorhydrin ether, $C_2H_5.O.CH(C_6H_5).CH_2Cl$, for example, with alcoholic ammonia, yielded chiefly β-ethoxyphenylethylamine, $C_6H_5.CH(OC_2H_5).CH_2.NH_2$, and di-[β-ethoxyphenylethyl]-amine, $[C_6H_5.CH(OC_2H_5).CH_2]_2NH$. With dialkylamines the halogen of the glycolchlorhydrin ether is replaced by the dialkylamine-residue, ethyl-glycolchlorhydrin ether and diethylamine, for example, yielding N-diethyl-2-ethoxybutylamine: $C_2H_5.O.CH(C_2H_5).CH_2Cl + NH(C_2H_5)_2 = HCl + C_2H_5.O.CH(C_2H_5).CH_2.N(C_2H_5)_2$. N-Diethyl-2-ethoxyisohexylamine, N-diethyl-2-ethoxyisoheptylamine, and N-diethyl-2-ethoxy-2-phenylethylamine were prepared in an analogous manner. By the action of strong hydrobromic acid, the ethoxy group can be replaced by hydroxyl, yielding compounds which possess considerable physiological interest and are of importance as materials for the synthesis of substances of the choline and adrenaline series.—A. S.

Hydrogenation of compounds with aliphatic ethylenic linkages in the presence of nickel under moderate pressure. A. Brochet and M. Bauer. Comptes rend., 1914, **159**, 190—192. J. Chem. Soc., 1914, **106**, i., 1069.

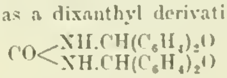
Using the method already described (compare Brochet, this J., 1914, 612) the authors have hydrogenated a number of aromatic compounds containing an ethylenic linkage in the side-chain and one aliphatic compound. Δ^1-Octene readily yields octane. Cinnamic acid, its sodium salt and its methyl ester yield phenylpropionic acid and its corresponding derivatives. The hydrogenation proceeds better with the sodium salt than with the free acid. Piperonylacrylic acid hydrogenates less readily than cinnamic acid, but the conversion readily takes place on using the sodium salt. Anethole, eugenol, and safrole readily undergo hydrogenation at 60°—80° C., whilst for *iso*eugenol the ordinary temperature suffices.

Hydrogenation under atmospheric pressure in the presence of nickel of compounds with aliphatic ethylenic linkages. A. Brochet and A. Cabaret. Comptes rend., 1914, **159**, 326—329. J. Chem. Soc., 1914, **106**, i., 1069.

The substances containing aliphatic ethylenic linkages which were hydrogenated in the presence of active nickel under a slightly increased pressure by Brochet and Bauer (see preceding abstract) also undergo hydrogenation under atmospheric pressure, but in this case the reaction takes place far more slowly and requires a larger amount of the catalyst.

Urea; Quantitative gravimetric determination of ——. R. Fosse. Comptes rend., 1914, **158**, 1076—1079.

A new method for the determination of urea depends on its precipitation as a dixanthyl derivative,



$$CO<\begin{matrix}NH.CH(C_6H_4)_2O\\NH.CH(C_6H_4)_2O\end{matrix}$$

by means of xanthydrol. The urea solution is diluted with 3·5 vols. of glacial acetic acid, and 0·5 vol. of a 10% solution of xanthydrol in methyl alcohol is added, preferably in five portions at intervals of 10 minutes. After one hour the crystals are collected, washed with alcohol, dried, and weighed. The results with 0·5% solutions were about 1% low, whilst for 0·2% solutions they were from 1—2% high. This is due to the precipitate containing a small proportion of xanthydrol as impurity at the lower concentrations; when pure 6·66% of its weight represents urea nitrogen.—G. F. M.

Xanthydrol; Chemical activity of ——, and its application to the determination of urea. R. Fosse. Comptes rend., 1914, **158**, 1432—1435. (Compare preceding abstract.)

Although xanthydrol possesses considerable chemical reactivity towards a large variety of substances, it does not precipitate from acetic acid solutions, under the conditions employed, any of the biological products likely to be contained in urine, other than urea. In addition to xanthyl derivatives previously described, condensation products with the following substances frequently met with in biochemical work have now been prepared and characterised: phenylurea, urethanes, biuret, malonamide, succinamide, pyrrole and its derivatives, and dimethylaniline.—G. F. M.

Urea; Gravimetric determination of —— at dilutions greater than 1 in 1000. R. Fosse. Comptes rend., 1914, **159**, 253—256. (See also preceding abstracts.)

The xanthydrol method for the estimation of urea in pure aqueous solution or in urine is equally applicable for the determination of small quantities of the order of 0·002 grm. if the following procedure be adopted. One vol. of the solution, exactly measured, is diluted with 2 vols. of acetic acid, and 0·05 vol. of a solution of xanthydrol in methyl alcohol is added at intervals of ten minutes, the addition being made three times. After one hour the crystals are collected and weighed. A large number of determinations made with solutions of varying strengths showed that the method is reliable.—G. F. M.

Urea; A method of determining ——. A. Desgrez and R. Moog. Comptes rend., 1914, **159**, 250—253.

A modified form of ureometer is described (see Comptes rend., 1911, **153**, 1007) by means of which an accurate gasometric determination of urea can be made in from 40 mins. to 1 hour. It consists of a U-tube, the shorter arm of which is open at the end and expanded into a bulb, and the longer arm is graduated and fitted with a tap and extension tube for introducing the reagents. It is charged successively with chloroform, the urea solution, and a reagent consisting of a mixture of equal volumes of a solution of 50 grms. of mercury in 100 grms. of cold nitric acid (sp. gr. 1·3322), and an aqueous suspension of infusorial earth. The latter, which is prepared by shaking 1 grm. of the earth with 100 c.c. of water, allowing to settle a minute, and decanting, acts as a catalyst, and enables the decomposition of the urea to proceed quantitatively at 17° C. After the decomposition of the urea, which is assisted by careful shaking from time to time, is complete, the carbon dioxide is washed out of the resulting gases first with 150 c.c. of water and then with a small quantity of potash solution, and the residual gas is measured after first adjusting the chloroform levels in the ureometer. Since none of the other nitrogenous constituents of urine are decomposed, except allantoin, and that very slowly (0·015 grm. in 24 hours), the method is suitable for the analysis of urine, serum, etc.—G. F. M.

Acetosalicylic acid. H. von Krannichfeldt. Ber., 1914, **47**, 156—159.

The acetosalicylic acid prepared by Bialobrzeski and Nencki in 1897 (Ber., **30**, 1776) and which, unlike salicylic acid, has only a slight antiseptic action, yielded chiefly *p*-hydroxyacetophenone when distilled with quicklime and hence must have the constitution:

$$C_6H_3(OH)(COOH)C_2H_3O[COOH : OH : C_2H_3O = 1 : 2 : 5].$$

Some phenol also was formed, and by distilling *p*-hydroxyacetophenone with lime, a yield of about 15% of the theoretical quantity of phenol was obtained. The ethyl ester of acetosalicylic acid, m. pt. 70°—71° C., the methyl ether, m. pt. 152° C., and the ethyl and methyl esters of the methyl ether, m. pts. 41°—42° C. and 96° C. respectively, were prepared. Acetosalicylic acid yielded no acetosalicylacetic acid when heated with monochloroacetic acid and sodium hydroxide (Meyer, Ber., 1913, **46**, 3266), but gave this acid, $C_2H_3O.C_6H_3(COOH)O.CH_2.CO_2H$, m. pt. 179° C., although in poor yield, when the sodium hydroxide was replaced by potassium hydroxide.—A. S.

Glycerol: Esterification of —— by acetic acid in the presence of catalytic agents. J. B. Senderens and J. Aboulenc. Comptes rend., 1914, **158**, 581—583.

When glycerol (1 mol.) was boiled for 1 hour with glacial acetic acid (3 mols.), 0·4 mol. of the acid was esterified. In presence of 15 grms. of potassium bisulphate 1·2 mols. were esterified; whilst in the presence of 2% anhydrous aluminium sulphate or 1% sulphuric acid, the respective amounts were 1·3 and 1·5 mols. Complete esterification of 1 mol. of glycerol was effected by boiling for 1 hour with 12 mols. of acetic acid in presence of 1% of sulphuric acid. The limits of esterification of 1 mol. of glycerol by boiling with 3 or 6 mols. of acetic acid in presence of a catalytic agent were practically reached in 1 hour. (See also this J., 1911, 830, 922.)—C. A. M.

dl-Glyceric aldehyde from a syrup obtained by the oxidation of glycerol; Isolation of crystalline ——. E. J. Witzemann. J. Amer. Chem. Soc., 1914, **36**, 2223—2234.

The reaction mixture obtained by oxidising glycerol with hydrogen peroxide in the presence of ferrous iron (Fenton and Jackson, Chem. Soc. Trans., 1899, **75**, 4) was proved to contain *dl*-glyceric aldehyde by converting this into the acetal, extracting with ether, and hydrolysing with very dilute sulphuric acid. Inoculation of the final syrup gave crystals of the pure compound.—F. Sodn.

Carvacrol ethers; Preparation of ——. P. Sabatier and A. Mailhe. Comptes rend., 1914, **158**, 608—612.

Carvacrol vapour passed over thorium oxide at 400°—500° C. gave on condensation a yellowish fluorescent liquid which, after removing unaltered carvacrol with caustic soda, distilled at about 330° C. and consisted of a mixture of *dicarvacryl oxide*, $(C_{10}H_{13})_2O$, and *dicarvacrylene oxide*,

$$\begin{array}{l} C_{10}H_{12} \\ | \\ C_{10}H_{12} \end{array}\!\!>\!O.$$

A mixture of carvacrol and methyl alcohol passed over thorium oxide at 420°—450° C. gave a yellow fluorescent liquid which was fractionated into carvacrol methyl ether, b. pt. 217° C., and dicarvacryl oxide, crystallising in small prisms, m. pt. 109°—110° C., insoluble in water but soluble in most organic solvents. When the reaction was carried out at about 480° C., dicarvacrylene oxide was also obtained and formed white crystals with a yellowish fluorescence, m. pt. 150° C., and only very sparingly soluble in cold alcohol. Ethyl alcohol substituted for methyl alcohol in this reaction gave only a small amount of carvacrol ethyl ether and an oily fluorescent liquid which could not be crystallised. A mixture of carvacrol and phenol distilled over thorium oxide at 470°—480° C. gave a liquid which after removal of unaltered phenols with caustic soda, yielded *carvacrol phenyl ether*, b. pt. 296° C., dicarvacryl oxide and dicarvacrylene oxide. No diphenyl ether or diphenylene oxide was obtained. A mixture of carvacrol and *p*-cresol gave at 440°—450° C. under similar conditions, *carvacrol-p-cresyl ether*, b. pt. about 300° C., and *di-p-cresyl ether*, m. pt. 50° C., b. pt. 285° C. At 480° C. the chief products were di-*p*-cresyl ether and *di-p-cresylene oxide*, m. pt. 166° C.—T. C.

Boiling points; Method of determining —— in the British Pharmacopœia, 1914, and its relation to the boiling point of ether. H. Finnemore. Pharm. J., 1914, **93**, 584.

In the 1914 edition of the British Pharmacopœia the effect of superheating and of changes of barometric pressure are ignored, although the much smaller correction for emergent stem of the thermometer is mentioned. Superheating is corrected by wrapping a thin layer of cotton-wool, upon which some of the liquid condenses, round the thermometer bulb. With this precaution a sample of ether distilled between 34·5° and 34·9° C., whereas under Pharmacopœial conditions it distilled between 34·5° and 37° C.—O. E. M.

Aldehydes; Catalytic decomposition of ——. M. Kusnetzow. J. Russ. Phys. Chem. Ges., 1913, **45**, 557—568. Chem.-Techn. Rep., 1914, **38**, 15—16.

The formation of carbon monoxide and hydrogen in the oxidation of methyl alcohol can be so limited by the use of metallic silver as catalyst, as to result in a 70% yield of the theoretical amount of formaldehyde; the decomposition of the aldehyde group with formation of carbon monoxide is a general property of aldehydes, palladium black acting most energetically as a catalytic agent.—O. R.

Hydrochloric acid; Catalytic influence of ——, *upon esterification in mixed solvents.* A. Kailan. Z. physik. Chem., 1914, **86**, 65—102.

The esterification of benzoic acid under the catalytic influence of hydrochloric acid in alcoholic and aqueous alcoholic solutions was appreciably retarded by the addition of ether, benzene, or carbon tetrachloride: this being the order of decreasing effect. The retarding influence of water in such mixtures increased successively in the following series: ether-alcohol, benzene-alcohol, carbon tetrachloride-alcohol. From the analogous results obtained by the addition of benzene to similar solutions of succinic, malic and tartaric acids it is concluded that the esterification of these acids occurs in stages rather than as a trimolecular reaction. Esterification in such mixtures is represented as a reaction of the first order.—J. R.

Alcohol; Action of hydrochloric acid upon ——. S. Kilpi. Z. physik. Chem., 1914, **86**, 427—444.

The reaction-velocity between hydrochloric acid and alcohol in aqueous solution was investigated at 97°, 102° and 110° C., the solutions containing 46·2% of alcohol and acid corresponding to strengths of 0·25, 0·5 and 1·0 *N*, respectively. The effect of adding ammonium chloride was also ascertained. The results point to the reaction occurring wholly between alcohol and undissociated hydrochloric acid, the effect of the ionised acid being negligible. Increase of temperature displaced the equilibrium in the forward direction; and the results are in accordance with Arrhenius' equation:

$$\log K_1 - \log K_2 = a\frac{T_1 - T_2}{T_1 - T_2},$$

where K_1 and K_2 are the reaction velocities at the temperatures (abs.) T_1 and T_2 respectively and a is the temperature coefficient.—J. R.

Bismuthated oil of vaseline. A. Vicario. J. Pharm. Chim., 1914, **9**, 458—459.

The unpleasant after-effects of large doses of bismuth subnitrate due to the formation of nitrites, as well as those due to to the solubility of bismuth oxide and carbonate in dilute acids, can be avoided by administering these drugs intimately triturated with oil of vaseline. Bismuth carbonate intimately triturated with oil of vaseline is not attacked even by concentrated hydrochloric acid.—T. C.

Mercuric iodide and aniline; Equilibrium in the system ——. J. N. Pearce and E. J. Fry. J. Phys. Chem., 1914, **18**, 667—676.

The system was studied over the temperature range from —11·48° to 181° C. At —11·48° C. an eutectic mixture of aniline and $HgI_2,2C_6H_5NH_2$ separates. With rising temperature, the solubility of the mercuric iodide increases gradually up to about 10° C. and then more rapidly up to 46·8° C., when a white compound, $HgI_2.2C_6H_5NH_2$, m.pt. 58·6° C., is in equilibrium with the saturated solution. Between 46·8° and 108° C. the solubility increases rapidly and linearly, and the solid phase is red mercuric iodide, the transition point to the yellow iodide being 108° C. in presence of aniline. Above 108° C. the solubility of the yellow iodide increases but slightly with rise of temperature, and a new solid phase, $Hg_2I_2,C_6H_5NH_2$, appears as a greenish-yellow, flaky, mica-like solid. The solubility of mercuric iodide expressed as grms. HgI_2 per 100 grms. of aniline, at different temperatures was:—6·5° C., 23·35; +0·4°, 28·69; 17·8°, 42·85; 21·1°, 47·55; 26·9°, 55·47; 30·1°, 62·05; 36·2°, 75·80; 42·9°, 96·49; 48·8°, 128·1; 63·6°, 163·8; 70·8°, 184·1; 76·2°, 201·6; 95·9°, 246·7; 115·7°, 281·8; 137·2°, 285·2; 181·1°, 297·9. To determine mercuric iodide in the presence of the easily oxidisable aniline, the sample was dissolved in a solution of acetic acid containing an excess of potassium iodide, and the mercury precipitated with hydrogen sulphide, the precipitate being washed with water and alcohol, dried, extracted with carbon bisulphide to remove free sulphur, and dried to constant weight at 70° C. (mercuric sulphide loses weight appreciably when heated at 110° C., as recommended by Treadwell and Hall, "Analytical Chemistry," 3rd Ed., Vol. II., p. 169).—A. S.

Chloro-derivatives of methane; Absorption of ultra-violet rays by the ——. G. Massol and A. Faucon. Comptes rend., 1914, **159**, 314—316. J. Chem. Soc., 1914, **106**, ii., 695.

The authors have examined three specimens of carbon tetrachloride having respectively b. p. 76·2° C./762·4 mm., 76° C./758 mm., 76·7° C./760 mm. Of these, the first two specimens gave broad absorption bands in the ultra-violet, whilst the third showed no absorption band. Specimen 2 was then submitted to fractional distillation, and a number of fractions were obtained boiling from 61·4° to 76·3° C., all of which showed an absorption band. A final fraction was obtained, b. p. 76·4° C./758 mm., which gave no absorption band, and was shown to be pure carbon tetrachloride. The others contained carbon bisulphide as an impurity, and this produced the absorption band.

Neither chloroform nor dichloromethane gave absorption bands in the ultra-violet. All three chloro-derivatives are colourless, and transparent to the visible and ultra-violet rays, only absorbing the rays of very short wave-length. The transparency for the latter rays diminishes as the number of chlorine atoms in the molecule increases.

Vaseline oil for internal use. Vicario. *See* IIA.

Mixing and setting of plaster [*for surgical work*]. Astruc and Juillet. *See* IX.

Source of genuine chaulmoogra oil. Francis. *See* XII.

Patents.

p-Phenetidine; Preparation of acyl derivatives of ——. P. Bergell. Ger. Pat. 277,022, Sept. 17, 1912.

p-Phenetidine is converted into its α-bromo-isovaleryl derivative, for example by treatment with bromo-isovaleryl bromide in presence of benzene. A product of m.pt. 151° C. is obtained, in which the physiological properties of the components are apparent.—T. F. B.

Acidyl derivatives of C-ortho-allyl-ortho-benzoic acids. L. Taub and H. J. Hahl, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,113,713, Oct. 13, 1914. Date of appl., Dec. 20, 1913.

See Ger. Pat. 274,047 of 1913; this J., 1914, 806.—T. F. B.

Apocynaceæ; Substance isolated from ——, *and process of producing the same.* L. Taub and G. Fickewirth, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,113,714, Oct. 13, 1914. Date of appl., Sept. 4, 1912.

See Ger. Pat. 255,537 of 1911; this J., 1913, 450.—T. F. B.

Acetic anhydride; Process of manufacturing ——. W. A. Beatty, Assignor to G. W. Beadle, New York. U.S. Pat. 1,113,927, Oct. 13, 1914. Date of appl., April 30, 1912.

See Fr. Pat. 447,646 of 1912; this J., 1913, 253.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photochemical properties of coloured resinates. Larguier des Bancels. *See* XIII.

Patents.

Cinematograph films; Manufacture of ——. H. Jerne, Merton Abbey. Eng. Pat. 22,234, Oct. 2, 1913.

A protective film of transparent celluloid is attached to the emulsion surface of a finished cinematograph film by means of amyl acetate or other solvent or adhesive. —T. F. B.

Colour photography and colour printing. J. and E. Rheinberg, London. Eng. Pat. 22,938, Oct. 10, 1913.

A negative or positive is taken in the usual manner through a multicolour screen composed of lines or dots of the "additive" colours, red, green, and violet; this is now printed on a viewing screen coated with a sensitised colloid, the screen being similar to that first employed, excepting that the "subtractive" colours (minus red, minus green, and minus violet, *i.e.*, greenish-blue, magenta, and yellow) are used: the screen must be in exact register with the positive, *i.e.*, minus red registering with red, and so on. The sensitised colloid layer is now developed and the screen is treated with a solvent which will dissolve the colours from under the colloid according to the amount of light action. For example, when albumin is the colloid used and the colour screen is made of collodion, an alcoholic solvent is suitable. In the picture thus obtained the image is composed of separate dots of colour; treatment with a solvent of the dyestuffs results in the colours of the dots intermingling: thus, a red object would first be represented by magenta, yellow, and colourless areas, which when blended would appear red. The finished picture may now be transferred or applied to paper. A number of variations of this process are described, but all involve the intermingling of the separate colour areas of the final print, either by the action of solvents or by heat or moisture. Multicolour prints made by successively printing coloured lines, dots, or patches over one another, are frequently somewhat out of register, with the result that portions of the constituent colour areas are seen separately: this may be corrected by treating the prints with a solvent of the inks or pigments used, or of the vehicle, *e.g.*, turpentine or a solution of caustic soda, or by applying heat or pressure sufficient to cause the colours to run or spread to a slight extent.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosibility of mixtures of air and ammonia. Schlumberger and Piotrowski. *See* VII.

Patents.

Blasting or exploding by liquid air, oxygen or like suitable liquefied gas or medium of low temperature. O. Simonis, Walthamstow, Essex. Eng. Pats. 24,137, Oct. 24, 1913, and 10,178, April 24, 1914.

The explosive mixture is produced by bringing liquid air or oxygen into contact with absorbent material, such as charcoal, kieselguhr, etc., impregnated with paraffin oil, just prior to the firing of the charge by a detonator, and the walls of the shot-hole are given a preliminary low cooling. The liquid air may be placed in a double-walled container made in two parts, fitting together telescopically, so that the cold evaporated air passing between the walls serves as a heat insulator. The container is embedded in the absorbent material, and the two parts are held together by means which can be broken automatically when a certain pressure is developed within the cartridge. In alternative forms, both the absorbent material and the liquid air are placed in a double-walled container, or the cartridge of liquid air may be placed in the absorbent material in an outer vessel, the liquid air vessel having a detachable flap which may be removed or torn by means manipulated outside the shot-hole.—B.N.

Explosives; Process of varying the velocity of detonation of ——. C. A. Woodbury, Chester, Pa., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,113,275, Oct. 13, 1914; date of appl., May 18, 1912. Renewed March 2, 1914.

The velocity of detonation of explosives containing ammonium nitrate may be decreased by increasing the size of the grains of ammonium nitrate or increased by decreasing the size of the grains.—B. N.

XXIII.—ANALYTICAL PROCESSES.

Thermo-elements of precision, especially for calorimetry. W. P. White. J. Amer. Chem., Soc., 1914, **36**, 2292—2313.

The quality of constantan ("ideal") wire for thermoelements has now been so improved that continuous lengths are frequently obtainable which vary less than 0·0002 in E.M.F. against copper, and with which sensitive thermoelements with errors usually less than 20 per million can be made. The more sensitive combination of several couples is recommended in preference to a single couple, even when great precision is not required. Details of testing the wire, constructing, enclosing, calibrating and testing the thermo-elements are given. For testing the homogeneity of the wire, it is drawn out of a heated bath, for example wound from one drum in a heated bath on to another outside the bath and the different portions of the wire tested as they are drawn successively out of the bath. Inhomogeneous portions of the wire are either cut out or are so placed in the thermoelement that they do no harm. Inhomogeneity causes errors only in the case of that portion of the thermoelement where the effective temperature gradient occurs; even a very bad portion of wire will not cause any inconvenience if it is 5 cm. below the level of the bath at either end of the thermoelement when this is in use. For insulating the junctions an unpublished method of L. H. Adams is recommended. The junction is dipped into a fairly thick solution of pure gum rubber in a mixture of benzene and carbon bisulphide, dried, and the rubber vulcanised by immersion for a few seconds in a solution of sulphur dichloride in carbon bisulphide (1 : 40) and dried at 40°—50° C. A harder coating may be obtained by using a mixture of rubber solution with 20% (of the weight of rubber) of precipitated sulphur, and vulcanising by heating at 130°—150° C. Cellulose acetate solution is the best of the insulating varnishes. To diminish lag the junctions after insertion in the glass or metal case are embedded in paraffin wax or naphthalene.—A. S.

Hydrochloric acid solutions; Method for the precise standardisation of ——. L. W. Andrews. J. Amer. Chem. Soc., 1914, **36**, 2089—2091.

A silica (or porcelain) dish, with cover and short stirring rod, also preferably of silica, and containing 1·9—2·0 grms. of pure silver nitrate is heated to 160° C. and then to constant weight at 240° C. (or to incipient fusion of the nitrate). 50 c.c. of the hydrochloric acid (if $0{\cdot}2N$) are introduced, and the mixture is stirred to complete the reaction, evaporated at 95°—100° C., dried by heating as before, and weighed. A similar dish containing a like volume of acid, but no silver nitrate, is treated at the same time in a precisely similar manner throughout. The normality of the solution is then

$$\frac{W - W_1 + w_1 - w}{0{\cdot}02655V},$$

in which V is the volume of solution and W, W_1, w, and w_1 are the respective weights of $AgNO_3$ + dish, $AgCl + AgNO_3$ + dish, companion dish, and companion dish after the experiment.—F. Sodn.

Iodine solutions; Titration of alkaline ——. A. Leclère. J. Pharm. Chim., 1914, **9**, 341—345.

The titration of iodine solutions with sodium thiosulphate gives very irregular results in presence of alkaline salts, particularly when using warm solutions. Correct results can, however, be obtained by titrating the alkaline iodine solution first with thiosulphate solution, then with sulphuric acid using methyl orange as indicator until neutral, and repeating the iodometric titration on a fresh quantity of solution after neutralising with the amount of acid found in the first titration.—T. C.

Copper and lead from tin and antimony; Use of hydrofluoric acid in the separation of —— by means of electric current. L. W. McCay. J. Amer. Chem. Soc., 1914, **36**, 2375—2381.

Dilute nitric acid to which a little hydrofluoric acid is added is an excellent solvent for antimony and tin and their alloys, and if the metals are present in the solution in the higher state of oxidation, they are not deposited by the electric current, so that copper or lead if also present may be separated electrolytically, the former as metal and the latter as dioxide, from the tin and antimony. Satisfactory results have been obtained in this way in the analysis of white metal, about 0·5 grm. being dissolved in 25—50 c.c. of dilute nitric acid (1 : 4) to which 5 c.c. of 48% hydrofluoric acid are added; the oxidation of the antimony is completed by addition of potassium bichromate solution. Deposits of lead peroxide are preferably dissolved in a mixture of dilute nitric acid and hydrogen peroxide, and the lead determined as sulphate. Copper can also be separated electrolytically from tungsten, and mercury and silver from tin and antimony, by using a dilute nitrohydrofluoric acid solution.—A. S.

Vanadium; Detection and determination of ——. H. Manz. Pharm. Zentralh., 1913, **54**, 1095. Chem.-Techn. Rep., 1914, **38**, 33.

The most delicate reaction of vanadium is the production of a red coloration insoluble in ether, by hydrogen peroxide in hydrochloric acid solution. Vanadic acid is determined by heating with potassium bromide and fuming hydrochloric acid, passing the bromine vapours into potassium iodide solution, and titrating the liberated iodine with sodium thiosulphate. $V_2O_5+2KBr+6HCl=2VOCl_2+Br_2+2KCl+3H_2O$. 1 c.c. of $N/10$ thiosulphate is equivalent to 0·0091 grm. of vanadic acid.—O. R.

Carbon monoxide in mine air: methods of determination and a suggested method of removing it. Harger. *See* IIa.

Electrical detection of firedamp. Ralph. *See* IIa.

New phthalein dyestuff of the naphthalene series. [*Indicator.*] König. *See* IV.

Behaviour of ammonium phosphomolybdate with ammonium hydroxide. Sircar. *See* VII.

Determination of iron, mercury and arsenic in sulphuric acid. Nisjenson. *See* VII.

Determination of zinc in treated wood. Frary and Mastin. *See* IX.

Colorimetric determination of titanium in iron and steel. McCabe. *See* X.

Analysis of silicol (ferrosilicon) and other silicon alloys used for the production of hydrogen. Jaubert. *See* X.

Determining gold in by-products containing platinum and iridium, etc. Jolly. *See* X.

Determination of rosin in fats and soaps. Leiste and Stiepel. *See* XII.

Detection of hydrocarbons in turpentine oil. Utz. *See* XIII.

Determination of the phosphoric acid in basic slag soluble in citric acid. Haussding. *See* XVI.

Determination of the sucrose and reducing sugars in the foliage of the [*sugar*] *beet and cane.* Pellet. *See* XVII

Pectin substances in [*beet*] *sugar factory products* [*and their influence on the determination of raffinose*]. Koydl. *See* XVII.

Determination of formic acid in honey. Luhrig and Doepmann. *See* XVII.

Purchase of malt on the basis of analysis. Heron. *See* XVIII.

Colour reactions of constituents of wine. Schaffer. *See* XVIII.

Determination of quercitin in wine. Von Fellenberg. *See* XVIII.

Detection of "saffron yellow" in white wine. Kreps. *See* XVIII.

Determination of potassium and magnesium by physico-chemical volumetric methods. Application to the analysis of wines. Duboux. *See* XVIII.

Preservation of milk samples for analysis. Tillmans and others. *See* XIXa.

Titration of milk with alcohol of various strengths. Löhnis. *See* XIXa.

Detection of small amounts of rye flour in wheat flour. Fanto. *See* XIXa.

Determination of fat in flour and bread. Neumann and others. *See* XIXa.

Determination of salicylic acid in jams. Serger. *See* XIXa.

Perchloric method of determining potassium as applied to water analysis. Scholl. *See* XIXb.

Detection of nitrites in water. Bornand. *See* XIXb.

Hydrogen number of some essential oils and essential oil products. I. Oils of sassafras, anise, fennel, clove, and pimenta. Albright. *See* XX.

Method of determining urea. Desgrez and Moog. *See* XX.

Gravimetric determination of urea. Fosse. *See* XX.

Chemical activity of xanthydrol and its application to the determination of urea. Fosse. *See* XX.

Gravimetric determination of small quantities of urea at dilutions greater than 1 in 1000. Fosse. *See* XX.

Method of determining boiling points in the British Pharmacopœia, 1914, *and its relation to the boiling point of ether.* Finnemore. *See* XX.

PATENTS.

Hydrometers. J. G. Lucas, London, and E. V. Smart, Ilford, Essex. Eng. Pat. 22,790, Oct. 9, 1913.

Errors due to the meniscus are avoided by providing a float, guided on the stem of the hydrometer and carrying an indicator whose position against the stem gives the specific gravity, or carrying a vertical scale which is read against a fixed mark on the hydrometer. The float consists of two celluloid tubes joined by end-plates so as to form a rectangular frame with a slotted base for guiding it on the stem. The hydrometer bulb is of disc form, and the stem is flattened in cross-section and small compared with the capacity of the bulb. The hydrometer is suitable for insertion between the plates of an accumulator.—A. T. L.

Thermo-element. E. Achenbach. Ger. Pat. 276,354, Feb. 14, 1913.

Boron silicide is used as electrode material for thermo-elements. It has the advantage of having an electrical conductivity twenty times as great as that of silicon, whilst in other respects it is equally good.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Nitrogen: Crude —— (nitrogen+rare gases) in natural gaseous mixtures. C. Moureu and A. Lepape. Comptes rend., 1914, **158**, 839—842.

Analyses of the crude nitrogen fractions obtained from such natural sources as the firedamp of mines, or from thermal springs have indicated a remarkable similarity in both qualitative and quantitative composition, and the conclusion is drawn that the constituent gases, nitrogen, argon, xenon, krypton and helium, have a common origin dating back from the nebulous epoch. Such slight variations as have been observed are amply explained by the operation at a later date of such physical processes as occlusion, solution, and diffusion.—G. F. M.

Sulphur solutions and compounds; The blue colour of ——. P. P. v. Weimarn. Chem.-Zeit., 1914, **38**, 482.

The blue colour of sulphur in solution in potassium thiocyanate or glycerin is a function of its dissolved state and is not due to the formation of oxy-compounds or to existence in the colloidal state. The colour of the solutions deepens on heating. The rose colour of ultramarine is explained by the sulphur being in solution in the form of its red vapour.—J. B.

Calcite which becomes phosphorescent when heated. F. Pisani. Comptes rend., 1914, **158**, 1121—1123.

A specimen of calcite, consisting of yellow and colourless crystals, exhibited distinct fluorescence when heated to about 150 C. The mineral was free from iron; the yellow crystals contained MnO, 0·06 to 0·07%, and oxides of the ceria and yttria group, 0·008 to 0·12%; the colourless crystals contained MnO, 0·15% and oxides of the ceria and yttria group, 0·005%. Both the coloured and the colourless crystals showed phosphorescence and the phenomenon does not appear to be due to the cerium-yttrium content since it is noticed in calcite free from rare earths. Fluorescent calcite is of rare occurrence; of numerous specimens from various sources examined, only three were decidedly phosphorescent, namely, calcite from Mayenne (France), Harz (Germany), and Derbyshire (England).—W. P. S.

Urease-content of certain Indian seeds. H. E. Annett. Biochem. J., 1914, **8**, 449—452. (See also Takeuchi, this J., 1910, 36; 1911, 566; Zemplen, this J., 1912, 597, 891; Armstrong and Horton, this J., 1912, 598; Falk, this J., 1913, 384.)

Out of six varieties of soya beans tested, the urease activity of five, viz., yellow, common, chocolate, black and Rymbsa Ktang, was practically identical, but that of the sixth, spotted soya bean, was distinctly greater. Urease appeared also to be present in the following seeds:—*Sida spinosa*, gram (*Cicer arietinum*), rice (*Oryza sativa*), cowa (*Setaria italica*), two samples of sword bean (*Canavalia ensiformis*) one from America, and the other grown at Dacca in India, *Urana lobata*, khulti kalai (*Dolichos biflora*), and castor bean (*Ricinus communis*). The urease activity of both the samples of sword bean was many times greater than that of any of the soya beans examined. Extremely rapid production of ammonium carbonate took place immediately on adding sword bean extract to urea solution.—J. H. L.

Glucosides, tannins, etc.; Action of —— on germination. W. Sigmund. Biochem. Zeits., **62**, 339.

Arbutin has but little harmful action on germinating seeds: of its components hydroquinone (quinol) is much more poisonous, whilst dextrose has no effect. Phloridzin, hesperidin, hesperetin, and phloretin have but little effect. Baptisin is a strong poison. Salicin is slightly toxic in a solution of 0·02 molecular weight in one litre. Helicin is more harmful. Populin, as far as it is soluble, has no effect. Coniferin is also but slightly active, but its hydrolysis products are more poisonous. Syringin and amygdalin have little effect. Aesculin is markedly toxic. Sinigrin and convallarin are not harmful. Helleborein is rather poisonous in relatively large doses, so are digitalin, saponin, and sapogenin. Strophanthin is poisonous. Phenol is toxic in a concentration of 0·02 molecular weight per litre. Pyrocatechol, pyrogallol, and resorcinol are very poisonous. Quinone in a concentration of 0·02 molecule per litre is fatal. Results are also given with saligenin, salicylaldehyde, benzaldehyde, vanillin, piperonal; salicylic, cinnamic, orthocoumaric acids; aesculetin, daphnetin; mandelic, protocatechuic, gallic, catechutannic acids; tannin and catechin.

Patent.

Tobacco; Process of treating [ageing] ——. L. W. Lawrence and F. F. Bahnson, Winston-Salem, N.C. U.S. Pat. 1,113,902, Oct. 13, 1914; date of appl., Aug. 28, 1914.

Tobacco is subjected alternately to the action of moist and dry air until properly aged.—W. P. S.

Trade Report.

Patents, Designs, and Trade Marks (Temporary Rules) Acts, 1914. Illus. Off. J., Nov. 18, 1914.

It is announced that the general principles upon which the Board of Trade will act in dealing with applications for the avoidance or suspension of Patents and Trade Marks under the above Acts, will be as follows:—

Patents.—Licences will, as a general rule, be granted where the applicants fulfil the necessary conditions, set out in Rule 1 of the Temporary Rules:—(1) Where there is no manufacture in this country under the Patent, and also (2) Where what manufacture there is, is carried on by a company or firm on behalf of alien enemies resident abroad, and there is any reason to doubt that the manufacture will continue to be carried on, or where it is in the interests of the country that some other manufacture should be started in British interests.

Trade Marks.—Suspension will, as a general rule, only be granted in the following cases:—(1) Where the Trade Mark is the name of a patented article, and a licence is granted under the Patent protecting it. (2) Where it is the only name or only practicable name of an article manufactured under an expired Patent. (3) Where it is the name or only practicable name of an article manufactured in accordance with a known process or a formula which has been published and is well known in the trade. Generally speaking, suspension will not be granted in the case of pictorial devices.

Prohibited exports. Revised and complete list.

A Proclamation dated November 10th, 1914, consolidates and supersedes all previous Proclamations or Orders of Council dealing with the same subject. In the main the list of articles is identical with that resulting from previous lists, with a few minor alterations. The full text is printed in the Board of Trade Journal of November 12th, 1914, pp. 414 seq.

Journal of the Society of Chemical Industry.

No. 23, Vol. XXXIII. DECEMBER 15, 1914. No. 23, Vol. XXXIII.

Official Notice.

DUTY-FREE ALCOHOL.

In view of the interest now associated with the conditions of supply of duty-free alcohol, the following statement has been prepared.

Duty-free alcohol in the form of methylated spirit is readily obtainable.

Mineralised methylated spirit.—To protect the immense revenue raised from potable spirit and to prevent misuse it is generally necessary to render duty-free alcohol non-potable. For common use this is effected by the addition of wood spirit (*i.e.*, crude methyl alcohol) and a trace of light petroleum, so that the mixture contains 10% of wood spirit and three-eighths of 1% of petroleum spirit. These small additions, whilst sufficient to deter most people from drinking the spirit, do not interfere with its use for a very large number of commercial purposes. Such spirit, which is known as mineralised methylated spirit, may be purchased throughout the country without formality in quantities not exceeding four gallons at a time from any retailer of methylated spirit, and permission to receive it in larger quantities is readily granted on application to the Commissioners of Customs and Excise when ordinary facilities for obtaining it are inadequate.

Industrial methylated spirit.—For manufacturers and large users of alcohol generally, however, and in those cases where a purer spirit is necessary, further provision is made by what is known as "Industrial Alcohol." This alcohol is denatured by the addition of half the quantity of crude methyl alcohol or wood spirit which is used in the mineralised methylated spirit, and no petroleum spirit is used; *i.e.*, this spirit contains 5% of wood spirit without other addition. Permission to receive this spirit must, however, be obtained and the use to which it is put be specifically authorised by the Board of Customs and Excise. Applications for such authorisation should in the first instance be made through the Surveyor of Customs and Excise for the district in which the spirit is to be employed. It should be noted that during 1913 the price of British industrial methylated spirit was lower than the price of alcohol in Germany.

Finally, in those cases where denaturing with wood spirit is proved to the satisfaction of the Commissioners of Customs and Excise to render the spirit unsuitable or detrimental for use in any art or manufacture, the Commissioners have power to grant the use of duty-free spirit under other conditions as explained in the following memorandum. Applications referring to this spirit should also be addressed to the Commissioners through the local Surveyor of Customs and Excise.

Pure spirit.—The following is the procedure to be observed in connection with the use in manufactures of pure spirit on which duty has not been paid (Sec. 8 of the Finance Act, 1902).

1. Any person desiring to use spirits without payment of duty in any manufacture carried on by him must make application in writing to the Commissioners of Customs and Excise for authority to receive and use such spirits, and must prove to the satisfaction of the Commissioners that the use of methylated spirits would be unsuitable or detrimental.

2. The applicant must give full particulars of the situation of the premises upon which and the purpose for which the spirits are to be used, together with a description of the process of manufacture. He must also state the means by which it is proposed to make the spirits unpotable before and during use, and the quantity likely to be required in the course of a year.

3. Any person authorised to receive spirits on which duty has not been paid must, if so required by the Commissioners of Customs and Excise, provide upon his premises a warehouse, structurally secure to their satisfaction, and all such spirits received must be deposited and retained therein until delivered on proper notice to, and in the presence of, the officer. He must also, if so required, provide a room approved by the Commissioners in which be fixed a vat or other vessel of sufficient size to admit of at least one hundred bulk gallons of spirit being rendered unpotable at one time, and must also provide satisfactory accommodation for the Officer of Customs and Excise in attendance at his premises. No charge is usually made for the services of this officer.

4. Security to the satisfaction of the Commissioners of Customs and Excise must be given for the due removal, safe custody, and proper use of the spirits, and the due observance of all regulations and conditions made by the Commissioners.

5. The substance or materials to be used for the purpose of rendering spirits unpotable and the mode in which the spirits are to be rendered unpotable must be approved by the Commissioners of Customs and Excise, and the person authorised to receive spirits upon which duty has not been paid must, if so required by the Commissioners, provide a store to be approved by them, and used solely for storing and keeping the substance or material so approved.

6. Spirits which have been rendered unpotable under these regulations shall not thereafter be purified in any manner or be recovered by distillation or any other means, except with the express sanction of the Commissioners of Customs and Excise.

The use of *absolute alcohol* is covered by the above regulations as to "Pure spirit."

Attention is also directed to the Report of the Departmental Committee on Industrial Alcohol (see this Journal, 1905, pp. 397—426), and also to the Minutes of Evidence taken before that Committee (No. Cd. 2477, price 2s. 4d.).

Birmingham Section.

Meeting held at Birmingham University, on Thursday, November 5th, 1914.

MR. H. T. PINNOCK IN THE CHAIR.

THE ESTIMATION OF MOISTURE IN ZINC ASHES.

BY ERNEST A. LEWIS.

The ferrocyanide assay of zinc is largely used in technical work and is accurate when carried out under standard conditions, but sometimes differences of 2% or more are obtained by assayers working on the same sample which has been passed through a 30 mesh sieve. The samples are prepared by grinding the ashes whilst hot, in which case the metallic zinc easily rubs up to a fine powder. The oxidation being negligible, this method is largely used by English smelters, and is to be preferred to the method of separating the fines and metallics by pounding and stating the percentage of each on the packets.

If the samples whilst hot are placed in bottles and sealed with sealing wax all over the top to exclude all moisture, there is seldom any serious discrepancy between assayers. It is evident that the errors must be due to the absorption of moisture which is not driven off by heating to 100° C., as is the practice of many assayers. In order to see to what extent zinc ashes of various types would absorb moisture, the following experiments were made. The material, which had been passed through a

30 sieve, was heated with continual stirring in an iron ladle for some minutes, as hot as possible without melting the zinc, put into corked bottles and allowed to cool in a desiccator. These conditions of heating are the same as many smelters use to estimate moisture. The samples were weighed out between watch glasses and then allowed to remain in the open air protected from dust for some days and re-weighed from time to time. A galvanizer's ashes containing about 3% chlorine gained 4·15% by weight in 24 hours, 4·66% in 48 hours, and 4·82 % in 72 hours. A sample of re-melted ashes free from chlorine gained ·57% in weight after 24 hours, 0·72% in 48 hours, and 0·76% in 72 hours. Some of the previous samples were left for some days in an artificially damp atmosphere; the material, which became caked together, was ground up in a porcelain mortar and transferred to a stoppered bottle. About 10 grms. was weighed out between watch glasses and put into a steam oven, and later to a hot air oven, remaining in each oven until the weights were practically constant. A sample of ashes containing about 75% Zn lost 1·87% after 4 hours in a steam oven, and a further 4·14% after 4 hours at 200° C., a total of 6·01%. The loss to the seller from being dried at 100° C. instead of 200° C. is thus equal to about 2·9% zinc.

Loss in weight per 100 *parts.* In another case, after 4 hours in the steam oven, the loss in weight was 0·88%, and after a further 4 hours at 200° C., 0·62%; total loss 1·5%. The loss in this case is equal to 0·4 unit of zinc.

The experiments were repeated with two other kinds of remelted ashes, free from chlorine. One sample gained 0·53 % on exposure to air for 24 hours; and 0·75% for 192 hours; when heated in the steam oven the loss amounted to 0·57%, whilst a further 0·31% loss occurred at 200° C. Another sample gained 0·30% during 24 hours exposure, and 0·52% in 192 hours; the loss in the steam oven in 4 hours was 0·25% and at 200° C. in 5 hours 0·32%. A sample of zinc oxide containing about 0·2% Cl gained 0·80% in weight on exposure to air for 24 hours and 0·84% after 72 hours; on heating for 4 hours in the steam oven the loss was 0·43%, and after a further 4 hours at 200° C., 0·46%, or a total of 0·89%.

Prolonging the heating much over 4 hours at 200° C. led to an increase in weight, due no doubt to oxidation of the metallic zinc.

These experiments show that it is not possible to remove all water from zinc ashes by heating to 100° C., especially when chlorides are present. Drying the sample at 200° C. for four hours practically removes all the moisture in all kinds of zinc ashes

Discussion.

The Chairman said the subject was of importance and might be given a much wider application, for there were difficulties in making such estimations in organic substances.

Mr. Alcock pointed out that difficulty was experienced in determining the amount of moisture in many substances, particularly in volatile oil and drugs. It must not be assumed that loss was always moisture; it might also be compensated by oxidation.

Mr. W. Clifford asked Mr. Lewis if he had any experience of drying the oxide, on the large scale. Was the moisture more easily driven off when chloride was absent than when present? It was not easy to get the moisture in the crude (galvaniser's) oxide below 50% by mere drainage and evaporation, especially if it contained a small amount of chloride. Was there a colloidal form of oxide which retained the moisture more tenaciously?

Mr. O'Shaughnessy pointed out that in the estimation of moisture, or what was called moisture, one was always faced with the difficulty referred to by Mr. Alcock; but in many cases in which such estimations were required not for scientific work, but for practical and control work, the difficulty might be overcome by the adoption of an arbitrary method, viz., drying at a fixed temperature under known conditions. After practical experience it was possible to interpret the values obtained very accurately.

Mr. Lewis said that to most smelters the word "moisture" meant everything volatile. The moisture was determined in order to get the dry weight of the whole bulk, and such residues were sold on the zinc content of the dry material. Some assayers adhered to the old method of drying at 100° C., and while a specially made steam oven might give that temperature, the average steam oven did not. He had had no experience of drying oxide in bulk. The moisture in the oxide was not as a rule much more than ½%, but he did not know how the makers got the amount down.

THE ESTIMATION OF NAPHTHALENE IN SPENT OXIDE.

BY WILLIAM C. DAVIS, B.SC. (LOND.), F.I.C.

The ordinary spent oxide from gas works contains very little if any naphthalene; the sample, however, which is the subject of this examination had been used in the Williams process for the extraction of cyanogen from the gas and contained a considerable quantity of naphthalene. It must, therefore, be assumed that the Williams process has in this case purified the gas, not only from cyanogen, but also from naphthalene.

The naphthalene is usually determined by means of picric acid as described by Colman and Smith (this J., 1900, 19, 128), Kuster (Ber., 1894, 1101) and Dickenson Gair (this J., 1905, 1279; 1907, 1263). These methods deal with the estimation of the naphthalene in coal gas, but Dickenson Gair gives a method for the estimation in spent oxide by dissolving out the naphthalene with alcohol and precipitating the clear solution with picric acid; no details are given.

A method for the estimation of naphthalene in tar is described in Lunge's Technical Methods of Chemical Analysis, vol. ii. p. 803; this method, which is proposed by White and Ball (J. Gas Lighting, 1904, **88**, 262), consists in weighing about 1 grm. of tar into a 50 c.c. Erlenmeyer flask provided with an air inlet and connected to a U tube. The first two-thirds of this tube is filled with quicklime and the remaining space with glass wool and phosphorus pentoxide. The entire apparatus is heated in an air-bath at 70°—80°. The outlet of the U tube is connected outside the air bath with a weighed second U tube immersed in ice-water. A current of air is drawn through the apparatus at a velocity of 2 litres per hour, which causes the naphthalene to volatilise and deposit in the cooled U tube. The operation is continued until the second U tube no longer shows an increase in weight.

For separation of the naphthalene from spent oxide the method of White and Ball modified as described below and also distillation with steam have been employed, and this latter method has proved more satisfactory.

Separation of the naphthalene by a current of warm air.—When working with this method great difficulty was experienced in completely volatilising the naphthalene. Ten grms. of the spent oxide were weighed into a bottle fitted with inlet and outlet tubes, so that a current of air could be drawn through it. The air current was passed for two hours over the sample of spent oxide, then through 10% citric acid solution to retain any ammonia, and then through three wash bottles containing measured quantities of a saturated picric acid solution of known strength in which any volatilised naphthalene is collected. The bottle containing the sample and also that containing citric acid were kept at 100° in an air bath. The contents of the wash bottles containing picric acid were then mixed together in a tightly stoppered bottle, heated in the water bath until all the naphthalene picrate was dissolved, and then cooled, with occasional shaking. The solution was made up to known volume, the naphthalene picrate separated by filtration and the picric acid in the filtrate estimated by titration with $N/10$ sodium hydroxide, using lacmoid as indicator.

When a current of dry air was used to volatilise the naphthalene the quantity found after two hours' treatment was 1·35%, and with moist air 1·9%. In both cases an examination of the spent oxide after treatment showed visible crystals of naphthalene.

Separation of the naphthalene by steam distillation.—The naphthalene, as was expected, was very easily removed from the spent oxide by steam distillation, and a simple and easy method of estimation of all the naphthalene as picrate was devised. The naphthalene picrate obtained was examined in order to find out if any other hydrocarbons were distilling over and interfering with the estimation.

The details of the method were as follows:—Ten grms. of the sample of spent oxide are weighed into a Würtz flask and subjected to steam distillation. The steam and vapours of the distillate are passed through a second small Würtz flask heated to 100° C and containing 50 c.c. *N*, sulphuric or citric acid, then into a condenser, and finally into a receiver consisting of a wide-mouthed bottle. The whole apparatus is sealed by placing at the exit a wash-bottle containing 25 c.c. of a saturated picric acid solution. The distillation takes about 10 minutes. After this has taken place the water in the condenser is regulated so as to allow any naphthalene to melt and run into the receiver; as soon as this is the case the picric acid seal is washed into the receiver and a further 125 c.c. of picric acid solution added. The receiver is closed with a rubber bung and heated in the water bath until a clear solution is obtained. It is then cooled with occasional shaking and the excess of picric acid determined by titration with *N*/10 sodium hydroxide. The whole estimation takes about 1½ hrs. The following results were obtained on samples from the same lot of oxide:—3·06%, 3·88, 2·98, 2·80, 3·16, 2·79, 2·81% naphthalene.

It was decided to test the method in two ways—by examining the naphthalene picrate for purity and by estimating known weights of naphthalene added to the oxide previously freed from naphthalene by steam distillation.

Examination of the naphthalene picrate for purity.—The naphthalene picrate obtained was subjected to steam distillation, and the naphthalene produced was dried by pressure between filter paper and the melting point determined. The residue of picric acid in the distilling flask was titrated with *N*/10 sodium hydroxide, and the amount obtained compared with that in the naphthalene picrate taken. The melting point of the naphthalene was only from 1°—3° below that of pure naphthalene, which melts at 79° C., so that there could only have been a very small quantity of other aromatic picrates present, if any The quantity of picric acid obtained from the naphthalene picrate was less by 25% than that estimated as having been combined with the naphthalene, as might be expected, since the naphthalene picrate is slightly soluble in the mother liquor and the water used for washing it.

Determinations with known quantities of naphthalene.—For the estimation of known quantities of naphthalene, it would have been best to make up a mixture similar in composition to the spent oxide containing known quantities of naphthalene, but this was considered almost impossible on account of the complexity of the mixture and the difficulty of getting a known quantity of naphthalene to diffuse uniformly through the mass. In order to work under similar conditions as far as possible, the check estimations were made by separating the naphthalene by steam distillation from 10 grms. of the oxide; when all the naphthalene had distilled the apparatus was allowed to cool and then a known quantity of naphthalene was added and estimated as described above. In the earlier stages of the investigation it was found that the formation of the naphthalene picrate takes place much more readily when the solid naphthalene in the distillate is crushed before heating with the picric acid solution, and again if the heating be carried out too quickly the naphthalene has a tendency to melt, and in this state it seems to react only very slowly with the picric acid. The method as carried out above appears to give results which are 10%—15% low. It was thought that a possible source of loss might occur in that the 150 c.c. picric acid solution are diluted by the distillate and by the water necessary to wash the tubes and the catch bottle into the reaction bottle. The volume of liquid obtained is usually 195 c.c.—205 c.c. at 33% dilution—the result being that some naphthalene picrate dissolves in the weak liquor. A series of tests was therefore carried out with weighed amounts of naphthalene in which, before heating the naphthalene with the picric acid solution, sufficient solid picric acid was added to make the whole solution saturated. The results obtained are given below:—

Weight of naphthalene taken.	% $C_{10}H_8$ taken.	Weight of naphthalene found.	% $C_{10}H_8$ found.	Error.
0·34 gms.	3·4%	0·306 gms.	3·06%	—10%
0·29 ,,	2·9%	0·302 ,,	3·02%	4%
0·31 ,,	3·1%	0·310 ,,	3·10%	Nil

A series of estimations was next made on the original spent oxide to compare the two methods, *i.e.*, with and without the addition of solid picric acid. In each case slightly higher results were obtained in those experiments in which the solid picric acid was used, the difference agreeing fairly well with the results previously obtained:—

No.	% $C_{10}H_8$ by original method.	% $C_{10}H_8$ by adding solid picric acid.	Difference.
1	—	2·92%	—
2	2·63%	2·77%	5·4%
3	2·57%	2·86%	10·1%
4	2·61%	2·91%	10·3%

Therefore when estimating naphthalene in samples of spent oxide or in similar cases in which the naphthalene can be separated in a state of sufficient purity by steam distillation a sufficiently accurate result will be obtained for most purposes if after the distillation, crystals of picric acid are added to the distillate in such a quantity that the resulting solution is saturated. but for a working test this is perhaps not necessary. It does not follow that in all samples of spent oxide the naphthalene can be estimated by this method unless the purity of the naphthalene picrate is tested as noted above.

As the sample of spent oxide which was the subject of the above examination has been shown to contain a higher percentage of naphthalene than is usually found in spent oxides it was examined as to its content of solid soluble in water, tar oils and sulphur. The following values were obtained: Soluble in water, 4·95% (ammonium thiocyanate, 71·45%; ammonium sulphate, 9·9%); tar oils, 1·78%; sulphur, 30·32%.

I wish to express my thanks to Mr. Rossiter for his advice during the preparation of this paper, and to the directors of the British Cyanides Co., Ltd., for permission to publish the results.

Discussion.

Dr. W. B. Davidson said that the author appeared to have achieved a satisfactory result, though there did not appear to be any great use in an estimation of that kind. In the Williams process there was occasionally some difficulty in extraction of cyanogen and the presence of naphthalene in the boxes containing spent oxide was no doubt due largely to the fact that liquor or water, sprayed in at intervals, had a condensing effect. The naphthalene was therefore collected gradually in the boxes, and it was certainly a nuisance in the process if the gas under treatment was pretty well laden with naphthalene. Ordinary spent oxide was very often acid. So much depended upon whether air was passed through the purifiers or not. In the Williams process the spent oxide was naturally alkaline because the liquor generally contained 4 to 6% of ammonia.

Mr. Pickering said he had tried washing the oxide with a warm solution of picric acid, practically saturated, finally washing the oxide with a little water and thus preventing loss, and then estimating the naphthalene in the picric acid. He checked the method by adding naphthalene to a sample of oxide which had been washed with picric acid; and he found his results to come to within 95% or 96% of agreement.

Mr. F. H. **Alcock** asked if Mr. Davis had found sulphuric acid with the naphthalene in the distillate? He would have thought it important to seek for other acids than picric. There might be present other things than naphthalene and picric acid. It might be advantageous to add a volatile agent to the spent oxide and then distil the naphthalene. Or the boiling point of the liquid containing the naphthalene might be raised by adding salt, shaking the distillate with ether, and then evaporating slowly. He did not agree that the detection in gas works spent oxide was of little importance, because if its vapour could be carried to the houses there would be a better illumination.

Dr. **Davidson** replied that the vapour of naphthalene would afford no advantage. The boiling point was 218° C. The vapour tension at ordinary temperatures was so low that the gas could not carry 0·008% by volume; and that was only equivalent to the light of a small fraction of a candle-power.

Mr. **Davis**, in reply, said he did not think washing of spent oxide with picric acid would be effective in samples from the Williams process, because ammonia was present. Further there would be a loss of naphthalene before the process was finished owing to time required for washing.

Manchester Section.

Meeting held at the Grand Hotel, on Friday, November 6th, 1914.

MR. JULIUS HÜBNER IN THE CHAIR.

THE OXIDATION OF SEWAGE WITHOUT THE AID OF FILTERS. PART II.

BY EDWARD ARDERN, M.SC., AND WILLIAM T. LOCKETT, M.SC.

In a paper[*] presented to this Section of the Society in April last, a long series of experiments were described dealing with the application of aeration methods to the purification of sewage. It was shown that the accumulated deposit designated "activated sludge" resulting from the complete oxidation by prolonged aeration of successive quantities of sewage, had the property of increasing enormously the purification effected by simple aeration of sewage. The research, which was confined to laboratory experiments, included an investigation of the conditions controlling the oxidising effect of the activated sludge.

The present communication is concerned with outdoor experiments on similar lines to those previously undertaken in the laboratory but on a larger scale. The whole of the earlier experiments were carried out on the "fill and draw" method. Working in this manner with Manchester sewage, it was shown that a highly satisfactory effluent could be produced when the sewage, in intimate contact with one-fourth of its volume of activated sludge, was aerated for a period of from six to nine hours.

Under the conditions of experiment, however, it was necessary to subject the activated sludge to a further period of aeration in order to maintain its highest activity.

It was suggested in the previous paper that improved results might reasonably follow the adoption of a continuous system of working. The following trials were therefore undertaken.

Continuous system experiments.—For the purpose of these experiments a wooden rectangular aeration tank of 35 gallons capacity was employed, measuring 4 feet by one foot, the depth varying from 21 inches at the inlet end to 12 inches at the outlet. The aeration was effected through a series of perforated pipes placed at intervals of 4 inches and fixed latitudinally at a depth of 12 inches from the surface. In order to ensure the complete admixture of the sludge and sewage, an additional perforated pipe was fixed at the inlet end along the centre of the base of the tank.

The effluent from the aeration tank passed forward to a sedimentation tank of similar dimensions, and means were provided for the removal of sludge from this tank with a minimum amount of disturbance.

The previous laboratory experiments worked on a "fill and draw" method, had shown that, in order to be certain of the complete nitrification of Manchester sewage, a period of from 10 to 18 hours aeration in contact with a certain proportion of activated sludge was necessary. Further, the maintenance of the activity of the sludge was apparently dependent on this complete nitrification. The first experiments on the continuous system were made with a rate of flow of sewage sufficient to fill the aeration tank in 24 hours, with the idea of ascertaining whether, under these conditions, a completely nitrified effluent could be maintained which would thus avoid the necessity for re-activation of the sludge removed from the sedimentation tank.

Examination of the effluents obtained by this manner of operation showed that such was not the case. The amount of ammonia present in the effluent increased as the experiment proceeded and eventually rendered it necessary to submit the sludge to a further period of aeration prior to re-circulation through the aeration tank.

As this further period of aeration of the sludge apparently could not be avoided, it was decided to increase the rate of flow of sewage so that a mean stay of six hours was obtained, a period which had previously been found sufficient to produce a satisfactory effluent when working on the "fill and draw" method. Working in this manner, it was of course necessary to make provision for the re-activation of the sludge employed. This was accomplished by introducing a separate aeration tank, in which the sludge received from the sedimentation tank was further aerated prior to passing forward to the aeration tank. Throughout the whole of this period the effluents obtained were non-putrefactive and contained varying amounts of nitrate, but the percentage purification effected did not compare with that obtained with a similar period of aeration when working on the "fill and draw" method. Moreover, there was a distinct increase in finely divided suspended matter and the effluents were imperfectly clarified.

Consideration of the possible reasons for this diminished purification, especially in view of the obvious mixing effect due to the admission of air, led to a study of the minimum period of stay in the tank of any portion of the incoming sewage. Such determinations made by replacing the sewage with a salt solution of known strength, showed that with a mean rate of flow of six hours, 3% of the incoming sewage would pass through the tank in less than twenty minutes, and 25% in under two hours. The decreased purification was thus largely accounted for, inasmuch as the sewage which passed through the tank with less than two hours aeration would retain in all probability, a proportion of its colloid matter.

It was thus apparent that satisfactory progress with this method of working was dependent on the design of a tank which without unreasonably increasing the mean rate of flow would allow a certain minimum period of aeration considerably beyond that given by the tank employed.

In the meantime, further experiments, to be described later, working on the "fill and draw" method had given such considerably improved effluents that the possible advantages of a continuous method of working were definitely minimised, especially in view of the fact that in these latter experiments the manipulation of the activated sludge is obviated. Attention was therefore concentrated on further experiments working on the "fill and draw" method. The authors do not consider the results of the above continuous experiments conclusive, and they hope at a later date to return to this question.

Outdoor experiments on the "fill and draw" method.—In all the previous work the aeration of the sewage was effected through plain tubes. During the progress of this investigation the authors had the advantage of noting the efficient distribution of air effected by means of porous tiles which were being used experimentarlly by Dr. Fowler and Mr. Mumford in connection with further work on the clarification of sewage by means of a specific organism. A similar method of air distribution was therefore employed in the following experiments.

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[*] This Journal, No. 10, Vol. XXXIII., pp. 523 to 539.

For these experiments wooden casks of 50 gallons capacity were employed. The aeration was effected by diffusing the air through a porous tile placed on the bottom of the cask. In general the volume of activated sludge was equal to one-fifth of the capacity of the cask, and consequently when in operation the casks were filled with 10 gallons of sludge and 40 gallons of crude sewage. Preliminary trials showed that an average period of six hours aeration was sufficient to produce effluents of remarkable purity, as will be seen from the following table of analytical results, nitrification in the majority of cases being entirely completed.

TABLE I.

Oxidation of Manchester sewage.

Results in parts per 100,000.

	Raw sewage.	Effluent after 6 hours' aeration.	Purification.
4 hours' oxygen absorption	10·90	1·10	90%
Free and saline ammonia ..	3·66	0·43	—
Albuminoid ammonia	1·12	0·085	92%
Nitrite } In terms	—	0·10	—
Nitrate } of NH_3	—	1·79	—
Absorption of dissolved oxygen 5 days at 65° Fah. Royal Commission test ..	—	1·09	—

Note.—Proportion of activated sludge to sewage 1 : 4. Temperature varied from 15° to 22° C.

Comparison of these results with those obtained when plain pipe aeration was employed, showed at once the beneficial effect of diffused air.

The following experiments relating to the rate of oxygenation of sewage by the use of (*a*) plain tubes, (*b*) porous tiles, offer a reasonable explanation of the improvement.

TABLE II.

Rate of oxygenation of raw sewage.

Results in parts per 100,000.

Time.	Excess of air used. Strong sewage.		Average amount of air used. Dilute sewage.		Minimum amount of air used Dilute sewage.	
	Aeration effected by :—		Aeration effected by :—		Aeration effected by :—	
	Plain tube.	Diffuser.	Plain tube.	Diffuser.	Plain tube.	Diffuser.
			Dissolved oxygen content.			
At commencement	·06	·06	·24	·24	·23	·23
After 5 minutes aeration	·23	·53	—	—	·21	·29
" 10 " "	·42	·63	—	—	·26	·46
" 15 " "	·49	·62	·42	·73	·23	·50
" 30 " "	·56	·66	·49	·74	·22	·59
" 45 " "	·56	·64	·56	·76	·22	·66
" 60 " "	—	—	·57	·77	·09	·56
" 90 " "	·57	·63	·63	·79	—	—

In the light of our earlier investigations, it appeared likely from the high degree of nitrification obtained in these preliminary experiments, that the activity of the sludge would be maintained without intermediate aeration of the sludge alone. The two casks were therefore operated according to the following cycle :—(*a*) 6 hours aeration period, (*b*) 1½ hours settlement, (*c*) ½ hour discharge of effluent, and thus each cask received 3 fillings of crude sewage per day, and dealt with a total volume of 240 gallons per day.

As the experiment proceeded it was noted that nitrification of the weaker morning sewage was completed before the end of the six hour aeration period and subsequently the cycle was modified so that the morning sewage was aerated for a period of 4 hours only.

In Table III. are given the average results obtained over a considerable period.

TABLE III.

Oxidation of Manchester sewage.

Results in parts per 100,000.

	Raw sewage.	Effluent after 6 hours. aeration.	Purification.
4 hours oxygen absorption	10·22	0·86	92%
Free and saline ammonia ..	3·56	0·32	—
Albuminoid ammonia	1·03	0·08	92%
Nitrite } In terms of NH_3	—	0·06	—
Nitrate }	—	1·87	—
Absorption of dissolved oxygen 5 days at 65° Fah. (Royal Commission test)	—	0·80	—

Note.—Proportion of activated sludge to sewage 1 : 4. Temperature varied from 16° to 22° C.

In view of these excellent results the period of aeration was further reduced to 4 hours, the casks consequently received 4 fillings per day and dealt with a total of 320 gallons of crude sewage daily.

The results obtained when working in this manner are recorded in Table IV.

TABLE IV.

Oxidation of Manchester Sewage.

Results in parts per 100,000.

	Raw sewage.	Effluent after 4 hours' aeration.	Purification.
4 hours oxygen absorption	10·23	1·03	90%
Free and saline ammonia ..	3·46	0·21	—
Albuminoid ammonia	0·99	0·10	90%
Nitrite } In terms of NH_3	—	0·07	—
Nitrate }	—	1·60	—

Note.—Proportion of activated sludge to sewage varied from 1 : 4 to 1 : 3. Temperature 15°—20° C.

The percentage purification was only slightly affected by the reduction of the aeration period from six to four hours.

The effluents obtained throughout this series of experiments were extremely well clarified and in general were superior to those yielded by the best type of bacterial filters.

The outstanding feature of these results is the fact that by employing diffused air the necessity for intermediate aeration and consequent manipulation of sludge was entirely removed and at the same time much better effluents were obtained than those yielded by plain pipe aeration when working with a similar aeration period.

The effluents obtained in the earlier laboratory experiments, when working with a six hours plain pipe aeration period, were liable to absorb an undue proportion of dissolved oxygen, as compared with that absorbed from acid permanganate of potash. It is therefore highly satisfactory to note that in the series of outdoor experiments under observation, the dissolved oxygen absorption of the effluents was remarkably low. This low dissolved oxygen absorption being coincident with a very low free ammonia content, appears to support the theory previously advanced, that the stage to which nitrification has proceeded is not without influence on the amount of dissolved oxygen absorbed.

General remarks. The earlier experiments showed that the question of temperature influenced the oxidation process. The above results were obtained during the summer with entirely favourable temperatures. It is scarcely to be expected that such a high rate of nitrification would be maintained throughout the winter months without the necessity arising of increasing the temperature of the sewage a few degrees, by the use of warm air or by other means.

During the earlier experiments it was occasionally necessary to increase slightly the alkalinity of the sewage dealt with, in order that nitrification should proceed without hindrance. Throughout the present out-door experiments, when working with 20 to 25% by volume of activated sludge no difficulty has arisen in this respect. The alkalinity or basicity of the sewage and sludge has always been sufficient to allow complete nitrification.

The opinion expressed on a previous occasion in regard to the possible retarding effect of abnormal quantities of bacterially inhibitory trade effluents, such as may be present, from time to time, in Manchester sewage, has been confirmed by wider experience in regard to the working of this oxidation process. As an example of this action, it may be mentioned that on September 6th a sample of sewage was dealt with, the 4 hours oxygen absorption of which was as high as 38·4 parts per 100,000, as compared with the usual average of from 8 to 13 parts per 100,000. This high oxygen absorption figure was caused by an undue proportion of tar compounds.

The effect of four hours aeration of this sewage in contact with the usual proportion of activated sludge was to produce an effluent whose oxygen absorption was 3·1 parts per 100,000, showing a purification of 92% on the original sewage. As might be expected, however, this abnormal sample of sewage exerted subsequently a deleterious effect on the activity of the sludge, more particularly in regard to the nitrification change. By increasing the aeration period to six hours over a period of a week, the sludge practically regained its original activity. In another instance more difficulty was experienced in re-establishing active nitrification.

Experience with this method of sewage purification has clearly indicated the necessity for adequate scientific control in order that the oxidation process may be maintained at its highest efficiency. The complete success of the process is dependent upon the maintenance of the activity of the nitrifying organisms, which, unless thoroughly established, are very susceptible to adverse conditions.

The difficulties previously mentioned concerning the maintenance of the activity of the sludge should not arise when dealing with domestic sewage, but where Manchester sewage or a strong trade sewage of similar character is concerned, it is obvious that careful attention will have to be paid to the varying nature of the sewage treated, with special reference to the presence of abnormal quantities of inhibitory trade effluents.

On the average, the amount of air used in the cask experiments described previously, has not exceeded 15 cubic feet of free air per square foot of tank area per hour. Special attention is being devoted to the question of the minimum air supply essential to the proper working of the oxidation process.

The important question of accelerating the rate of initial accumularion of activated sludge is also being closely investigated. Slurry obtained from percolating filters has been found useful in this respect. Experiments are also in progress to determine the most economical proportion of sludge to be employed.

The outdoor experiments described in this communication, are at present being translated on to the working scale by the use of a tank of 20,000 gallons capacity. on the basis of the cask experiments, it should eventually be possible to deal with 60,000 gallons of sewage per day in this tank, the area of which is 400 square feet.

For the present the authors do not propose to refer to the question of cost other than to say that the results which have been described shew such a marked advance on those hitherto obtained, as to add great force to the remarks made in the previous paper, in regard to the practical application of this method of sewage purification.

In conclusion, the authors have again to express their sincere thanks to Dr. Fowler for his continued interest in this research, and they wish to place on record their appreciation of his invaluable enthusiasm in regard to the progress of the experimental work.

The authors' thanks are also due to the Worshipful Company of Grocers for facilitating the progress of this research, by the election of one of them to a Research Scholarship.

They are indebted to the Rivers Committee of the Manchester Corporation, for permission to publish these further results of their investigations, which have been carried out at the Corporation Sewage Works, Davyhulme.

THE PURIFICATION OF SALFORD SEWAGE ALONG THE LINES OF THE MANCHESTER EXPERIMENTS.

BY S. E. MELLING, F.I.C.

Prior to the reading of the paper on the oxidation of sewage without the aid of filters by Ardern and Lockett (see this J., 1914, **33**, 523), I had, through the courtesy of Dr. Fowler, seen certain work carried out at Davyhulme upon raw sewage with activated sewage-sludge, under laboratory conditions.

At that time, these gentlemen, having already built up a reserve of the activated sludge to establish finally the principles of its action upon sewage under aerobic conditions—details of which were embodied in their paper and have been subsequently elaborated—were considering ways and means of translating the experiments on to a much larger scale.

As an official closely concerned with the problem of sewage disposal in the neighbouring Borough of Salford, it appeared to me very desirable to make some out-of-doors investigation along similar lines, particularly since we were fortunately situated in regard to the requisite air supply for extensive experiments.

Whatever measure of success has been met with in so far as clarification and purification are concerned, it must be made very clear at the outset that the all-important question of cost has not yet been shown. The results which have so far been obtained are such as to warrant an extension of the work, and we look forward with confidence to the time when this method shall reveal itself as altogether rational for the treatment of sewage.

A few words are necessary here in explanation of the plant which the Rivers Committee of the Salford Corporation placed at the disposal of Mr. W. H. Duckworth, the Manager of the works, and myself for the work.

The method of treatment at Salford is chemical precipitation of the screened sewage (lime and iron salts) and sedimentation followed by filtration. Interposed between the precipitation-tanks and percolating filters, is a system of so-called "roughing" filters, which were introduced by the late Mr. Joseph Corbett, Borough Engineer, some seven years ago. These roughers (six in number) form two of the original twelve precipitation-tanks, and cover an area of about 2000 square yards. They contain 2 ft. 6 in. of fine gravel, and their function is to intercept solids in the tank effluent, and so minimise the tendency to choke the percolating filters. During normal working, mechanical cleansing of the gravel-media by means of air, covers a period of about 18 out of the 24 hours. Below the media the air pipes are arranged crosswise; the air-outlets or jets are ⅛ in. diameter, and placed 8 ins. apart on the top and sides of the pipe; to each filter there are about 15,000 jets. A roughing filter is sub-divided into 3 sections, separated by dwarf walls 4 ft. 6 ins. high—a full section to within an inch or two of the wall-coping holding roughly 25,000 gallons.

Half of one of the above sections of a roughing filter, with a capacity of 12,000 gallons was exposed, and the floor so prepared as to obviate any appreciable settling out of the sludge during either the blowing or the quiescent periods.

On June 16th the first charge of crude sewage was introduced and air forced through at a pressure of about 2 lb. The procedure at first decided upon, was to continue aeration until such time as a diminution in reducing power, along with sensible nitrification, were observed, followed by settling for a sufficient period and careful decantation. At a later date, matters were accelerated by the addition of copperas at the rate of 16 grains per gallon (*i.e.*, on four occasions only); and also of washings from slurry (free from coarse detrital matter) which had been removed from the filtered effluent carrier.

The analytical results are embodied in the following tables:—

TABLE 1 (A).

Experiment commenced, June 16th, 1914. No chemicals added. Analysis of effluent on shaken sample. Temperature averaged 20·5° C.

All results expressed in parts per 100,000.

	Raw sewage.	Aeration for :—					
		1 day.	2 days.	3 days.	4 days.	5 days.	6 days.
Chlorine in chlorides	25·7	23·6	23·6	23·6	Sterilised with HgCl$_2$		24·1
Nitrates, Nitrites } as N	0·09	0·21	0·21	0·19	0·17	0·18	0·17
Free and saline NH_3 (as NH_3)	2·28	1·43	1·30	1·43	1·71	1·85	1·71
Albuminoid ammonia (as NH_3)	0·63	0·51	0·59	0·30	0·31	0·31	0·31
Oxygen absorbed, in 4 hours	9·34	4·06	3·4	3·14	2·43	2·6	2·43
Alkalinity (as CaCo3)	33·5	27·0	26·7	26·3	—	26·7	26·3

TABLE 1 (B).

Experiment commenced, June 23rd, 1914. No chemicals added. Temperature averaged, 20·2° C.

	Raw sewage.	Aeration for :—					
		1 day.	2 days.	3 days.	4 days.	5 days.	6 days.
Chlorine in chlorides	24·0	23·6	23·6	23·6	Sterilised with HgCl$_2$		23·6
Nitrates, Nitrites } as N	0·16	0·19	0·17	0·17	0·19	0·14	0·14
Free and saline NH_3 (as NH_3)	1·86	1·28	1·14	1·28	1·43	1·57	1·43
Albuminoid ammonia (as NH_3)	0·46	0·34	0·26	0·26	0·26	0·34	0·24
Oxygen absorbed, in 4 hours	5·57	2·51	1·91	1·70	1·37	1·51	1·56
Alkalinity (as CaCo$_3$)	25·0	—	22·1	21·4	22·1	21·6	22·0

TABLE 1 (C).

This experiment proceeded for a further 4 days during which very slight in and out changes were observed. Copperas added. Temperature, 20·5° C.

All results expressed in parts per 100,000.

	Raw sewage.	Aeration for :—					
		1 day.	2 days.	3 days.	4 days.	5 days.	6 days.
Chlorine in chlorides	25·0	25·0	25·0	24·7	HgC12	HgC12	25·0
Nitrates, Nitrites } as N	0·15	0·18	0·14	0·18	0·14	0·12	0·16
Free and saline NH_3 (as NH_3)	2·28	1·71	1·93	1·71	1·57	1·86	1·57
Albuminoid ammonia (as NH_3)	0·51	0·43	0·31	0·26	0·23	0·26	0·28
Oxygen absorbed in 4 hours	7·43	3·17	1·74	1·90	—	1·61	2·21
Alkalinity (as CaCO3)	21·4	25·0	22·1	2·30	22·6	22·6	22·8

Laboratory experiments upon Salford sewage, involving the gradual building up of sludge of such a degree of activity as to bring about, in from two to three hours, upwards of 85% purification, together with a clarified and stable effluent, are not quoted here. Whilst fully substantiating parallel records at Davyhulme they are of secondary importance when compared with the subsequent trials on the larger scale at Salford.

The results fluctuate from day to day sometimes unaccountably, but it would appear that the maximum effect—if any virtue can be attached to it—is brought about in approximately 48 hours. Whilst a very material reduction in oxidisable matters and also some clarification is seen, it would appear that the cause is more physical than biochemical.

As shown in Table 1 (D), the period of blowing was now

TABLE 1 (D).

Remarks. Copperas was added to each charge of sewage. Temperature averaged 19·5° *C.*

All results expressed in parts per 100,000.

	Raw sewage.	Aeration :		Raw sewage.	Aeration :		Raw sewage.	Aeration :	
		1 day.	2 days.		1 day.	2 days.		1 day.	2 days.
Chlorine in chlorides	25·0	25·0	24·7	18·0	17·1	17·4	29·6	29·3	29·0
Nitrates } as N .... Nitrites }	0·09	0·09	0·07	0·05	0·13	0·12	0·06	0·13	0·12
Free and saline NH_3 (as NH_3)	2·36	1·30	1·14	2·07	1·57	1·93	2·57	2·21	2·28
Albuminoid ammonia (as NH_3)	0·51	0·24	0·20	0·57	0·34	0·31	0·46	0·34	0·37
Oxygen absorbed in 4 hours	6·41	1·86	1·40	8·60	3·20	2·71	6·14	2·80	1·54
Alkalinity as $CaCO_3$	25·0	23·6	24·3	24·0	26·0	25·0	24·3	23·3	24·0

cut down, and the results are perhaps typical of what one might expect, in spite of any precipitation induced by the copperas added, since the amount of sludge at this stage is exceedingly small and its activity problematical.

Our next move was to accelerate the accumulation of sludge and to oxidise it as thoroughly as possible. Accordingly, on July 20th and 21st, the slurry washings from the filtered-effluent carrier above referred to, were added to the already-existing sludge, and blown, without a charge of sewage. The depths of washings, etc., was 14 ins. The blowing continued with little cessation until August 13th, by which time the physical character of the sludge had undergone certain changes, but most marked in regard to its flocculent condition.

On August 14th, fillings with crude sewage were recommenced and included in Table 2 are two series of interesting analyses :—

TABLE 2 (A) AND (B).

Temperature averaged 19° *C.*

	(A)					(B)		
	Raw sewage.	Aeration for :				Raw.	Aeration for :	
		1 day.	3 days.	4 days.	5 days.	sewage.	6 hours.	1 day.
Chlorine in chlorides	21·4	21·4	21·0	21·4	22·0	23·3	23·6	23·6
Nitrates } as N .... Nitrites }	Nil	1·12	2·34	2·57	2·80	Nil	0·70	1·03
Free and saline NH_3 (as NH_3) ..	2·57	1·28	0·30	0·06	0·05	2·36	1·36	1·07
Albuminoid ammonia (as NH_3)..	0·63	0·23	0·20	0·20	0·18	0·57	0·28	0·28
Oxygen absorbed in 4 hours	7·83	1·50	2·0	2·19	1·96	35·3	15·7	6·76
Alkalinity as $CaCO_3$	—	—	—	—	—	27·1	23 6	21·4

TABLE 3.

Averages of 35 fillings.

	Raw sewage.	Aeration for :			
		1 hr.	2 hrs.	3 hrs.	12 hrs.
Chlorine in chlorides	18·1	19·1	19·3	19·8	19·1
Nitrates } as N .... Nitrites }	0·098	0·60	1·0	1·20	1·85
Free and saline NH_3 (as NH_3)	2·50	0·81	0·33	0·13	Nil
Albuminoid ammonia (as NH_3)	0·49	0·21	0·16	0·13	0·11
Oxygen absorbed in 4 hours	7·71	1·83	1·53	1·50	1·03
Alkatinity as $CaCO_3$	17·8	15·7	13·7	10·6	8·3

Table 2 (A).—In 24 hours there is 50% reduction in "free and saline" ammonia, 80% purification based upon the 4 hours oxygen-absorption test, and active nitrification is in evidence. At the end of the third day, there was very good clarification and the ureal ammonia is now reduced 88%, accompanying increased "nitrites and nitrates." By the fifth day, nitrification was practically complete, and the experiment was not carried further. The effluent gave a satisfactory result upon incubation at 36° C. for five days.

With the subsequent filling on August 21st, a not altogether unexpected difficulty was experienced. Occasionally Salford sewage is liable to contain highly-oxidisable effluents of an objectionable type—coal-tar oils, phenoloid bodies, and so forth.

It was almost too much to expect the sludge, which was showing signs of marked activity, would survive intimate contact with sewage of the type shown in Table 2 (B), but, although oxidation was quite incomplete in one day, the fact that nitrification was proceeding, in a very few hours, was highly satisfactory, Some inhibitory effect, particularly upon the nitrifying organisms present, was suggested by the result of the next few days, which were not so good.

From the 28th August to 6th September, a period is covered in which the blowing varied accordingly to circumstances: in one case it continued for 55 hours, but a full day was allowed as the minimum. Intermediate samples, however, were taken to trace the reactions proceeding, and without multiplying figures it may briefly be stated that the most drastic change had taken place by the end of the sixth hour. Reduction in "Free and saline" ammonia and "Albuminoid" ammonia in no case was less than 50%, and nitrification was well established. As regards clarification, comparison of the filtered sample with filtered tank effluent was consistently to the advantage of the former.

In the next stage (September 8th to October 16th exclusive) the effluent is sampled at more frequent periods, *i.e.*, after 1, 2, 3 and 12 hours. The average for 35 fillings is given in Table 3.

The purification is shown to be progressive as the sludge is gradually accumulating. When on the 16th October we were working with perhaps 20% by volume of the sludge, in two hours there was a purification of 91% based on the oxygen-absorption figure, and the "free and saline" ammonia had been reduced from 2·64 parts to 0·028 part per 100,000, with "nitrous and nitric nitrogen," 1·17 parts per 100,000. Beyond the third hour aeration gradually removes all the ureal ammonia, but clarification is not so good at the end of the twelfth hour than was noted at intermediate stages. As there is obviously no further supply of ammonia to be converted, increase in nitrification, as shown, probably proceeds at the expense of the activated material, and, as suggested by Messrs. Ardern and Lockett, this might account for the increased turbidity observed due to fermentation of nitrogenous matter in the sludge.

Materially reducing the full period of blowing to three hours, we now arrive at the latest stage of these trials, and the results both as to clarification and purification are so remarkable that I venture to give another table (Table 4), showing analyses up to the 30th ult. Having regard to the exigencies of the occasion we worked on October 18th at the rate of from 3 to 4 charges per diem, and are still proceeding along these lines. On the 23rd ult. we had more than sufficient activated sludge for our purpose, so that an additional section of approximately 22,000 gallons capacity was inoculated with about one quarter of the volume of the well-settled activated sludge from the first section. This extension of the work is giving very promising results. The characteristic physical property of the activated sludge has been referred to. Its average composition is shown in Table 5, and for comparison an analysis of ordinary "tank" sludge, as sent to see, is included.

There are many interesting points brought about by this investigation, but the main fact is established that it is possible to clarify and purify crude sewage in bulk in 3 hours, under the above-demonstrated conditions: in effect to produce an effluent that will more than satisfy any local or international standard.

In conclusion I have to acknowledge the generous advice given by Dr. Fowler, to whom I have referred many doubtful points on the subject. To my assistant at the sewage works, Mr. Norman Lovett, I am also indebted for the laborious care he has exercised throughout the period of these tests, and finally to Mr. Duckworth, the manager of the works, special thanks are due for his valuable co-operation and the painstaking control of the working conditions involved.

TABLE 4.

Parts per 100,000.	Best result.		Worst result.		Average result.	
	Raw settled.	3 hours shaken.	Raw settled.	3 hours shaken.	Raw settled.	3 hours shaken.
Chlorine in chlorides	17·1	17·7	22·0	22·0	19·3	19·3
Nitrates } Nitrites }	0·07	1·41	0·12	1·41	0·10	1·11
Free and saline NH_3	2·86	Nil	3·0	0·03	2·86	0·01
Albuminoid ammonia (as NH_3)	0·61	0·14	0·60	0·13	0·53	0·13
Oxygen absorbed in 4 hours	7·90	0·54	7·18	1·37	7·11	0·75
Alkalinity (as $CaCO_3$)	14·6	8·6	17·3	10·7	16·3	8·8
Dissolved oxygen in 5 days at 18° C.	—	0·24	—	0·59	—	0·46
% Purification.						
On albuminoid ammonia		77	—	78	—	76
On 4 hours oxygen		93	—	81	—	90

TABLE 5.

Analysis of sludge.

	"Activated."	"Tank."
Water.	94·6%	88·0%
Analysis on dry sample:—		
Mineral matter	45·5%	68·8%
Volatile "	54·5	31·2
Phosphoric acid (P_2O_5)	2·1	1·1
Nitrogen	3·75	1·20
{ Unsaponifiable matter	1·87	2·20
{ Fatty acids	2·93	5·00

DISCUSSION.

Mr. J. P. Wakeford (City Engineer of Wakefield) said he had tested the process with the sewage at Wakefield, which was composed of various trade effluents, notably wool-scouring refuse, and partook of many of the characteristics of the Bradford sewage but was not quite so concentrated. Humus tank sludge was brought into condition by aeration, and the quantity gradually increased to 25% of the barrel capacity (35 galls.) by decanting off the top water and adding more sludge. By this method nine days were required for the experiment. Crude sewage was then added and aeration continued. In this way after 48 hours the free and the saline ammonia were completely removed; at the present time the same results were being obtained in something like three to four hours, which indicated that the sludge had become more thoroughly activated. The dry sludge contained organic matter 43·99%, mineral matter 56·01, nitrogen, free and saline, ·052; total nitrogen 4·59, phosphates 2·74, iron 9·67. The figure for mineral matters was accounted for by the fact that for some three weeks the crude sewage used was taken direct from the outfall sewer without any settlement. Of course it was advisable to give the sewage as effective detritus tank treatment as possible, but still the results were interesting. Money expended in the past on the construction of filters would not be money wasted, as the experiment showed the percentage purification was most rapid in the initial stages; therefore it would most probably be found cheaper to use aeration methods as a preliminary process rather than an end in itself. In practice it would be found that further aeration of the sludge was necessary to keep up its high potential energy. It would also be noticed that the iron figure of 9·67 was high. The iron had possibly acted as a catalyst in bringing down the colloidal matter, and if so it might be found advisable to add iron where it was not present in the crude sewage.

At the present time Wakefield sewage was costing about 17/– per million gallons for treatment with lime. He could not at present see why the application of air should cost more than about 10/– per million gallons.

Mr. Duckworth said that the quantity of sewage purified at the present time at the Salford works by the activated sludge method was about 80,000 gallons per day, with three fillings in 21 hours, on the fill-and draw system, with three-quarters of an hour to fill, three hours blowing, two hours settlement, and one hour to run off. A sample taken after blowing one hour was allowed to settle and was quite clear. The experiment appeared to be worthy of very full investigation on a large scale. It was intended in Salford to put a 12,000 gallon tank on a continuous flow. One difficulty had already shown itself, namely, the stopping up to some extent of the holes in the aeration pipes.

Councillor Mather said that the experiment conducted at Salford had been very encouraging. It was hoped that in a very short time there would be such a number of filters in operation as would enable experiments to be conducted on a very large scale.

Mr. **Welch** approached the question from the point of view of the engineer, who was perhaps not so optimistic about it as the chemist. The effluents produced and the manner in which clarification was obtained within such a short time were noteworthy. The great difficulty in sewage treatment was that as a rule it was impossible to obtain sufficient clarification. Tank effluent frequently contained a large amount of solid matter, and engineers had been compelled to add one series of filters after another. That solid matter appeared to a very large extent to be absent from the samples of effluent that Mr. Ardern had previously exhibited. Another remarkable point was that the sludge samples did not possess anything like the greasy, fatty appearance that was customary. He was surprised, upon an inspection of Mr. Melling's analysis of sewage sludge, to find that the fatty acids were 2·93 for activated sludge as against 5·0 for tank sludge, and the unsaponifiable matter 1·87 against 2·20. The sludge seemed very granular. He would have thought that there would have been less fat than appeared to be shown on the tables. From the original paper in April he gathered that the air pressure was used partly to blow the activated granular sludge so that it came into close contact with the whole of the sludge, and that it was this intimate contact between sludge and sewage that was responsible, to a certain extent at least, for the success of the purification. If that were so that might occur in the case of perforated pipes; but in the case of diffused air he would have thought the effect was somewhat modified. It might be possible to reduce that cost of the process by aerating for one hour to get about 90% of purification, and get a further purification by precipitation or filtration. Although the aeration process necessitated a certain amount of working expenses, it could certainly be balanced by an enormous reduction in the first cost as Mr. Ardern suggested, and his experience was borne out by later speakers, that tank accommodation for one quarter of the daliy flow would be sufficient to give a satisfactory effluent without further treatment. That suggestion appeared incredible. He suggested that it might be desirable to compare summer treatment and winter treatment by using tanks surrounded and covered with non-conducting material.

Dr. G. J. **Fowler** said the achievement of Mr. Melling in dealing with 80,000 gallons of sewage per day, with a purification of something like 90%, was worthy of great praise. An arrangement had been made by the Manchester Corporation to deal with the sewage of the Stockport authority, or a population of 100,000 at the Davyhulme works. In the ordinary way this would seem a rather large undertaking, but if Mr. Ardern's results could be substantiated on a large scale, and the experience of Salford showed that they could, the whole of the sewage of Stockport could be dealt with in a single tank at Davyhulme, and with a considerably better result than was being obtained at the present time with full double-contact, and moreover with the production of a sludge which contained three or four times as much nitrogen as ordinary sludge. The resulting sludge could be dried almost instantaneously and in appearance was almost like sand. It contained a large proportion of phosphates. He quoted a paragraph from a paper sent to the International Congress at Washington several years ago.

"The scientific solution of the sewage problem will not be attained until the following results can be guaranteed for any given case :—

"(1) An effluent which will not deteriorate the stream into which it flows.

"(2) No nuisance in the course of sludge disposal.

"(3) No nuisance from smell or from flies in connection with filter beds.

"(4) An expenditure strictly proportionate to the sanitary and æsthetic results achieved."

Apparently all four conditions were now capable of fulfilment. It was quite obvious that the expenditure could not be excessive in making provision for the blowing of a quarter of a cubic foot of air per minute per square foot of water surface for a period of three or four hours, because in the one process the whole thing was complete; sludge treatment, purification and everything else, with the exception of course of simple manipulation. The process described in the papers was the only process existing which purified sewage thoroughly from beginning to end in one operation. To that extent it really constituted a revolution in sewage treatment. Heretofore chemists had always been accustomed to think of the necessity of first a tank, then a filter, and then the production of some intractable material known as sludge. The new process put an end to these conditions. He now felt that it was in the direction indicated by the papers that the final solution of the sewage problem was to be sought. A debt of gratitude was due to the chemists who had undertaken research work on the new lines, but of course the development of an idea could not be credited to any one worker. The idea which started these particular researches originated really at the Lawrence experimental station at Boston, Massachusetts. He was interested in Mr. Wakeford's statement concerning the probable catalytic effect of iron, and probably "M7" played some part in the process. A great amount of research work still remained to be done on the bacteriological and physico-chemical side of the question, but the further investigation was carried the easier the problem appeared to be.

Mr. J. H. **Lester** was struck by the extreme simplicity of the processes. There were many iron precipitation methods, metallic iron had been used in the "Electrical" process, and iron largely accounted for the purification taking place in contact beds, but probably the best method of distributing iron in colloid form was that now described, in which the iron was distributed throughout the sludge and was thoroughly mixed with the sewage.

Dr. J. **Grossmann** said that the question of cost was the principal factor. Again, if air was blown through a liquid there was bound to be a certain amount of spray. Would his tend to the creation of a nuisance in the case of sewage, and was it possible for pathogenic germs, which otherwise might be latent or stagnant, being blown about in the atmosphere? The treatment of sewage not only involved purification but also highly the important sludge problem.

The present process was understood to be biological, though he was not aware that that had been clearly demonstrated. It would be interesting to learn definitely whether it was or was not a purely physical process, or to a great extent a physical process, the result being simply due to the much larger surface which was given to the sludge. For instance, if fifty parts of sand, kieselguhr, or other substance were mixed with one part of sludge and air blown through it, would the same result be obtained? Mr. Melling's figures indicated that the sludge treated was abnormal, because the nitrogen content was low and so was the grease (sum of unsaponifiable matter and fatty matter). The mineral matter was reduced by blowing from 68·8 to 45·5%: the only conclusion he could draw was that there was an addition in bulk of 50% of sludge as the result of the process by blowing. The figure of 7·2% for total fats in a sludge was extremely low. It appeared to him that altogether a much larger bulk of sludge was formed, and he would like to learn whether exact observations had been made on the point. The activated sludge contained 94·6% of water and the ordinary tank sludge 88%; this in addition to the other increase in bulk shown by the decrease of the mineral matter would increase the bulk of the sludge produced by this method considerably more than threefold. And in dealing with the sludge subsequently more than twice the quantity of water would have to be removed by some means or other. Mr. Ardern had stated that a great deal of the water could be eliminated by a process of fine sieving so far as laboratory experiments went, but it was doubtful whether such a system could be applied on a large scale. Sludge containing 5% of fatty matter was unsuitable for agricultural purposes, so that it would have to be degreased in order to obtain a marketable product, and three times the bulk would have to be dealt with.

Mr. **Ball** said that if the figure for nitrogen could be maintained it might be possible to make a profit out of the sludge.

Mr. W. **Thomson** inquired whether the sludge had been examined for bacterial life, and whether there was an increased quantity in the activated sludge. The greater proportion of mineral matter contained in the ordinary as compared with the activated sludge might possibly be explained by the mineral matter falling to the bottom during aeration. The phosphoric acid in the activated was about twice the quantity of that in the ordinary sludge. Was it possible that that could have any effect upon the rapid development of bacterial life? Assuming phosphoric acid had some considerable effect in propagating bacterial organisms, would finely divided bone charcoal, when mixed with the sludge, increase the purifying action on the sewage? In sewage matter there was always a certain amount of protoxide of iron, the sewage matter having the effect of deoxidising the peroxide of iron. It was probable that the iron oxide present in the sludge might act as a catalytic agent in bringing about the more rapid oxidation of the organic matter.

Mr. Pettigrew asked whether the sludge was not extremely liable to putrescence. It appeared to him, from the sample he had seen, that after partial or wholly drying it was extremely liable to have a strong odour. In Glasgow, for the ordinary treatment of their sewage in the East End, they ran the sewage on to the old sludge, and in half an hour obtained a much superior effluent than they did when they worked the process continuously. He was very pleased to find that the idea which was originally stated, that the air was only to be used for mixing the sewage, had been dropped. He believed the rationale of the process was that it did away with the filtering media of a biological filter, and the ease with which the sludge or the humus matter coming from a sprinkler filter was rendered fit for activated sludge appeared to demonstrate that that was practically the basis on which the process operated. It was not necessary to have an oxygen saturated atmosphere in a filter; in fact, the result was rather deleterious. A small quantity of oxygen was necessary. Probably some of them had read Dr. Angus Smith's works, and they would remember his statement that when he blew air through sewage there was never putrescence; the sewage effluent had to be prevented from turning all the oxygen into carbonic acid. He was pleased to find it had been shown by Mr. Ardern's paper that the actual presence of free oxygen in the effluent was absolutely necessary, and also that it was requisite to pay attention to the method of distributing it. He thought the views of some of the gentlemen who had spoken would be modified if they saw the samples of effluent; when they saw how compact the sludge settled, how granular it was in appearance, and the clearness of the liquid obtained on the top. There was another question to be considered, and that was the small amount of nitrogen obtained after having got rid of the free ammonia and the nitrogen in the effluent. If all the nitrogens were added together there was very much less nitrogen contained in the effluent than there was in the original sewage. For instance, a biological filter might give a nitrogen content of about 2½ grains to the gallon or 1·5 on the average, whereas the effluents he had seen had a nitrate content of about 0·2 to 0·5. He should imagine if activated sludge was allowed to stand nitrogen gas would be given off.

Mr. Ardern, in reply, said they were naturally very pleased to hear of the success of the aeration experiments at Wakefield. He had rather anticipated that with sewage containing a high proportion of soapy matters, preliminary treatment with lime would have been required. In the light of the experience gained at Manchester, he was rather of opinion that it would be more economical to carry the oxidation process to complete oxidation in tanks alone, rather than to reduce the aeration period and nitrify the resultant effluent on filters working at a high rate. Working in the latter manner, there appeared to be considerable difficulty in maintaining complete activity of the sludge, as this was dependent on the stage to which nitrification proceeded. If, therefore, the question of intermediate aeration or reactivation of the sludge had to be considered, the difference between the cost of complete purification in tanks alone, and that necessary for clarification or partial purification, did not leave much margin for filtration charges. With regard to the Wakefield experiments it could not be assumed that the high percentage purification obtained with one hour's aeration would be maintained, if the sludge was called upon to deal with successive quantities of sewage with a period of one hour's aeration each. In regard to the method of air distribution, a contrivance in the nature of a box was employed, the top surface of which was composed of a specially prepared porous tile. The air was admitted underneath and diffused through the porous tile. It was highly important to obtain a complete admixture and intimate contract of the activated sludge with the sewage, otherwise not only was a proportion of the sludge removed from the sphere of action, but the deposit of sludge resulting from imperfect circulation, was liable to give rise to secondary changes inimical to the oxidation process. The covering of the tanks as suggested by Mr. Welch might be useful, but the winter temperature of many sewages frequently fell below the optimum required for the most efficient working of the process, a difficulty which could not be overcome by any methods designed purely from the point of view of the conservation of the heat of the original sewage. The question of cost had received serious consideration, and from this point of view the process was eminently practicable. The actual cost would depend on details concerned with the mechanical application of air, which remained to be fully developed. There was much to learn in regard to the mechanism of the reaction, whilst physical actions were undoubtedly involved, the purification process was essentially a vital one. The real activity of the sludge was considerably influenced by the stage to which nitrification proceeded. An experiment with sterile sludge quoted in the previous paper showed no purification effect. The possibility of nuisance or danger from the moist atmosphere rising from the surface of the aeration tanks, could only be regarded as infinitesimal when compared with the present-day methods of sewage purification. No reliable determination had yet been made of the volume of residual sludge resulting from the oxidation process. Since a sludge containing upwards of 4% nitrogen was looked upon rather as an asset than a liability this question had not been considered of vital importance. He could not agree that the low fatty matters content of the dried sludge would inhibit its use as a fertiliser. A large number of manures on the market contained a greater quantity of grease.

The sewage of many industrial towns contained appreciable quantities of iron, and the question of its action as a catalyst or conveyer of oxygen was one of considerable interest. This question was at present being investigated. In principle there was no difference between the reactives invoved in the aeration tank and in a percolating filter. In the aeration process the action was intensified by a more intimate contact with the sewage of a greater proportion of sludge in a more thoroughly oxidised state. The loss of nitrogen referred to by Mr. Pettigrew was more apparent than real because of the dilution effect of the volume of sludge employed, the free ammonia content of which would be practically nil.

However, there was usually a loss of nitrogen, which apparently varied directly with the rate at which the free ammonia was removed. Previous experiments had shown that quantitative nitrification could be obtained when working with a small proportion of sludge and a longer period of aeration, while as the quantity of sludge employed was increased and the aeration period required for complete purification consequently reduced, certain nitrogen losses were observed. The reason for this was at present undetermined.

Mr. Melling said that he had dealt with sludge similar to that taken out to sea by the S.S. "Salford" three or four times a week; the mineral matter was, in fact, higher in proportion than in normal Salford sludge. In the Salford experiments the bulk of sludge was found to be a rapidly-increasing quantity. When a change was made to charges of three hours' full aeration there was built up such a volume of activated material that a week later there was 33 to 35% by volume present. It was not necessary to carry the experiment beyond 25%. The excess over and above what was necessary was employed to inoculate a tank twice the size, and it was largely owing to the quick and highly satisfactory results obtained in the second tank that Mr. Duckworth had spoken with optimism as to the success of the treatment. In reply to Mr. Thomson, the samples of sludge were taken indiscriminately from different parts of the tank and at different depths, and all mixed together, and a representative sample taken from the bulk. It had not been possible to differentiate between what had been termed the "sandy" and the organic matters.

The problem of the conservation and utilisation of sludge containing such a high percentage of nitrogen would have to be seriously considered as almost apart from sewage purification; in his opinion, there were great future possibilities.

Newcastle Section.

Meeting held at Bolbec Hall, on Wednesday, November 18, 1914.

PROF. H. LOUIS IN THE CHAIR.

GERMANY AND CHEMICAL INDUSTRY.

BY N. H. MARTIN.

Although I have had more than fifty years' experience of making chemicals, and of handling and examining a wide range of the chemicals which are made in this country and in Germany, the problem of the Chemical Industry of Germany is so complex and requires for its full understanding the consideration of so many factors that I can only hope to indicate some of the ways in which she has gained such supremacy as she enjoys. If it were not so regrettable, because it misleads the public and influences the legislature, it would simply be ridiculous to contemplate the astounding ignorance which prevails as to the part which England has played and the share which she still holds in the great edifice of Chemical Manufactures. Her supposed decadence is set down, even by members of our own Society, to want of enterprise, of scientific knowledge and of capital. In no other great industry for which England is famous is it so frequently stated that those who carry it on have allowed a competitor to gain innumerable advantages over them, by ignorance and indolence. If I can divert your minds from such loose talk and through you the minds of others, and concentrate attention on some of the true causes which have in so many ways handicapped English manufacturers I shall feel that I have done some small service to my country of which I am proud and to those who conduct chemical manufactures, of whom neither I nor any Englishman, who knows or will take the trouble to ascertain the facts, need be ashamed.

At the outset I must dissociate myself from the cry "War on German trade" which is so prominent a topic in our newspapers and in the mouths of public speakers. If as the result of this unhappy war the industrial and productive capacities of the German nation are crippled it will be an irreparable loss to the whole world. Whatever belongs to Germany as a consequence of her natural resources, of the genius and industry of her people, will I hope remain to her and go on increasing for generations after this war is over and its ravages have passed into history. I do want, however, to defend the products of the brains, the industry, and the honesty of Englishmen from the unfair attacks which are made upon them, and there is no reason why Germany should not be taught —and if need be compelled—to be as honest in manufacturing and distributing her productions as we hope she will be forced to be in her political relations.

For the present purpose I will roughly group my remarks under four heads, and then by way of illustration quote some facts and allude to some specific handicaps which are imposed upon us. The four heads are, labour, patents, registration of trade marks, and finance.

In the matter of *labour* and its price the Germans have decidedly gained the better of us in the past forty years. We had the most highly skilled and industrious workmen (I include brain as well as hand workers) the world has ever seen, and in the building up of England's wealth and reputation they were free to put forth their best efforts, but from causes which I need not explain a considerable number are now content to perform their duties in the most perfunctory manner. I suppose we all have in our minds the great aniline industry of which Germany has captured so large a proportion of the output and which has been the basis and the initiative of a large amount of research in respect to other departments of synthetic chemistry. While our makers were handicapped by many difficulties of which alcohol was a very important one at the time, the Germans were making large sums of money which enabled them to increase their staffs of scientific chemists and, in order to keep them employed, they filled up their time in making large series of chemicals only wanted in small quantities and considered not worth the attention of an English manufacturer. One great difference between the English chemical manufacturer and the German has been that the former concerned himself mainly with heavy chemicals and those which were required in large quantities while the German would make any and everything, however small the quantity, and he had an abundance of *cheap* scientific labour at his command. In another very important department connected with the success of chemical industry, namely, the making of glass and porcelain ware, graduated instruments and so forth, which were formerly made to a large extent in this country, it was not a case of the Germans capturing the trade but of our workmen driving it away by the despotic and arbitrary conditions which the workmen through their Unions imposed on themselves, and now the art of making such things is almost lost to this country and it will not be revived unless wiser counsels prevail.

Patents.—I am not competent to deal with the great question of our Patent laws and the various ways in which they have played into the hands of Germany or been twisted by Germans to their own advantage, but that this has been to them a source of very great wealth there is not the smallest doubt. I would recommend those who are interested to read the remarks under the head of "Reform of our Patent Laws" in the Presidential address which Mr. Levinstein gave at the Annual Meeting at Liverpool in 1902. For a long term of years the Germans were free to hold patents in this country and to send the product here for sale without employing a single labourer or contributing a fraction to the government or expenses of this country. This was intended to be remedied by the Patents Act of 1907, and to some extent it has probably been done, but even here, if rumour may be trusted, the proverbial coach and six is often driven through the Act and more or less of a pretence of manufacturing is set up while the bulk comes in from Germany. According to a decision of Lord Justice Parker the *onus probandi* that the patent is not being "adequately worked" is placed on the complainant, who has no access to the patentee's books or means of proof as to the ratio of manufacture to actual sales. In this connection I quote from a Patent Agent of wide experience who writes :—"The English Courts are so studiously fair that they are more disposed to lean towards a foreigner than against him." This Act, by the way, known as Lloyd George's Act is an example of protection pure and simple given to us by a free trade government.

Trade Marks.—In the use of trade marks the German has twisted the English law to suit his own purpose. Instead of using the registered trade mark as a brand to distinguish the goods of one manufacturer from similar goods made by another, they invariably used it as the name of the article itself, and having by various methods got this word adopted by the users they secured to themselves the monopoly of the whole manufacture of certain definite pharmaceutical preparations, such as antipyrin. They were not content with doing this in the case of things which they discovered and introduced, but they also applied it to scientific preparations which were discovered in this country, and thus diverted the trade in the article to themselves. As an instance of this I may mention an important derivative of morphine, diacetyl morphine hydrochloride, which was discovered in Great Britain and described in English scientific literature and was afterwards made by a German house who sold it under the registered name of Heroin.

Finance.—After giving our foreign competitors opportunities denied to Englishmen of accumulating riches, it is adding insult to injury to taunt the latter with the lack of capital to embark upon chemical manufacture on an adequate scale. But things are not always what they seem and their very wealth and the facility with which they get support from the State and help from their banks may have tempted the Germans to speculate beyond the region of prudence and even have led to their financial undoing. There is no lack of capital in this country which will quite easily and naturally flow into the channels of chemical manufacture when it is encouraged to do so. The suggestion for the creation of special banks to deal with this and, still more foolish, the suggestion that the State shall come to the aid of manufacturers with advances of capital, can only come from those who are conscious of their inherent incapacity to face this problem unaided. Men with brains and character and a reasonable initial capital can obtain privately from any English bank all the capital which the wise development of their enterprises may require.

Since this note on State Aid was written I see that the Government through the Board of Trade has decided under certain circumstances to subscribe a portion of the capital and to guarantee the interest on a considerable further proportion to enable the consumers of dyestuffs to form a company to manufacture dyes for their own use. Presumably there is nothing to prevent this new company from obtaining the monopoly of the manufacture as, if the new company is established, "the Government would be prepared to take all necessary steps to secure the acquisition of any other concerns in the United Kingdom whose transfer to the new company might be desirable." On behalf of manufacturers I view this step on the part of the Government with some misgiving. There is absolutely no more reason for the Government either directly or indirectly to subsidise or assume control of the dye manufacturing industry than of any other chemical industry. There are large and important aniline dye manufacturers in this country who will quickly cope with the necessities of the consumers, and as they have struggled for so long a period against the unfair handicap which the Government has allowed, it is unjust now to create a government factory, which may easily become a monopoly, to deprive them of their legitimate reward. If you want to know the part which England and Englishmen have taken in this great enterprise read the whole of the address by Mr. Levinstein to which I have before alluded.

At the outset I alluded to the ignorance which prevails as to what England does do in the way of manufacturing chemicals of prime importance, and nowhere is this more apparent than in the region of medical substances. With regard to morphia I am informed that even so able a man as Sir William Tilden in the "Times" bewailed that this "to a considerable extent" came from Germany, whereas as a matter of fact practically the whole supply for Europe, including Germany, is manufactured in Great Britain. Quinine is, of course, made on the Continent, but the production in this country is far more than is required for the whole of the British Empire. Caffeine was first made by an Edinburgh firm and exhibited by them at the Vienna Exhibition of 1873; after that, when the demand increased, it was made in Germany until our Government allowed the waste tea which came into the London Docks to be denatured, after which and ever since caffeine has been made to an enormous extent in this country.

Many other alkaloids are produced in this country in large quantities, and one maker to whom I wrote replied:—"On the general question of alkaloids we may assure you that in scarcely any instance have we ourselves been outstripped by Germany in such products as we have ever seriously taken up. On the contrary before the war Germany was our best customer and we venture to think this is a fairly good answer to a great deal of the loose talk at present indulged in by writers to the newspapers on what is sometimes described as the decadence of British industries."

With regard to chloroform, I am assured that practically none came from Germany, and also, while chloroform is made in Germany for their own consumption, that it is British chloroform which to a considerable extent is exported to all parts of the world.

With regard to synthetic drugs which figure largely in the popular imagination I cannot do better than quote the following from the address on education and competition which I delivered before this Section in 1899.

"Amongst synthetic remedies antipyrine was controlled by a German patent and was a great success, but its very success has proved a snare to German science. Hardly a month passes but that some new substitution compound with a trivial name to indicate its alleged medicinal properties, and a scientific name intended to suggest profound research, is introduced to English medicine. They come with laboratory and medical reports attested by men with University degrees, couched in language calculated to deceive the very elect, but the touchstone of practical trial reveals how science has been prostituted to commercial ends, and the substances, one after the other, pass into oblivion. Such experience serves to bring discredit upon chemical novelties introduced from Germany, and suggests the thought that when science ceases to pursue truth for its own sake, and becomes the badly-paid slave of commerce, its deterioration is inevitable."

This is as true to-day as when it was written, and although for a time we are placed at a great inconvenience with respect to the *few* remedies which are of value, I am assured by one of the oldest aniline manufacturers in this country that there are no difficulties in making these drugs by anyone who understands the business, that they are making them and are increasing their output enormously, and that probably other people will be making synthetic medicinal products.

With regard to scores of other medicinal synthetic remedies (so called) the sooner they are consigned to the oblivion from which German enterprise brought them forth the better for science and for medicine.

I will give you one other instance of a handicap if you will pardon a personal experience. It was Brown-Sequard, a Frenchman, who first made suggestions with regard to the medicinal value of certain internal secretions on which is based the whole fabric of modern scientific organotherapeutics and our own fellow-townsman, Prof. George Murray, who first put to practical use in medicine the most important of them all, thyroid extract, which my firm manufactured for his use. Although we were thus the first to manufacture animal extracts of the kind in this country, we were soon, in the case of one of these, outdistanced by the importation of the active principle adrenalin from America and then from Germany. The manufacture of this particular active principle was impossible without being able to gauge the activity and purity of the product by experiments upon animals and we were compelled to seek, and we obtained, the licence from the Government to do this, after which we were not many weeks before we were manufacturing a product which in all respects was equal to what was being made and sent into this country from abroad. There exists this difference in regard to experimental research in relation to medicine, at home and abroad, that while in Germany and America no difficulty is placed in the path of scientific research or manufacture, we at home are hampered by numerous restrictions and it is only with difficulty and at great expense that we can obtain suitable animals for our purpose. Hundreds of such derelict animals are annually destroyed in this town in what is called the lethal chamber, without having been of the smallest service to any human being, whereas in our and similar laboratories during their passage to euthanasia the same animals might have performed great service to suffering humanity and helped to redeem our investigators and manufacturers from the stigma of being without scientific knowledge or technical skill. In this instance a little group of well-meaning persons with badly balanced minds are able through the legislature to impose a definite handicap on such workers.

One other matter which will of necessity arise in connection with this subject is the question of fiscal safeguards. We cannot estimate how big a factor this has been in Germany's success—probably larger than all the others put together. Although on other grounds I have for thirty years been a tariff reformer, I should deprecate any panic or greedy legislation in the direction of protection, but I should be prepared to consider wise measures of defence so that any and every industry in this country, including the chemical industry, should receive fair treatment and be placed on a basis of equality in meeting its foreign competitors. England is the only country in the world which goes naked and unarmed into the world of production and expects to hold her own against unscrupulous competitors, and I throw out the suggestion that it may be worthy of consideration whether the competition of Germany or any other country should not be held in check by forbidding the importation into, and selling any products in Great Britain, and as far as possible in her colonies and dependencies, at a less price than they are sold in the country where they are produced.

In conclusion every member of our Society should be a missionary of truth to the outside world and do his share to dispel the mists of error which have grown round this subject, instead of allowing the uninstructed man in the street through his political tendencies to handicap and defeat the aims of the intelligent and patriotic few who, amidst unparalleled difficulties, have kept alive the torch of chemical research and manufacture in this country.

Discussion.

Professor P. P. Bedson said it had always appeared to him that Germany's position in chemical industry was very largely due to the educational facilities whereby scientific knowledge was diffused amongst the people, who in consequence were ready and willing to provide capital to carry on scientific chemical industries. In the manufacture of heavy chemicals, such as sulphuric acid by the contact process, and the ammonia soda process, the fundamental reactions were discovered in this country, but it was Germany who brought them to perfection as industrial processes. What was wanted in this country in connection with the chemical industries was the application of brains, and educated capital. It was of little use to have chemists doing good work capable of industrial application, unless they had educated capital to support it. One of the great advantages which Germany enjoyed in connection with the manufacture of aniline dyes and similar products was that she was able to employ scientific labour. Only a board of directors, fully conversant with scientific methods and knowledge, could have sanctioned the expenditure of the money (nearly a million sterling) on investigations which the manufacture of artificial indigo necessitated.

The last time he was in Germany he was much impressed in the works he visited by German thoroughness and the extensive scientific staff employed. In this country there was nothing like the same extensive scientific equipment. The nearest approach was Messrs. Brunner, Mond & Co., where they had a large and technically-equipped staff; this was doubtless due to the fact that the founders of the enterprise were men educated on those lines themselves, who understood and appreciated research; and until in this country this system was more widely extended, he did not think they could advance much in the manufacture of fine chemicals. The services of the chemist in works in this country were not appraised nor utilised as they ought to be. Not infrequently instances were met with of the baneful influence of engineers and engineering—chemical factories under the control of engineers who had no knowledge of chemistry, whereas the chemist himself occupied quite a subordinate position. He was not given the opportunity of expressing his opinion on purely chemical matters, or if at all, then only through a medium imperfectly acquainted with chemistry. That was not as it should be. In a chemical manufactory of any kind the chemist should have a recognised and responsible position. Until the science of chemistry received its due recognition in the works there could be little success attending its industrial application.

Dr. J. T. Dunn would have liked to hear more of the views of industrial and commercial men, who were more directly in touch with facts than he. Still, a professional man did see something of what went on, and perhaps saw tendencies of which the industrialist was not conscious. He said that even if free alcohol had been available in this country, and had our manufacturers been able at that time to set up works at once to make aniline dyes, it was doubtful whether they would have devoted any considerable portion of their profits to the establishment of research laboratories. He could not see why things such as filter paper and laboratory glass should not have been made quite well in England, unless it were that the English manufacturer's mind did not work in that way, and that with his tendency to let well alone, he refused to have anything to do with a process which would not at once be profitable. He instanced the by-product coke industry. Durham was the home of coke, and at the present time the old bee-hive oven was largely superseded and by-product coke ovens had risen in all directions; yet the home of the by-product coke oven was Germany, and he questioned very much whether at the present time we should have had any by-product coke ovens in England if there had not been by-product coke ovens in Germany. Our colliery owners and coke manufacturers seemed inclined just to go on making no doubt handsome profits from their minerals under the old conditions, but, on the other hand the German tackled the problem scientifically, and it was only through his initiative that the system was introduced into this country, when the Durham coke-maker found there was a danger of his being ousted from the markets by coke made in Germany from his own coal. We were also equally well able with Germany to build these ovens, but up to the present time a considerable portion of these ovens was built with purely German materials. This was one of the largest fire-brick districts in the country, then why were we not ready to produce proper fire-bricks for building these ovens? Largely, he thought, because fire-brick makers had certain clays which their fathers had used and they made fire-bricks from them still in the same way. They did not consider the subject from the scientific point of view. If a fire-brick did not answer to certain purposes they replied that "it was a pity," whereas the German tackled the problem scientifically, and they were able to produce fire-bricks, by a judicious admixture of clays, which would fulfil certain definite conditions. That was done in Germany long before it was done in England, and he doubted whether it was done in England even now amongst a large proportion of fire-brick manufacturers. He thought that attitude was largely responsible for such progress as Germany might have made in chemical manufacture to the detriment of England. Naturally, the man in the established position tended to be content; but it behoved him to be alert, to realise what would be the attitude of his not yet established rival, and to take all practicable measures to preserve his supremacy. He sometimes wondered whether finance in Germany dealt with inventions and inventors quite in the same way as it did in England. Many inventions had simply been killed through the inventor getting into the hands of a syndicate who wished to use the invention merely as a means of making a large profit, and who had spoiled the invention by making it "stink in the nostrils of the investing public." He did not know whether that happened in Germany, but it happened in this country, and it was undesirable from the point of view of pure industry.

Mr. S. Evans quoted a case where gear wheels had been manufactured at a cost of 20s. per cwt., but that manufacture had to be discontinued because they were being supplied from Germany at 14s. per cwt., delivered into the works. Again, a company in London had formerly made a lot of tungsten, but had been driven from the market by German competition; he knew of three or four cases where the manufacture was now being carried on on an experimental scale, and it ought to attain to large proportions in time, for the English chemist could carry out the process just as well as the German chemist. In regard to the zinc industry' Germany was supplying more than half of the spelter, and the Germans had actually contracted for twenty years ahead for the production of all the zinc concentrates from Australia, but when war was declared and these supplies were interrupted a lot were diverted to this country. He could not see any difficulty in the way of manufacturing spelter in this country to compete with the Germans. Electrolytic zinc was produced in the United States, France, Belgium, and Germany, but the only firm he knew in this country who manufactured it was the firm of Brunner, Mond & Co. This zinc was used solely for making cartridge cases. Probably everyone would admit the advisability of some form of protection in order to foster the industries of this country. There was no doubt that a new industry, if it had to compete against some industry developed in Germany years and years ago, was on a weak footing indeed, and it was not surprising that financiers would not capitalise them.

With regard to chemical education in this country, his objection was that the chemist was treated purely and simply as a chemist, and had no idea of working costs. The only way they could get over that was by having a commercial man as manager. The modern chemist in works was looked upon as something a little less than the typist.

Mr. A. **Short** said that Germany had used the experience of older nations like ourselves, and all honour was due to her because she had come to the top. Perhaps we had lagged a little behind, but he thought that in time, even if we could not educate our boards of directors, we had future boards coming on, and they would realise, when they had to start in a small position like Germany had done, that it was only by studying the wants of the people for whom they manufactured that progress would be made. Our education of chemists was certainly far better than it used to be. There were many firms doing a lot of research work and many firms who were giving the chemist a good deal to say in the running of their works, and in time he thought that we should come to the top again.

Mr. S. H. **Collins** said that agriculture stood in a different position to other industries, although it was becoming very much a chemical industry. We were not entirely deficient in sources of potash. Agriculture did not grow on those big concentrations of capital which made it practical for any other business concern to employ a large amount of scientific research, and it had to leave that side of the question more to Government and private enterprise.

Mr. E. F. **Hooper** said that in their misfortunes in trade they always seemed to think that it was the other party who was making the mistake. One thing that was necessary was to get more effective help and support from our Government and its departments. The trouble which many chemical manufacturers experienced in shipping and exporting their products was greater in this than in many other European countries. Those in the chemical trade knew the considerable difficulty they had in getting real assistance from the Customs or from the Home Office authorities in making shipments of products abroad; he understood that, especially in Germany, the shipping and rail facilities and package facilities were always at the command of any chemical works. There was no doubt also that we had suffered a good deal from artificially assisted imported products in recent years. Another branch of our Government service which they had found unsatisfactory was our consular arrangements. A large number of our consular agents were Germans, and it was unlikely that they would give us every assistance for exporting our chemical products to a great and growing country like South America in preference to those of their own country. It was to be hoped that now our consular service would be served by Englishmen in every country. In England they were said to be under a very great and grievous difficulty with regard to the use of absolute alcohol in manufactures owing to the disinclination of the Government to assist chemical firms to use alcohol to the same extent as was allowed abroad. It was to be hoped that the Chambers of Commerce would secure an alteration in that direction, if the hindrance was a real one.

With regard to trade in Germany, they had to reflect that there was a more united system of dealing and manufacturing in Germany than in England. A large proportion of the German by-product firms dealing with tar were under one syndicate, and that undoubtedly enabled them to get facilities from their Government which we were entirely at a loss to obtain. There was a lack of cohesion among our chemical firms, and there was a great tendency to compete unduly one with another, whereas some system of co-operation and control such as they had in Germany would be of value both in cheapening working costs and in regularizing output. One could only hope that out of evil good would come, and there was no doubt that one of our trades might be immensely stimulated by the disastrous condition of things at the present time. He referred to the beet sugar industry. There was no finer climate or soil for the production of beet for sugar purposes, and the manufacture of sugar in our own country would provide work for an enormous number of men on farms, and a considerable source of potash would be obtained from the residues of beet sugar when manufactured on a large scale in this country. There was no reason why toughened glass should not be made here as well as in any other country. The manufacture of tungsten had been mentioned; there were many alloys which this country, which is pre-eminently the home of the finest steel, ought to be able to produce.

Professor H. **Louis** said that the discussion had extended over a wide range of subjects, but there seemed a pretty definite consensus of opinion that in many directions at any rate Germany had distinctly the better of us in scientific and technological manufactures. The blame had been distributed among our Government, our manufacturers, our financiers and our method of education; rather less stress had been laid upon the question of natural advantages or disadvantages, and he was personally inclined to think that those of Germany had been somewhat overlooked; for example, here were the enormous natural deposits of potash salts on a scale which, as far as he knew, were not to be found anywhere else in the world. It might be possible to extract potash from such bodies as potash felspar, and if there was a dearth of potash it might stimulate work in that direction. Zinc manufacture was a fair example of how natural advantages sometimes work out. Germany was a zinc manufacturer long before zinc was known through the production of calamine brass. England, however, was the first to take up the manufacture of zinc as such by what was known as the old English process. Then came Belgium and Germany, and these had the advantage of large deposits not only of zinc ore but above all of high-class fire-clays, and England lost its place in the zinc industry through no fault of her manufacturers, but because she had not those particular high-class clays. But the balance has since been redressed now that it has been found an admirable retort can be made from carborundum. That, of course, brought in another form of natural advantage, for they required a cheap source of electricity, and America had now taken a prominent place in zinc manufacture. It was clear that in these discussions one must not forget the natural advantages of the countries concerned.

With regard to the other parties who had to bear their share of the general blame, he thought that it was quite justifiable to say that our Government was in various ways responsible for it. Possibly that was inevitable in a system of party Government. To what extent our manufacturers were to blame was very difficult to decide. It was certain that for a long time they did not appreciate the advantages of technical education. But they had factories that worked steadily and paid well, and they therefore stuck to their old well-tried methods, and if any of them were manufacturers in the same position they would probably do the same thing.

To what extent our methods of education might be to blame it was also very difficult to say. Germany commenced by educating in the truest sense of the word. She worked at science for the sake of science itself.

Before 1870 Germany was divided into small kingdoms the rulers of each of which required to be surrounded by the shrewdest and most capable men they could get, and this gave an immense impetus to national education;

add to this the undoubted bent of the German mind towards science, and it is obvious why science was pursued for its own sake. It was only afterwards that the German manufacturers began to discover that there was money in this same science, and now Germany had ceased to pursue science except for what she could make out of it, and he was inclined to think there were signs of a corresponding decadence in German science, not altogether to our disadvantage. Finally, came the very difficult question to what extent the financiers were to blame. In Germany they had a large number of industrial banks, banks that were prepared to subsidise industries, even young and growing industries almost to any extent, and unquestionably that had been an enormous advantage to German industry. He had come across cases where English firms had been beaten out of the market because the Germans had at their backs the huge capital which their banks were ready to offer, and he had felt the enormous power which that attitude of German bankers gave the Germans, but on the other hand it brought with it a corresponding danger. He remembered some eight or nine years ago a terrible financial crisis caused by the failure of one large German firm which had been subsidised by the banks, and that crisis very nearly brought about a financial panic in Germany. Upon the whole he thought it would be better if some banks were prepared to pursue a more open policy in that respect and laid themselves out for the support of industrial undertakings; but he admitted that it was a very debatable point. He was very much at one with Mr. Martin in objecting to the proposed subsidy for the dye industry by the Government. It was to him an entirely false policy, for if it was a bad business why should the Government put our money into it? If, on the other hand, it was a good business, there would be no difficulty in finding capital for it. He could not see that policy was a sound one or one to be recommended.

Mr. Martin then briefly replied to the discussion, and the proceedings terminated.

Lectures.

THE SUPPLY OF CHEMICAL PRODUCTS TO BRITAIN AND HER DEPENDENCIES.

Delivered before the Royal Society of Arts on Nov. 25, 1914. By Sir William A. Tilden. J. Roy. Soc. Arts, 1914, **63**, 26—37.

(Abstract.)

After the days of Lavoisier, and during the earlier part of the nineteenth century, the foundations of theoretical chemistry were laid by the efforts of the chemists of England, France, and Sweden, including Davy, Faraday, Dalton, Gay-Lussac, Dumas, and Berzelius. There were no German chemists of the front rank in those days, the only fundamental discovery of great importance attributed to Germany being the discovery of isomorphism by Mitscherlich in 1819. Thus, whilst acknowledging the brilliant services to chemistry of such men as Liebig, von Bayer, and Fischer, it is clear that the fundamental principles underlying chemical theory have been established almost entirely by the chemists of other nations.

In 1862, A. W. Hofmann said that the British had maintained their pre-eminence among the chemical manufacturers of the world, and at about the same time W. Gossage prepared the following statistics relating to the alkali trade, beside which are placed those collected by C. Allhusen in 1852, from 81% of the manufacturers of the United Kingdom:—

	1852.	1861.
	tons.	tons.
Soda ash	71.193	156.000
Soda crystals	61.044	104,000
Bicarbonate..............	5.762	13,000
Bleaching powder	13.100	20.000
Estimated total value	£1,250,000	over £2,000,000

In 1907 soda compounds, excluding bleaching powder and chromates, were produced in the United Kingdom to the value of £3,390,000, whilst the value of the bleaching powder made was £527,000; imports of these products in 1912 from Germany were £8700 and £44,600 respectively. These figures show that British manufacturers have been able, up to the present, to hold their own against foreign competition in these chemicals, and a similar remark applies to aluminous compounds, coal-tar products not dyes, cyanides, sulphuric acid, and other acids.

The immense advances made in all civilised countries have brought increasing demands for a variety of products, many of which are the outcome of recent chemical progress: these include coal-tar dyestuffs, drugs, antiseptics, essential oils, photographic chemicals, explosives, and analytical and laboratory reagents. The sources of supply of dyes, drugs, photographic chemicals, and perfumes in the United Kingdom are seriously inadequate, a large proportion having been obtained from Germany. Thus, in 1913 we imported from Germany artificial dyestuffs to the value of £1,730,278, and "drugs, unenumerated, including medicinal preparations," £332,464. Our exports to Germany of dyes and other chemicals from coal tar amounted in the same year to £24,691, whilst our production of dyestuffs in 1907 was valued at £373,000. There has been no appreciable production of fine chemicals for analysis in this country.

The German chemists have been boasting that, having secured the trade in fine chemicals and dyes, they will now attack the heavy chemical business. In this connection it is to be noted that the export of sulphuric acid from Germany in 1912 was three times as large as that from the United Kingdom in 1913. The successful establishment in Germany of works for the production of ammonia from its elements, and for the fixation of atmospheric nitrogen as cyanamide, is also very significant.

Though the development of scientific teaching and research in this country has not been so marked as in Germany, there is here considerable activity in chemical research, but further co-operation between industry and science is needed; the secret of the success of German chemical factories has been the employment of the best available scientific skill and the constant appeal to scientific research. One of the most notable instances of this has been the production of synthetic indigo, the ultimate success of which was attributed by Brunck to the co-ordination of intellectual labour and the industry of many men for a number of years. British chemists, including Perkin, Meldola, and Green, agree that Germany's success has been due to her better appreciation of the value of science.

To remove reproach from British chemical industry and to render the Empire independent of supplies from foreign sources, it will be necessary to have many first-rate chemists, a few engineers, plenty of capital, and some good business men: a combination of these in due proportion is certain of success. If the demand for scientific assistance were more general, the supply of well-qualified men would increase and greater attention would be given by teachers to the industrial side of the subject. Further, the remuneration offered to the chemist is often insufficient, and the employer frequently expects immediate profitable returns from the engagement of a scientific man. In German works research and manufacture are regarded as inseparable.

The establishment of new industries requires assistance from the State, and encouragement is already promised for the dye industry; but remembering that the manufacturer of dyestuffs depends on a number of intermediate compounds, the production of which is associated with other chemical manufactures, it is to be hoped that temporary protection will be extended beyond the immediate field of the colour-maker.

Finally, when the war is over, everyone should demand that business at home shall be limited to British goods, in spite of the powerful organisation and long experience behind the German chemical manufacturers.

Discussion.

The Chairman (Sir William Ramsay, K.C.B.) said that it was for the scientific and technical chemists of this country to outline the steps necessary to recover their ormer supremacy. German chemical industries were nanaged by specialists, aided by a highly trained staff of cientific, technical, commercial, and legal men, and were rotected by fiscal and other legislation, by low freights, nd by bounties. Such competition must be met by o-operation amongst chemical manufacturers, for example y smaller works combining to obtain efficient laboraories, and by protecting our industries by means similar o those adopted in Germany.

Prof. J. J. **Dobbie** said that as regards the supply of rained chemists, this country was in a better position han it had ever been. In the smallest of the Scottish niversities, twelve research students were assisting in he production of certain drugs required by the Army nd Navy. Unless chemical manufacturers were prepared o avail themselves of scientific assistance, and to renunerate it adequately, little progress could be made. he Government Laboratory had recently applied to everal manufacturers for chemicals previously made broad, but no one would undertake the manufacture, nd finally it had been made in the Laboratory itself. hat indicated either lack of suitable men in the works, or nwillingness to devote the time to the problem. What as needed here was proper organisation.

Mr. A. E. **Berry** said that many manufacturers were andicapped by the restrictions with regard to duty-free pirit.

Prof. A. G. **Green** said that the Germans had considered t worth while to pay to obtain knowledge, whilst we had ot. In addition to the difficulties with regard to alcohol, he British manufacturer was handicapped by the price of uch products as ether and ethyl acetate, which had to be ade from industrial alcohol. However, the question of lcohol was not of premier importance; the question of he employment of chemists came first.

Mr. A. C. **Chapman** said that it was necessary to educate any British manufacturers and also the British public. he brewing industry had recognised the value of science.

Mr. W. F. **Reid** said there were many inventions made this country but worked abroad. The British Governent had at first refused to adopt smokeless powder for he Army, because, if they had done so, all the rifles would ave had to be altered. The commercial aspect of the uestion was of the greatest importance. It would be seless to invest large sums in plant for new manufactures nless such manufactures could be protected in some way fter the end of the war.

Col. C. E. **Cassal** referred to the very low salaries offered and accepted by trained chemists.

The **Author** replied briefly to the various points raised.

HE PREPARATION AND COMMERCIAL USES OF HYDROGEN.

By A. W. Crossley. Pharm. Soc., April 21, 1914. Pharm. J., 1914, 92, 604—607, 637—640, 676—679.

It is only within the last ten years or so that hydrogen as become a substance of great commercial importance.

The methods by which hydrogen is now made on the rge scale may be divided into four groups :—1. The ction of acids on metals ; 2. The action of steam on etals and other substances ; 3. Electrolytic methods ; . Other methods.

1. *Action of acids on metals.*—In some industries and for lling balloons in stationary military camps hydrogen is ade by the action of dilute sulphuric acid on iron, but ere are many objections to this method, not the least eing the enormous quantities of material which have to e used. For example, a military airship of no very ceptional capacity requires from 250,000 cubic feet (about 000,000 litres) to 500,000 cubic feet of hydrogen to inflate , which would necessitate, taking the lower figure of pacity, the use of about 18 tons of iron and 31 tons of lphuric acid.

2. *Action of steam on metals, etc.*—The two most idely employed methods coming under this head are the ction of steam on iron, giving oxide of iron and hydrogen, and the action of steam on coke, producing the so-called water-gas,

$$C+H_2O=CO+H_2$$

which contains on the average H 48, CO 43, CO_2 4, N 4%, together with small amounts of O and CH_4. The carbon monoxide and other impurities can be removed by a variety of methods; for example, Frank (Fr. Pat. 371,814, 1906; this J., 1907, 408) suggests passing the dried water-gas over calcium carbide at above 300° C., when carbon monoxide and dioxide react with the carbide, forming calcium oxide, calcium carbonate, and carbon :—

$$CaC_2+CO=CaO+3C$$
$$2CaC_2+CO_2=2CaO+5C$$

and nitrogen is absorbed with formation of calcium cyanamide :—

$$CaC_2+N_2=CaNCN+C$$

In order partially to remove the oxides of carbon the water-gas may first be treated with solvents or strongly cooled to liquefy them. Jouve and Gautier (Fr. Pat. 372,045 of 1906; this J., 1907, 401) pass the gas through a porous partition of unglazed porcelain so as to separate the hydrogen by reason of its more rapid rate of diffusion. A single passage through the partition reduces the content of carbon monoxide from 45 to 8%. The Cie. du Gaz de Lyon (Fr. Pat. 375,164 of 1907; this J., 1907, 863) pass water-gas mixed with steam at a temperature exceeding 400°—500° C. over a catalyser, such as oxide of iron, when the carbon monoxide is replaced by an equal volume of hydrogen :—

$$CO+H_2+H_2O=CO_2+2H_2$$

and the carbon dioxide produced is removed by lime. (See also Elworthy, Fr. Pat. 355,324 of 1905; this J., 1905, 1164). The Griesheim Elektron Company (Eng. Pat. 13,049 of 1912; this J., 1913, 278) pass water-gas, mixed with steam, into a heated retort charged with quicklime, when calcium carbonate is formed :—

$$[H_2+CO]+CaO+H_2O=CaCO_3+H_2+H_2$$

The elimination of the monoxide is very complete, and the resulting hydrogen (containing the nitrogen originally present in the water-gas) costs about one penny per cubic metre.

Some of the working methods may be briefly described as follows :—

The Linde-Frank-Caro Process (compare Linde, this J., 1911, 746; also Frank, this J., 1911, 893) starts with water-gas, having practically the composition indicated in Column 1 :—

—	1.	2.	3.
Hydrogen	48—54%	97—97·5%	99·2—99·4%
Carbon monoxide	42—44%	1·7—2%	Nil
Carbon dioxide	2—5%	Nil	Nil
Nitrogen	3—5%	1—1·8%	0·6—0·8%
Oxygen, marsh gas, sulphur and phosphorus compounds	Variable amounts	Nil	Nil

The carbon dioxide is removed by using absorbents, such as lime, caustic soda, or more simply by a solution of caustic soda under the pressure necessary for separating the water-gas into its constituents. This separation is based on the fact that hydrogen boils (— 253°) much lower than either carbon monoxide (— 192°) or nitrogen (— 196 C°). Hence if the gaseous mixture be cooled with liquid air, carbon monoxide, nitrogen, and other impurities are condensed, while hydrogen remains in the gaseous form. There is thus obtained one portion of the water-gas very rich in carbon monoxide (80—85%), which can be burnt in a gas-engine serving to drive the plant; and a second portion, very rich in hydrogen, with composition given in Column 2 above. Further purification can be effected by treatment with soda-lime, when the whole of the carbon monoxide is removed, and the resulting gas has the composition indicated in Column 3 above. The inventors of the process claim that hydrogen produced in this way contains no heavy hydrocarbons, oxygen, or compounds of sulphur and phosphorus, and that it can, therefore, be used for catalytic reactions or for filling balloons, because it contains nothing liable to corrode balloon fabric or to cause explosions. The cost of producing the gas with the composition given in Column 2 is 1½d. per cubic metre, and the gas of the composition indicated in Column 3, 2d. per cubic metre. The gas can be stored in gasometers or, as it issues from the apparatus under about 50 atmospheres pressure, in compression cylinders.

The Messerschmitt patents. (Eng. Pat. 12,117 of 1912; Fr. Pats. 444,105 of 1912; 461,480, 461,623 and 461,624 of 1913; Ger. Pats. 254,222, 263,390, 263,391, 268,062 and 268,339 of 1912; this J., 1912, 1079, 1126; 1913, 351, 944; 1914, 136, 137, 201, 313) combine the production of hydrogen by the action of steam on iron and reduction of the resulting iron oxide by water-gas. These two reactions, which take place between 700° and 800° C., are known respectively as the gassing or oxidation period and the reduction period. They are carried out alternately so long as the reactions take place with sufficient speed, averaging about ten minutes and twenty minutes respectively. The principles of the process have been known for a long time, and are the subject of numerous patents (Lane, Eng. Pat. 17,591 of 1909; Dieffenbach and Moldenhauer, Fr. Pat. 444,044 of 1912; this J., 1910, 1057; 1912, 1126); but there are many technical difficulties which up to the present have not been mastered, more particularly that of heating the contact mass uniformly and sufficiently speedily without running the risk of over-heating and melting it. The Messerschmitt patents claim to have overcome these difficulties by a series of details of furnace construction, ensuring even heating and heat economy. On leaving the generators the hydrogen is purified by spraying with water to remove dust, and is then led through chambers filled with bog ore and lime to remove traces of sulphur compounds and carbon dioxide. The gases used for heating and reducing, which do not cost more than one-halfpenny per cubic metre of hydrogen produced, are carefully purified, thus rendering the life of the contact mass a very long one, and securing, with the small amount of further purification already mentioned, an almost chemically pure hydrogen containing only traces of nitrogen.

Another method makes use of the application of high pressure in promoting chemical reactions whereby it is possible to retain the liquid state from the boiling point up to the critical point, and thus to utilise the physical properties of a liquid at high temperatures, causing reactions to take place which cannot be carried out at low temperatures. Led by the assumption that in the presence of a metal water in the liquid state might be made to decompose into hydrogen and oxygen, Bergius (this J, 1913, 462) has investigated and patented a process for producing hydrogen in large quantities by the action of water on iron. The reaction takes place quantitatively in accordance with the equation :—

$$3Fe+4H_2O=4H_2+Fe_3O_4$$

and is carried out at 300° to 340° C. The oxide of iron is produced as a very fine powder, which can easily be reduced to the metallic state by either carbon or carbon monoxide. The speed of the reaction increases with increase of temperature, and is also affected by the presence of such substances as sodium chloride, ferrous chloride, or a metal such as copper, as can be seen from the results detailed in the following table :—

	Temp.		Quantity of hydrogen per hour. c.c.
Iron and pure water	300°	..	230
Iron and pure water + $FeCl_2$	300°	..	1,390
Iron and pure water + $FeCl_2$ + Cu	300°	..	1,930
Iron and pure water + $FeCl_2$ + Cu	340°	..	3,450

Within the limits practically obtainable, the speed of the reaction is so great that in a vessel of 10 gallons capacity about 3000 cubic feet of hydrogen can be generated per day. Since iron and water are the raw products, it is possible to obtain an extremely pure form of hydrogen, mainly because the carbon and sulphur compounds in the iron are practically unattacked by the water. A sample of the gas has been analysed by passing 30 litres over heated copper oxide and weighing the water and carbon dioxide formed. In a second experiment 200 litres of hydrogen were passed under pressure through a copper coil cooled in liquid air and the condensed fraction analysed for carbon dioxide, carbon monoxide, saturated and unsaturated hydrocarbons, with the following results :—H, 99·9495; CO, 0·0011; C_nH_{2n+2}, 0·0416; unsaturated hydrocarbons, 0·0078%. Advantages claimed for the method are that as the reaction is vigorous the hydrogen is obtained under high pressure (up to 300 atmospheres: Ger. Pat. 254,593 of 1911 and Fr. Pat. 447,080 of 1912; this J., 1913, 195, 364), and may be directly filled into cylinders without previous compression; further, that compared with the latest and cheapest technical process for the production of hydrogen, that of Linde-Frank-Caro, it gives a very much purer gas without cost of purification, without cost of compression, and with a total expense of energy 60% less than is needed in the Linde process. The gas containing less than 1·01% impurities, and costing about three-farthings per cubic metre, is now being produced at a factory in Hanover. Bergius has also patented another process (Ger. Pat. 259,030 of 1911; this J., 1913, 657), in which a mixture of carbon dioxide and hydrogen is produced by heating together coke and water in presence of thallium chloride. The carbon dioxide is removed by lime, and the resulting hydrogen is obtained absolutely pure and under a pressure of more than 100 atmospheres.

3. *Electrolytic methods.*—One of the main difficulties met with in the preparation of hydrogen by the electrolysis of water or some suitable electrolyte, is that a mixture of oxygen and hydrogen is given off at both electrodes. The hydrogen contains about 1% of oxygen and the oxygen about 2% of hydrogen. Depending on the use to which the hydrogen is to be put, this amount of oxygen may become very dangerous, as for example, in the synthetic preparation of ammonia, where the mixture of gases is heated to a fairly high temperature. In order to avoid this, the electrodes may be separated by a diaphragm, which, however, increases the resistance in the cell to such an extent that the efficiency of the apparatus is seriously reduced. The difficulty has been overcome in a variety of ways, and in the Garuti system (see Eng. Pats. 23,663 of 1896, 12,950 of 1900, 2820 of 1902, and 27,249 of 1903; this J., 1897, 337; 1900, 1121; 1902, 778; 1905, 94) which is used in Italy, the diaphragm consists of iron sheets about 1 mm. thick, covered on both sides with a metallic net to facilitate the separation of the small bubbles of gas which collect. The electrolyte is a 26% solution of potassium hydroxide, which must be very pure as if it contains chlorides or sulphates, Cl and SO_4 ions are formed, which attack the electrodes. Other forms of electrolytic apparatus are described in Fr. Pat. 355,652 of 1905; Ger. Pat. 198,626 of 1906, Fr. Pat. 397,319 of 1908; this J., 1905, 1240; 1908, 946; 1909, 799).

The Elektron Works at Griesheim on Rhine prepare hydrogen by the electrolysis of potassium chloride. Three important products—hydrogen, chlorine, and potassium hydroxide are thereby made in one operation. The Maschinenfabrik Oerlikon use a solution of potassium carbonate as electrolyte, and the Heraeus Company in Hanau use a 20% solution of potassium hydroxide maintained at 60—70° C. Both firms require an expenditure of six kilowatt-hours per cubic metre of hydrogen. Where electric power costs £4 per horse-power year, as is frequently the case in Germany, the electric energy necessary for the production of one cubic metre of hydrogen amounts to about three-farthings.

Large quantities of hydrogen are also formed in various electrolytic processes, such, for example, as the preparation of sodium hydroxide.

4. *Other methods.*—In this connection may be mentioned the action of water on calcium hydride, CaH_2, prepared by passing electrolytic hydrogen into metallic calcium heated in an electric furnace (Fr. Pat. 327,878 of 1902; this J., 1903, 950), and the so-called hydrolith and hydrogenite processes. *Hydrolith* is a white crystalline powder consisting of about 90% calcium hydride, the remainder being oxide or nitride. When treated with water about one cubic metre of hydrogen is evolved from each kilo. of

hydrolith. *Hydrogenite* consists of 25 parts of ferrosilicon, 60 parts of sodium hydroxide, and 20 parts of slaked lime: when suitably ignited, it reacts with production of hydrogen, and the silicates of sodium and calcium. One kilo of hydrogenite yields from 270 to 370 litres of hydrogen.

Pictet (Eng. Pat. 14,703 of 1911; this J., 1912, 686) prepares a mixture of hydrogen and carbon monoxide in any desired proportion (by regulating the supply of water) by heating together a mixture of water and hydrocarbon vapours, such as petroleum. Every litre of petroleum furnishes about 3000 litres of gas. (See also Badische, Fr. Pat. 463,114 of 1913; this J., 1914, 313.)

The Carbonium Company at Friedrichshafen, the headquarters of the Zeppelin dirigible balloon management, prepare hydrogen by decomposing acetylene electrically. The carbon is produced in such a fine state of division that it commands a high price as a pigment. (Compare also Pictet, Fr. Pat. 421,838 of 1910; this J., 1911, 542).

Numerous other methods have been suggested, but it would hardly seem likely that many of them could really be considered as sources of cheap hydrogen when compared with some of those already mentioned. Uyeno (Eng. Pat. 11,838 of 1912; this J., 1913, 289) treats each part of an alloy of 78—79 parts Al, 1—15 parts of Zn and 0·5—7 parts of Sn, with 0·025—0·12 part of Hg. After heating to as high a temperature as possible, without volatilising the mercury, the mass is treated with hot water.

Teissier and Chailláux (Fr. Pat. 447,688 of 1912; this J., 1913, 234) heat a mixture of barium sulphate and manganous oxide to a red heat, finally to a white heat, and pass steam under pressure over the resulting mass, when the following reactions are stated to take place :—

$$BaSO_4+4MnO = BaS+4MnO_2$$
$$BaS+4MnO_2=BaS+4MnO+2O_2$$
$$BaS+4MnO+4H_2O=BaSO_4+4MnO+4H_2$$

Jaubert (Fr. Pats. 427,191 of 1910; 438,021 of 1911; this J., 1911, 1058; 1912, 536) prepares hydrogen by the ignition and autocombustion of mixtures containing excess of a combustible body, capable of decomposing steam at high temperatures, with an oxidising agent to maintain combustion, and a substance capable of evolving steam when heated. Such mixtures are: powdered iron 20 parts, slaked lime 10 parts, potassium perchlorate 6 parts; or ferrosilicon 20 parts, lead monoxide 10 parts, and soda lime 60 parts.

Uses of hydrogen.

Hydrogen is used as a combustible on account of the high temperature attainable when it is burnt in presence of oxygen (up to 2800° C.). The so-called oxy-hydrogen flame is employed, for example, in the fusion and welding of platinum and in uniting the edges of lead sheets for making vessels to hold acids. The best proportion in which to use the gases for welding is one part of oxygen and four parts of hydrogen; if the proportion of oxygen is increased, the flame acquires an oxidising action. The oxy-hydrogen flame has now been largely replaced by the oxy-acetylene flame, because the latter yields a higher temperature, and whilst in the reducing flame about 4 cubic metres of hydrogen are required for one cubic metre of oxygen, only 700—800 litres of acetylene are necessary. The oxy-hydrogen flame is also employed in working fused quartz for making laboratory apparatus or quartz mercury lamps.

In the manufacture of tungsten filament lamps an inert atmosphere is required in which to heat the filaments to a high temperature during their final treatment. Generally a mixture of hydrogen and nitrogen in equal volumes is employed, and it is of importance that the hydrogen should be very pure on account of the tendency of the filaments to oxidation.

Hydrogen is now largely used for the filling of balloons and dirigible airships. It is calculated as possessing a lifting capacity of 1 kilo. per cubic metre, and must be of a sufficient degree of purity not to attack the balloon fabric. It is recorded (this J., 1907, 1130) that a balloon burst at Milan in 1906, the fabric of which was marked with spots which could be easily torn. These were proved to have been caused by phosphoric and arsenic acids, arising from the oxidation of phosphine and arsine in the hydrogen with which the balloon had been filled. The quantities of hydrogen required for the filling of airships are on the manufacturing scale, and, moreover, the supply must be regular because of the high rate of diffusion of hydrogen; though improvements in the manufacture of balloon fabrics are now largely minimising this objection.

In the last decade two entirely new industries have sprung into existence, depending on the behaviour of hydrogen in presence of certain catalysts. These are :—

(1) The synthetic production of ammonia directly from nitrogen and hydrogen. (2) The hardening of fats.

In 1897 Sabatier and Senderens discovered a general method for hydrogenating volatile organic substances, based on the employment of certain metals in a fine state of division as catalysers. Numerous detailed researches have appeared on the subject in the *Comptes Rendus* and the *Bulletin de la Société chimique de France* by Sabatier and Senderens (1897—1905), Sabatier and Mailhe (1904—8), and Sabatier and Murat (1912). Sabatier and Senderens have also published a résumé of their researches in the *Annales de Chimie et de Physique* (1905 [8], **4**, 319; 1909 [8], **16**, 70); Sabatier has delivered a lecture on the subject before the German Chemical Society (*Ber.*, 1911, **44**, 1984), and a still more detailed account is to be found in the recently published book entitled "La Catalyse," by P. Sabatier (see also this J., 1914, 733). The process consists essentially in passing the vapours of a substance mixed with excess of hydrogen through a tube containing a metallic catalyser, such as platinum black, nickel, cobalt, iron, or copper, maintained at a suitable temperature, which may be the ordinary temperature, but which is in general from 150—200° C., 180° C. being frequently the most suitable. Of these five metals, nickel is the most active, and together with cobalt the only one capable of producing certain hydrogenations such as that of the benzene ring; copper is the least active, platinum and iron being intermediate between cobalt and copper. The hydrogen must be rigorously purified from such substances as hydrogen sulphide, arsenide, phosphide, and chloride. This is accomplished by passing it through a long glass tube containing copper turnings heated to redness, which arrests the major portion of the impurities; then through a long tube filled with moistened potassium hydroxide to arrest acid vapours or hydrogen sulphide, and finally drying the gas. The activity of the nickel varies very much according to the nature of the oxide from which it is prepared, and the conditions under which the oxide is reduced. Nickel obtained by reduction at a bright red heat is practically inert as a catalyser, whereas when produced by precipitating the hydroxide from the nitrate, drying, and reducing at 250° C. it is excessively active, but also very variable in character. The best product is obtained by dissolving commercial nickel in nitric acid, free from hydrochloric acid, calcining the nitrate at a dull red heat, and reducing the oxide so obtained at about 300° C. Such nickel is capable of producing a great variety of reactions, and maintains its activity for a very long time. If the reduction is carried out above 350°, the nickel is of little use for reducing substances containing the benzene ring, but at 250° or 280° C. the resulting substance is quite active in this respect. The presence of infinitesimal amounts of chlorine, bromine, or iodine poisons the catalytic effect of nickel, and therefore the metal should never be prepared from oxide precipitated from the chloride. The catalytic activity of nickel exhibits three stages, an initial short period during which the catalyst adapts itself to its function, a normal period of activity and a period of decline. The second period of normal function is generally very long, and would probably be indefinite if the metal did not come in contact with any traces of substances capable of altering its surface, as may easily be derived from the hydrogen used, from the substance itself or from the product of the reaction. Traces of sulphur or of the halogen elements (as already mentioned) completely suppress the activity of nickel; for example, benzene which has not been completely purified from thiophene cannot be transformed into cyclohexane, and the presence of a minute trace of bromine in phenol prevents the latter being changed into cyclohexanol. When carefully prepared the nickel can, however, be used for a very long time, and Sabatier and Senderens quote an instance where they employed the same tube of nickel for transforming benzene into cyclohexane for more than a month. Sooner or later its action becomes enfeebled (the more active the metal, the more rapid the change), due to traces of toxic substances, which gradually accumulate, and most frequently to small amounts of non-volatile tarry matters, which condense on the active surface and so prevent contact with the hydrogen and the substance under treatment. When an enfeebled specimen of nickel is dissolved in dilute hydrochloric acid there is always a fetid smell of hydrocarbons, and a deposit of brown viscous matter. The same effect is noticed when the reaction gives rise to substances which are only slightly volatile at the temperature of the reaction, and which gradually impregnate the metal and prevent its activity. For example, in the hydrogenation of aniline at 190° C. there is mainly produced cyclohexylamine, $C_6H_{11}NH_2$, boiling at 134° C., but also two non-volatile amines, dicyclohexylamine, $(C_6H_{11})_2NH$ and cyclohexylaniline, $C_6H_{11}NH{\cdot}C_6H_5$, which boil above 250° C. It is for this reason that it is necessary to avoid allowing the metal to become moistened with the liquid under treatment, which may be caused by an excess of the substance or by a lowering of the temperature of the reaction tube.

Hydrogenations can only take place within a certain range of temperature, and both the substance to be transformed and the transformation product must be kept in the state of vapour. Within a certain limit, the higher the temperature the greater the acceleration of the reaction, but changes of temperature may produce profound changes in the course of the reaction. Thus benzene can be converted into cyclohexane, C_6H_{12}, by hydrogen in presence of nickel at 70° C., the amount formed increasing with the temperature and reaching a maximum at 180°—200° C. Then the amount gradually decreases to 300° C., at which temperature the reaction no longer takes place; on the contrary, cyclohexane is decomposed into benzene and hydrogen, or into benzene and methane, according to the equation:—

$$3C_6H_{12}=2C_6H_6+6CH_4.$$

Above 300° C. the reaction is limited to the transformation of benzene into methane. When a substance is capable of adding on several molecules of hydrogen, this can often be carried out in stages by a choice of temperature, thus anthracene, $C_{14}H_{10}$, at 180° C., is changed into the perhydride, $C_{14}H_{24}$; at 200° C. into the octohydride and at 260° C. into the tetrahydride. The easiest reactions to carry out are those capable of being brought about over a large range of temperature such as the reduction of an ethylenic linkage or of certain nitro-derivatives. The most difficult are where the range of temperature is narrow, as in the hydrogenation of the aromatic nucleus, and, above all, with the diphenols or pyrogallol.

The reactions may be divided into four classes:—1. Reduction without fixation of hydrogen. 2. Reduction effected with fixation of hydrogen. 3. Direct fixation of hydrogen, as, for example, at a double bond. 4. Hydrogenations effected with decomposition of the molecule.

1. Reduction without fixation of hydrogen is of little importance. It may be exemplified by the conversion of nitrous oxide into nitrogen and water without the formation of either ammonia or hydrazine.

2. Reduction effected with fixation of hydrogen is illustrated by the behaviour of carbon monoxide:—

$$CO+3H_2=H_2O+CH_4.$$

The reaction commences at 180°—200°, and is rapid at 230°—250° C., so that with a mixture of 3 vols. of hydrogen and 1 vol of carbon monoxide, it is practically complete, and pure methane results. Below 250° C., the nickel can be used indefinitely and is completely soluble in dilute hydrochloric acid without leaving any carbonaceous residue. Above 250° C. there is a complication due to the reaction:—

$$2CO=C+CO_2,$$

and at 380°, when using the mixture of gases which is totally converted into methane at 250° C., a mixture is formed containing in 100 vols., 10·5 vols. CO_2, 67·9 vols. CH_4, and 21·6 vols. H_2. Carbon dioxide is likewise converted into methane,

$$CO_2+4H_2=CH_4+2H_2O,$$

and at 300° C., using excess of hydrogen, the reaction can be made to furnish almost pure methane, by washing the resulting gases with potassium hydroxide, drying and liquefying, under conditions such that any hydrogen present in the mixture is not condensed, and therefore escapes. The production of methane by the direct hydrogenation of carbon monoxide or dioxide can be utilised for the industrial preparation of a gas possessing very high calorific power and capable of being used for heating or lighting (Int. Congress Applied Chem., Rome, 1906, 4th Section, 188). Several methods have been suggested, of which the most promising would appear to be the preparation of water-gas at as high a temperature as possible, when it consists of almost equal volumes of carbon monoxide and hydrogen, with very small amounts of nitrogen and carbon dioxide. By a process of cooling three-quarters of the carbon monoxide can be liquefied, giving a gas of the composition one vol. of carbon monoxide and 4 vols. of hydrogen, which, when passed over nickel at 200°—250° C., is converted into a mixture of equal vols. of methane and hydrogen. The refrigeration has the further effect of condensing the sulphur compounds present in water-gas, which would poison the nickel.

3. The preparation and careful study of the properties of hydrogenated aromatic, or hydroaromatic, compounds have long been of the greatest importance on account of their close connection with such substances as the naphthene hydrocarbons of petroleum and the naturally occurring terpenes and camphors. Many hydroaromatic substances have been prepared by indirect methods, but their direct preparation from aromatic compounds, in many cases, has been rendered possible by Sabatier and Senderens' reaction. In the great majority of cases the hydrogenation of the aromatic nucleus by hydrogen in presence of finely divided nickel takes place at about 180° C. without any considerable amount of side reactions, and consequently the products are obtained in very good yields. (Compare Skita and Ritter, Ber., 1911, **44**, 668.) Below 250° C. toluene, the three xylenes, mesitylene and pseudocumene give, in almost quantitative yields, the corresponding methyl-cyclohexanes. Traces of unaltered aromatic hydrocarbons are always present, but they are easily removed as nitro compounds by treatment with a mixture of 1 vol. of concentrated nitric acid and 2 vols. of concentrated sulphuric acid. In the case of aromatic hydrocarbons with a long side chain, there is always produced, besides the principal normal product, more or less of the saturated hydrocarbons with shorter side chains, *e.g.*, ethylbenzene gives ethylcyclohexane and some methylcyclohexane; propylbenzene gives propylcyclohexane together with some methyl- and ethyl-cyclohexanes. The amounts increase with rise in temperature, and it is therefore important to limit the temperature to 180° C. in these reactions. Phenol is easily converted into cyclohexanol at 180°: thymol and carvacrol into the corresponding methylisopropylcyclohexanols at 180°—185° and 195°—200° C. respectively.

4. The phenomenon of hydrogenation accompanied by decomposition of the molecule largely depends on the temperature. Generally speaking, between 300° and 350° C. cyclic hydrocarbons are broken down into small molecules, principally methane (see benzene, above). Acetylene gives at quite a low temperature ethane and small amounts of higher gaseous and liquid hydrocarbons. By carrying out the reaction at 200° C., Sabatier and Senderens obtained a liquid consisting principally of pentane and its homologues, together with small quantities of ethylenic hydrocarbons and traces of aromatic hydrocarbons. The liquid in density, odour, and fluorescence resembled Pennsylvanian petroleum; whereas the same reaction without the use of any hydrogen and at 200°—300° C. gave rise to a liquid consisting principally of aromatic hydrocarbons and strongly resembling Caucasian petroleum. On these facts Sabatier and Senderens have formulated a theory of the formation of natural petroleum. They

presume that in the interior of the earth large masses of the alkali metals and metals of the alkaline earths exist, together with their carbides. These, when acted upon by water vapour, would liberate hydrogen and acetylene respectively, and reactions similar to the above would take place. If the hydrogen was in large excess, then on coming in contact with nickel, cobalt, or iron at temperatures lower than 200° C., American petroleum would result, together with large quantities of combustible gases (hydrogen, methane, ethane, etc.), such as are actually met with at Pittsburgh. If acetylene encountered the metals without any appreciable amount of hydrogen, there would result principally aromatic hydrocarbons or Caucasian petroleum. Intermediate conditions would give rise to the petroleums of Galicia or Roumania.

Finely divided cobalt, such as is produced by the reduction of its oxide, may be substituted for nickel in all of the reactions which the latter is capable of bringing about, but its activity is less marked than that of nickel, and in general higher temperatures are necessary. Finely divided iron, obtained by the reduction of its oxides, can be substituted for nickel in many reactions, but not in all. For example, it is possible to use it for reducing ethylenic hydrocarbons, acetylene, aldehydes, or ketones, but it is useless for transforming carbon monoxide or dioxide into methane, and also for the fixation of hydrogen to the aromatic nucleus. Another disadvantage is that the oxides must be reduced at temperatures between 400°—450°, which takes six or seven hours to accomplish, for if the temperature is higher then the catalytic activity of the metal is practically negligible. Copper is also capable of producing many reductions, though not all, and on account of its cheapness and the ease with which it is obtained from its oxide by reduction at 180° C., it may become of commercial importance. Its activity, however, varies considerably according to its method of preparation. It is the best metal for using in the reduction of aromatic nitro derivatives, because its action is only directed to the NO_2 group, and not to the aromatic nucleus. Nitrobenzene can be thus easily transformed into aniline at 230°; between 300° and 400° C. the reaction is regular and rapid, if hydrogen is in excess, when aniline is obtained pure and in a 98% yield. The behaviour of copper is sometimes quite different from that of nickel; for example, at 300°—330° it converts cyclohexanol into cyclohexanone.

The preparation of chemical substances by the process of Sabatier and Senderens is carried out on the commercial scale by Poulenc Frères, under the direction of Senderens.

The reactions so far described deal with the action of hydrogen in presence of a finely divided metal on a substance in the form of vapour, but many processes have been devised for applying the principle to liquids, as suggested by Ipatieff, Paal, Willstätter, and Skita. The method of Ipatieff consists in heating the substance to be hydrogenated in presence of nickel or its oxide with hydrogen under a pressure of at least 100 atmospheres. The work is described in a series of papers appearing principally in the Journal of the Russian Physical and Chemical Society from 1906 to the present time. On the whole, the results are very similar to those obtained by the method of Sabatier and Senderens, *e.g.*, the aromatic nucleus is hydrogenated in all cases, benzene giving at 250° cyclohexane, which is decomposed at 300° C. into benzene, methane, and hydrogen with deposition of carbon. Acetone and homologues give secondary alcohols, and other examples are summarised in the following table:—

—	Temp.	Pressure in atmospheres.	Product
Phenol	245°	—	Cyclohexanol
Camphor ..	350°	—	Borneol
Limonene ..	300—320°	120	Limonene dihydride
Pinene	265°	—	Pinene dihydride
Carvone ..	280°	120—130	Carvomenthone
Naphthalene	250°	120	Tetra- and deca-hydrides
Anthracene	260—270°	100—125	Tetra-, deca-, and perhydrides

Quinoline, which is only converted into the tetrahydride by Sabatier and Senderens' method, gives almost entirely the decahydride. Oleic acid at 100° C. and under 26 atmospheres pressure does not suffer any appreciable change, but at 60 atmospheres pressure it is converted into stearic acid.

Paal's method.—Many attempts have been made to use metals in the colloidal state as the catalyst in processes of hydrogenation. In presence of certain organic bodies, as proved by Paal, the stability of colloidal metal solutions is considerably increased. The two substances principally used by Paal are called by him protalbinic and lysalbinic acids, and may be prepared from egg albumin (this J., 1902, 996), by heating at 100° C. with 3% aqueous sodium hydroxide for one hour. On acidifying with acetic acid protalbinic acid is precipitated and is purified from salts by dialysis. After washing with alcohol and drying it forms a white powder, easily soluble in aqueous acetone or acetic acid, and in both acids and alkalis. Lysalbinic acid is contained in the mother liquors of protalbinic acid, and is isolated by evaporating to a small bulk, and acidifying with sulphuric acid. It is then purified by pouring its concentrated aqueous solution into alcohol, and is a fine white powder, soluble in water. It constitutes about one-quarter of the original weight of albumin. An alkaline solution of sodium lysalbinate or protalbinate is treated with platinic chloride and a slight excess of hydrazine hydrate and allowed to stand five hours. The salts produced are removed by dialysis, and the solution concentrated, first, on the water bath, and then in a vacuum. The product, when dried at 100° C., forms black glistening scales, which dissolve readily in water to a dark brown opalescent solution. Colloidal solutions of palladium may be prepared in a similar manner (Skita and Meyer, this J., 1913, 46). The solutions are very stable, and even when concentrated can be heated for some time without undergoing change.

An aqueous solution of the colloidal platinum is added to an alcoholic solution of the substance to be hydrogenated, and hydrogen passed in. It is of importance to keep the liquid agitated, and temperature and pressure both exercise an influence on the course of the reaction. (Compare Skita, Ber., 1908, 41, 2938; 1910. 43, 3393.) The results obtained are similar to those produced by Sabatier and Senderens' method, but colloidal palladium will not reduce the benzene nucleus. The reduction of oleic acid to stearic acid was effected by Fokin (this J., 1907, 1149) at the ordinary temperature, using palladium or platinum black. Paal and Roth (this J., 1908, 864) have shown that sodium oleate and colloidal palladium give a 60% yield of pure stearic acid, and, further (this J., 1909, 611), that castor oil, croton oil, olive oil, cotton-seed oil, linseed oil, butter, and lard can be completely reduced by colloidal palladium and hydrogen to give in all cases a hard, white, brittle crystalline substance. In 1911 Skita and Paal patented (Ger. Pat. 230,724) the use of palladous chloride and gum arabic instead of colloidal palladium, and they have proved (Ber., 1911, 44, 2,862) that strychnine in dilute acetic acid containing a little 1% palladium chloride and 1% gum arabic is reduced to strychnine dihydride in presence of hydrogen under two atmospheres pressure, and under three atmospheres to strychnine tetrahydride. Brucine under similar conditions is converted into brucine dihydride.

Willstätter's method.—The researches of Willstätter have made the use of platinum or palladium black in presence of hydrogen of almost general application. The substance to be acted on is dissolved in a suitable solvent, mixed with platinum black (one-third to one-thirtieth of the weight of the substance) and hydrogen led in, during which time the apparatus is shaken continuously. In this manner ethylenic linkages easily become saturated; ethyl oleate is changed to ethyl stearate; eugenol and isoeugenol give propylguaiacol (Fournier, Bull. Soc. Chim., 1910 [4] 7, 23); cholesterol in ethereal solution with one-third of its weight of platinum black is completely changed to cholesterol dihydride in two days (Willstätter and Mayer, this J., 1908, 642, 829). The method gives good results with aromatic hydrocarbons, which are converted into the corresponding cyclohexanes and also with the terpenes.

Platinum would appear to give in general more satisfactory results than palladium.

Synthetic ammonia.

The affinity of nitrogen for hydrogen is so small that the two gases do not unite to any appreciable extent either at ordinary or raised temperature. The best mixture of these gases for the production of ammonia is 1 vol. of nitrogen to 3 vols. of hydrogen, but the limit of the percentage of ammonia attainable under ordinary pressure is at high temperatures very small indeed, as will be seen from the following table :—

Percentage amount of NH_3 *in the equilibrium of the reaction* $N_2+3H_2=2NH_3$.

Temperature.	Pressure in atmospheres.		
	1	100	200
400°	0·48%	—	—
500°	0·13	10·8%	—
550°	0·0769	6·70	11·9%
600°	0·048	4·5	—
650°	0·0321	3·02	5·71
700°	0·021	2·1	—
750°	0·0159	1·54	2·99
800°	0·011	1·1	—
850°	0·0089	0·874	1·68
950°	0·0055	0·542	1·07
1000°	0·0032	—	—

It would, therefore, appear from the figures in the first column of the table that the production of ammonia by this process would be practically impossible. There is, however, another factor of the greatest importance to be considered, for the number of molecules on both sides of the equation

$$\underset{4\text{ mols.}}{N_2+3H_2}=\underset{2\text{ mols.}}{2NH_3}$$

is not the same, and this decrease means that the percentage of ammonia attainable is proportional to the working pressure over a wide range. As will be seen, the values for the percentage equilibrium at 100 and 200 atmospheres show a very different state of affairs, and technical synthesis becomes a possibility if the equilibrium at such pressure can be reached and in a short enough time. The process developed is due to the work of Haber and Le Rossignol (Z. anorg. Chem., **44**, 341 ; Ber., 1907, **40**, 2144 ; Z. Elektrochem., 1908, **14**, 181 ; 1910, **16**, 244 ; Ger. Pats., 235,421, 1908 ; 238,450, 1909 ; Fr. Pats. 406,943 of 1909 ; see also this J., 1905, 131, 545 ; 1910, 485, 488, 1057 ; 1913, 134 ; 1914, 49). Haber has shown that with suitable catalysts it is possible to work at temperatures ranging between 500° and 600° C. and at high pressure, so that the equilibrium is nearly maintained with a high rate of flow of gas. The actual process used by the "Badische Anilin und Soda Fabrik," which firm has taken over the patents, is based on the description given by Haber (see this J., 1913, 134). It consists in compressing a mixture of 1 vol. of nitrogen and 3 vols. of hydrogen in presence of a catalyst, when under a pressure of 175 atmospheres and at a temperature of nearly 550° C. about 8% by vol. of ammonia is formed. The gases pass from the compression cylinder to a cooling arrangement, where the ammonia liquefies, and may be drawn off, or water may be directly introduced into the apparatus, and under the pressure used a concentrated solution of ammonia produced directly. The very high pressure used limits the space which may be filled with the catalyst, but more than 1 kilo. of ammonia can be produced per hour for each litre of catalyser space. The necessary heat is produced by the reaction itself, for 13,000 grm.-calories are set free at this temperature by the formation of 1 grm.-equivalent of ammonia from its elements. Haber describes osmium as the best catalyst but for use on the large scale it cannot be seriously considered, as the world's stock does not amount to much over 100 kilos. and only small amounts are obtained annually. Next in order comes uranium, which, in the form containing carbide, such as is produced in the electric furnace from uranium oxide and carbon, crumbles under high pressure to a very fine powder possessing at 500° C. very high catalytic activity. An essential when using uranium is that no water or substances which would give rise to water should be present in the gases. When this process came to be applied on the large scale, difficulties of quite an unusual nature had to be overcome, more particularly in the construction of apparatus to withstand the necessary pressure and temperature. Steel loses its carbon at the temperatures in question, so that its capability of withstanding pressure is reduced to a minimum. Iron completely changes its properties and at high temperatures becomes, in quite a remarkable degree, pervious to hydrogen under high pressure. But these and many other difficulties have now been completely overcome, and the works of the Badische Company at Oppau, near Ludwigshafen-am-Rhein, are producing large quantities of ammonium sulphate annually. The process is not without danger, as very slight amounts of oxygen or air entering the apparatus are sufficient, at the high pressure, to cause explosions. Automatic devices for indicating the presence of oxygen have been introduced, and the danger from explosion is guarded against by setting up the apparatus in bomb-proof chambers. A very careful study has been made of the various catalysts which can be used, and it has been found that in general they are made more active by the presence of certain foreign substances or promoters ; in many cases a very minute quantity is sufficient to raise the catalytic activity very considerably. Among the more important promoters are the oxides, hydroxides, and salts of the alkali metals and of the metals of the alkaline earths. Moreover, osmium and uranium are not by any means the only possible catalysts, for iron itself, manganese, or tungsten can be used with good effect. Another factor of great importance is the recognition of certain specific poisons for ammonia catalysts. The most active poisons are sulphur, selenium, tellurium, phosphorus, arsenic, boron, or the hydrides of these elements ; also many organic compounds and certain metals of low melting point, which can easily be formed from their compounds by reduction with hydrogen ; for example, lead, bismuth, and tin. Extremely minute quantities of oxygen-sulphur compounds, such as sulphur dioxide, which are almost always present in the purest commercial products or in the so-called pure gases, suffice to render the catalysts absolutely inactive or to diminish their activity very considerably ; thus iron prepared from its oxide with a content of 0·01% Na_2SO_4 or containing 0·1%S is quite useless. The recognition of these facts necessitates the preparation of contact materials free from such poisons, and also the very careful purification of the gases which are to be used. As little as one part per million of sulphur in the gas mixture can be injurious, so that even electrolytic hydrogen has to be further purified. The nitrogen is prepared by the Linde method, or by passing air over heated copper, and the hydrogen by any of the methods already alluded to. In order to free hydrogen from traces of carbon monoxide treatment with caustic alkalis at high temperatures is especially recommended (Badische, Fr. Pat. 439,262 of 1912 ; this J., 1912, 722) ; for instance, hydrogen containing 1% CO can be treated with (A) 80% caustic soda at 260° under 50 atmospheres pressure or (B) 25% caustic soda at 240° C. under 200 atmospheres pressure. Great as the possibilities of this process seem to be, neither the Chilian nitrate nor Norwegian nitrate industries are likely to suffer thereby, for the annual increase in demand for these substances is calculated to amount to 185,000 tons of ammonium sulphate.

The hardening of fats.

The hardening of fats consists in adding to the glyceride of an unsaturated acid the necessary number of atoms of hydrogen to convert it into the glyceride of a saturated acid.

Though by weight the amount of hydrogen required for converting an oil into a workable solid fat is not great, the volume of hydrogen assumes enormous proportions. One ton of oleic acid requires roughly 79,000 litres or 2800 cubic feet, and one ton of triolein requires 75,900 litres or 2680 cubic feet of hydrogen. It has not been found possible to obtain any accurate idea of the amount of oils which are thus treated annually, but it may be mentioned that the Linde Company's method for the production of hydrogen (this J., 1911, 746, 893) is being carried out in various factories for fat hardening to the extent of 1000 cubic metres per hour, which amount is sufficient to harden 100,000 tons of fat annually. There is further a factory in Norway capable of producing 4500 cubic metres of hydrogen by an electrolytic method, and of hardening 150 tons of whale oil every twenty-four hours (Offerdahl, see later). The reason why the hardening of fats has assumed such large proportions is that so much of the natural supply of hard fats is now employed in the making of margarine and other foodstuffs, that the amount of such fats available for soap boiling has been considerably encroached upon, and hence it has become necessary to find other sources of hard fats for the latter purpose. One of the principal oils submitted to the process of hardening is whale oil, of which the world's supply in 1912 amounted to 1,200,000 barrels (about 42,000 tons), more than half of which was obtained from Norway (Offerdahl, this J., 1914, 32) Ten or fifteen years ago only small amounts of whale oil were used in the tanning industry or for lubricating, its taste and smell prohibiting its employment for other purposes. More recently larger quantities have been worked up for the isolation of glycerol. The oil is now almost entirely hardened to a substance melting between 40° and 50° C., which possesses neither taste nor smell.

Although in the application of Sabatier and Senderens' reaction, substances are only used in the state of vapour, and these authors lay stress on the point that the catalyst should not be allowed to become moistened with the substance under treatment, the present methods for the hardening of oils are the direct outcome of the researches of Sabatier and Senderens. The first patent dealing with the hydrogenation of oils in the liquid form was taken out by Normann (Eng. Pat. 1515, 1903; this J., 1904, 26). This patent marks the commencement of a new industry, but, in view of more recent work, it does not appear to contain many of the essentials of success, some of which are :—1. The preparation of the catalyst in a suitable condition. 2. The proportion of the catalyst used. 3. The temperature at which hydrogenation is carried out. 4. The refining of the fatty body. 5. The application of continuous mechanical agitation. 6. The use of hydrogen free from hydrogen sulphide, 0·1% of this gas being sufficient to stop the reaction. The importance of some of these points is illustrated by the following records of experiments by O. Hehner :—

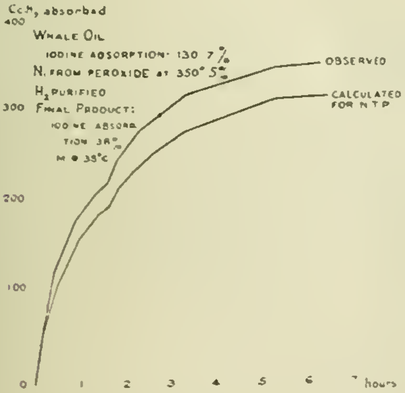

FIG. 1.

Figs. 1 and 2 show the behaviour of whale oil and rape oil respectively when submitted to the action of hydrogen in presence of reduced nickel. The time during which the experiment lasted and the volume of hydrogen absorbed are indicated in these and following diagrams. It will be seen that the iodine value of the whale oil fell from 130·7 to 38, and the melting-point of the resulting solid was 38° C. With the rape oil the iodine absorption fell from 105·4 to 8·3, and the melting-point of the resulting solid was 57° C. Figs. 3 and 4 illustrate the necessity of exercising care in the preparation of the catalyst. Nickel prepared from the hydroxide or from the nitrate, through the oxide, was of approximately equal effect with whale oil at 250°, though much less active in the latter case at 180° C., whereas nickel prepared by strongly heating the nitrate and reducing the resulting oxide was practically without effect on linseed oil, and nickel obtained from the sulphate through the hydroxide (probably containing traces of sulphur) was markedly less active than carefully purified nickel from the hydroxide. The following example, taken

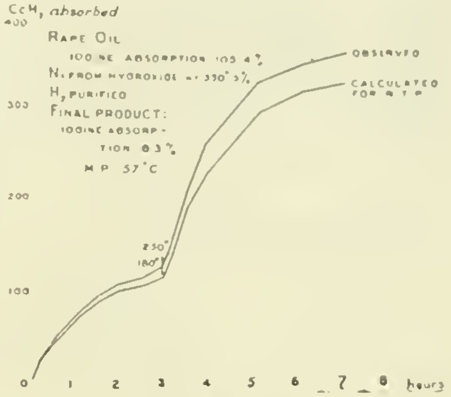

FIG. 2.

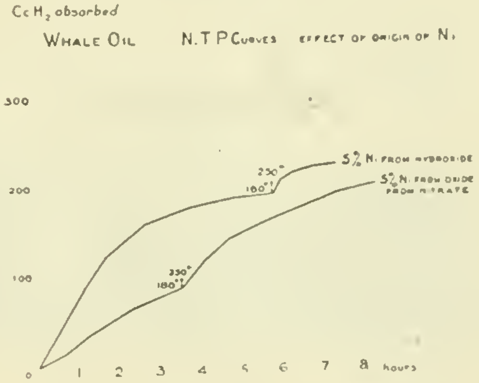

FIG. 3.

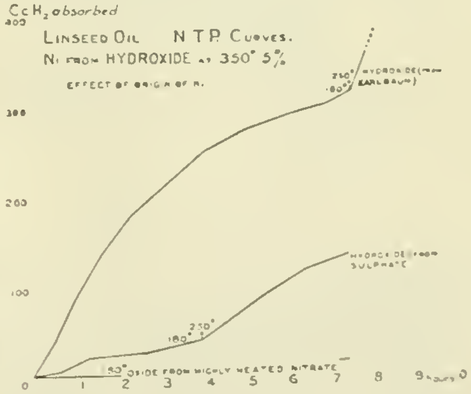

FIG. 4.

along with some other data here quoted, from evidence handed into court in the case of Joseph Crosfield and Sons, Limited, v. Technico-Chemical Laboratories, Limited, may be cited in further exemplification of this point. The iodine value of an oil was decreased from 108·4 to 72·1 by treatment with hydrogen in presence of nickel obtained by igniting nickel carbonate at 400°—450°, and reducing the resulting oxide with hydrogen at 400° C. A specimen of the same oil had its iodine value lowered to 13·2 when treated in presence of nickel prepared from the carbonate by roasting at 300° for 5—6 minutes, and reducing the resulting oxide with hydrogen at 300° C. for 4—5 minutes.

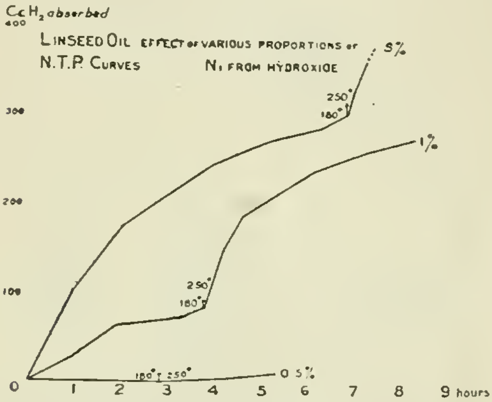

Fig. 5.

The curves in Fig. 5 show the great importance of selecting a definite proportion of the catalyst, and also, in common with most of the previous curves, the effect of temperature on the absorption of hydrogen. With 0·5% of nickel there was practically no absorption of hydrogen, even on raising the temperature to 250°; with 1% of nickel absorption was slow at 180°, increasing rapidly on raising the temperature to 250°, whereas with 5% of nickel.

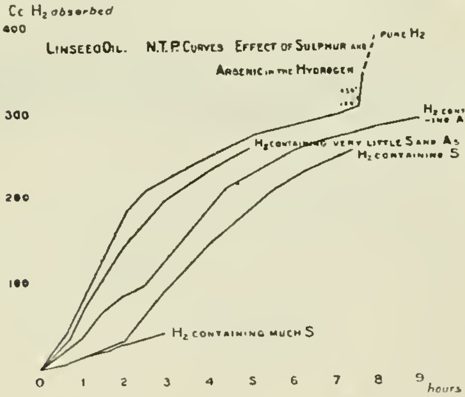

Fig. 6.

the absorption was at the end of seven and a half hours considerably greater at 180° than it was at 250° C., when using only 1% of nickel. Figs. 6 and 7 show the effects produced by the presence of arsenic and sulphur in the hydrogen or by using commercial gases, such as water-gas. By unpurified hydrogen is meant the gas such as would be obtained from a good specimen of zinc without further removal of impurities. Hydrogen containing arsenic was generated from an ordinary sample of zinc. Hydrogen containing much sulphur refers to the gas passed through a very dilute solution of hydrogen sulphide in water. The effect of hydrogenation on a variety of acids and oils is well illustrated by the figures contained in the following table, comprising the results of numerous experiments conducted by F. W. Passmore.

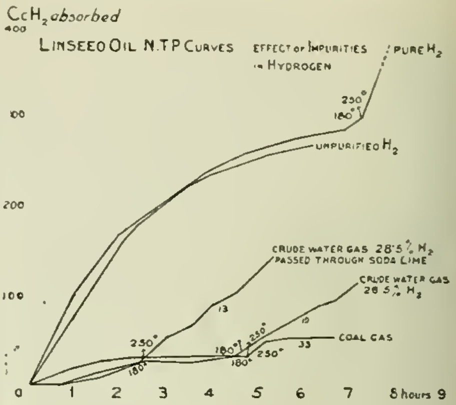

Fig. 7.

	% Ni used	Temp	Time in hours	Iodine value.		Melting point.	
				Of original substance.	Of product.	Of original substance.	Of product.
Ricinoleic acid	3	180°	2	89·8	7·99	Liquid	53°
,, ,,	6	100°	4	91·8	3·69	,,	72°
Erucic acid	10	180°	1	120·3	5·95	,,	58·5°
,, ,,	3	180°	1	74·0	2·05	34°	79°
Linoleic acid	3	240–250°	2	182·1	30·00	Liquid	60·5°
,, ,,	3	180°	2	176·0	7·79	,,	66°
,, ,,	6	100°	3	179·2	5·98	,,	65°
Oleic acid	3	240–250°	½	82·9	4·08	,,	63°
,, ,,	1	100°	1½	82·1	9·77	,,	61°
,, ,,	6	100°	2	84·8	3·83	,,	63°
Whale oil	3	180°	1¾	120·0	10·30	,,	54°
,, ,,	3	240–250°	1¾	123·0	27·7	,,	48·5°
Cod oil ..	3	240–250°	1¾	157·0	13·1	,,	56°
,, ,, ..	3	180°	3	159·5	11·1	,,	57°
Linseed oil	3	240–250°	1½	181·2	9·52	,,	66°
,, ,,	10	180°	1¼	176·8	4·75	,,	62·5°
Rape oil	3	180°	1½	118·2	11·2	,,	59°
,, ,,	3	100°	10½	119·1	24·3	,,	56°
Cotton seed oil	3	175°	1¼	101·8	18·5	,,	58°
Fish oil ..	2	190–200°	6	124·5	51·5	,,	solid
Almond oil	2	175–185°	6	92·1	22·6	,,	—

Despite the large amount of work which has been done on the hardening of fats, the literature on the subject is very meagre, and almost the only information which is forthcoming is in numerous patents.* A good, though brief description of many of the processes and forms of apparatus employed is to be found in a paper by C. Ellis (this J., 1912, 1155). There is, however, one patent (Lessing, Eng. Pat. 18,998 of 1912; this J., 1913, 917) not mentioned in Ellis's paper, which appears to differ materially from others, more particularly in the novel method for bringing catalyst and oil in contact. According to this process hydrogen containing 5—10% of carbon monoxide, such as may easily be prepared from water-gas or the thermal decomposition of coal gas or hydrocarbons, is passed over reduced nickel, with formation of nickel carbonyl. The nickel need not be pure, but in the form of such complex mixtures as are obtained in the treatment and reduction of nickel ores. The mixture of hydrogen and any desired proportion of nickel carbonyl is then passed into the substance to be hydrogenated at a temperature between 200°—240° C., when the nickel carbonyl is decomposed and elementary nickel, in a very pure and particularly active form, is produced. The proportion of nickel carbonyl required is very small, excellent results having been obtained with an amount equivalent to 0·1 part of nickel per 100 parts of oil. Fresh nickel carbonyl is always passing into the substance to be hydrogenated, and the nickel is believed to act in the nascent condition at the moment of decomposition of the nickel carbonyl. This seems to be borne out by the fact that if the same percentage of nickel be introduced into an oil as nickel carbonyl, the latter decomposed and then hydrogen passed in, there is practically no result from the commercial point of view. (Compare C. Ellis, *loc. cit.*; Shukoff's Ger. Pat., 241,823 of 1910.)

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* *English Patents.*—1515, 1903; 2520. 1907; 9112, 1908; 3752, 7726, 29,612, and 30.282, 1910; 72, 4702, 5773, 18,282, 18,310, 18,998, 23,377, 23,643, and 28,754, 1912; 16,283, 1913.

German Patents.—256,500 and 260,885, 1911.

French Patents.—378,528, 1907; 426,343, 1910; 425,729 and 433,294, 1911; 439,262, 441,097, 447,420, 447,688, 449,668, and 450,703, 1912; 458,445, 1913.

U.S. Patents.—1,004,034 and 1,004,035, 1911; 1,040,531, 1,040,532, and 1,043,580, 1912: 1,058,738, 1,059,720, and 1,060,673, 1913. (See this J., 1904, 26; 1907, 1150; 1908, 296; 1909, 1005; 1910, 1396; 1911, 966, 1022, 1266, 1461; 1912, 139, 398, 443, 722, 826, 1085, 1186; 1913, 234, 253, 475, 497, 543. 610, 612, 705, 797, 798, 917, 958, 989, 1119.)

The process of hydrogenation gives rise to fats of any desired degree of hardness, which are used at the present time primarily for soap making. It is stated that the soaps produced are very hard and do not lather well, but this objection would not appear to be of a very serious nature, as the hardened fat could be mixed with a suitable quantity of another fat, which would give the desired quality to the resulting soap. Hardened fish oil is odourless and gives a good soap, but unless the iodine value of the oil has been lowered during hydrogenation to 50 or less, then, on ironing materials washed with such soap, the odour of fish oil again becomes noticeable. Hardened oils seem likely to be used largely in the future for lubricating purposes, and as foodstuffs. Even at the present time hardened cottonseed oil, a substance resembling lard, is used edibly, and a great number of physiological experiments carried out on the edible properties of hardened whale oil (Offerdahl, *loc. cit.*) have proved it to be easily digested. One point, however, will require very careful consideration in this respect, namely, that an oil hardened by a process including nickel as catalyst always contains small amounts of nickel. Offerdahl has shown that the average amount of nickel in hardened whale oil is from 0·5—2 mgrms. per kilo., whilst the most found was 4 mgrms. per kilo. Despite the facts that 99·8% of nickel taken is eliminated from the system, and that Normann and Hügel (*Halbmonatsschrift für Margarin-industrie*, 1913, VI., No. 17) have shown that this amount of nickel is very much less than that contained in many foodstuffs, prepared in nickel vessels, which have had no injurious effects on those who have eaten them, the matter is one which will require detailed attention.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

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I.—GENERAL PLANT; MACHINERY.

Patents.

Smoke and like particles in air or gases; Treatment of ——. G. B. Burnside and J. S. Anderson, Glasgow. Eng. Pat. 23,605, Oct. 18, 1913.

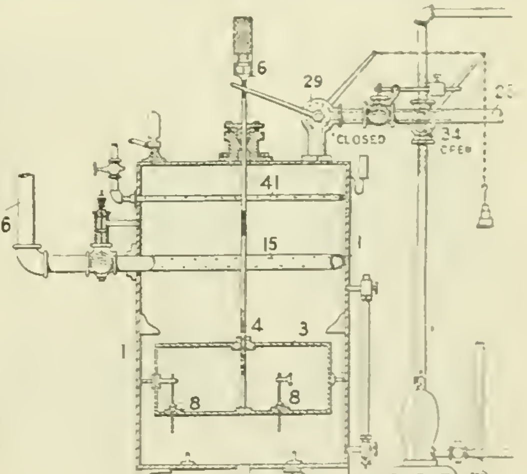
The particles are caused to coalesce and condense by treating the gases with moist steam which has been electrified by passage through a fine jet.—W. H. C.

Sizing and classifying comminuted materials; Process and apparatus for ——. H. M. Sutton and W. L. and E. G. Steele, Dallas, Tex. U.S. Pat. 1,114,935, Oct. 27, 1914; date of appl., Jan. 22, 1914.

The materials are fed upon a continually moving, transversely inclined belt, having a roughened surface. A vibratory motion is imparted to the belt from below, the frequency of the impulses increasing from the feed point onwards, thus causing the particles to diverge from their normal path at increasingly greater angles according to their dimensions. The products of different sizes fall into separate receptacles.—W. H. C.

Evaporating-accelerator. E. C. Dun, Santiago, Cuba. U.S. Pat. 1,110,752, Sept. 15, 1914; date of appl., May 3, 1911.

The condensed water and air from the heating chamber of the evaporator enter the receiver, 1, through the pipes, 16, 15, and the water accumulating at the bottom of the receiver causes the float, 3, to rise, closing the valve, 29, and opening the steam valve, 34. Steam enters the pump, 22, which commences to pump the water out of the receiver. When the float sinks to the bottom of the receiver, the valve, 29, connected by way of pipe, 26, with a vacuum pump, is opened and the steam valve, 34, is shut. The vacuum pump, withdraws the air from the receiver and some air from the external atmosphere enters the float through the valve, 6, and the hollow shaft, 4, and drives out any water that may have entered the float through the valves, 8. If any steam enters the vessel, 1, it may be condensed by a spray of cold water from the pipe, 41.—W. H. C.



Filter-leaf. N. A. Burgess, New York, Assignor to Butters Patent Vacuum Filter Co., Inc. U.S. Pat. 1,114,224, Oct. 20, 1914; date of appl., Aug. 30, 1913.

A horizontal pipe fitted to the filter-leaf has an opening protected by an overlapping lip beneath the surface of the filter-cake.—W. H. C.

Separating apparatus. P. Kropp. Fr. Pat. 469,073, Feb. 20, 1914. Under Int. Conv., Feb. 21, 1913.

Solid particles suspended in a liquid are removed by imparting to the latter a motion similar to that of a breaking wave by means of appropriate baffles.—W. H. C.

Absorption and decoloration; Method of effecting ——. G. H. Hellsing, Trollhättan, Sweden. Eng. Pat. 22,063, Sept. 30, 1913.

See Ger. Pat. 276,343 of 1913; this J., 1914, 1083.—T.F.B.

Driers; Continuous automatic centrifugal ——. C. A. Wendell, Joliet, Ill., U.S.A. Eng. Pat. 4808, Feb. 24, 1914.

See U.S. Pat. 1,088,754 of 1914; this J., 1914, 631.—T.F.B.

Separator; Centrifugal ——. W. Mauss, Johannesburg, Transvaal. U.S. Pat. 1,115,852, Nov. 3, 1914. Date of appl., March 25, 1913.

See Eng. Pat. 6478 of 1913; this J., 1913, 858.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Explosions in Mines Committee; Sixth report of the ——. [Cd. 7638.] 17 pp. (See also this J., 1913, 476, 688, 1148.)

Firedamp in the air helps the inflammation of coal dust, but it does not appreciably diminish the protective effect of an admixture of fine uninflammable dust, 50% of which should pass a 200-mesh sieve. Water spraying must be uniform; an atomiser is best. To prevent propagation of flame from coal-dust when a 24-oz. charge of powder is fired into it, 30% of water is required, and 50% in the case of the cannon and 5 lb. of coal dust, or coal gas and air through 150 ft. of the 3-foot gallery. Reduction of the oxygen to 17% would not prevent explosion, and would be harmful to the miners. Home Office recommendations are: (i) 50% of non-inflammable dust (pulverised argillaceous shale is recommended), or (ii) 30% of water in the dust throughout the roads, or (iii) a combination of these.—O. E. M.

Acetylene; Quantity of —— necessary to cause an explosion in a closed space. Bosnische Elektricitäts-A.-G. Z. Bayr. Rev.-Vereins, 1909, Nr. 6. J. Gasbeleucht., 1914, 57, 65.

A mixture of acetylene and air will not explode if the proportion of acetylene is less than 2·5%. The experiments were carried out in a large chamber of 11 cb. m. capacity, ignition being effected by a flame. There is no danger of explosion in dwelling houses, etc., having rooms with over 40 cb. m. air space, if the charge of carbide does not exceed 2 kilos.—A. T. L.

Carbonisation results with coal stored in the open and in bunkers. K. Bunte. J. Gasbeleucht., 1914, 57, 450.

Tests were made at the Karlsruhe experimental gas works with the same coal, part of which had been stored in the open air for 3½ years to a height of 3·5 metres, and part in bunkers to a height of 3 metres. The results showed that so far as gasification was concerned there was practically no difference effected by the method of storage, but that the coke from the coal stored in the open was much smaller and more friable.—J. H. J.

Coke-oven gas; Long-distance transmission of ——. R. Witzeck. J. Gasbeleucht., 1914, 57, 361—368, 389—392.

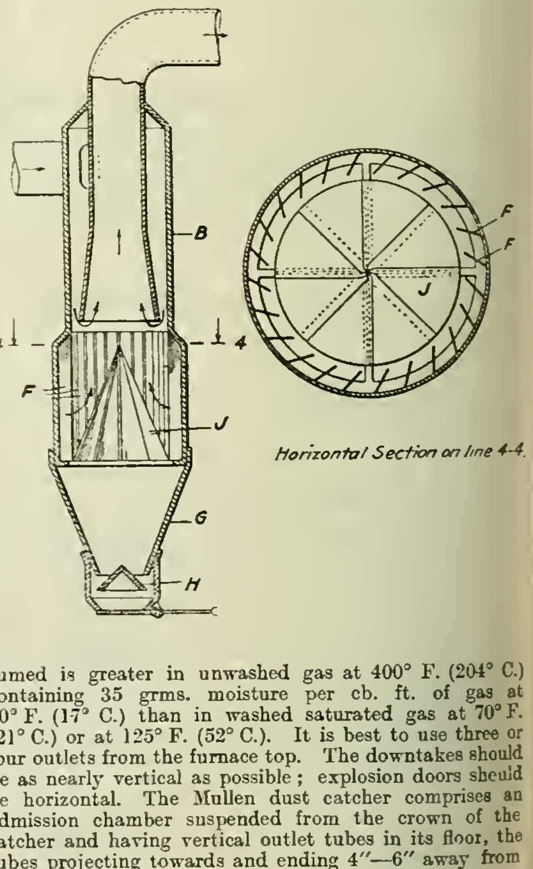
The history of the coke oven and its development into the modern regenerative form, with by-product recovery, are discussed. It is shown that there are advantages in manufacturing in a large oven, situated in a coalfield, and distributing through considerable lengths of pipe, over manufacturing on the small scale near the consumer. Examples of modern installations are described in detail. —O. E. M.

Producer gas; The Hilger rotating grate generator for ——. V. O. Keller. J. Gasbeleucht., 1914, 57, 80—82.

The roof of the generator is provided with a hopper for admitting the charge, and a lock chamber, so as to seal the interior of the furnace from the air during the feeding. The hearth of the furnace has the form of an inverted bowl which can be rotated by means of worm gear. The rotating bowl contains the grate which is composed of two parts. On the lower part there is a star-shaped hood. A star-shaped opening leads from here to the top of the grate, and permits the air and steam mixture to be admitted to the furnace. By means of a simple mechanism, the cogged wheel which drives the hearth can be engaged by worm wheels on either side. The direction of rotation can thus be reversed and a tilting motion imparted to the ash basin. The consumption of fuel is more thorough with this than with other generators.—J. N. P.

Blast-furnace gas; Cleaning and utilisation of ——. J. E. Johnson, jun. Met. and Chem. Eng., 1914, 12, 685—692.

When the gases contain a large amount of water vapour some may be removed even by wet scrubbing. The total heat available per lb. of dry fuel gas consumed is greater in unwashed gas at 400° F. (204° C.) containing 35 grms. moisture per cb. ft. of gas at 60° F. (17° C.) than in washed saturated gas at 70° F. (21° C.) or at 125° F. (52° C.). It is best to use three or four outlets from the furnace top. The downtakes should be as nearly vertical as possible; explosion doors should be horizontal. The Mullen dust catcher comprises an admission chamber suspended from the crown of the catcher and having vertical outlet tubes in its floor, the tubes projecting towards and ending 4″—6″ away from the surface of water maintained in continuous flow by a supply pipe at the centre of an inverted cone-shaped water container. The gases pass through an annular chamber surrounding the admission chamber to the outlet. In the Brassert-Witting primary dry cleaner, used after the ordinary centrifugal dust chamber, the gases enter tangentially an annular chamber, B, the lower end of the outlet being flared. Below the outlet the chamber is larger and contains side baffles, F, and a central conical baffle, J. A cone, H, is placed at the bottom of the conical dust collector, G. In a modification the end of the outlet is barrel-shaped, a spiral deflector is placed in the annular



chamber, B, and an annular chamber is formed outside the baffles, F, which have vertical spaces between them. In another modification bars on the outer wall of the chamber, B, and extending above and below the flared end of the outlet, replace the baffles, F, and cone, J.

—W. F. B.

Coal gas residuals. F. H. Wagner. Met. and Chem. Eng., 1914, 12, 696—702.

The following results have been obtained with the Feld hot tar washing process (see Eng. Pats. 20,139 of 1907 and 9086 of 1910; this J., 1908, 1011; 1910, 999).

Washing without Pelouze condenser.

Gas temperature at inlet to washer.	Tar content in grains per cb. ft.		Grains removed	Efficiency, %	Gas passed per 24 hrs., cb. ft.
	Inlet.	Outlet.			
131° F.(55° C.)	11·512	0·2930	11·219	97·46	2,463,000
127° F.(53° C.)	10·386	0·2160	10·170	97·92	2,453,832
129° F.(54° C.)	10·818	0·2930	10·525	97·29	2,341,800
129° F.(54° C.)	13·518	0·4170	13·101	96·92	2,397,000
126° F.(52° C.)	9·907	0·5250	9·382	94·70	2,400,000
Washer with Pelouze condenser.					
140° F (60° C.)	10·050	0·0436	10·0064	99·56	2,600,000
194° F.(90° C.)	13·100	0·0872	13·0128	99·34	2,600,000

With the Feld system of ammonia extraction (see this J., 1912, 430 and 1911, 1381) combined with the Bueb process for the extraction of cyanogen (this J., 1903, 204) a plant carbonising 300 tons of coal per day, working 250 days per year, gave the following results :—

Cyanogen	1147 cwt. at £3 2s.	£3556
Sulphate	12,047 cwt. at 14s.	£8433
NH_3 in press cake	266 cwt. at 32s. 6d.	£432
Total gross earnings		£12,421

The working expenses were :—

Materials	£770
Steam	£346
Power	£560
Miscellaneous	£208
Labour	£521

Total working expenses	£2405
Net earnings per year less interest and depreciation	£10,016

—W. F. B.

Tar: Electrical removal of —— from gas. F. W. Steere. J. Gas Lighting, 1914, **128**, 309—311. (See also this J., 1914, 1000.)

When crude coal-gas or producer gas is submitted to an alternating high-tension discharge at 40,000—80,000 volts in an ioniser, the tar fog condenses to large globules, which can be readily removed by a centrifugal or by a Pelouze and Audouin extractor. In an experimental apparatus treating 30,000 cb. ft. of gas per hour, rich coal-gas given off during the earlier part of the coking period was passed through a washer-cooler and then through the ioniser. The best temperature was 65°—80° C. (149°—176° F.). The naphthalene was separated in crystalline form by passing the tar-free warm gases from the tar-extractor through a washer-cooler, and the cooled gas contained only sufficient naphthalene vapour for saturation at the temperature of the gas. The separated tar contained little benzene and toluene, a larger proportion of these constituents remaining in the gas and increasing its illuminating power. This effect was increased by raising the temperature at which the gas entered the ioniser. The process has been used continuously since January for removing tar from producer gas for use in engines.

—A. T. L.

Gas and water mains; Corrosive action of electrical currents on the —— in the town of Gablenz a. N. (Austria). T. Herrmann. J. Gasbeleucht., 1914, 57, 88—89.

Attention is drawn to the serious electrolytic corrosion of water and gas mains in Gablenz. The origin of the earth currents is attributed to the electric tramways in the streets. These vagrant currents are assisted by impurities introduced into the soil through acids formerly discharged by factories in various places. The damaged pipes are for the most part situated under the tram rails, and cast and wrought iron tubes were equally attacked. In a large number of lead pipes, the metal was transformed into a brown powder, whereby serious leaks of gas occurred. The accumulation of gas led in one instance to a disastrous explosion. Especial damage has been caused at the gas works where many lines converge, through stray currents travelling along the main pipes connected with the plant. The water conduits and oil pumps were thus destroyed. Accidents also arose from the difference in potential existing between the earthed gas plant and the tram rails, which led to discharges between the two. In addition to electrolytic actions, a number of accidents have arisen through lightning discharges. These have struck the overhead live wires, or in some cases exposed metal fittings, and created a short circuit between the electrical leads and the gas mains or telephone wires. The disturbances at the gas works have been obviated by suspending electrical traction altogether and by interrupting the metallic connection between the street mains and the gas works. This has been effected by the use of flanged joints between the pipes, packed with layers of mica. This method however has introduced an additional danger on account of lightning discharges. Electrical charges concentrated in the ground surrounding the works tend to pass along the whole length of pipes as offering the path of least resistance to distribution in the earth; currents thus tend to leap over the insulated section and cause dangerous discharges at the metallic termini. The parasitic earth currents arise from the difference in potential—in some cases amounting to 20 volts—between the tram rails and adjacent pipes, and these can best be minimised by lowering this potential. It is desirable therefore to increase the conductivity of the rails. Short circuits by lightning discharges can be obviated by more carefully arranged installations.—J. N. P.

Petroleum; Notes on the composition of Mid-Continental (U.S.A.) ——. F. W. Bushong. J. Ind. Eng. Chem., 1914, 6, 888—890.

The results of repeated fractional distillations of a sample of Oklahoma petroleum are given. The crude oil had the sp. gr. 0·8513 at 15°/15° C. (the original oil at the well was lighter, some gasoline being lost during transport). The total gasoline fractions (b. pt. up to 150° C., sp. gr. 0·6296—0·7687, n_D^{15}=1·3616—1·4300) amounted to 13·77% and the kerosene fractions (b. pt. 150°—300° C., sp. gr. 0·7715 0·8530, n_D^{15}=1·4320—1·4760) to 28·80% by vol. The fraction of b. pt. 296°—298° C. yielded 10% of a red ozonide (compare Molinari and Fenaroli, this J., 1908, 1146) of which a portion purified by dissolving in ether had the composition, $C_{17}H_{20}O_6$. The fraction of b. pt. 252°—254° C. was refined by treatment with liquid sulphur dioxide (Edeleanu, this J., 1910 143; 1914, 343); the oil recovered from the sulphur dioxide extract yielded a nearly white ozonide which after being purified by washing its ethereal solution with potassium hydroxide had the composition $C_{15}H_{16}O_3$. The reaction of unsaturated hydrocarbons with ozone is considered to be a valuable means of detecting new constituents of petroleum, which constituents can be extracted from the oil by means of liquid sulphur dioxide.

—A. S.

Viscosimeters [for mineral oils]; Comparison of Engler's and Barbey's ——. C. Baheux. Les Matières Grasses, 1913, 6, 3221—3224. Petroleum, 1913, 9, 161—162.

Barbey's ixometer measures the fluidity of an oil, but does not give information of the behaviour of a lubricating oil in practice. In the case of machine oils, whose fluidity is usually determined at 35° and 50° C., the results are concordant, but for testing cylinder oils (100° C.) Engler's viscosimeter is preferable, since less time is required. Moreover, the use of an oil-bath with the ixometer involves a considerable error due to the irregular distribution of the heat, whereas the heating bath of Engler's apparatus is easily regulated. The values obtained with the two apparatus do not agree in all cases, the friction coefficient being greater in the case of Barbey's apparatus, which has a much longer outlet tube. Of two oils with equal viscosity that with the smaller friction coefficient will pass more rapidly through the outlet tube of Barbey's apparatus than the other. This is particularly noticeable with compound oils, the friction coefficient of which is lower than that of mineral oils of equal viscosity. Only mineral oils of the same viscosity that have been refined, etc., in the same way can be compared by means of Barbey's apparatus. Engler degrees may be calculated into Barbey degrees by the formula :—

$$f=\frac{720{,}000,}{v.a.m.}$$

where f represents the Barbey fluidity degree, v the Engler viscosity, a the efflux velocity (seconds in Engler's viscosimeter) of 200 c.c. of water at 20° C. and m a factor varying with the temperature and the quality of the oils. The results agree well in the case of mineral oils at 50° and 100° C., but are not applicable without correction to oils tested at 35° C., or to compound oils.—C. A. M.

Mineral oils ; Use of the Kubierschky column in the distillation of ——. E. Graefe. Petroleum, 1913, 9, 303—307.

Kubierschky's fractionating column consists of superposed chambers having the construction shown in Fig. 1. It has given excellent results in the manufacture of bromine, and has now been adapted to the distillation of mineral oils, in a series of two or four (Fig. 2). The crude oil from the reservoir, F, is heated in G by vapours from the column II, the heaviest fraction of these vapours being simultaneously condensed. The condensed portion falls into the cooler, K, which is charged with water, and thence into D_2, where it is separated from the water. The heated oil from G is passed into the column I, where it meets an ascending current of steam, and is freed from its lighter fractions. It then falls into the vessel, D_1, whence, after separation of water, it is pumped by the pump, E, into the heater, H, and is heated to a higher temperature by the vapours from II. It then passes into II and is freed from lamp oil fractions by superheated steam, whilst the residue is drawn off at N. If further fractionation is required a third or fourth column is added to the apparatus. For the distillation of lubricating oils the steam from the superheater, M, must have an initial temperature of not less than 550° C., and, to prevent condensation of oil, must not cool below about 300° C. For the recovery of the steam the vapours leaving the column are passed into the heater, G, where the temperature falls to 100° to 150° C. and the lubricating oil is condensed and drawn off into K. Part of the steam is conducted into the column I and used for distilling light fractions from another oil, whilst the remainder is brought back to the superheater, M, and again heated to 550° C. In the distillation of crude benzine about 5% of b. pt. up to 150° C. is separated in I, whilst the remainder is heated in II to obtain a product boiling exactly at 150° C., and a residue (4%) of b. pt. up to 225° C. One part of steam is required for each part of distillate. In the case of oils containing asphaltum the temperature need not exceed 250° to 280° C., and a good quality of asphaltum is obtained, whilst there is only slight decomposition of sulphur compounds. Petroleum residues containing paraffin wax are readily fractionated into a semi-solid distillate and a hard undecomposed amorphous wax. It is essential, however, that the lower parts of the columns should be well insulated to prevent loss of heat.—C. A. M.

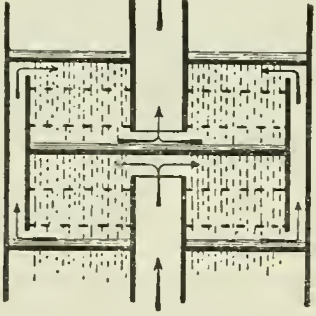


Fig. 1.

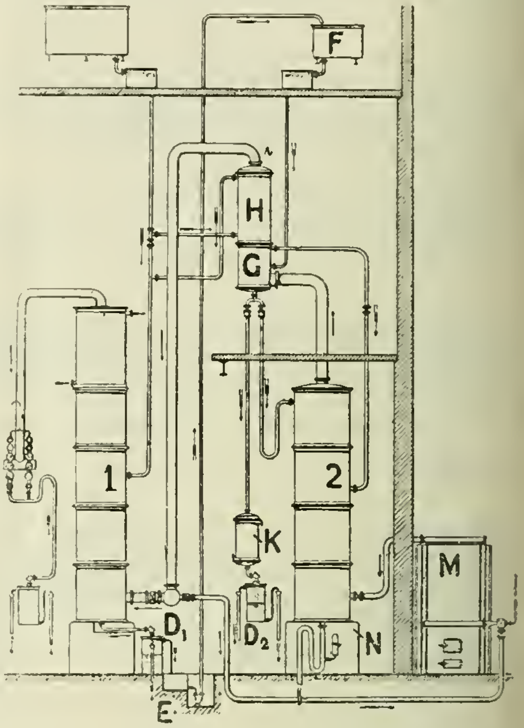


Fig. 2.

Motor fuel ; Peroxidised kerosene as ——. G. B. Selden. Petroleum, 1914, 9, 1304—1305.

Kerosene and other heavy petroleum oils can be utilised as fuel for internal combustion engines if small quantities of peroxides or other highly oxygenated substances, such as picric acid or nitronapthalenes, etc., are either dissolved in them or sprayed into the air inlet of the carburetter. Thus petroleum with 3% of hydrogen peroxide is stated to be perfectly stable, to differ from the original oil but little in either colour, specific gravity, or flash point, and to burn perfectly clean and without residue in the cylinder or odour in the exhaust. The power of the engine is moreover increased. Although aqueous peroxide may be used as a spray, it is preferable to shake the aqueous peroxide with the oil, and allow to separate. The hydrocarbon layer will then contain most of the hydrogen peroxide, and is decanted off. Many nitrated substances have also been employed in amount varying from 0·5 to 5% in solution in the oil, with similar results. It is claimed for example that an addition of 2% of naphthalene picrate increased the power of the engine by more than 100%. Similar nitrated compounds of naphthalene, phenanthrene, pyrene, and picene have also been used.—G. F. M.

Heavy oils (tar, tar-oil) ; Use of —— *in internal-combustion engines.* F. Drexler. Oelmotor, 1913, 2, 125—137, 309—315, 433—437, 563—575. Chem.-Techn. Rep., 1914, **38**, 358.

Regular ignition and complete combustion of crude tar and heavy oils are difficult to obtain in a Diesel engine on account of the varying quality of the fuel. A more rational method of using tar as fuel for engines is by the production of oil-gas from the tar, and of carbon monoxide from the non-volatile residue, the mixed gases being used in a gas-engine.—A. T. L.

Benzine; Electrification of ——. F. Dolezalek. Chem.-Ind., 1913, [6]. Petroleum, 1913, 9, 24—25.

Electrification of benzine passing through a pipe is intensified when the pipe is connected with the earth owing to the removal of the electricity from the pipe. Connection of a benzine tank with the earth is thus no safeguard against electrification of the liquid, and is also superfluous, since in practice tanks are not sufficiently insulated to retain electrostatic charges. The increase in electrification when air and benzine are forced together through a pipe is due to the greater friction produced. The igniting capacity of a spark depends upon the heat generated, and this depends upon the potential difference and the quantity of electricity. For the production of a spark at least 300 volts are required, but such a spark only causes ignition when a sufficient quantity of electricity is present; on the other hand a spark produced by 10,000 volts will not cause ignition when the amount of electricity is very small. The very slight, barely perceptible sparks given by electrified benzine have only slight igniting power, since only small quantities of electricity can accumulate owing to the poor conductivity of the liquid; yet such sparks may cause ignition when they meet fine conductive particles. The addition of soap to benzine, as suggested by Richter, is useless as a protection. (See also this J., 1913, 128.)—C. A. M.

Benzine from natural gas. Z. Biluchowski and S. v. Pilat. Petroleum, 1914, 9, 1305.

The natural gas obtained from the oil wells of Galicia contains considerable quantities of benzine. Gases of sp. gr. 0·820 to 0·892, after drying with calcium chloride, were led through three well-cooled vessels, connected together in series, containing benzine or kerosene. The issuing gas was specifically lighter and had given up from 3·6 to 9·6% of benzine vapours. The benzine obtained from the naphtha contained 30 to 56% more aromatic hydrocarbons than a similar benzine obtained from the natural gas by condensation, and it is consequently concluded that benzine can be most advantageously obtained from the gas by absorption. The heating value of the natural gas only falls by this process from 9132 to 8856 calories.—G. F. M.

Mineral oils; Detection of rosin oil in ——. Nachr. f. d. Zollstellen, 1914, 139—140. Chem.-Techn. Rep., 1914, 38, 363.

Aniline dyes are sometimes added to mineral lubricating oils in order to destroy fluorescence. Before testing such oils for rosin oil the dye should be extracted by shaking the oil repeatedly with strong hydrochloric acid, and then washing with water. Viscous oils should be diluted with ether to facilitate the extraction; the ether being afterwards evaporated.—A. T. L.

Paraffin wax in mineral oils; Determination of ——. F. Schwarz and H. von Huber. Chem. Rev. Fett Ind., 1913, 242—244. Petroleum, 1913, 9, 235—236.

From 1 to 5 grms. of distillate (or less of crude wax) are dissolved in the smallest possible quantity of a mixture of butanone (methyl-ethyl-ketone) and water (sp. gr. of mixture 0·812 at 20° C.) (see this J., 1912, 62), the solution cooled to —20° C., and sufficient butanone added to keep the oil in solution. The precipitate is collected on a filter chilled by a freezing mixture, and is washed with butanone (sp. gr. 0·812) at below —15° C., with constant stirring, until free from oil, and then dissolved in petroleum spirit, the solvent evaporated, and the residue weighed. In some cases slightly more paraffin wax was found by this method than by treatment with alcohol-ether, but oils freed from wax by means of butanone never gave a precipitate with ether-alcohol. For quantities of wax below 13% the results agreed with theory within 0·4% (usually 0·1 to 0·2%).—C. A. M.

Asphaltic material; Determination of —— in petroleum by the so-called excise method. L. Gurwitsch. Petroleum, 1914, 9, 1303—1304.

The determination of asphaltum in petroleum products as carried out by the Russian excise authorities consists in shaking 50 c.c., diluted with 100 c.c. of benzine, with 10 c.c. of sulphuric acid of sp. gr. 1·84, and after standing, reading off the volume of separated asphaltic material. Experiments show that in the case of lubricating and vacuum oils, not only is the indicated percentage of asphaltum in some cases too high owing to benzine being carried down with it, but also a considerable quantity of pure oil may be held in solution in this benzine. In an actual test where 56% of asphaltum was indicated, only 9·5% was present, the difference being benzine and pure oil. On the other hand with a cylinder oil known as viscosine, 13% of asphaltum was indicated by the test, but when this same oil had been concentrated, but not further refined, so that the residue then contained a still larger proportion of asphaltum, the excise test gave a zero value. In some cases, in fact, a negative percentage of asphaltum may be indicated owing to absorption of sulphuric acid by the benzine solution of the oil. It is concluded that the test is absolutely useless for the valuation of lubricating and cylinder oils, although for a rough characterisation of crude petroleum products it may be of some utility.
—G. F. M.

Asphaltum in petroleum and its distillation products; Determination of ——. K. Charitschkoff. Njeftjanoje Djelo, 1913, No. 13; Petroleum, 1914, 9, 690—691.

Colorimetric and densimetric methods have been suggested, but have not been found practicable. The French method, although imperfect, is the only one in use: the oil, dissolved in benzine, is shaken with sulphuric acid, and the quantity dissolved is taken as the asphaltum (compare preceding abstract). Secondary reactions, such as polymerisation, addition, etc., cause errors. The iodine value gives the content of unsaturated hydrocarbons, which should be deducted from the asphaltum.—O. E. M.

Naphthenic acids; Investigation of —— from heavy commercial lubricating oils. V. Herr. Petroleum, 1914, 9, 1198—1199.

An aqueous solution of the commercial product known as "muilonapht" gave on addition of sulphuric acid an oil of sp. gr. 0·9476, and refractive index 1·4848. The low gravity compared with that of the naphthenic acids from kerosene residues, 0·9621, is considered to be due to the presence of a neutral oil which was isolated by distilling the potassium salt of "muilonapht" with superheated steam till nothing but water distilled over. A solar oil of sp. gr. 0·8878 was obtained as distillate, and the residue on acidification gave naphthenic acids which on distillation in vacuum formed a yellow oil of sp. gr. 0·8737. Another method consisted in fractionating the methyl esters obtained by esterifying the acids in the crude oil liberated by sulphuric acid from "muilonapht." The fraction 270° to 350° C. was saponified and an acid of sp. gr. 0·9578 obtained. From another commercial naphthenic acid an acid of sp. gr. 0·9702 was isolated by the potassium salt method. These experiments indicate that the naphthenic acids obtained from the higher-boiling fractions of Baku petroleum belong to the same homologous series as the kerosene naphthenic acids, and that the specific gravities of the technically pure naphthenic acids from both fractions are almost the same. This is not in accord with the observations of Albrecht (Chem. Rev. Fett-Ind., 1911, 18, 152 and 189) who found that the rise in boiling-point was accompanied by a decrease in specific gravity.—G. F. M.

Cleaning and utilisation of blast-furnace gas. Johnson. *See* X.

Physiological effect of methane. Rybak. *See* XIXb.

PATENTS.

Fuel; Composition ——. W. T. Vint, Bradford, and S. G. Grimshaw, London. Eng. Pat. 20,625, Oct. 6, 1914.

A SMALL proportion of the fibrous root of the canna plant is added to a mixture of coal and pitch, before briquetting, to prevent the finished briquettes from falling to pieces in the fire.—W. H. C.

Gas producers, blast furnaces, etc. Hoppers for ——. Babcock and Wilcox, Ltd., London. From The Babcock and Wilcox Co., New York. Eng. Pat. 23,054, Oct. 13, 1913.

A CYLINDRICAL hopper is provided midway of its height with a loose conical ring, which forms a seating for a valve opening downwards. This valve has a downward tubular extension enlarged at the lower end to form a combined spreader and valve which provides a second closure at the bottom of the hopper.—A. T. L.

Gas, oil and ammonia; Manufacture of ——. R. Maclaurin, Cambusbarron, Scotland. Eng. Pat. 24,426, Oct. 28, 1913.

PRODUCER gas containing at least 14% H_2 is passed upwards through a column of bituminous fuel above the producer chamber so as to form ammonia, and distil off tar and oils from the fresh fuel. The distilling chamber has metal walls with annular partitions inclined upwards and inwards so as to form troughs for collecting and withdrawing the oils which condense in the cooler part of the fuel column. The oils are thus prevented from running back into the hot fuel and being converted thereby into more viscous oils and finally into tar. The fuel is supported above the annular troughs by horizontal or inclined perforated annular plates. Part of the producer gas is withdrawn directly from the producer chamber, in order that the temperature of the fuel column may be kept at 700° C. decreasing gradually to 500° C. in the ammonia-generating zone, and below 500° C. in the distilling chamber. The draught is regulated so that the fuel remains in the ammonia-generating zone for 4 hours. The producer chamber is of comparatively large cross-section and has very thick walls to prevent loss of heat. For making illuminating gas and coke as well as oil and ammonia, a large producer chamber (diameter 8—10 ft. for burning 1 ton of coal per hour), with walls 2 ft. thick, is surmounted by an ammonia-generating and oil-distilling chamber of three-fourths the diameter and 4—5 ft. high. The producer chamber is blown alternately with air and with water-gas or coal-gas. The gas formed during the air-blow is drawn off at the top of the producer chamber, and the heated current of coal-gas or water-gas is passed up through the distilling chamber to an outlet at the top of the producer. Coke is withdrawn through lateral doors above the grate.—A. T. L.

Gas producers. P. A. J. Cousin, Loos-lez-Lille, France. Eng. Pat. 4673, Feb. 23, 1914. Under Int. Conv., Jan. 8, 1914.

A ROTARY grate for gas producers is formed with a deep annular trough around its outer edge for the reception of clinker and ash from an inclined radial channel in the grate. The central part of the grate forms a blast chamber having a number of tuyère openings. The tuyères which project upwards into the fuel have a cutting edge in the direction of their movement and air-discharge openings in their rear wall. The radial channel in the grate is covered by grate-bars which can be raised and lowered by cams. To facilitate the passage of the clinker and ash through the radial channel to the annular trough, a rod carrying hinged plates is worked to and fro in the bottom of the channel. A fixed inclined plate dipping into the annular trough removes the clinker from the trough as the latter rotates.—A. T. L.

Fire-grates for gas producer furnaces. W. P. Gibbons and C. J. McEwen, Dudley, Worcestershire. Eng. Pat. 12,582, May 22, 1914.

SEPARATE hanger-bars rest freely on a series of horizontal rods fitted at different heights across the grate-opening. The bars extend downwards and each rests upon the next below, thus forming an inclined grate, which projects downwards into the water-sealed ashpit. The separate bars are in contact where they rest on the rods, but are narrower at the lower part so as to leave air spaces. The top of each bar projects outwards horizontally, forming a shelf on which ashes can be placed to bank the fire. The surface of the bars exposed to the fire is grooved and water is run down it from an annular trough at the top of the grate.—A. T. L.

Gas-producer. J. H. Hirt, Sewickley, Pa., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,114,355, Oct. 20, 1914; date of appl., Nov. 30, 1908.

Two superposed cylindrical chambers are separated by a partition having a central opening. Fuel is fed through an oblique port near the bottom of the lower chamber and "moisture" through an oblique port near the top of this chamber. The producer gas is withdrawn from the upper part of the upper chamber.—W. H. C.

Gas-producer. C. M. Garland, Chicago, Ill. U.S. Pat. 1,114,979, Oct. 27, 1914; date of appl., Dec. 15, 1913.

THE producer comprises an upper chamber for the distillation of fresh fuel by means of a downward current of steam and gas, and a lower chamber in which gas is generated from the coked fuel by means of an upward current of steam and air admitted through a central tuyère. The steam is generated in an annular boiler which forms the wall of the upper chamber. This chamber is fitted with a depending bell which forms the fuel chamber and provides an annular space through which the gases pass from the top of the lower chamber to an outlet near the top of the producer. The steam passes, part through a three-way valve, and a superheating-coil in the walls of the producer, and part direct, to an injector nozzle which draws some of the gases from the lower chamber and delivers them into the upper part of the upper chamber to form the downward current of hot gases. A thermostat in the upper chamber controls the three-way valve so as to maintain the temperature of this heating current constant.—A. T. L.

Gas generator. G. Akerlund, Assignor to Standard Gas Power Co., Atlanta, Ga. U.S. Pat. 1,115,268, Oct. 27, 1914; date of appl., Feb. 2, 1912.

IN a down-draught gas-producer, the gas is withdrawn through a central collector in the lower or ash-zone, and the air and steam are admitted at a number of points around the wall of the producer at about the middle of its height. An independent supply of air and steam is also admitted at the top of the fuel column.—A. T. L.

Gas; Process of making ——. J. O. Carrey, St. Louis, Mo. U.S. Pat. 1,115,392, Oct. 27, 1914; date of appl., July 26, 1913.

AN inclined partition extends from the axis of the producer near its lower end to the upper part of one of the walls, and forms the side wall of a distillation chamber for the raw fuel. It is heated by the incandescent fuel beneath it and by the hot gases passing to the gas outlet. The coked fuel descends from the distillation chamber to the furnace chamber in the lower part of the producer and is moved by stirring arms so that all parts of the fuel are subject in turn to the blast which is admitted at separate points. Distillation gases drawn from the upper part of the producer are admitted at points between the blast inlets. —A. T. L.

Coal gas; Process for purifying ——. R. Fabry, Sheffield. Eng. Pat. 29, Jan. 1, 1914.

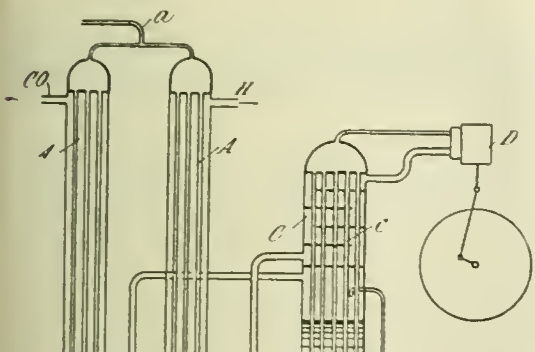
THE cooled and tar-free gas is washed with a solution of a mixture of alkali (preferably potassium) carbonate and caustic ammonia in such proportion as will take up the excess of H_2S, CO_2 and HCN over that which will be absorbed by the ammonia in the gas. The washing solution is regenerated by heating in a dissociating still and the vapours and gases given off are mixed with those from the ammonia liquor still and passed into a saturator containing sulphuric acid. The gases from the saturator are utilised by partial or complete combustion.—W. H. C.

Mixing the constituents of a combustible gaseous mixture; Method of and means for ——. A. C. Ionides, jun., London. Eng. Pat. 23,350, Oct. 15, 1913.

A DEVICE for mixing gas and air in a burner in the proportions requisite for complete combustion, and at the same time preventing backward propagation of the flame (see Eng. Pats. 15,455 of 1909 and 21,112 of 1911). The wall of the air conduit, which is surrounded by a gas chamber, is perforated with holes arranged spirally around it and increasing in number towards the burner. By this arrangement the mixture is richest at the part of the mixer nearest the burner and a backward propagation of the flame is retarded by the weaker mixture at the other end of the mixer. The orifices may be fitted with inclined tubes projecting into the air conduit, those tubes furthest from the burner leading furthest towards the axis of the conduit. The mixer may be used with the crucible furnace described in Eng. Pat. 2839 of 1912 (this J., 1913, 198).—A. T. L.

Gaseous mixtures [e.g., water-gas]; Separation of the constituents of ——. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. G. Claude), Paris. Eng. Pat. 13,160, May 28, 1914. Under Int. Conv., May 29, 1913.

COMPRESSED water-gas enters the heat interchangers, A, A, through the pipe, *a*, passes through the tubes and away by the pipe, b^1, to the reservoir, B^1, and thence up the tubes, *b*, *c*. Carbon monoxide condenses and collects in the reservoir, B^1, and the cooled compressed hydrogen passes to the engine, D, where it expands, does work and is further cooled. The expanded hydrogen circulates round the upper part of the tubes, *b*, *c*, in the vessel, C, and completes the condensation of the carbon monoxide which was commenced in the lower part of the tubes by the cold produced by the evaporation of a previously liquefied portion of carbon monoxide which supplied the vaporiser, B, by the pipe, b^2, from the reservoir, B^1. The separated hydrogen and carbon monoxide pass through the jackets of one or other of the vessels, A, A, to the outlets.—W. H. C.



Hydrocarbons; Conversion of heavy into lighter ——. W. A. Hall, New York. Eng. Pat. 17,121, July 25, 1913.

HYDROCARBON vapours are heated to above 600° C. in the presence of a suitable catalyst and under a pressure of about 5 atmospheres. The vapours are then passed through an expansion chamber provided with screens for separating the free carbon, and through a condenser. Suitable catalysts are Ni, Co, Ag, Pd, Cr and Mn, and their oxides. Gas oil treated in this way yields 60—70% of oil of sp. gr. 0·765, suitable for petrol engines.—A. T. L.

Paraffins; Separation of solid —— from oils containing them. Allgem. Ges. f. Chem. Industrie m. b. H. Ger. Pat. 276,994, May 3, 1913.

SOLID paraffins may be separated from hydrocarbon oils by treatment with liquefied sulphur dioxide in presence of an unsaturated aromatic hydrocarbon which is soluble in liquefied sulphur dioxide and will dissolve the volatile paraffin hydrocarbons. In some cases, such as with the oils from lignite tar, treatment with liquefied sulphur dioxide alone is sufficient to separate the solid paraffins.—T. F. B.

Water-gas; Apparatus for the manufacture of ——. A. G. Glasgow, Richmond, Va., Assignor to The United Gas Improvement Co., Philadelphia. U.S. Pat. 1,115,065, Oct. 27, 1914. Date of appl., Nov. 11, 1911.

SEE Eng. Pat. 28,855 of 1910; this J., 1912, 64.—T. F. B.

Calorimeter. U.S. Pat. 1,115,238. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Distillation of hardwood; Effect of pressure on yields of products in the destructive ——. R. C. Palmer. J. Ind. Eng. Chem., 1914, 6, 890—893.

EXPERIMENTS were made with maple and birch sawdust and birch chips, 1×½×½ in. in size, distillation being effected in a cast-iron autoclave, 15½ ins. deep by 8½ in. inside diameter. The effect of pressure was to increase the yield of charcoal and gas and, to a slight extent, of wood alcohol and to decrease the yield of acetic acid, pyroligneous acid and tar. A greater effect was produced by increasing the pressure from atmospheric to 60 lb. than by a further increase. The greatest effect was on the yield of tar which was decreased 60—65% at 60 lb. pressure. It is suggested that possibly pyroligneous acid free from soluble tar might be obtained by subjecting the distillate to high pressure during the vapour stage. —A. S.

Gas lighting and hygiene. M. von Grüber. J. Gasbeleucht., 1914, 57, 690—691.

TESTS were carried out in rooms in which the conditions could be controlled. Sulphur dioxide and carbon monoxide could not be detected in the air in the rooms, even after the burners had been alight for 67 hours; traces of nitric oxide were usually present, the largest amount found being 10·4 c.c. per cb. metre. The quantity of carbon dioxide never exceeded 4 parts per 1000 and the temperature of the rooms was only raised a few degrees. In comparative experiments with gas and electric lights, the difference in the increase of the temperatures of the rooms amounted to 1·6° C., whilst the difference in moisture-content of the air was generally less than 5%. In the room lighted with electric lamps the ventilation was such that about one-third of the air was replaced per hour; in the room having gas lamps, two-thirds of the air was replaced per hour. The hot gases from the lamps did not appear to have any disinfecting effect on the air.—W. P. S.

Gas lighting and electric lighting in Japan. Iwabushi. J. Imp. Gas Assoc., Tokyo, 1914, No. 1. J. Gasbeleucht., 1914, 57, 600.

ALTHOUGH the gas industry is older than the electrical industry, the latter has surpassed the former owing to the mountainous nature of the country being especially favourable for small electric works with water power.

Fourteen towns with a total population of over six millions have nearly one million gas connections, or 124 per thousand inhabitants, whilst the electricity connections exceed two millions, equal to 272 per thousand inhabitants. —J. H. J.

Patents.

Coals and other hydrocarbonaceous substances; Apparatus for and process of treating ——. J. D. Scott, New York. U.S. Pats. 1,115,453 and 1,115,454, Oct. 27, 1914; date of appl., Aug. 26, 1910.

The materials are spread in thin layers on a number of superposed perforated trays spaced apart within a double-walled chamber. Hot gases are circulated through the space between the walls and then downwards over the material to an exhaust pipe.—W. H. C.

Distilling wood, peat, moss, straw, etc.; Process for ——. H. Plauson and G. von Tischenko. Ger. Pat. 276,811, Dec. 22, 1912.

A combined distillation and extraction of wood, peat, moss, straw, and similar materials, is effected, with only a very small production of gas, by treatment with superheated steam and the vapours of a solvent, such as an alcohol, naphtha, an oil, etc. Addition of alkali or alkaline-earth salts produces a catalytic effect, resulting in the formation of larger quantities of liquids of low boiling-point, such as turpentine and terpenes from pine wood. A higher yield of ketonic or other oxygen compounds, lubricating oils, etc., is obtained if the mixture of steam and solvent is heated to 300°—600° C.—T. F. B.

Arc-light electrode. A. V. Wilker, Berea, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,114,953, Oct. 27, 1914; date of appl., Jan. 22, 1912.

The electrode contains a silicide of a rare earth metal, *e.g.*, cerium silicide.—A. T. L.

Incandescence bodies made of tungsten or similar metal; Process for making —— *of uniform diameter.* Allgem. Elektricitäts-Ges. Ger. Pat. 276,037, July 27, 1913.

Wires of tungsten or similar metals, for use in incandescence lighting, are heated in presence of a substance which will, under these conditions, attack the thicker parts, which are less strongly heated. For example when tungsten wire is heated electrically in presence of hydrogen containing less than 1% of oxygen, the thicker parts, heated to a red heat, are oxidised, whilst the thinner parts, which become more strongly heated, are not oxidised. Nitric acid may be used for the same purpose, and is suitable for treating wires of tungsten, molybdenum, or tantalum.—T. F. B.

Arc-light carbon. H. Ayrton, London. U.S. Pat. 1,115,480, Nov. 3, 1914. Date of appl., March 7, 1914.

See Eng. Pat. 1775 of 1913; this J., 1914, 346.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Tar and its derivatives; Applications of ——. Kayser. J. Gasbeleucht., 1914, **57**, 200—203 and 220—231.

Owing to the large amount of benzene for use in dye manufacture recovered in the production of coke in coke-ovens, new outlets are necessary for the tar and its derivatives produced in gas works. The use of tar oil as fuel in furnaces and engines is one such. In furnaces the oil should be supplied under pressure and then broken up by air streams. A flat stream issuing under low pressure appears better than spraying through easily choked fine orifices. In the Irinyi apparatus the oil is vaporised in a retort in the furnace, oil flowing to the retort by gravity. The advantages of tar-oil in furnaces are smokeless firing, simplicity of working and cheapness. Tar oil is also used in Diesel engines; and Körting's have a plant of 500 H.P. running with tar from vertical retorts: this works as well as a tar oil installation while the cost of fuel is less, but a special starting means is necessary. Tar has also been used in furnaces. Tar is in demand for road making and for coating wood, etc., especially in roof work. Pitch is used in the coal briquetting industry. Separate works for the distillation of 175—200 tons of tar per annum are not profitable. Combined working of such outputs should be resorted to. Both continuous and discontinuous distillation processes are used. A continuous plant of H. Hirzel comprises a raised reservoir into which tar is pumped, and whence it flows through a vertical chamber having horizontal baffles and heated to 180° C. to drive off water and light oils. It then passes through a series of three stills, placed side by side and stepwise. In the first medium oils are driven off, in the second heavy oils, and in the third anthracene, the pitch being drawn off through a cooler into pits. The distillates are passed through condensers into reservoirs. A fourth still is used alternatively as the third in the series, and alternate cooling tanks are used for the pitch. In the discontinuous process a vertical retort is usual, the means for driving off water and light oils being the same as in the continuous process. For large plants a vacuum process is desirable. In the Sadewasser system, tar in a continuous stream is passed through a superheater and sprayed in a vacuum chamber; the ensuing vapour is condensed in fractional cooling chambers. Pitch is suggested as an alternative to cement for building purposes.—W. F. B.

Use of heavy oils (tar, tar oils) in internal-combustion engines. Drexler. *See* IIa.

The sale of tar. Chem. Trade J., Nov. 28, 1914.

The following conditions relative to the sale of tar have been agreed upon by the Joint Committee of the Institution of Gas Engineers representing tar producers and distillers, and are recommended for adoption throughout the United Kingdom.

I.—*Sliding-Scale Contracts.*—(a) The tar distillers and gas authorities, or their valuers, to meet each month as usual, to fix the values of the products other than pitch. (b) The tar distillers to pay to the tar producers the aggregate value of such products, *plus* 2s. 6d. per ton of tar on account, for the pitch, less the usual 2½% and working expenses. (c) All pitch made and delivered since August 1, 1914, by individual tar distillers during the period of crisis to be paid for each month *pro rata* to the deliveries of tar of each producer, allowance being made for the 2s. 6d. per ton of tar already paid on account. (d) On the resumption of the export of pitch at present suspended, the value of such pitch delivered each month to be settled by the usual arbitrators, and the value ascertained each month to be added to the tar values and paid by the tar distillers to the tar producers, less the 2s. 6d. per ton of tar already paid on account. (e) The additional cost (if any) incurred by the removal and storage of pitch to be equally borne by the tar producers and the tar distillers.

II.—*Price-Fixed Contracts.*—(a) The sum of 17s. 6d. per ton of tar to be paid by the distillers and accepted by the producers in part payment as the value of products other than pitch and part value of pitch. (b) The balance to be paid as and when the pitch is delivered by the distillers *pro rata* to the deliveries of tar of each producer.

III.—*Minimum Price of Pitch.*—A committee has been appointed to consider and, if advisable, to fix prices from time to time.

IV.—*Revision of Conditions.*—These conditions may be amended by mutual arrangement between the tar producers' committee and the tar distillers from time to time.

IV.—COLOURING MATTERS AND DYES.

Dyes and other products from the waste liquor of the soda cellulose process Cram. *See* V.

Explosion in a dyestuff plant in the United States. Oil, Paint, and Drug Rep., Nov. 16, 1914.

A series of explosions, which resulted in the death of one man and injury to 26 others, occurred in the dyestuff plant of Dr. W. Beckers, Brooklyn. Experiments on the manufacture of certain azo dyestuffs were in progress, and it is believed that the accident was due to unskilful handling of the diazo salts.

Patents.

Azo dye ; Yellow ——. K. Hagemann, Leverkusen, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,114,750, Oct. 27, 1914. Date of appl., April 21, 1914.

An aminoacidyl compound of an o-aminophenolsulphonic acid (*p*-aminobenzoyl-2-amino-4-chloro-1-phenol-6-sulphonic acid) is combined with a methylketol compound (2-methyl-indole) ; when printed on the fibre with chromium acetate as mordant, these dyestuffs give yellow shades fast to light and milling.—T. F. B.

Isatin ; Preparation of an oxidation product of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 276,808, June 12, 1913.

Isatin is oxidised by means of permanganate in neutral aqueous suspensions ; a yellow crystalline compound, $C_{16}H_8N_2O_2$, is obtained, of m. pt. 262° C., which is very reactive and therefore suitable for use in preparing indigoid dyestuffs. It is converted into Indigo White when heated with excess of alkali and sodium hydrosulphite.
—T. F. B.

Vat [anthracene] dyes. A. Hamburger, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,115,188 and 1,115,189, Oct. 27, 1914. Dates of appl., Dec. 26, 1911, and July 25, 1912.

See Eng. Pat. 12,865 of 1912 ; this J., 1912, 1025.—T. F. B.

Monoazo dyestuff. H. Jordan and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,114,711, Oct. 27, 1914. Date of appl., April 16, 1913.

See Eng. Pat. 17,322 of 1912 ; this J., 1913, 862.—T. F. B.

Azo dyes. A. Zart, Opladen, and H. Schweitzer, Leverkusen, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,114,844, Oct. 27, 1914. Date of appl., Dec. 3, 1913.

See Fr. Pat. 465,794 of 1913 ; this J., 1914, 639.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Oxycellulose in linen goods. M. Saget. Assoc. Gén. des Chimistes de l'Ind. Textile. J. Soc. Dyers and Col., 1914, 30, 331.

The formation of oxycellulose during the "creaming" of linen is suggested as the cause of the loss of strength during the bleaching process. This oxycellulose could not be detected by chemical tests, but its presence was demonstrated by measuring the strength of the fibre after steaming and treating with alkali. Linen which has been partly converted into oxycellulose tenders under the influence of sunlight and rain. The presence or absence of chlorine in the fibre is not considered to be necessarily an indication of its strength (see this J., 1908, 27, 260).
—T. F. B.

Soda pulp from aspen ; Effects of varying certain cooking conditions in producing ——. H. E. Surface. U.S. Dept. Agric., Bull. No. 80, Aug. 31, 1914, 1—63.

The variable conditions separately studied were : proportion of NaOH to wood ; time of digestion ; temperature or pressure ; initial concentration of NaOH. Increase of any of these factors increases the severity of the digestion, which is measured by the quantity of NaOH neutralised per unit weight of wood, and decreases the yield of pulp and the amount of bleaching powder required to bleach it. Severity of digestion may be judged by the microscopic appearance of the pulp ; in over-boiled pulps the walls of the fibre are weakened and transparent, those of the vessels and cells partly obliterated ; in under-boiled pulps the walls of all the elements are dense, and sharply defined : fibre-aggregates are common. The strength of the pulp may either decrease or increase with increased severity of treatment ; when this is produced by increasing the proportion of NaOH or the time of digestion, the strength of the pulp decreases, but when it is produced by increasing the temperature or the initial concentration, the strength of the pulp may increase, possibly owing to the production of hydrated cellulose. The decreased yields resulting from more severe digestion involve a greater cost for wood and alkali per ton of pulp and a point is soon reached at which these costs are not compensated by the lower cost of bleaching. Aspen wood may be successfully digested with a minimum charge of 20—25% of NaOH on the dry weight of wood and a consumption efficiency up to 95% of the NaOH present can be obtained by suitable adjustment of the temperature and time of digestion. In the experiments, using only clean, sound, picked wood of the best quality, yields as high as 56—58% of well-separated unbleached fibre were obtained ; with yields of 54—55% the pulp bleached well with 10—11% of bleaching powder. These results are 10—25% better than those reported from pulp mills working with ordinary wood under practical conditions. Of the factors of cost, that of the wood is of the most importance, next comes bleaching powder, and lastly alkali. Tables and curves are given showing the influence of the variable factors of digestion upon yield, bleaching quality, colour, freedom from shive and strength of the pulp, and the various digestions are illustrated by samples of the pulp produced. In illustration of the conditions adopted for the preparation of a clean, easy-bleaching pulp, the following particulars may be cited from the tables : weight of air-dry chips, 40 lb. ; initial volume of lye per lb. of dry wood, 0·376 gall. ; concentration of NaOH, 80 grms. per litre ; proportion of NaOH to dry chips, 25% ; total time of digestion, 8 hrs. ; time at maximum pressure, 7 hrs. ; maximum pressure 100 lb. per sq. in. ; yield calculated dry 52·5% ; bleaching powder required, 9·0—9·5%. When the time at maximum pressure was reduced to 5 hrs., the yield was 53·7% and the consumption of bleaching powder 10·5%.—J. F. B.

Sodium peroxide for bleaching rag half-stuffs ; Suitability of ——. von Possanner. Wochenbl. Papierfab., 1913, 3161 ; Chem.-Techn. Rep., 1914, 38, 241.

Experiments with sodium peroxide as a substitute for bleaching powder for bleaching rag half-stuffs showed that its bleaching action is very feeble and that even for improving the colour of pulps already bleached it is not particularly satisfactory and can only be recommended in exceptional cases where complete freedom from chlorine compounds is essential and cost of little consequence.
—J. F. B.

Dyes and other products from the waste liquor of the soda cellulose process. M. P. Cram. J. Ind. Eng. Chem., 1914, 6, 896—897.

100 c.c. of the crude black liquor of sp. gr. 1·25 were treated with 30 c.c. of hydrochloric acid of sp. gr. 1·18 and heated to boiling. The precipitate produced (yield 14 grms.) agglomerated into plastic lumps which became brittle on cooling. It was composed entirely of organic matter and was soluble in alkalis and dilute alcohol. When dissolved in caustic soda it could be used as a size for paper, to which it imparts a reddish-brown tint, or as a stain for wood. Its alcoholic solution could also be used as a wood stain. It is partly soluble in chloroform and the soluble part, dissolved in a volatile solvent, could be used as a varnish. When heated with potassium sulphide and sulphur to 185°—230° C. it yielded a dyestuff giving

dark brown or black shades, fast to light, on wool, silk and unmordanted cotton. Brown to yellow wool dyes were obtained by nitrating the precipitate or the original liquor. The filtrate from the precipitate yielded, on distillation, acetic acid and an organic compound, probably a phenol, which yielded products capable of dyeing wool and silk when treated with various reagents.—A. S.

Recovery of spent lime from causticising operations. Payne. *See* VII.

PATENTS.

Textile fibres, goods and fabrics ; The conditioning of ——. E. L. Joseph, London. Eng. Pat. 24,043, Oct. 23, 1913.

THE material is treated in a closed chamber with a gaseous oxidising agent such as ozonised air, a series of chambers and fans being so arranged that the ozonised air may be discharged either from one chamber to the next or into the atmosphere. The oxidising strength of the ozone is progressively increased in the later stages of the treatment. Animal fibres are preferably treated after the oiling process when in the form of rovings or sliver, vegetable fibres preferably after the bleaching and before the spinning operation.—J. F. B.

Crape and crimped or embossed fabric from cotton or thread made from cellulose ; Manufacture of ——. Courtaulds, Ltd., London, and W. S. Gilles, Braintree, Essex. Eng. Pat. 13,150, May 28, 1914.

FABRICS of cotton or artificial cellulose threads are treated with a solution of acetate or other salt of aluminium, or else first with albuminous or gelatinous matter and formaldehyde and subsequently with the aluminium acetate, then heated, dried and crimped or embossed. The crimped fabric is finished by applying a dressing, *e.g.*, a solution of shellac in alcohol or of gelatin in the form of a spray to one or both sides and drying.—J. F. B.

Paper pulp ; Apparatus for straining ——. W. W. Beaumont, London. Eng. Pat. 25,082, Nov. 3, 1913.

IN strainers of the "jog-knotter" type, the strainer plates and their frame are mounted upon spring-supported bearings arranged at opposite sides of the vat and vibratory motions are imparted to the bearings on one side only, so that the entire inner vat partakes of a vibratory movement about a longitudinal axis which passes through the centre of gravity of the mass moved, the same actuating motions operating, in conjunction with the reactions of the bearing springs, to impart to the vat an up-and-down movement. —J. F. B.

Drying machine [*for paper stock*]. J. O. Woodsome, Assignor to Crane Co., Chicago, Ill. U.S. Pat. 1,114,215, Oct. 20, 1914 ; date of appl., Aug. 19, 1911.

THE paper stock is passed successively over two systems of heated rollers. The system with which the paper comes last into contact is heated by direct steam and the exhaust steam from this system passes through a controlling device to the rollers of the other system where it is condensed. —W. H. C.

Waste sulphite liquor ; Bleached ——, *and process of preparing same.* M. F. Coughlin, Stroughton, Mass., and C. E. Swett, Providence, R.I, Assignors to F. H. Kennard, Newton Center, Mass. U.S. Pat. 1,114,120, Oct. 20, 1914 ; date of appl., Feb. 21, 1914.

THE waste sulphite liquor is first treated with an oxidising agent (permanganate) and then with a reducing agent (hydrosulphite).—J. B.

Rosin soap sizing composition. J. A. De Cew, Montreal, Canada. Eng. Pat. 12,686, May 22, 1914.

SEE U.S.Pat.1,099,168 of 1914 ; this J.,1914, 785.—T. F. B.

Finishing composition, and method of preparing same [*from waste sulphite liquor*]. U.S. Pat. 1,114,119. *See* VI.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Bleaching ; The theory of ——. S. H. Higgins. J. Soc. Dyers and Col., 1914, 30, 326—328.

THE bleaching action of hypochlorous acid is due initially to the direct production of oxygen, but as the bleaching proceeds, hydrochloric acid accumulates and reacts with hypochlorous acid according to the equation, $HOCl+HCl=H_2O+Cl_2$. This action is reversible, the reverse direction representing the behaviour of chlorine water (see this J., 1912, 486), and in each case when equilibrium occurs the bleaching action ceases. When a hypochlorite is used for bleaching, the hydrochloric acid produced is used in liberating more hypochlorous acid. The removal of free hydrochloric acid from either chlorine water or hypochlorous acid by addition of calcium carbonate has been shown experimentally to accelerate the bleaching action. Taylor's observation (this J., 1914, 308) that there is always a certain amount of residual colour in cotton treated with hypochlorous acid or chlorine water, is explained by this state of equilibrium ; when calcium carbonate is added, the cotton is completely bleached. The colouring matters of brown linen and of boiled cotton are at once partially bleached on immersion in chlorine water, but prolonged treatment has very little further effect. The action of bleaching powder solutions on cotton dyed with direct and basic dyestuffs has been examined ; in a number of cases the solutions to which hydrochloric acid was added caused a change of colour, whilst when boric acid was added, no such change was observed. In the majority of cases the solutions containing hydrochloric acid had the more rapid bleaching action ; with Alizarin Sapphirole, however, the reverse was the case. The author concludes that the bleaching action of hypochlorites is due to the direct production of oxygen and to the production of nascent chlorine. Thus, it has been found that a large quantity of acetaldehyde is produced on warming dry calcium hypochorite with alcohol, whilst it is known that bleaching powder can convert alcohol into chloroform. It is considered that the nascent chlorine is formed by the interaction of the chloride with the free hypochlorous acid. The effect of the calcium chloride produced during bleaching with bleaching powder is shown to be negligible, but when calcium chloride is added during the bleaching process it always has a stimulating effect, showing that hypochlorous acid is present during the whole process. Attention is drawn to the importance of using carefully prepared fibre in bleaching experiments, and of making allowance for the fact that the colouring matters of cotton and linen are of an acid nature, especially in comparing the bleaching actions of acid and alkaline solutions. (See also this J., 1911, 485 ; 1914, 785.) —T. F. B.

Sodium perborate ; [*The true value of* —— *in bleaching*]. W. Kind. Z. ges. Textil-Ind., 1913, **16**, 1045. Chem.-Techn. Rep., 1914, **38**, 123.

ALTHOUGH perborate cannot compete with the chlorine bleach on the ground of cost, yet it has advantages over hydrogen peroxide, mainly on account of the ease with which a solution of the required strength can be made up and the way in which it gradually gives up its oxygen without the development of too great a degree of alkalinity. Perborate has advantages for special purposes in bleaching, *e.g.*, for coloured and finished goods. As a starch remover it can compete in certain circumstances with "Diastafor." It destroys active chlorine but not chloramines. In dyeing it is used for after-treating vat and sulphide dyes, in cleaning for removing stains and for bleaching feathers, etc. It has found its greatest application in the laundry on account of being safer than the chlorine bleach. Generally its use in ordinary bleaching is too expensive. —J. B.

Dyed textiles; Loss of colour on storing ——. P. Heermann. Leipz. Monatsschr. Textil-Ind., 1913, **28**, 204, 237 and 268. Chem.-Techn. Rep., 1914, **38**, 121.

The loss of colour may be due to such a large variety of causes that no single method of testing the fastness of dyed material is available. Conditions of storage have great influence: for instance gases given off by the lighting arrangements sometimes cause trouble. The most common causes of damage are heat and light, with varying conditions of moisture.—J. B.

Garments; Improvised waterproofing of military ——. G. A. Le Roy. Comptes rend., 1914, **159**, 633—634.

Wool fat is melted with a little chloroform, carbon bisulphide or tetrachloride and then at once dissolved in motor spirit or other industrial hydrocarbon to form a 5—10% solution. If a non-inflammable solution be desired, the hydrocarbon may be blended with half its volume of carbon tetrachloride or dichloroethylene. Garments steeped in this solution for a few minutes, wrung out and dried in the air become effectively waterproofed and retain this quality when in use; the appearance and physical qualities of the cloth are quite unaffected.

—J. F. B.

Patents.

[*Scouring.*] *Treating cheeses, cops, etc. of woollen yarn preparatory to warping.* H. Heymann, Bradford. Eng. Pat. 28,294, Dec. 8, 1913.

Cheeses, cops and similar forms of yarn spun from previously dyed wool are degreased by means of a volatile solvent, thus avoiding the hanking of the yarn for the usual scouring or the energetic scouring required when this operation is performed on the woven piece.—J. B.

Bleaching fabrics; Apparatus for ——. J. T. Niblett, London. Eng. Pat. 26,727, Nov. 20, 1913.

A rotary laundry machine comprising a drum mounted in a stationary casing is provided with electrodes fitted either to the rotary drum or to the outer casing; in the latter case the electrodes may be contained in a recessed opening or sump over which the solution flows during the treatment. The electrolyte consists of a solution of a suitable chloride in which the goods are rotated while electrolysis is taking place.—J. F. B.

[*Dyeing hat bodies.*] *Apparatus for agitating solid bodies in a liquid.* J. H. and W. Robinson, Stockport. Eng. Pat. 17,125, July 20, 1914.

The hat bodies are agitated in the dye-bath by means of a vane revolving round a central axis. The vane projects a little above the surface of the liquor and is of such a size that a space is left between its outside edge and the wall of the vat.—J. B.

Dyeing machine. J. H. and D. M. Giles, Amsterdam, N.Y., Assignors to J. H. Giles Dyeing Machine Co., Portland, Me. U.S. Pat. 1,114,464, Oct. 20, 1914; date of appl., Dec. 29, 1913.

The yarn is carried on sticks supported on a wheel which revolves partially immersed in the dye-bath. The sticks have star wheels at their ends and ratchet arrangements to cause them to revolve periodically, somewhat after the manner of the Klauder-Welldon machine.—J. B.

Dyeing or washing machine. H. Hennig, Paterson, N.J. U.S. Pat. 1,115,072, Oct. 27, 1914; date of appl., Aug. 10, 1911.

Yarn is hung on sticks in a tank on either side of which are vertical flues fitted with air injectors and having at their tops deflecting plates for directing the liquid and air laterally and downwards into the centre of the tank.

—J. B.

Finishing composition and method of preparing same [*from waste sulphite liquor*]. M. F. Coughlin, Stroughton, Mass., and C. E. Swett, Providence, R.I., Assignors to F. H. Kennard, Newton Center, Mass. U.S. Pat. 1,114,119, Oct. 20, 1914; date of appl., Sept. 22, 1913.

A waxy material, with or without a soluble soap, is incorporated with waste sulphite liquor in such proportion as to be readily emulsifiable with water.—J. B.

Hanks of thread, etc.; Apparatus for liquid treatment of ——. J. Clayton, Coventry, Assignor to Courtaulds, Ltd., London. U.S. Pat. 1,116,242, Nov. 3, 1914. Date of appl., Oct. 28, 1913.

See Eng. Pat. 9067 of 1913; this J., 1914, 197.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Spent lime from causticising operations [*and in sugar factories*]; *Recovery of the* ——. J. H. Payne. J. Ind. Eng. Chem., 1914, **6**, 937—939.

The long rotary kiln such as is used for Portland cement manufacture has been applied successfully in the Western United States for re-burning the spent-lime obtained in the manufacture of beet sugar and more recently to the re-burning of the spent-lime from causticising in alkali and wood-pulp factories. The capital cost of a plant with a capacity of 30 tons per day would be about 17,000 dollars (£3540) and the working expenses for a plant using producer-gas would be:—

	s.	d.
Fuel, 500 lb. coal at 12s 6d. per ton (2000 lb.)	3	1½
Labour, 2 men at 10s. 5d. and 2 men at 8s. 4d.	1	3
Repairs (including 1 lining per year at £188)..........		8
Power, 30 H.P. at £8 for year		5½
Interest and depreciation		9½
Taxes and insurance		2
Yard labour, supplies and miscellaneous		7½
Unforeseen		8
Total cost per ton of lime recovered	7	9

With a properly designed plant practically no dust is produced and the waste gases leave the kiln at about 350° F. (177° C.). The recovered lime slakes and causticises more slowly than fresh lime, but settles much more rapidly.—A. S.

Preparing neutral ammonium citrate solution. McCandless. *See* XVI.

Ammonium sulphate standard. Chem. Trade J., Nov. 28, 1914.

The chairman of the Sulphate of Ammonia Association has issued a circular to the members urging them to improve the quality of the product and to make sulphate which tests from 24¾ to 25% ammonia, with not more than 3% moisture and not more than ½% acid, adopting if possible, 25% as a selling basis. It is believed that the adoption of these standards will enable British manufacturers to compete in markets from which they have been or are being excluded.

Patents.

Alumina compounds; Solutions of ——. [*Stable sodium aluminate solution.*] H. Spence, T. J. I. Craig, and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 20,970, Sept. 17, 1913.

Commercial sodium aluminate solution is treated with a small proportion of an organic substance capable of inhibiting the spontaneous separation of aluminium hydroxide; for example, it is heated for about 2 hours at 100° C. with 0·5—1·5% of sugar.—F. Sodn.

Hydrous alkali-metal silicate and method of producing it. E. A. Paterson, Port Arthur, Ontario, Canada. U.S. Pat. 1,111,918, Sept. 29, 1914 ; date of appl., Dec. 17, 1913.

A dry powder containing a large percentage of silica is produced by partially drying an alkali silicate at a comparatively low temperature and under reduced pressure, so as to form a solid mass, coarsely grinding the product, further drying and grinding to a fine powder, and then again drying until the water content (preferably reduced to 12—19% of combined H_2O) is only sufficient, in connection with the alkali present, to render the material readily soluble in cold water.—F. Sodn.

Barium and strontium oxides ; [Continuous] Process of producing ——. H. G. Akers, Toronto, Canada. U.S. Pat. 1,113,178, Oct. 13, 1914 ; date of appl., May 8, 1913.

Crude barium or strontium carbonate, mixed with a flux and a reducing agent, is melted at about 1200° C., preferably in a carbon-lined furnace in which a reducing atmosphere is maintained, and the mass refined by again adding a reducing agent, the evolved gases being ignited to heat the charge and preheat the incoming charge. Any carbon dioxide liberated from the charge may be diluted with the combustion gases from the fuel employed in heating the furnace, in order to lower its partial pressure. —F. Sodn.

Nitrogen ; [Cyclic] Methods of fixing ——. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co. U.S. Pats. (A) 1,113,598 and (B) 1,113,599, Oct. 13, 1914 ; dates of appl., Aug. 8, 1911 and May 12, 1913.

(A) A salt, *e.g.*, a haloid salt, of a metal capable of forming a nitride, is electrolysed, and the separated metal converted into nitride by reaction with nitrogen or a nitrogenous reagent, and the nitride treated with a hydrogen compound (*e.g.*, halogen acid prepared from the electrolytic halogen) or an ammonia-halogen compound, so as to yield ammonia, or substance containing ammonia, and the original salt. (B) A metallic nitride, produced as above, is treated with a hydrogen compound (such as water), so as to form a substance containing ammonia and an oxygen or other compound of the metal, and the latter is converted by treatment with at least one reagent (preferably halogenous in character) into a salt which can be electrolysed. —F. Sodn.

Magnesium sulphate from residues of potash salt manufacture containing kieserite ; Preparation of——. R. Heintz Techn. Buro f. d. Chem. Ind., G. m. b. H. Ger. Pat. 275,702, March 6, 1913.

The residual products containing kieserite, obtained in the treatment of carnallite and "*Hartsalz,*" are dissolved in dilute magnesium chloride solution at about 80°—100° C., and the solution is completely or partly saturated with sodium chloride at the same temperature and allowed to cool, whereupon magnesium sulphate crystallises.—T. F. B.

Ammonia from its elements ; Process for obtaining —— using cerium nitride as catalyst. Kunheim und Co. Ger. Pat. 276,986, June 20, 1912.

A mixture of nitrogen and hydrogen under pressure is passed over a heated catalyst consisting of cerium nitride (obtained by the action of nitrogen on coarsely powdered cerium) or a substance containing not less than 20% of cerium nitride.—T. F. B.

Ammonia from its elements ; Catalytic preparation of ——. F. Hlavati. Ger. Pat. 277,054, June 19, 1910. Addition to Ger. Pat. 275,343.

A mixture of nitrogen and hydrogen is subjected to treatment by electric spark discharges and passed over a catalyst which has the power of absorbing both nitrogen and hydrogen. When a catalyst consisting of platinum and titanium is used, the temperature of the catalyst is regulated to induce absorption first of the hydrogen by the platinum and then of the nitrogen by the titanium ; the temperature is then raised to such a degree, not above 500° C., that the gases are liberated in an active condition. The pressure is increased or decreased according to whether absorption or evolution of the gases is taking place.—T. F. B.

Hydrogen ; Process for liquefying commercial —— by expansion. J. E. Lilienfeld. Ger. Pat. 276,657, Dec. 23, 1910.

The compressed hydrogen, containing 1 to 2% of air, is allowed to expand in two or more stages, and at one of the intermediate stages the pressure and temperature are so regulated that the air separates in the form of a liquid, but is not solidified. A temperature of about —215° C. is suitable for this purpose.—T. F. B.

Gaseous mixtures ; Separation of easily condensed or absorbed constituents from hot, compressed ——. J. Ephraim. Ger. Pat. 276,718, Dec. 14, 1912.

The gaseous mixture is cooled and expanded, then passed through a condensing or absorption apparatus, and again heated and compressed by aid of the heat and energy obtained in the first stage of the process. The process may be applied to the separation of ammonia from the gaseous mixtures produced in the catalytic process.—T. F. B.

Nitric acid ; Process of concentrating ——. F. Hausmann, Assignor to Verein Chemischer Fabriken in Mannheim. Mannheim, Germany. U.S. Pat. 1,115,192, Oct. 27, 1914. Date of appl., Sept. 9, 1913.

See Fr. Pat. 462,290 of 1913 ; this J., 1914, 311.—T. F. B.

Nitrate of lime and other salts ; Reduction of —— to powder. Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. Eng. Pat. 468, Jan. 7, 1914. Under Int. Conv., Jan. 23, 1913.

See Fr. Pat. 466,963 of 1914 ; this J., 1914, 865.—T. F. B.

Nitrates ; Production of commercially pure ——. C. Bosch and W. Wild, Ludwigshafen, Germany, Assignors to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,115,164, Oct. 27, 1914. Date of appl., June 22, 1909.

See Ger. Pat. 210,167 of 1908 ; this J., 1909, 656.—T. F. B.

Nitric oxide ; Electrodes for use in the production of——. C. Rossi, Legnano, Italy. Eng. Pat. 23,959, Oct. 22, 1913. Under Int. Conv., Oct. 22, 1912.

See Fr. Pat. 463,821 of 1913 ; this J., 1914, 421.—T. F. B.

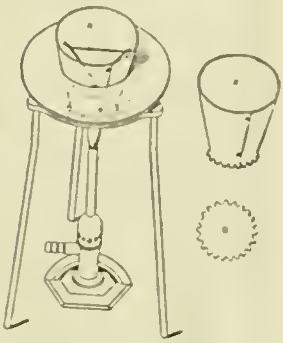
Hydrogen ; Producing ——. C. Bosch and W. Wild, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,115,776, Nov. 3, 1914. Date of appl., June 30, 1913.

See Fr. Pat. 459,918 of 1913 ; this J., 1914, 24.—T. F. B.

VIII.—GLASS ; CERAMICS.

Glass analysis ; Some rapid methods for ——. E. C. Sullivan and W. C. Taylor. J. Ind. Eng. Chem., 1914, 6, 897—899.

The glass is decomposed by a mixture of hydrofluoric acid and oxalic acid (instead of suphuric acid). For glasses



containing only silica, lead, soda and potash, with small amounts of iron, alumina, manganese, lime and magnesia as impurities, 1 grm. of the finely-powdered sample is moistened with water in a platinum crucible of about 40 c.c. capacity, and 2 grms. of oxalic acid and enough 48% hydrofluoric acid to half-fill the crucible are added. The mixture is evaporated to dryness on a radiator (see below) at a temperature just high enough to expel the excess of oxalic acid. When all the acid is expelled the crucible is cooled and the evaporation repeated twice more with oxalic acid (about 5 grms. in all) and water. The residue is treated with hot water, cooled, and filtered. The insoluble portion consists of lead oxalate, with a trace of calcium oxalate, and may be titrated with permanganate or the lead determined as sulphate. The filtrate is evaporated, the residue heated to decompose the oxalates, dissolved in dilute hydrochloric acid and evaporated to remove silica. The residue is treated with hot water and a few drops of hydrochloric acid, and a few drops of bromine water and a little ammonia added to the solution which is boiled, and the precipitated hydroxides of iron, aluminium, and manganese filtered off. In one portion of the filtrate, any magnesium is precipitated as magnesium ammonium phosphate and calculated to chloride. The remainder is evaporated, heated to expel ammonium salts, and the chlorides weighed, the weight of magnesium chloride found and also the alkali obtained in a blank determination being deducted. The potassium is determined with platinum chloride and the sodium obtained by difference. In the case of glasses containing other elements, Ca and Zn give insoluble oxalates ; Cd is also insoluble, but in presence of Zn traces are found with the soluble oxalates ; Co, Cu, Ni, Ba, and Mg oxalates are mostly insoluble, but must be tested for in the soluble oxalates unless special precautions be taken ; Na, K, Al, Cr, and As are found with the soluble oxalates ; Mn up to 2% is soluble, but with larger quantities partly insoluble ; Fe is soluble, but in presence of Zn traces remain insoluble ; Sb is usually soluble unless the oxalates be heated too strongly. Borates do not interfere, but the results are not satisfactory when more than 3% Al_2O_3 is present. A complete analysis can be made in a day.

The success of the method depends to a considerable extent upon the use of the radiator (see above) shown in the figure (compare Hillebrand, Bull. No. 422, U.S. Geol. Survey, p. 31). R is of sheet iron, aluminium or nickel, 6—7 cm. high, 8 cm. diam. at top and 5 cm. at bottom. The base, B, of iron, nickel, or platinum, is attached to R by turning the cogs of B up and over those of R. A platinum triangle is inserted about 4 cm. from the base ; and an aluminium ring with an opening slightly larger than the underlying crucible is placed over the radiator to hasten evaporation.

For determining boric oxide in borosilicate glasses a modification of Wherry's method (this J., 1908, 1179) is used. 0·5 grm. of the glass is fused with sodium carbonate, the product treated with 20—30 c.c. of hot water, filtered, and the filtrate and washings treated with about 7 c.c. of concentrated hydrochloric acid in a 250 c.c. round-bottomed flask, and then Wherry's method followed, except that barium hydroxide is used in place of sodium hydroxide for the titration.—A. S.

PATENT.

Oven suitable for use in the manufacture of tiles, pottery, and analogous ware, and for other purposes. C. Dressler, Marlow. U.S. Pat. 1,116,036, Nov. 3, 1914. Date of appl., March 17, 1913.

SEE Eng. Pat. 8228 of 1912 ; this J., 1913, 792.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement raw materials from Naga, Cebu ; Efficiency of ——. W. C. Reibling and F. D. Reyes. Philippine J. Sci., 1914, 9, 127—148.

VARIOUS raw materials (especially coralline limestone and tuff) were found suitable for the manufacture of high-grade cement, comparatively rich in SiO_2 and poor in Al_2O_3, the best results being obtained with a hydraulic modulus, 2—2·3. The setting properties were easily controlled by adding a small proportion of plaster, but, with a low hydraulic modulus, the cements were apt to be very quick-setting. Satisfactory artificial Roman cement with a cementation index

$$\left(\frac{2{\cdot}8\times\%SiO_2+1{\cdot}1\times\%Al_2O_3+0{\cdot}7\times\%Fe_2O_3}{\%CaO+1{\cdot}4\times\%MgO}\right)$$

as high as 2·47 was prepared by burning mixtures of calcareous and silicious materials in a rotary kiln at about 1000° C.—F. SODN.

Portland cement raw materials at Naga, Cebu ; Geology and field relations of ——. W. E. Pratt. Philippine J. Sci., 1914, 9, 151—160.

EASE of quarrying and transport combine to render the materials referred to in the preceding abstract desirable for cement manufacture in the Philippines. An ample supply of each is available.—F. SODN.

Natural cement versus brick ; Iwahig Penal Colony raw materials. W. C. Reibling Philippine J. Sci., 1914, 9, 163—173.

FINE-GRAINED coral sand was utilised with the local clay for the artificial preparation of natural (Roman) cement, the mixture being pugged with water to a stiff mud, moulded into bricks, and burnt at about 1000° C. The product, for most purposes, proved as good as or superior to brick made from the same clay, and the manufacture of a similar cement from other fine-ground calcareous sand is advocated, the application of existing brick presses and kilns being suggested ; a temperature of 1000° C., maintained for 3—4 hours is sufficient, and the clinker is readily ground. The advantage of mixing natural cement with a small proportion of Portland cement is pointed out.
F. SODN.

Building stone ; Porosity of ——. D. G. Campbell. School of Mines Quart., 1914, 35, 242—246.

THE least porous rocks form the strongest and most durable building stones ; the porosity of granites and gneisses is less than 1%, that of limestones up to 10%, and of sandstones up to 20%. Unseasoned stones having large pores (*e.g.*, sandstones) are less affected by freezing than those having sub-capillary pores. The seepage of water through porous rock usually results in the solution of any colour-forming impurities and re-deposition of the latter upon the surface of the stone. By exposure to running water or water under pressure, porous stone containing calcareous ingredients soon becomes honeycombed and disintegrated. Owing to slow alteration by oxidation and hydration, a large proportion of accessory minerals may prove a source of weakness in igneous rock.
—W. E. F. P.

PATENTS.

Cement ; Method of producing —— *from molten blast-furnace slag.* W. Lessing, Menzenberg, Assignor to Mittelrheinische Cement-Industrie G. m. b. H., Cologne, Germany. U.S. Pat. 1,115,321, Oct. 27, 1914 ; date of appl., Aug. 9, 1913.

BY means of a mechanical agitator, molten slag is projected, in a disintegrated condition, into a horizontal, rotary tube through which a current of air and steam is passed in the opposite direction ; the rotary tube may be cooled and the air used without steam.—W. E. F. P.

Fire-brick. C. Hidecker, San Anselmo, Assignor to Ione Fire Brick Co., San Francisco, Cal. U.S. Pat. 1,115,429, Oct. 27, 1914; date of appl., June 3, 1913.

The brick is composed of silicious material fusing at 2800° F. (1538° C.), 75; argillaceous material fusing at 2500° F. (1371° C.), 10; shale fusing at 2250° F. (1232° C.), 10; and "material which cannot be fused below 4000° F. (2204° C.)," 5%.—W. E. F. P

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron; Electrical resistance and critical ranges of ——. G. K. Burgess and I. N. Kellberg. J. Franklin Inst., 1914, **178,** 634—635.

The determination of the variation of the electrical resistance of pure iron over the range 0°—950° C. was made in terms of that of platinum, using a very sensitive Wheatstone bridge. No anomalies in the resistance were found below the A2 region, but at 757° C. there was a sharp cusp in the temperature coefficient. At Ac3, which was identical with Ar3 (894° C.), the resistance fell abruptly 0·005 of its value, recovering it within 25°. A2 was found to be a strictly reversible transformation, whilst the A3 transformation took place at a higher temperature on heating than on cooling (see also this J., 1913, 1070).
—W. F. F.

Cast-iron; Some notes on the heat treatment of ——. R. Carrick. Proc. British Foundrymen's Assoc., 1913—1914, 196—208.

The term "heat treatment" is here applied collectively to those conditions brought about by the melting, casting, solidification, and the cooling subsequent to solidification, of a metal or alloy. The physical condition of cast-iron is largely controlled by the time taken for the solidification of the molten metal after pouring. By causing the iron to solidify quickly, a finer-grained, more homogeneous casting is obtained. This may be brought about by the use of "denseners" (chills). These must however be removed at the proper time to avoid chilling the solidified metal and so rendering it too hard to be machined.—T. St.

Malleable-iron castings. H. Ford. Proc. British Foundrymen's Assoc., 1913—1914, 173—180.

White pig-iron is employed. *Silicon* is the most active agent in a malleable iron mixing. A content of 0·35% will give white castings up to 2 in. thick, if cast hot enough. With Si 1%, the other ingredients being normal, anything thicker than about 0·5 in. would probably be grey. *Manganese* should be between 0·5 and 0·6% in the pig-iron. A considerable amount is burnt off in melting, but too much manganese causes hardness, and trouble in annealing. The malleable iron should contain 0·15 to 0·30%. *Sulphur* should be between 0·02 and 0·07%. High sulphur weakens the iron so that it is unable to resist the internal strains always present in hard castings, with the result that cracked castings are produced. *Phosphorus* should be below 0·25%, or cracked and warped castings will result. *Combined carbon* should be between 1·5 and 4·2%. If below 1·5% the casting will not anneal. *Graphitic carbon* is undesirable because it opens the structure and allows the oxidation to penetrate and weaken the iron in annealing. *Annealing.* Iron melted in a furnace is generally packed in puddler's scale (an iron silicate) and annealed at 1250°—1400° F. (676°—760° C.). Iron melted in a cupola is packed in pulverised hæmatite ore and annealed at 1600°—1800° F. (871°—982° C.). During annealing the combined carbon is almost entirely converted into "temper" carbon, with the result that the hard, brittle casting, having a distinctly white fracture, is changed so that it can be twisted, bent, and hammered hot or cold, without injury. The strength of the casting is greatly increased, being in some cases more than doubled. In American practice annealing is stopped when the carbon conversion has taken place, but the European practice is to continue annealing until carbon is actually removed to a depth of about ½ inch.—T. St.

Steel castings; The annealing of ——. A. T. Adam. Proc. British Foundrymen's Assoc., 1913—1914, 218—225.

Test-pieces of the same steel were annealed at the same temperature for varying lengths of time, all other factors being as far as possible identical. Annealing for a prolonged period allowed of the temperature being lowered, so that not only was the structure of the casting thereby rendered more homogeneous, but the risk of overheating was considerably reduced. Castings which had been annealed at a high temperature acquired a finer and more homogeneous structure when re-annealed at a temperature slightly above the lower recalescence point A2, and maintained at that temperature for a period equivalent to two hours in the case of a small test-bar.—T. St.

Steel and cast-iron bars broken at different temperatures; Physical properties of ——. H. Perrine and C. B. Spencer. School of Mines Quart., 1914, **35,** 194—212.

A Rhielé machine of 100,000 lb. capacity was used for testing the specimens, each of which was heated electrically (in a platinum-wound, porcelain tube) while in position. The following results were obtained, E being the elongation, R the reduction of area, and U the ultimate strength—

Material.	Observation.	Temperature.									
		75° F. (24° C.)	200° F. (93° C.)	300° F. (149° C.)	400° F. (204° C.)	500° F. (260° C.)	600° F. (316° C.)	700° F. (371° C.)	800° F. (427° C.)	900° F. 482° C.)	1000° F. (538° C.)
Bessemer Steel .... (C=0·39%)	E.	34·33	31·30	26·44	25·33	26·00	31·55	41·77	47·77	50·67	52·66
	R.	56·63	54·84	50·59	49·90	48·78	50·16	65·58	78·54	83·34	89·57
	U.	72530	66940	71030	73550	75380	74780	67400	54015	43920	32580
Bessemer Steel .... (C=0·23%)	E.	43·33	31·00	31·33	27·11	29·11	32·89	45·78	54·72	55·33	61·18
	R.	67·28	61·03	60·12	56·78	57·60	61·69	72·76	82·03	86·91	91·63
	U.	59955	59255	63620	69060	69400	65908	56880	44953	35160	26315
Cast Steel .... (C=0·196%)	E.	27·33	—	—	25·78	21·67	26·45	—	31·11	—	49·00
	R.	36·99	—	—	41·64	37·51	38·36	—	51·85	—	80·17
	U.	81310	—	—	73180	74580	77930	—	63520	—	36450
Cast Iron No. 1 .. (C=2·69%)	U.	21140	—	—	20490	—	19500	—	17750	18720	12810
Cast Iron No. 2	U.	—	—	—	—	—	29940	—	30010	25360	20200

It is suggested that the strength of steel is dependent on its "fibrous character," the term "fibrous" being used in contradistinction to "granular," as applied to cast iron and not taken too literally. When heated to 500° F. (260° C.) the fibres change their relative positions temporarily, so that if the hot bar be broken, increased strength is exhibited; but on cooling, the fibres return to their original position. The same action takes place at above 500° F. (260° C.), but is offset by the weakening effect of the repulsive action of heat on the molecules. The more fibrous the character of the metal, the greater the action of heat in increasing its strength.—W. E. F. P.

[*Steel.*] *Martensite structure; Note on crystal twinning and the* ——. C. H. Desch. Faraday Soc., Nov., 1914. [Advance proof.]

By slowly cooling an overheated steel (C 0·28%) a martensitic structure was obtained without increase of hardness; by examination with an immersion objective, the whole mass was found to consist of pearlite packed closely in some parts and loosely in others. The view of Edwards and Carpenter (this J., 1914, 552) that martensite and austenite are constitutionally identical, the former being repeatedly twinned, and its hardness due to the formation of amorphous material at the surfaces of slip on which twinning occurs—is rejected and it is considered that the martensitic structure is an accompaniment, and not the cause, of the hardness of a quenched steel, martensite being so much harder than its components as to suggest the presence of a solid solution.—W. E. F. P.

Steels; The part played by the amorphous phase in the hardening of ——. J. C. W. Humfrey. Faraday Soc., Nov., 1914. [Advance proof.]

The formation of the hard, amorphous solution of α-iron and iron carbide (comparable with Beilby's amorphous phase formed by overstrain) to which the hardness of quenched carbon-, or normally cooled alloy-steels is due, is explained on the assumption that in the passage of a substance from one allotropic modification to another of different crystalline form, as at the Ar_3 point in steels, a temporary amorphous phase is produced corresponding to the liquid phase of the modification about to be formed; and that owing to sudden cooling or the presence of certain alloyed elements, whereby the change point is lowered to a temperature at which crystallisation in the viscous mass becomes difficult, the amorphous phase is retained in a metastable form in the cold.—W. E. F. P.

Gold proof plate; Preparation of a fine ——, *by chlorine gas.* Memorandum by the Assayers of the Melbourne Mint. Ann. Rep. Mint, 1913, 138—140.

Cornets of gold, derived from the metal obtained by reduction with sulphurous acid, and containing 0·1% of impurity (chiefly Ag), were treated with cold *aqua regia* (4 : 1), the solution largely diluted and allowed to stand for a week to effect separation of silver chloride. Three successive quantities of a dilute solution of silver nitrate (containing Ag 0·5 grain) were then added at intervals of 3 days, the surface of the liquid being gently stirred after each addition, and the whole was allowed to stand for 14 days. Any iridium or other impurity suspended in the liquid was entangled in the precipitated silver chloride; the clear solution was siphoned off, evaporated to dryness and ignited in porcelain; the sponge gold fused in a clay crucible with potassium bisulphate and nitrate, borax added, the melt allowed to cool, the cone of gold treated with boiling hydrochloric acid to remove adhering slag, placed by hand upon borax-glass contained in a clay crucible within a large, covered guard-pot, and melted under conditions precluding contamination of the metal by furnace dust. A slow current of chlorine was then passed through the molten metal for 1 hour, the gas being conducted through a clay tube (½ in. bore) by which the gold was continuously stirred. The charge was allowed to cool in the crucible, the cone of gold treated with boiling hydrochloric acid and finally rolled (with special precautions against contamination) into a fillet which was also treated with boiling acid. The original gold weighed 21·5 oz., the finished fillet 21·28 oz., and 0·204 oz. was subsequently recovered from the slag. The fineness of the metal, as determined by the assay of 20 samples taken along the fillet, was higher than that of the Board of Trade 1899 fine gold proof plate (999·98).—W. E. F. P.

Gold; Annealing of ——. Memorandum by T. K. Rose. Ann. Rep. Mint, 1913, 55—56. (See also this J., 1913, 869.)

Pure gold is softened by heating for 30 mins. at 130° C.; re-melting in air causes a slight reduction of the annealing temperature, although no change in the purity of the gold can be detected by assay; after re-melting in hydrogen, of which the metal absorbs 0·002%, gold is not completely softened by heating for 30 mins. at 300° C. Other impurities have similar but less marked effects: *e.g.*, the annealing temperature of gold containing Ag 0·05% is 225° C. The relative purity of two samples of "proof" gold is more readily determined by heating hard-rolled test-pieces for 30 mins. at 130°—150° C. and testing the degree of softening, than by the ordinary methods of assay; the heated specimens are tested in a machine for measuring hardness; or by immersion for an hour in cold dilute *aqua regia* (1 : 1) when the softened metal becomes recrystallised while the structure of the less pure (hard) gold remains unchanged. As shown by microscopical examination of specimens of gold in various stages of annealing, recrystallisation (softening) begins and finishes in particular laminæ or flattened crystals, other laminæ or crystals remaining unchanged until more time has elapsed or the temperature has been raised; hence, partly-annealed gold is composed of alternate bands of hard and soft material, and has weak places where its rigidity and resistance to rupture are little higher than those of the fully-annealed metal.—W. E. F. P.

Nickel and nickel-bronze coinages of the world (*to the end of* 1912). Ann. Rep. Mint, 1913, 90—93.

Of 895,920,035 nickel coins in circulation at the end of 1912, 62·5% were in use in Austria-Hungary; 17·2% in France and Turkey; 16·9% in Germany, Italy and Switzerland; and 3·4% in Mexico, Montenegro, Danish West Indies, and Zanzibar. In Austria-Hungary, nickel has been coined and issued regularly since 1892; in France, it was adopted, for 25-centime coins only, in 1903, but by a new law passed in Aug. 1913, these coins and the present bronze currency are to be withdrawn and gradually replaced (over a period of 10 years) by 780,000,000 coins (25, 10 and 5 centimes) of pure nickel; in Turkey, nickel coinage was introduced in 1911. Of 4,136,851,348 nickel-bronze (Ni 25, Cu 75%) coins in circulation at the end of 1912, 31·4% were in use in British Colonies, Belgium and United States; 37·6% in Germany and Switzerland; and 31·0% in 34 other countries including Holland, Greece, Portugal, Egypt, Persia, Japan, Siam, Korea, most of the South and Central American States, some of the smaller European States, parts of East and Central Africa, etc. Practically all the nickel-bronze coins struck for British Colonies have been issued since 1907; and the alloy was first adopted by Belgium in 1861.—W. E. F. P.

Metal melting at the Royal Mint; Comparative costs of ——, *with coal-gas and coke fuel.* Memorandum by E. Rigg. Ann. Rep. Mint, 1913, 34—35.

The following table shows the saving (27·3%) effected by the substitution of coal-gas for coke fuel in the melting houses of the Royal Mint, London; the results for the two years are comparable since the proportion of nickel-bronze melted (requiring a higher temperature than gold and silver) was about the same (55—56%) in each.

Year.	Weight of good bars cast (tons).	Rate per ton (shillings).			
		Fuel.	Crucibles.	Wages.	Total.
1909 (coke)	1197·7	24·29	42·09	15·68	82·06
1913 (coal-gas)	1957·9	22·09	26·69	10·84	59·62

The daily output per furnace was greater in 1913 than in 1909, the percentage increases for gold, silver, bronze and nickel-bronze being 88·5, 124·5, 157·7 and 161·1, respectively; and the amount of "sweep" produced was much less.—W. E. F. P.

Copper products; Leaching —— at the Steptoe (U.S.A.) works. W. L. Austin. Min. and Eng. World, **41**, 806.

The dust from roasting-furnace dust chambers is treated, together with a silicious oxidised ore, to obviate the smelting of low-grade silicious flue dust. The greater portion of the copper in the chamber dust is soluble in water, and, when mixed with water, contains sufficient acid for lixiviating the silicious ore. The chamber dust, after treatment with water, is settled in vats, and the clear liquid is percolated through the silicious ore in wooden vats with a filter bottom, the liquid being finally treated with scrap iron in precipitating boxes.—B. N.

Cathode copper; Impurities in ——. L. Addicks. Met. and Chem. Eng., 1914, **12**, 706—708.

The impurities in cathode copper may have been directly deposited or may be derived from anode slime or included electrolyte. Plotted results show a straight line relation between fouling by nickel and arsenic and content of these elements in the electrolyte. The curve shows that in the case of nickel there is no fouling from anode slime. The large content of nickel in cathode copper suggests fouling by electrodeposition in addition to included electrolyte. Fouling by silver and gold should be directly proportional to the content in the anodes, as all the silver and gold in the anodes enters the slimes.—W. F. B.

Copper; Absorption of gases by refined ——. W. Stahl. Metall und Erz, 1914, **11**, 470—482.

The gas-absorbing power of molten copper increases in general with the temperature up to a certain point, also with increasing purity of the metal, and with the partial pressure of the gas; the presence of Pt or Ni, however, has a favourable influence on the absorption.

Sulphur dioxide. The disintegration of copper which takes place during solidification has been traced to occluded SO_2, which is formed by oxidation of the sulphur present, and given up during solidification with a "spitting" action. Up to 1500°, the absorption increases almost linearly with the temperature, and approximately as the square root of the pressure. The fact that the gas causes the metal to "spit" and become spongy during solidification, and that a considerable quantity of gas is still retained in the cold metal, shows that absorption and not adsorption effects are concerned. SO_2 does not diffuse through solid copper below 1000° C. The interaction of cuprous oxide and sulphide, giving copper and sulphur dioxide, is exothermic; the reverse reaction can be expressed as $Cu_2S+2Cu_2O=6Cu+SO_2$—38,000 cals. It follows from this that an equilibrium relation will be obtained. Estimations of the lowering of freezing point produced by the oxide and sulphide show that the compounds occur as Cu_2S and Cu_2O, and that their solubilities are more than sufficient to account for the absorption of SO_2 by decomposition and chemical reaction. The fact that the addition of either Cu_2S or Cu_2O to the system diminishes the solubility of the gas, is also in accord with this view. That a state of equilibrium between the four participating bodies occurs at all temperatures has been verified in a number of investigations.

Hydrogen. Evidence of the solubility of hydrogen is given by the surface disintegration and blister-like structure assumed by the metal during solidification after exposure to this gas. An absorption of H_2 in, and diffusion through copper has been detected at 650° C. Up to 1500° C., the absorption increases almost linearly with the temperature, except at the melting point of the metal, when a sudden increase occurs. At 650° the solubility is 0·1 and at 1500° C., 1·4 mgrms. H_2 per 100 grms. of copper. With both the molten and solid metal, the solubility increases as the square root of the pressure. The conductivity of copper is not affected by dissolved hydrogen. On heating copper containing oxide in a hydrogen atmosphere, the gas penetrates the metal and reduces the oxide with formation of water, which escapes by disintegrating the metal and rendering it unsuitable for further mechanical working. A reaction of this nature takes place in molten copper during the "poling" treatment.

Hydrocarbons are decomposed by molten copper into carbon and hydrogen, of which the former is oxidised and the latter absorbed. No occlusion of any undecomposed hydrocarbon has been observed.

Oxygen. The dissociation pressure of cuprous oxide equals the partial pressure of atmospheric oxygen, or 0·21 atm., at 1662° C. When in solution in the copper, the dissociation pressure is lowered, so that, at 1600° C., it is certain that no thermal decomposition of the dissolved oxide occurs, and the absorption of O_2 at this temperature is not a physical solution but a chemical combination.

Water, carbon dioxide, nitrogen, argon, helium. No absorption of any of these gases in either solid or liquid copper can be detected.

Carbon monoxide. A slight solubility of this gas in copper has been shown by changes in the density produced in the metal by its presence, by the blister-like structure it imparts to the metal, by spectrum analysis, and by direct measurement. At 1420°, 61 grms. of Cu absorb 0·15 c.c. CO. This small quantity of gas appears to have a marked influence on the physical properties of the refined metal.

The above data indicate that during the refining of molten copper, the absorption of CO predominates during the end of the "hard poling" period, and at the beginning of the "green poling," while the absorption of H_2 predominates during the latter period when the oxygen has been removed.—J. N. P.

Lead ores; Smelting —— in the blast-furnace. I. A. Palmer. Mining and Eng. World, Oct. 24, 1914, 755—759.

In modern smelting practice, the pre-roasting of the ore and sintering are accomplished in one operation. Oxidised fines, silicious sulphides, concentrates, and slimes may be mixed and sintered together with the ore, but flue-dust can only be satisfactorily treated after briquetting. One of the most serious objections to fines in the blast-furnace is that irregularities in the formation of slag and matte occur, and these lead to metal losses. All the constituents of the charge should be well mixed and arrive at the fusion zone of the furnace at approximately the same time, and materials of very different composition should not be used, as the influence of inequalities in distribution is then accentuated. In roasting ores, iron sulphide is the first, and zinc and lead sulphides are the last to be oxidised. On treatment in the blast-furnace, zinc sulphide, which does not mix in all proportions with the other sulphides, separates, when present in considerable quantity, and floats on the top of the matte, forming a pasty scum which prevents a good separation of matte and slag. Laboratory experiments have shown that slags consist of a mixture of constituents, and large variations in the proportion of these constituents do not materially affect the fusibility or fluidity. As a result of improved methods of preparing the charge higher temperatures can now be used in smelting, and hence, without diminishing the fluidity, larger quantities of lime can be introduced and more basic and more refractory slags can be produced. The minimum quantity of coke required is that corresponding to 10% pure carbon of the weight of material (less slag and fuel); often it is necessary to use 12%. The blast-pressure used in the larger plants is 30 to 40 oz. per sq. inch. The loss of lead through volatilisation is apt to be large and overlooked. The sulphides of the heavy metals cannot be completely separated from the slags, on account of the slightly solvent action of the latter on the former.—J. N. P.

Lead; Electrodeposition of ——. F. C. Mathers and B. W. Cockrum. Met. and Chem. Eng., 1914, **12**, 714—715.

To obtain smooth finely crystalline deposits there is added to the bath an "addition agent" prepared by shaking 12·5 grms. of aloes with 500 c.c. of warm water, separating the solution and dissolving the insoluble tar or gum in 25—50 c.c. of glacial acetic acid. This acid solution is added to the bath, which should contain 100 grms. of lead acetate and 40 grms. of ammonium perchlorate per litre. A current density of 3·6 amp. per sq. ft. for thick deposits and 7·2 amp. per sq. ft. for thin may be used. With lead lactate and lead formate solutions, the baths should contain 4% of lead as lactate or 2% as lead formate, 1—5% of lactic or formic acid, 4% of ammonium perchlorate and 0·25% Barbadoes aloes, the mixture being warmed and filtered before use. A current density of 3·6 amp. per sq. ft. may be used. Sodium naphthalenesulfonate may be used instead of the ammonium perchlorate. (See also this J., 1913, 429; 1914, 358).—W. F. B.

Aluminium-magnesium alloys; Supplement to the phase diagram of ——. H. Schirmeister. Metall und Erz, 1914, **11**, 522—523. (See also Grube, Z. anorg. Chem., 1905, **45**, 225.)

The alloys (200 grms. in each case) were melted in a nickel wire electric furnace, and the progress of the cooling registered by means of a thermo-element and recording galvanometer. The first stationary points were found at temperatures which gradually fell from 657° to 550° C., as Mg increased from 0 to 20%. Second stationary points, denoting a eutectic, were found at 580°—590° C. with alloys of between 2 and 15% Mg, and a second similar eutectic point was found at 455° C., with alloys containing between 12 and 15% Mg.—J. N. P.

Calorizing. Coating metals with a layer of aluminium alloy for protection against high temperatures. H. B. C. Allison and L. A. Hawkins. Met. and Chem. Eng., 1914, **12**, 730.

The metal to be coated is heated in a revolving drum with substances containing *inter alia* finely ground aluminium, or it is packed in or painted with a suitable mixture containing aluminium and heated. Calorized iron tubes withstand oxidation at 900°—1000° C. With copper the calorizing is effective against oxidation at low and high temperatures. The effect of calorizing on the electrical resistance and temperature coefficient of iron is shown in the table. No. 1 had a lighter calorizing coat than No. 2.

Samples.	Electrical resistance, ohms per m. (19°).	Temp. coeff. (0°—150°) × 10^{-8}.
Iron ribbon	0·905	5·61
do. calorized No. 1	2·45	1·72
do. calorized No. 2	7·6	0·151

—W. F. B.

Metals; The influence of allotropy on the metastability of ——*, and its bearing on chemistry, physics and technology.* E. Cohen. Faraday Soc., Nov. 23, 1914. (See also this J., 1908, 1155; 1909, 1139; 1910, 94, 281; 1914, 597).

Experiments made with pure cadmium are described, measurements being made with the pyknometer, the dilatometer, and with low voltage standard cells in which the negative electrode consisted of cadmium deposited electrolytically on a platinum spiral. The results show that ordinary cadmium contains three allotropic forms. Density and dilatometric measurements made with pure lead indicated for this metal also the simultaneous presence of more than two allotropic forms. The conclusion is drawn that the pure metals (Cd, Pb, Bi, Cu, Zn, Sb) as known until now, are metastable systems consisting of two (or more) allotropic forms. This is a consequence of the very strongly marked retardation which accompanies the reversible change of these allotropic modifications below and above their transition-points. All the physical and mechanical constants of metals hitherto determined thus refer to complicated metastable systems, which are entirely undefined, as the quantities of the α, β, and γ modifications they contain are not known. The reversible transformations of one modification to another must play an important rôle when metals are subjected to changes of temperature. If the metals are in contact with electrolytes (water), the transformation velocity is enormously accelerated, and the volume changes which generally accompany these transformations may cause the disintegration of the metals. These phenomena must be taken into account in cases where corrosion occurs.—T. St.

Hardness [of metals]; Interstrain theory of ——. A. McCance. Faraday Society, Nov., 1911. [Advance proof.]

Pure iron, like other metals, is hardened when strained so as to cause permanent deformation. The iron is then in a condition of "interstrain," in which the arrangement of the atoms in the original crystalline structure is so far disturbed that the atoms can no longer return to their positions of equilibrium, and it is this condition whch is considered to involve increased hardness. Under strain, α-iron remains magnetic, and γ-iron non-magnetic, showing that the metal is not merely reduced to an amorphous structure by strain, but retains the distinguishing properties which are the result of crystalline form. To harden steel by quenching, it must be heated to the temperature at which the carbon is all in solution, and the greatest hardness is obtained when the temperature reaches the highest change-point. The maximum hardness is obtained with C 0·7%: since the hardness is not proportional to the amount of carbon dissolved, the action of the carbon is indirect. Steel which is non-magnetic at the temperature of quenching becomes magnetic in the hardened state, owing to the conversion of γ- into α-iron. With a given rate of cooling this change of crystalline structure stops at a point determined by the increase in the internal viscosity at the lower temperature and in this way a condition of interstrain is produced involving increased hardness. Tempering removes the condition of interstrain.—A. T. L.

Acetylene in welding and cutting; Precautions in using ——. Karbid u. Azetylen, 1913, 255—260; J. Gasbeleucht., 1914, 57, 306.

The use of an efficient water-trap, to prevent oxygen from entering the acetylene pipe or container either by stopping it or discharging it to the atmosphere, is a sufficient safeguard in practice. Vessels packed with sand or wire gauze uselessly complicate the apparatus and only arrest the explosion of mixtures poor in oxygen.—O. E. M.

Welding; Electropercussive ——. C. E. Skinner and L. W. Chubb. Met. and Chem. Eng., 1914, 12, 713—714.

Wires are welded together by means of electrical discharges from a condenser directed across their ends as they are being mechanically pressed together. Any combination of metals can be welded by these means, but joints of, for example, Al and Sn or Pb and Fe are not permanent.—W. F. B.

Plaster-of-Paris in foundry work. C. Heggie. Proc. British Foundrymen's Assoc., 1913—1914, 95—119.

The possibilities of plaster-of-Paris for making patterns for foundry work are stated to be unappreciated both in this country and in America. The methods of mixing the plaster and its formation into patterns are discussed, and the preparation of various patterns is described in detail.—T. St.

Flotation; An experimental contribution to the study of ——. H. Schranz. Metall und Erz, 1914, 11, 462—470.

The floating of small particles is determined by the angle, at the point of contact of liquid, air, and solid, between the submerged surface of the particle and the tangent to the surface of curvature of the liquid assumed at this point through surface tension forces; the size and the curvature of the surface bounding the particle, the specific gravity, and the volume of the particle. The buoyancy of zinc blende on water was unaffected by the addition of sulphuric acid, but that of galena diminished with increasing concentration of the acid. This is attributed to the difference in solubility of the sulphates of the respective metals, whereby the nature of the surface is unchanged or modified in the two cases. Surface impurities of all kinds affected to a high degree the floating power. In many cases, physical changes produced by heating or by exposing to air determined largely the boundary angle and the ability to float. The nature of the fracture of the particle, *i.e.*, whether the surface was bright or rough, also had some influence.—J. N. P.

Minerals; New results with the microscopical investigation of opaque ——. O. Stutzer. Metall und Erz, 1914, **11**, 450—455.

The microscopical examination of opaque minerals by means of reflected light has been applied in petrography to an increasing extent for the purpose of identifying mineral composition, and for the examination of the constituents of crude ores. Chalcopyrite, iron pyrites, pyrrhotite, magnetite, and some other minerals which occur in rocks can usually be detected on a polished section of a fragment of the ore by means of the colour. If the polished section be etched, similarly coloured minerals often show other very marked differences. Constituents which are unattacked by the etching agent retain their polish and stand in relief. The characteristics in the microstructure of native platinum, osmiridium, and nickeliferous pyrrhotite are pointed out. In the last case, the nickel was seen to be associated mechanically with the pyrrhotite in the form of pentlandite, whereas formerly it was considered to be in chemical combination in the molecules of the pyrrhotite. In titaniferous magnetite, microstructural examination shows that the titanium occurs partly in mechanical association with the magnetite as ilmenite, and in part replaces the iron chemically in the magnetite molecules. The structure of the magnetite-ilmenite mixture is ascertained by etching with hydrochloric acid, when magnetite dissolves, whilst ilmenite is not attacked. In copper-iron pyrites bornite, $3Cu_2S,Fe_2S_3$, copper glance, Cu_2S, chalcopyrite, $CuFeS_2$, enargite, Cu_3AsS_4, and iron pyrites, FeS_2, can be identified by their microstructure. In low-grade copper ores, the metal appears not to occur in chemical combination with the pyrites molecule, but to be mechanically associated in the form of the known copper minerals.—J. N. P.

Smoke from metallurgical furnaces; Recent progress in the abatement of ——. C. Schiffner. Metall u. Erz, 1914, **11**, 257—278.

The sulphur dioxide produced in roasting sulphide ores is reduced to sulphur, in Young's "Thiogen" process (this J., 1913, 293), by a flame of hydrocarbon in sufficient excess over that required to deal with the free oxygen; BaS or CaS is used as catalyst. Hall's process consists in roasting in an atmosphere containing insufficient oxygen to oxidise the sulphur. In Cottrell's process (this J., 1911, 1037; 1914, 1054) suspended matter is removed by passing the gases between electrodes at a tension of 17,000 to 40,000 volts; sulphur dioxide is removed by converting the gases into a mist by a water spray or other means. Püning (Ger. Pat. 262,882) uses the water spray as the positive electrode. Small scale researches, described in detail, show that with simple apparatus it is impossible to obtain a mist capable of absorbing all the sulphur dioxide in flue gases, but that by blowing in steam and cooling, or by mechanical spraying, this result might be attained.
—O. E. M.

Working and health conditions of lead and zinc smelters in Germany. See XIXb.

Determination of uranium. Schlundt. *See* XXIII.

Patents.

Iron or steel; Prevention of oxidation or rusting of ——. F. R. G. Richards, Warwick, and M. A. Adam, London. Eng. Pat. 25,134, Nov. 4, 1913.

The iron or steel article (*e.g.*, cycle tubing) is immersed for 2—20 mins. in a solution prepared by dissolving manganous carbonate (1¾ lb.) in a boiling mixture of phosphoric acid, B.P. (60 fl. oz.) and water (87 fl. oz.).—W. E. F. P.

Iron, steel, and cast iron; Impregnation of —— *with nickel.* A. C. Hyde, London. Eng. Pat. 26,712, Nov. 20, 1913.

Articles of iron, steel, or cast iron are heated at 500°—1000° C. in a gas containing carbon monoxide which has been passed over nickel or nickel oxide below a red heat, or are heated in powdered nickel or nickel oxide in an atmosphere of carbon monoxide or hydrogen for 2 hours at 500°—1000° C.—O. E. M.

[Iron, steel, etc.] Clad metals; Method of making ——. J. F. Monnot, Paris, Assignor to Duplex Metals Co., New York. U.S. Pat. 1,114,792, Oct. 27, 1914; date of appl., Apr. 2, 1910.

To plate iron, steel, or other metal, it is cleaned, coated with a suitable alkali solution and then with a metal or alloy of lower m. pt. in a highly heated condition; after which the desired metal is applied in molten form.
—W. E. F. P.

Steel or iron sheets; Oxidising ——. J. E. Carnahan and A. J. Maskrey, Canton, Ohio. U.S. Pat. 1,115,281, Oct. 27, 1914; date of appl., June 11, 1913.

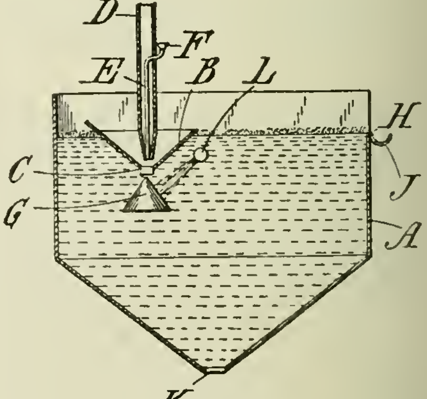
Sheets in packs are heated in a sand-sealed protecting box within a sand-sealed annealing box and then separately exposed to an oxidising agent.—O. E. M.

Ore concentration; Apparatus for ——. A. H. Higgins, W. W. Stenning, and Minerals Separation Ltd., London. Eng. Pat. 21,650, Sept. 25, 1913.

An apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid, consisting of a series of contiguous, rectangular vessels each having an inlet for ore-pulp; an outlet for residues; near the bottom, an inlet for air or other gas and means for producing a zone of violent agitation and aeration; and, near the top, for producing a comparatively quiet zone where the mineral froth collects and is separated.—W. E. F. P.

Ores; Method and apparatus for concentrating ——. Minerals Separation Ltd., London. From G. E. Öhrn, Stockholm. Eng. Pat. 22,346, Oct. 3, 1913.

The powdered ore, or pulp, is mixed with a minute quantity of a mineral frothing agent and subjected to the action of a steam jet directed on to the surface of water. A spitzkasten, A, (fig.) has a hopper, B, having an outlet, C, below the water-level, a steam-pipe, D, being arranged in the hopper so as to form an injector. Within the steam-pipe is a tube, E, having an external



funnel, F, through which the frothing agent is supplied; and under the outlet, C, a cone, G, is centrally disposed. The spitzkasten has an overflow lip, H, a launder, J, and an outlet, K, for the tailings; and a water-spray, L, is arranged under the surface of the water in the spitzkasten so that streams of water are directed on the froth as the latter rises to the surface.—W. E. F. P.

[*Copper, iron, etc.*] *Metals; Method of and means for producing and refining* ——. S. B. Frumkin, Minsk, Russia. Eng. Pat. 22,834, Oct. 9, 1913.

The ore is reduced, and/or the metal melted, without flux, in a closed, invertible, horizontal, annular furnace-chamber into which a blast of air, with or without heating gases, is passed tangentially from a horizontal, tubular regenerator; the inlet and outlet of the chamber are close together and communicate with the regenerator by means of a common, funnel-shaped member. The chamber is then inverted and the blowing continued, the molten metal being further heated by contact with the refractory lining of the roof, and finally discharged by tilting the apparatus.—W. E. F. P.

[*Copper.*] *Metals; Chemical concentration of* ——. C. S. Bradley, New York. U.S. Pat. 1,114,726, Oct. 27, 1914; date of appl., Feb. 27, 1913.

Ore containing cupric oxide is treated with an aqueous solution of sulphur dioxide and calcium chloride to produce a solution of cuprous chloride.—W. E. F. P.

Salt bath furnaces [*for heating or tempering metals*]. S. N. and E. R. Brayshaw, Manchester. Eng. Pat. 28,097, Dec. 6, 1913.

A salt bath furnace for high-speed steels having a combustion chamber wider at the bottom than at the top and a burner the flame of which enters tangentially and is guided by baffles completely round the melting-pot. —O. E. M.

Aluminium alloy. W. A. McAdams, Bayshore, N.Y., U.S.A. Eng. Pat. 4779, Feb. 24, 1914.

An alloy of Al 100, Ag 15, Cd 10, and Ti 3, parts by weight.—W. E. F. P

Metal alloy. E. Smith, London. U.S. Pat. 1,114,055, Oct. 20, 1914; date of appl., Jan. 30, 1914.

An alloy of Cu 40, Ni 8·5, Zn 5, Sn 2·5 and Pb 1 (parts by weight), prepared by melting the granulated nickel with "a flux of silica," adding half the copper gradually, with stirring, and the remainder in bulk, then the zinc, and finally the tin and lead together.—W. E. F. P.

Alloy. S. W. Parr, Urbana, Ill. U.S. Pat. 1,115,239, Oct. 27, 1914; date of appl., Feb. 27, 1914.

A corrosion-resisting alloy, of high electrical resistance, composed of Ni 63, Cu 5, metals of the Cr-group 27% (*e.g.*, Cr 20, Mo 5, and W 2%) with less than 2% each of Al, Mn, and B as deoxidisers. In the unworked condition it has a tensile strength of 60,000 lb. per sq. in.—O. E. M.

Briquette composition and process of making [*ore*] *briquettes.* E. A. Paterson, Port Arthur, Ontario, Canada. U.S. Pat. 1,111,919, Sept. 29, 1914; date of appl., Dec. 26, 1913.

A silicious ore, such as iron ore, is agglomerated with a mixture of alkali silicate and alkaline-earth carbonate *e.g.*, hydrous sodium silicate and limestone). The powdered ore is preferably discharged as a layer upon a suitable surface, a mixture of ore dust with hydrous alkali silicate solution and water discharged upon this layer, the mixture moulded and dried upon the same surface, and the briquettes finally discharged, adhering particles of ore being removed. The quantity of carbonate should be proportioned to the total silicic acid in the finished briquettes, and these may be hardened by exposure to carbon dioxide.—F. Sodn.

Ore-roaster. G. H. Dern, Salt Lake City, and T. P. Holt, Park City, Utah. U.S. Pats. 1,113,961 and 1,113,962, Oct. 20, 1914; date of appl., April 9, 1914.

A column of ore is roasted "by internal combustion" in a vertical chamber having a crushing grate (for supporting and disintegrating the charge) beneath which is situated an air-pressure chamber, of inverted conical shape, which also serves as a receptacle for the roasted product. —W. E. F. P.

Roasting-furnace. F. Laist, Anaconda, Mont. U.S. Pat. 1,114,371, Oct. 20, 1914; date of appl., Oct. 15, 1913.

Between two of the hearths of a furnace of the superposed-chamber type is a combustion chamber having, on opposite sides, horizontal inlets for furnace gases and, at the bottom, a series of vertical openings disposed radially, and communicating with the lower hearth; from the latter the gases pass outwards and thence to the upper hearth.—W. E. F. P.

Ores; Process of roasting ——. F. Laist, Anaconda, Mont. U.S. Pat. 1,114,372, Oct. 20, 1914; date of appl., Nov. 22, 1913.

In an apparatus of the superposed-chamber type, the ore, after being heated at a high temperature by furnace gases, is removed to a zone of comparatively low temperature while still in contact with the gases, and thence to a heat-insulated chamber where it is mixed with salt and the process concluded without further heating. —W. E. F. P.

Furnace; Metallurgical ——. U. Wedge, Ardmore, Pa. U.S. Pat. 1,115,263, Oct. 27, 1914; date of appl., Feb. 25, 1913.

Rotating hearths attached to a central vertical shaft alternate vertically with fixed hearths attached to an outer casing. Rabbles fixed to the under side of each hearth rake the one below.—O. E. M.

Detinning; Process of ——. J. Weber, Essen-on-the-Ruhr, Germany. U.S. Pat. 1,115,262, Oct. 27, 1914; date of appl., Jan. 31, 1912.

Tinned iron is treated with a current of chlorine above the temperature at which iron is attacked; the chlorine is passed through a cooler to remove the heat of reaction. —O. E. M.

Metals from ores; Process for separating ——. H. A. Wagner, East Orange, N.J. U.S. Pat. 1,115,351, Oct. 27, 1914; date of appl., Jan. 27, 1914.

Copper, zinc, and similar metals are separated by suspending their sulphide ores in the anode compartment of an electrolytic cell containing a solution of common salt; the anode and cathode are separated by a diaphragm and a depolariser is placed in the path of the current to prevent hydrogen from appearing in the anode compartment. —O. E. M.

Metal wires; Process for drawing or alloying ——. Wolfram Lampen A.-G. Ger. Pat. 276,894, April 16, 1913.

A lubricant for use in wire drawing consists of a suspension or solution of a metal which will alloy with the metal being drawn, or a suspension or solution of an alloy or compound of such a metal; the metal or metals constituting the lubricant are alloyed with the wire by heating during or after drawing. Gelatinous thorium compounds, such as the gelatinous hydroxide obtained by precipitating a thorium solution with a base, may be used in preparing wires of tungsten-thorium alloy, and vanadium hydroxide may be used in alloying iron wire with vanadium.—T. F. B.

Furnaces; Electric ——. F. J. Machalske, Plattsburg, N.Y., U.S.A. Eng. Pat. 15,455, June 27, 1914. Under Int. Conv., June 27, 1913.

See U.S. Pat. 1,099,559 of 1914; this J., 1914, 796.—T.F.B.

Electrodes for electric welding or soldering; Preparing ——. O. Kjellberg, Gottenborg, Sweden. U.S. Pat. 1,115,317, Oct. 27, 1914. Date of appl., Jan. 29, 1912.

See Eng. Pat. 3762 of 1911; this J., 1912, 590.—T. F. B.

Briquetting iron ores and the like; Method of ——. G. Crusius, Gross-Ilsede, Germany. U.S. Pat. 1,116,024, Nov. 3, 1914. Date of appl., Nov. 29, 1913.

See Eng. Pat. 27,538 of 1913; this J., 1914, 488.—T. F. B.

Hoppers for gas producers, blast furnaces, and the like. Eng. Pat. 23,054. *See* IIa.

Producing cement from blast-furnace slag. U.S. Pat. 1,115,321. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Corrosive action of electric currents on gas and water mains. Herrmann. *See* IIa.

Patents.

Furnace; Electric ——. W. N. Crafts, Oberlin, Ohio. U.S. Pat. 1,114,733, Oct. 27, 1914. Date of appl., Nov. 28, 1911.

The furnace comprises a basin below which is a magnetic core and primary winding, together with an incomplete secondary having terminals at the bottom of the basin, and arranged so that the circuit is completed by the bath of material in the basin; the secondary is composed of material of relatively high conductivity which does not melt during the operation of the furnace.—T. F. B.

Electrode. R. L. Seabury, Lakewood, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,115,027, Oct. 27, 1914; date of appl., Aug. 2, 1911.

The electrode (for furnace use) consists of a carbon rod tightly enclosed in a carbon tube, the two parts being moulded under pressure, placed in position, and baked together.—W. E. F. P.

Electric arcs; Means for the production of long continuous ——. O. Schönherr, Christiania, and J. Hessberger, Christianssand, Assignors to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 1,115,249, Oct. 27, 1914. Date of appl., May 18, 1910.

See Fr. Pat. 410,710 of 1909; this J., 1910, 829.—T. F. B.

Electric discharges in gases; Method of producing continuous or constant ——. C. F. R. von Koch, Stockholm. U.S. Pat. 1,115,625, Nov. 3, 1914. Date of appl., March 20, 1911.

See Fr. Pat. 427,745 of 1911; this J., 1911, 1070.—T. F. B.

Apparatus for bleaching fabrics. Eng. Pat. 26,727. *See* VI.

XII.—FATS; OILS; WAXES.

Soap solutions; Effect of resene on the lathering power of ——. C. H. Herty and C. W. Williard. J. Ind. Eng. Chem., 1914, 6, 895—896.

Soap solutions to which a small quantity of resene (unsaponifiable constituents) from the oleoresin of *Pinus heterophylla* was added, formed less lather when shaken than similar solutions free from resene and the time required for the complete subsidence of the lather was considerably less when resene was present.—A. S.

Patents.

Oils and fats; Process of bleaching ——. C. Baskerville, New York. U.S. Pat. 1,114,095, Oct. 20, 1914; date of appl., Jan. 24, 1913.

The oils are treated with a mixture of an inorganic absorbent (*e.g.*, fuller's earth), and a fibrous organic absorbent (*e.g.*, cellulose), with or without an electrolyte such as sodium chloride.—C. A. M.

Oils and the like; Apparatus for treating [hydrogenating] ——. L. Mandelstam, New York. U.S. Pat. 1,114,623, Oct. 20, 1914; date of appl., Apr. 30, 1912. Renewed Mar. 13, 1913.

Catalytic hydrogenation of the oil is effected in a closed vessel containing a steam coil and provided with means for spraying the oil from above as it circulates in relatively small quantities from the bottom of the chamber. The hydrogen introduced under pressure agitates the mixture of oil and catalytic agent.—C. A. M.

Process of making lard substitute [hydrogenised oil]. U.S Pat. 1,114,963. *See* XIXa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Dyes and other products from the waste liquor of the soda cellulose process. Cram. *See* V.

Patents.

Luminous composition. C. P. Karr, Assignor to J. M. Flannery, Pittsburgh, Pa. U.S. Pat. 1,097,979, May 26, 1914; date of appl., Aug. 15, 1912.

A mixture of barium carbonate and sulphate, zinc oxide and sulphide, silica and "asbestine" all in the colloidal condition, is exposed to the emanation from radio-active substances. The material is then dried and made into a paint with any suitable oil other than linseed oil.—W. H. C.

Rosin; Treating ——. F. E. Mariner, Assignor to The Pensacola Tar and Turpentine Co., Gull Point, Fla. U.S. Pat. 1,114,278, Oct. 20, 1914; date of appl., Dec. 23, 1913.

To obtain a lubricating product containing over 65% abietic acid, rosin from which the oil of turpentine has been separated is distilled at a temperature (*e.g.*, 275° C.) below its b. pt. at atmospheric pressure (*e.g.*, by superheated steam), the temperature being finally raised to complete the distillation.—C. A. M.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber factory; Essay on an ideal ——. A. Douglas. India Rubber J., 1914, **48**, 18—19.

The greatest possible cleanliness must be aimed at, and certain precautions in factory-design and equipment are enumerated. There must be no bright light, which darkens the rubber, and no dark corners to harbour fungi. Rainwater should be collected and used for dilution of latex and acid. Smoke chambers should be of wood with heavy corrugated iron roofs lined with sacking. The procedure recommended for the production of smoked sheets is as follows:—The latex is diluted to standard gravity and mixed in a white-tiled tank. From 0·7 to 1% of its bulk of 10% acetic acid is added, and the mixture stirred with a glass rod, and then transferred in pails to the pans, which when full are skimmed and dividing boards introduced. On the following morning the coagulum is gently pressed until about ¾ in. thick, then reduced to ordinary sheet thickness by 3 or 4 passages through smooth rollers, and finally once through marking rollers. The sheet is drained on racks for 2 hrs., then smoked. Decayed timber and coconut husks form good fuel. The rubber is ready to pack in 10 days. In making thick gristly crepe the rubber is first sheeted very thin between smooth rollers, then dried, and finally re-rolled thick in the diamond rollers and dried further. It is ready for packing in 21 days.—E. W. L.

Rubber ; Prohibition of exportations of raw ——.

By an Order in Council, dated November 20th, 1914, the exportation of raw rubber to all destinations is prohibited.

Patent.

Rubber latex ; Means for bringing about the coagulation of ——. C. de C. Pinto, Para, Brazil. Eng. Pat. 16,840, July 15, 1914.

The coagulant consists of creosote, 2 kilos., quinine hydrochloride, 1 kilo., and sodium carbonate, 1 grm., dissolved in a sufficient quantity of alcohol. Ten grms. of this liquid are mixed with 200 grms. of whey from rubber milk and then added to 2 kilos. of the latex.—W. P. S.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Leaching experiments [with tanning materials] ; Laboratory apparatus for ——. L. Balderston and W. K. Alsop. J. Amer. Leather Chemists' Assoc., 1914, 9, 484—489.

The authors have devised small leaches with which it is possible to obtain in the laboratory more information as to how materials will work in practice than can be obtained from the ordinary analysis. The leaches are of tin-coated copper, and the brass lids, with rubber gaskets, are bolted on. In the lid are three perforations, one for the entrance of liquor, another for a thermometer, and one for an air-vent. The leaches are provided with false bottoms of fine copper gauze, and the liquor escapes from beneath by a brass tube which is connected with the next leach by a ground "lip union." A series of leaches is arranged on steps, so that the tail leach is highest. Such a series has worked well for eight months.—F. C. T.

Hide powder ; Adoption of standard ——. Leather World, 1914, 6, 766—777.

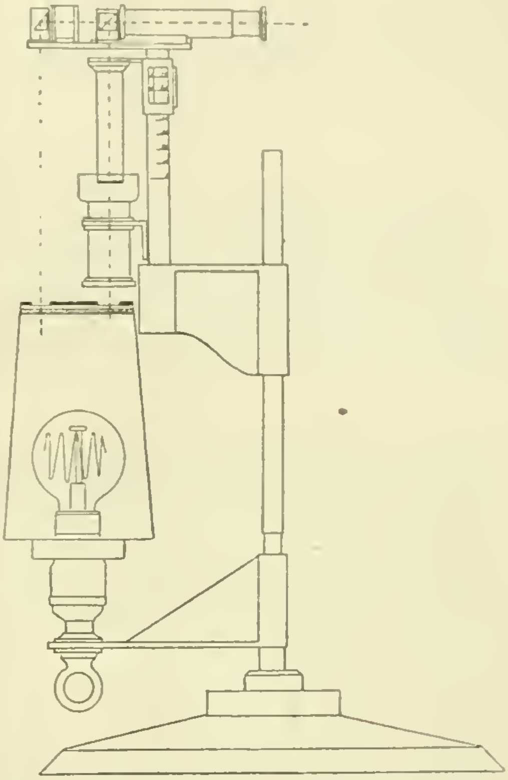
Owing to discrepancies in analytical results of tanning materials arising out of the use of different hide powders the British section of the International Association of Leather Trades Chemists, on the recommendation of a special research committee, have adopted a standard hide powder which must be used in all official analyses. This hide powder is of American origin and can only be obtained from Baird and Tatlock, Ltd., 14, Cross Street, Hatton Garden, London, E.C. New supplies of hide powder will be tested by the Hide Powder Committee and a selected powder will replace the present official powder after Jan. 1, 1915.—T. C.

Tannin extracts ; Determination of insolubles in the analysis of ——. W. K. Alsop. J. Amer. Leather Chemists' Assoc., 1914, 9, 465—466.

Total solids determined with solutions ten times the ordinary analytical strength, have been found to agree within a few tenths per cent. with the amount found by the official method (American). The strong solutions filter sometimes more quickly and sometimes more slowly than those of official strength, and show often a much higher percentage of insoluble matter.—F. C. T.

Tanning materials ; Colour valuation of ——. G. A. Kerr. J. Amer. Leather Chemists' Assoc., 1914, 9, 451—463.

The author describes an improved method of making colour tests on pelt, which complies with two principles that he lays down, first, that the pelt must detannise the solution, and second, that the pelt must be in the same state as hide before tannage. The grain split from limed green salted hides or calf skins is used, and must be prepared as carefully as is hide powder. The author considers the results of no great value to the tanner or extract manufacturer. An improved method of colour measurement of tannin solutions is described. A modified form of the Schmidt and Haensch colorimeter (see fig.) is used. There is no comparison with arbitrarily numbered glasses, but a solution of the same tint as that to be measured is made by mixing standard colour solutions. A cubic centimetre cell of the solution to be tested is placed where the glasses usually are, and the cylinder is used for the mixture of solutions of standard colours. The method is accurate and can be worked rapidly, also the depth of colour solution is in direct proportion to the strength of the solution tested.—F. C. T.



Sulphite-cellulose blends. W. H. Dickerson. J. Amer. Leather Chemists' Assoc., 1914, 9, 489—496.

Results of analyses of mixtures of sulphite-cellulose and various tanning extracts are given. A slight loss of tannin is shown, which was lessened by the use of small quantities (0·1—0·5%) of acetic acid. Tests are recorded of liquors to which sulphite cellulose has been added. Here no loss of tannin resulted, but a decided gain.—F.C.T.

Green salted weight and white weight ; Relation between —— *of various portions of the hide.* F. A. Loveland. J. Amer. Leather Chemists' Assoc., 1914, 9, 463—465.

Hides were rounded, and the various parts taken through the beam-house together, each portion receiving almost exactly the same treatment. The bends were intended to be 50% of the total weight, the bellies 25%, the shoulders 15%, and the heads 10%. The various portions were weighed after going through the beam-house.

	Number of pieces.	Invoice weight of hide.	Per cent. of total hide.	Pelt weight of hide.	Pelt weight per cent. of invoice weight.
Whole hide	3,638	108,237	100·00	125,391	115·8
Bends ..	7,276	52,625	48·62	60,096	114·4
Shoulders	7,276	18,806	17·37	24,920	132·5
Bellies ..	7,276	26,441	24·48	29,937	113·2
Heads ..	7,276	19,365	9·57	10,438	100·7

—F. C. T.

Sole leather ; Bleaching of ——. F. O. Sprague. Shoe and Leather Reporter, Oct. 15, 1914. J. Amer. Leather Chemists' Assoc., 1914, **9**, 496—497.

Five vats are used in the order: water, alkali, water, acid, water, or water, alkali, acid, acid, water. The temperatures, except for the last vat, are from 125° to 130° F. (52°—54° C.). Sulphuric acid is used, and the alkali is sodium carbonate. The loss in solids removed from the leather is very slight, varying from 1·5% to 4%.
—F. C. T.

Analyses [of leather, tan liquors, etc.] ; Standard forms for reporting ——. W. K. Alsop. J. Amer. Leather Chemists' Assoc., 1914, **9**, 479—484.

From information received from members of the Amer. Leather Chemist's Assoc., the author has suggested forms for the uniform report of analyses of leather, tan liquors, barks and extracts. Completeness has been aimed at in the suggestions, for instance in the analysis of liquors, the proportion of tannin to 1° Barkometer, and proportion of tannin to acid are to be given.—F. C. T.

Patents.

Composition of matter [leather preservative] and method of producing the same. S. M. Darling, Chicago, Ill. U.S. Pat. 1,114,590, Oct. 20, 1914 ; date of appl., Sep. 30, 1912.

Oil or tar from the destructive distillation of lignite is distilled to dryness, and the fraction of b.pt. over 350° F. (177° C.) is redistilled while a current of oxygen is blown through it until a wax-like residue is left. This is mixed with an oxidising oil to form a leather preservative.
—C. A. M.

Glue ; Manufacture of [vegetable] ——. Perkins Glue Co., Lansdale, Pa., U.S.A., and H. C. Heide, Liverpool. Eng. Pat. 23,421, Oct. 16, 1913. Addition to Eng. Pat. 24,692, Nov. 6, 1911.

See Addition of Oct. 28, 1913, to Fr. Pat. 436,297 of 1911 ; this J., 1914, 559.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Argillaceous sediments ; Chemistry of the ——. G. Linck. Mitt. K. K. Techn. Versuchsamtes, 1914, **3**, [1], 19—22.

The hydrolysis of silicates and leaching out of alkali and alkaline-earth metals which mark the first stage in the transformation of eruptive minerals into sedimentary deposits lead to the disappearance of Ca, Na, Mg, and K in the order given ; subsequently, as a result of adsorption by the degraded silicates, these metals are taken up again in the inverse order. The excess of alumina over the sum of the alkali and alkaline-earth metals is greater, therefore the more complete the degradation and the more recent the deposit (*i.e.*, the more incomplete the process of adsorption). The molecular ratio of adsorbed alkalis and alkaline-earths to alumina cannot probably exceed 1 : 2 or 1 : 3, but the natural ratio is often disturbed by the admixture of carbonates, etc., during deposition. Analytical data for a number of sedimentary deposits and eruptive rocks are given in the form of a diagram.
—F. Sodn.

Humic substances ; Influence of —— *on the weathering of silicates.* H. Niklas. Diss., Kgl. Techn. Hochschule, München, 1913. Kolloid-Zeits., 1914, **14**, 58.

Finely-powdered felspar, augite, hornblende, olivine, mica, and labradorite respectively were mixed with peat and the mixtures kept for 7 years in closed vessels and then examined. No appreciable quantities of the silicates were brought into solution nor were they rendered less resistant to hydrochloric acid. After incinerating the peat, however, the residual silicates were more easily attacked by hydrochloric acid than the original minerals. By the prolonged action of water on the silicate-peat mixtures, mostly silica and alkalis were dissolved, lime and magnesia only to a slight extent ; and by subjecting the mixtures to electrolysis, mostly iron and aluminium were dissolved.—A. S.

Vanillin in soils ; Origin of ——. *Vanillin in wheat and in the water in which wheat seedlings have grown.* M. X. Sullivan. J. Ind. Eng. Chem., 1914, **6**, 919—921.

Experiments are described showing that vanillin is present in wheat seeds and seedlings and in the water in which wheat seedlings have grown, the quantities found ranging from a trace up to 18 parts per million, referred to the weight of original seeds : the vanillin content increases during the early growth of the plant. A larger quantity of vanillin can be extracted from the seeds if they be first treated with dilute sulphuric acid ; and the vanillin is probably present, at least in part, in the form of coniferin. Vanillin has also been detected in rotten oak wood, in pineapple pulp and parings, and in the hot water extract of lawn grass, consisting of blue grass and a small amount of white clover. (See also this J., 1914, 432.)—A. S.

Manures ; Researches and observations on the movements of —— *in the soil.* J. Lefèvre. L'Engrais, 1913, **28**, 908. Chem.-Techn., Rep., 1914, **38**, 218—219.

In a soil containing 13—16% H_2O, it was found that at the end of a month potassium chloride had diffused 6 cm. horizontally and 10 cm. vertically from the spot where it was applied. Experiments made by Malpeaux, Lefort, Müntz, and Gaudechon in the years 1910 (moist) and 1911 (very dry) show that saltpetre in sandy soils (without vegetation) under the influence of natural rain moves upwards, this being due to the capillarity of the soil and to the evaporation of the surplus moisture. These considerations apply to a greater degree to soils under cultivation, and depending upon the stage of growth of the plants, manuring should be carried out at different times, it being possible then to retain the fertiliser at the desired depth in the soil.—J. P. O.

Nitrogen ; Fixation of —— *by so-called zeolites.* G. Wiegner. J. Landw., 1913, **61**, 11. Kolloid-Zeits., 1914, **14**, 55—56.

When a solution of an ammonium salt is placed in contact with a zeolite (permutite), ammonium ions are adsorbed by the solid and are replaced by an equivalent quantity of cations (mostly Ca- and Na-ions) from the latter. Equilibrium is rapidly attained and the percentage of ammonia thus fixed, referred to the total quantity of ammonium salt present, is lower the more concentrated the solution. This adsorbed ammonia is available for plants only after it has been brought into solution, *e.g.*, by carbonic acid secreted by the plants. Assimilation of the dissolved ammonium salt by the plants displaces the equilibrium, which is, however, rapidly restored, and the zeolite thus acts as a regulator preventing the injurious action of high concentrations of the salts.—A. S.

Lime rich in hydrated silica as a fertiliser. H. Immendorff. Landw. Versuchsstat., 1913, 79—80, 891. Kolloid-Zeits., 1914, 14, 57.

Silicious lime is usually considered to be unsuitable as a fertiliser. Mixtures of different kinds of heavy soils with samples of lime containing varying proportions of soluble silica, were incorporated with water and test-pats of the mixtures allowed to harden, control tests being also made with the soils alone. In all cases the soils alone gave harder products than when mixed with lime, even when a highly silicious lime was used. Field tests gave corroborative results, and it was found that addition of cement containing 19·5% soluble silica also produced a loosening of the soil. If the lime applied to soil be uniformly distributed, even large applications will not cause any hardening or incrustation, and a moderate content of hydrated silica is advantageous owing to its adsorptive power.—A. S.

Bone meal; Influence of fineness upon the availability of ——. S. S. Peck. J. Ind. Eng. Chem., 1914, 6, 922—926.

A commercial bone-meal was divided by sifting into the four sizes: less than 40-mesh, 20—40-mesh, 12—20-mesh, and larger than 12-mesh, and with each grade laboratory experiments were made on the rate of formation of ammonia, nitrates, and soluble phosphoric acid respectively in presence of soil. The results confirmed the view that the efficiency of the meal as a fertiliser increases with its degree of fineness. As a standard for commercial bone meal it is suggested that 65% should pass a 50-mesh and at least 90% of the remainder should pass a 25-mesh sieve.—A. S.

Ammonium citrate solution; Exact and easy method for preparing a neutral ——. J. M. McCandless. J. Ind. Eng. Chem., 1914, 6, 921—922.

The purity of the citric acid used is first determined by titration with $N/10$ caustic soda in presence of phenolphthalein and a solution is then prepared containing a quantity equivalent to 1850 grms. of the pure acid ($C_6H_7O_8,H_2O$) in 7 litres. A solution is also prepared containing 25 c.c. of concentrated ammonia per 500 c.c., and its strength is determined by titrating a portion with $N/2$ acid in presence of methyl orange. The citric acid solution is neutralised with the calculated quantity of the ammonia solution (1 part NH_3 to 3·765 parts $C_6H_8O_7$), and the mixture is shaken well, allowed to cool and diluted till it has the sp. gr. 1·09 at 20° C.

By adding a large excess of strong alcohol to an ammoniacal solution of ammonium citrate, a precipitate was produced which became crystalline on standing overnight. The crystals were filtered off and washed with strong alcohol, with the aid of the pump, and dried between paper. When dissolved in water the solution was distinctly alkaline to corallin (the indicator prescribed by the Amer. Assoc. of Official Agricultural Chemists for the preparation of neutral ammonium citrate solution): the ratio of $NH_3 : C_6H_8O_7$ was 1 : 3·768.—A. S.

Volumetric determination of small quantities of potassium. Zaleski. *See* XXIII.

XVII.—SUGARS; STARCHES; GUMS.

Refractometer; Use of the —— *for the analysis of sugar factory products, and the direct determination of the Brix (dry substance) of the juice of the beetroot.* [*Comparison between the original and improved types of refractometer.* H. Pellet. Intern. Sugar J., 1914, 16, 521—523.

Attention is called to experiments recently made by Mezzadroli at the Beet Cultivation Station, Rovigo, Italy, showing that in determining the density of beet juice by means of the refractometer the result obtained by reading in the presence of the pulp is practically the same as that found with the expressed juice freed from the pulp, provided that the intensity of the light generally used be increased by the use of an electric lamp of about 50 c.p. Similarly the author has proved that in taking the refractometric index of a massecuite of the first or second jet the presence of crystals does not disturb the result. It is considered that the "new" or Schönrock type of refractometer adapted for use in sugar laboratories (this J., 1914, 153) is less sensitive than the original instrument, and that the fact that the maximum Brix capable of being read without dilution is only 85° is a further disadvantage. The results given by the two instruments do not agree. Those obtained with the "new" instrument are nearer the "true" dry substance found by desiccation, while those found with the "old" refractometer approach more closely those indicated by the hydrometer reading, as the following average figures for the dry substance of a beet juice show: "true" dry substance (by desiccation), 13·86, "new" type of refractometer, 13·80; "old" type of refractometer, 14·21; and Brix hydrometer, 14·96%.—J. P. O.

The beet sugar industry in Europe. Board of Trade J., Nov. 19, 1914. [T.R.]

The National Sugar-Beet Association, Ltd., has published the following statistics relating to the beet sugar industry in the principal countries of Europe during the last three seasons:—

—	Factories.	Beetroot.			Raw Sugar production.
		Area cultivated.	Total yield.	Yield per acre.	
	No.	Acres.	Tons.	Tons.	Tons.
Austria-Hungary—					
1911-12 ..	196	1,012,250	7,770,000	7·67	1,145,572
1912-13 ..	201	1,121,250	12,540,000	11·19	1,901,615
1913-14 ..	201	1,078,250	10,840,000	10·05	1,692,000
Belgium—					
1911-12 ..	73	152,625	1,600,000	10·45	244,908
1912-13 ..	72	165,000	1,960,000	11·88	298,584
1913-14 ..	68	138,250	1,510,000	10·90	230,300
Denmark—					
1911-12 ..	8	62,500	760,000	12·00	114,000
1912-13 ..	9	80,925	1,020,000	12·65	149,400
1913-14 ..	9	77,250	950,000	12·31	146,000
France—					
1911-12 ..	224	562,125	4,020,000	7·15	506,046
1912-13 ..	213	571,250	6,580,000	11·54	960,900
1913-14 ..	209	540,500	5,980,000	11·07	786,000
Germany—					
1911-12 ..	341	1,267,782	8,930,000	7·04	1,501,459
1912-13 ..	342	1,369,625	16,400,000	11·97	2,706,327
1913-14 ..	341	1,333,272	16,700,000	12·52	2,725,000
Italy—					
1911-12 ..	37	132,800	1,510,000	11·34	171,045
1912-13 ..	37	132,500	1,680,000	12·71	213,632
1913-14 ..	39	150,000	2,770,000	18·46	327,800
Netherlands—					
1911-12 ..	27	136,457	1,700,000	12·45	266,970
1912-13 ..	27	172,555	1,990,000	11·54	316,177
1913-14 ..	27	154,250	1,530,000	9·89	228,600
Russia—					
1911-12 ..	281	1,968,375	13,040,000	6·63	2,053,840
1912-13 ..	288	1,908,240	10,270,000	5·38	1,374,550
1913-14 ..	294	1,811,700	12,180,000	6·72	1,731,000
Spain—					
1911-12 ..	32	83,085	780,000	9·39	92,000
1912-13 ..	32	92,500	1,160,000	12·59	173,500
1913-14 ..	31	127,415	1,220,000	9·55	160,000
Sweden—					
1911-12 ..	21	72,610	810,000	11·14	127,807
1912-13 ..	21	68,080	830,000	12·11	132,018
1913-14 ..	21	71,787	870,000	12·16	136,500

Recovery of spent lime from causticising operations [and in sugar factories]. Payne. *See* VII.

Molhant process of fermentation in the cane molasses distillery. Miroir. *See* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Fermentation ; Molhant process of —— in the cane molasses distillery. V. Miroir. Bull. Assoc. Chim. Sucr., 1914, 31, 936—940.

EXPERIMENTS made in a cane molasses distillery in Madeira with the Molhant process (this J., 1913, 956) showed it to possess the following advantages over the method of working generally in vogue : (1) the yield of alcohol is greater ; (2) the daily production is increased in consequence of the larger volume passing through the distillation columns ; (3) the steam consumption is less ; (4) the spent wash has a higher concentration and hence requires less evaporation to render it fit for utilisation ; and (5) it may be worked for nearly a year without the yeast being renewed.—J. P. O.

PATENTS.

Malting grain, and withering, drying and curing malt ; Machine for ——. J. Sleeman. Eng. Pat. 23,488, Oct. 17, 1913. (See also Eng. Pat. 22,204 of 1911 ; this J., 1912, 1091.)

A CLOSED rotary cylinder, with inlets and outlets for air and grain, is provided inside with an immovable perforated floor running from end to end, to support the whole charge during malting and curing, and one or more floors situated above, which can be removed or folded back against the internal walls of the cylinder, and on which part of the charge can rest during the withering and drying processes.—J. H. L.

Vessels for use in breweries, distilleries and the like ; Sterilising ——. G. W. Smallwood, St. Austell, Cornwall. Eng. Pat. 25,239, Nov. 5, 1913.

FERMENTING vats, refrigerators, etc., are coated on their interior with a composition consisting of 75 to 90% of kaolin and 10 to 25% of a solution of either formaldehyde (sp. gr. 1·080), calcium bisulphite (sp. gr. 1·070), or sulphurous acid (sp. gr. 1·030) ; the vessels are ready for use when the coating has dried.—W. P. S.

Brewers' filtering apparatus. O. Selg, New York. U.S. Pat. 1,101,098, June 23, 1914 ; date of appl., Feb. 16, 1914.

THE filtering vessel, provided with lid, manhole and sparging apparatus is made with a number of hopper-shaped sections at the bottom. Each section is composed of two inclined walls converging towards the bottom, leaving between their lower edges an opening which is closed by a horizontal perforated plate on hinges. The lower part of this trough is surrounded by a jacket the bottom of which is closed by a solid hinged plate corresponding to the upper perforated plate. The liquid which filters through the perforated plate is accumulated in the jacket and withdrawn through pipes situated at a high level in the external pocket. These pipes communicate with a main filtrate pipe provided with a vent which can be opened to the atmosphere when suction is not required. In each hopper-section is mounted a peaked presser-plate above the perforated plate which can be adjusted vertically by a rack so as to pack the lower layers of the filter-bed more or less closely against the plate.—J. F. B.

Alcohol ; Apparatus for the elimination of fusel-oils during the distillation and rectification of ——. F. Pampe, Halle-on-Saale, Germany. U.S. Pat. 1,116,322, Nov. 3, 1914. Date of appl., Aug. 8, 1905.

SEE Eng. Pat. 8476 of 1905 ; this J., 1906, 230.—T. F. B.

Process of manufacturing alcohol from garbage. U.S. Pat. 1,114,017. *See* XIXB.

XIXA.—FOODS.

Milk ; Composition of —— as shown by analyses of samples of known purity made by the Massachusetts State Board of Health. H. C. Lythgoe. J. Ind. Eng. Chem., 1914, 6, 899—908.

THE results of the examination, during the past six years, of 600—700 samples of milk of known purity are tabulated ; fairly complete analyses were made of nearly 500 of the samples, of which 434 were from individual cows and the remainder from herds. The composition of the milk varied chiefly according to the breed of the cow and only to a lesser extent with the period of lactation and the season. In the case of the milk from herds, the total solids ranged from 11·56 to 14·57% ; fat, 3·35—5·40% ; protein, 2·66—4·02% ; ash, 0·65—0·79% ; solids-not-fat, 7·63—9·48% ; lactose, 4·35—5·25% ; protein : fat ratio, 0·66—0·95 ; fat in total solids, 28·2—37·1% ; refraction of copper serum at 20° C. ; 36·7°—38·8° ; of acetic serum at 20° C., 41·8°—44·6° ; of sour milk serum at 20° C., 41·3°—43·5° ; ash of sour milk serum, 0·764—0·852 grm. per 100 c.c. The copper serum was prepared by adding 4 vols. of milk to 1 vol. of copper sulphate solution (72·5 grms. per litre, adjusted to give a reading of 36° at 20° C. on the scale of the Zeiss immersion refractometer or to the sp. gr. 1·0443 at 20°/4° C.), shaking well and filtering. The acetic acid serum was prepared by Leach and Lythgoe's method (this J., 1904, 1116) or by Pfyl and Turnau's modification (Arb. Kais. Ges., **40**, 247), 50 c.c. of milk being shaken with 5 c.c. of carbon tetrachloride in a shaking machine for 5 mins., then treated with 1 c.c. of 20% acetic acid, again shaken for 5 mins., centrifuged, and the clear serum poured off. Watering and skimming of milk may be detected within reasonable limits from the content of total solids and fat. The values for lactose are calculated with the aid of the formulæ :

$$\text{I. } S = TS - \left[F + 0{\cdot}7 + \left(TS - \frac{TS}{1{\cdot}34}\right)\right] ;$$

$$\text{II. } S = TS - \left\{F + 0{\cdot}7 + [0{\cdot}4(F - 3)] + 2{\cdot}8\right\},$$ where S=lactose, TS=total solids, F=fat, and 0·7=ash, and from these values a table is constructed for milks of fat content (horizontal columns) between 2·5 and 5·0% and content of total solids (vertical columns) between 10·5 and 13·6%. When the difference between the values calculated by the two formulæ does not exceed 0·1, the milk is regarded as pure and heavy dividing lines are drawn in the table to divide such milks from those in which the difference exceeds 0·1. Samples falling above the upper dividing line may be suspected of being skimmed and those falling below the lower dividing line of being watered. There is no relation between the refraction of the milk serum and the ash content of the sour serum, and if both values are below the minimum for pure milk, it is a positive indication of the presence of added water. If the protein-fat ratio exceed 1, skimming is indicated ; and if this ratio be below 0·7 or the percentage of fat in the solids be above 35, samples may be declared watered if the serum have a low refraction, not necessarily below the minimum value ; in normal milk with a protein-fat ratio below 0·7, the refraction of the copper serum should be above 37 ; of the sour serum, above 40 ; and of the acetic acid serum, above 41. (See also Richmond, this J., 1911, 1082 ; Ramsay, this J., 1913, 998.)—A. S.

Sucrose and lactose in condensed milk ; Determination of —— by means of acid mercuric nitrate. C. Revis and G. A. Payne. Analyst, 1914, 39, 476—479.

THE authors find that acid mercuric nitrate has a distinct inverting action on sucrose, even in the cold, and that it slightly raises the rotation of lactose : the inversion factor is 141·71 and the lactose factor 0·3086. The following method is recommended for the determination of the two sugars :—65·085 grms. of the condensed milk are placed in a 250 c.c. flask, diluted with water to about 220 c.c., and heated in boiling water for 10 minutes or allowed to stand over-night. The mixture is then diluted to the mark, 100 c.c. of the solution are treated with

10 c.c. of acid mercuric nitrate solution (mercuric oxide dissolved in twice its weight of nitric acid, sp. gr. 1·42, and then diluted to 5 times its volume with water) in a stoppered cylinder, shaken violently for about 30 seconds, and after standing for 5 minutes, filtered. The filtrate is polarised at 20° C. Twenty-five c.c. of the filtrate are then placed in a stoppered 50 c.c. flask, weighed, heated in boiling water for 8 minutes, cooled, the weight is adjusted, and the solution is polarised at 20° C. The readings are corrected for the increase in volume due to the added mercuric nitrate, less the volume of the fat and protein; this correction, C, will be :—

$$C = 10 - \left(\frac{(F \times 1{\cdot}11) + (P \times 0{\cdot}82)}{100} \times 26{\cdot}031\right)\text{c.c.,}$$

and the readings must be mutiplied by (C × 100). The following formulæ then give the percentages of sugars :—

$$\text{Sucrose} = \frac{(D-I) \times 100}{R_c - \frac{T}{2}} \quad \text{Lactose} = (D-S) \times \frac{R_L}{26.031} \times 100,$$

where D = direct reading; I = invert reading; R_c and R_L = the inversion and lactose factors, and T = the temperature of the invert reading.—W. P. S.

Grain dusts; Explosibility of ——. H. H. Brown. J. Ind. Eng. Chem., 1914, **6**, 934—937.

In laboratory experiments in the U.S. Bureau of Mines different grain dusts were tested by Wheeler's method (this J., 1913, 447) in the condition as received from the mill, without drying, and the ignition temperatures found varied from 995° C. oat and corn (maize) elevator dusts, 1015° C. for feed dust from dust collector, 1020° C. for ground oat hulls, 1025° C. for yellow-corn dust, to 1115° C. for wheat elevator dust and 1235°—1270° C. for flour dusts. Wheeler's method gives the relative ignition temperatures but not the relative inflammability, and to determine this an explosion flask of about 1400 c.c. capacity was used in which a dust cloud was driven against a platinum coil heated to a known temperature (measured by a thermo-couple), and the pressure developed measured by a Crosby pressure gauge. Experiments were made at 1200° C., 1100° C., 1000° C., and 900° C. respectively, and the results obtained are given in diagrams. Most of the grain dusts were more inflammable than the Pittsburgh coal dust used as a standard in the U.S. Bureau of Mines, higher pressures being developed, especially at the lower temperatures. Dusts from oats and yellow corn appeared to be more inflammable than those from wheat or other grain. The pressure developed was considerably increased when the dusts were previously dried. A large number of the recent explosions in grain mills appear to have been caused by the introduction of foreign material into grinding machines. The causes which have been assigned to many of these explosions and the various preventive measures which have been suggested are mentioned. (See also this J., 1912, 599, 699; 1913, 764, 808, 1080.)—A. S.

Chlorine-bleached flour; Some characteristics of ——. C. A. A. Utt. J. Ind. Eng. Chem., 1914, **6**, 908—909.

Unbleached flour may contain up to 576 parts Cl per million; flour bleached with chlorine contains over 600 parts per million. The chlorine in bleached flour can be detected by the copper wire flame reaction applied to the oil extracted from the flour by benzene (Alway, Bull. 102, Nebraska Expt. Stat., 53); unbleached flour which has been in contact with bleached flour may also give the reaction. The treatment with chlorine increases the acidity of the flour and does not improve its bread-making qualities.—A. S.

Phosphoric acid; The rapid determination of —— in dough, etc. L. Sobel. Schweiz. Woch. Chem. Pharm. 1913, **51**, 677. Chem.-Techn. Rep., 1914, **38**, 116.

25 grms. of dried and powdered dough are ground three times with 96% alcohol (100 c.c. each time), the extracts being filtered and the residue washed with alcohol till 300 c.c. of solution are obtained. An aliquot part of the solution is evaporated with 2 to 3 grms. of magnesium chloride and 3 grms. of potassium nitrate and incinerated. The ash is dissolved in dilute hydrochloric acid and the phosphoric acid estimated as ammonium magnesium phosphate.—J. B.

Prussian blue in tea; Determination of ——. C. W. Knight. J. Ind. Eng. Chem., 1914, **6**, 909—910.

One hundred grms. of the finely powdered tea are thoroughly moistened with 85% phosphoric acid (30—40 c.c.) and the mixture distilled, the vapours being passed into a mixture of 4 c.c. of 10% caustic soda solution and 30—40 c.c. of water contained in a flask placed in cold water. When the distillation is finished, the contents of the receiver are filtered, neutralised, if necessary, with 10% caustic soda solution and 3 c.c. excess of the alkali, a small crystal of ferrous sulphate, and a few drops of 10% ferric chloride solution added. The mixture is boiled for 1 minute, made distinctly acid with hydrochloric acid of sp. gr. 1·2, filtered, and the precipitate washed with 95% alcohol. It is then treated successively with about 4 c.c. of 10% caustic soda solution and 8 c.c. of water, the solution acidified with acetic acid, treated with a few drops of hydrochloric acid and of ferric chloride solution and then with hydrochloric acid until no brown coloration remains. The solution is evaporated to half its bulk, diluted somewhat, and the Prussian blue collected in a Gooch crucible, washed with very dilute hydrochloric acid, water, alcohol, and ether, dried at 100° C. and weighed. One part of Prussian blue in 200,000 and, in some cases, in 300,000 can be detected by the method, and in two independent determinations on the same sample, 0·0019 and 0·0016% respectively were found. —A. S.

Diastase of alfalfa; An investigation of the —— and the effect of rapid curing on the food value of alfalfa. R. C. Shuey. J. Ind. Eng. Chem., 1914, **6**, 910—919.

The diastatic activity of alfalfa is greater in the morning or after a period of darkness than after a period of exposure to light; much greater during summer than during the spring or autumn; and greater in young plants than in older ones. For example, in the case of the plant dried at 50° C. the activity (grms. of maltose produced from soluble starch by 1 grm. of sample in 1 hour at 40° C.) was 0·92 in the evening and 1·25 in the morning; for plants cut in the morning, the activity was 0·75 in May, 0·84 in July, 1·51 in August, and 1·25 in October; and in the case of plants 12 ins. and 6 ins. high, cut in November, the activities were 1·03 and 1·24 respectively. The activity is diminished by drying at elevated temperatures (even 50° C.) in a humid atmosphere, but markedly increased by drying in a current of air with gradually increasing temperature. The conditions which favour the production of hay of good colour and odour are also favourable to high diastatic activity. Light and weathering in the field tend to destroy the diastase and rain during curing is very detrimental. Alfalfa of high diastatic activity generally shows a greater solubility by auto-digestion than samples low in diastase, but the degree of solubility cannot be increased beyond a certain limit. The loss of digestible constituents during the handling and curing of alfalfa in the field may range from 20 to 30%. Hay of better colour, odour and flavour can be produced by curing by artificial heat on the counter-current principle than by other means, and the hay appears to retain many of the valuable properties of the green plant ordinarily lost in curing. With a dryer located near both the field and the source of fuel, the cost of artificial drying would be less than the losses generally sustained in field curing.—A. S.

Patents.

[*Margarine manufacture.*] *Production of emulsions.* S. H. Blichfeldt, Southall, Middlesex. Eng. Pat. 23,653, Oct. 18, 1913. (See also Eng. Pat. 7498 of 1912; this J., 1913, 763.)

One ingredient is passed through a continuous narrow channel the walls of which move relatively to one another, and the second ingredient is introduced at successive points in the channel. In the apparatus described a disc rotates within a fixed casing, with only a narrow, adjustable, space (10—100μ) between the sides of the disc and the walls of the casing. One ingredient is introduced into this space at the centre of the disc, and travels to the circumference. The second (fatty) ingredient is injected through passages in the walls of the casing, at successive distances from the centre. To ensure an equal pressure on the liquid at both sides of the disc, the latter is perforated by concentric slots, and rides loosely on the driving shaft. The second ingredient is supplied from a revolving tube, geared from the main shaft and provided with outlets which register intermittently (and at different times for different distances from the centre of the disc) with the passages in the walls of the casing. The slots in the disc are so disposed as to face the passages through which liquid is at any given time being injected, so that the liquid passes freely to both sides of the disc.—J. H. L.

Liquids [milk, cream, butter fat, etc.]; Device and process for treating ——. A. O. Fox and R. R. Bates, Assignors to General Purification Co., Madison, Wis. U.S. Pats. (A) 1,114,874 and (B) 1,114,875, Oct. 27, 1914; date of appl., July 9, 1913.

(A) The apparatus comprises a receptacle for the liquid, means for forcing gas under pressure (upwards) into the receptacle, and a stationary device below the surface of the liquid provided with inclined faces separated at their edges so that the rising gas is divided and deflected. The receptacle may be provided near the top with a device for obstructing passage of the liquid out of the apparatus. (B) Air admixed with hypochlorous acid, *e.g.*, by passage through aqueous solutions of unstable hypochlorites, is forced under pressure through milk, cream, butter fat, etc.—J. H. L.

Food for animals and process for the manufacture of the same. The Molassine Co., Ltd., East Greenwich, and J. J. A. de Whalley, Lee, Kent. Eng. Pat. 24,912, Nov. 1, 1913.

Amylaceous material, such as middlings or maize residue, is treated with 2% of its weight of sulphur dioxide in the form of an aqueous solution, and heated for 15 minutes under a pressure of 4 atmospheres. The steam and acid are then blown off, any remaining acid is neutralised by the addition of calcium carbonate or sodium carbonate, and the product is dried and ground.—W. P. S.

Lard substitute [hydrogenised oil]; Process of making ——. J. C. Chisholm, Assignor to The Chisholm Process Oil Refining Co., Dallas, Tex. U.S. Pat. 1,114,963, Oct. 27, 1914; date of appl., Oct. 8, 1912. (See also this J., 1914, 1062.)

The oil is caused to pass by centrifugal action through curved passages formed by spirally-wound coils of wire, the surface of the wire forming a catalytic agent; the operation is carried out in an atmosphere of hydrogen. —W. P. S.

Canned foods; Process for preventing the spoilage of ——. E. W. Duckwall, Aspinwall, Pa. U.S. Pat. 1,114,972, Oct. 27, 1914; date of appl., March 29, 1913.

Sample tins of a stock of canned foods are incubated for a suitable length of time, then opened, and a portion of the substance from the centre of the tin is examined bacterioscopically. Should the presence of bacteria be detected, the remainder of the tins are heated in boiling water for a period of time sufficient to heat the contents throughout to not less than 180° F. (82° C.).—W. P. S.

XIXb.—WATER PURIFICATION; SANITATION.

Filtration of drinking water: Biological results of the rapid ——. R. Kolkwitz. J. Gasbeleucht., 1914, **57**, 724—726.

Experiments in connection with an investigation of the Barmen valley water led to the adoption of a new method of clarification. A water can be made clear and rendered free from suspended matter by passing through a silk net or a very fine copper sieve with 10,000 meshes per sq. cm. An uninfected water may be considered as clarified by rapid filtration when it contains not more than 1 c.c. of suspended matter per cub. m., the suspended matter being matter larger than $\frac{1}{15}$ mm. In a laboratory test, 50 litres of the water are filtered and should not yield more than 0·05 c.c. of suspended matter. Under the low powers of the microscope the filtered water can be seen to contain *Asterionella*, *Synedra*, *Gymnodinium*, etc. A clarity test for the filtered water can be carried out in a tube 10 m. long with its ends closed by glass plates; when this tube is filled with the water, a candle flame held at one end should be visible through the water from the other end.—J. H. J.

Hard water; Taste of ——. A. Friedmann. Z. Hyg. u. Inf. Krankh., **77**, 125—142. J. Gasbeleucht., 1914, **57**, 452.

Carbon dioxide was dissolved in pure distilled water at 15°—17° C. With up to 116 mgrms. per litre no effect was produced, but with from 116 to 246 mgrms., the opinions of different persons varied as to the taste. In hard water, carbon dioxide could be tasted in much smaller concentration than in distilled water; 52·5 mgrms. per litre were detected in water of 36·4° hardness (German) at 14·2° C. A water with 173 mgrms. per litre of free CO_2 was returned as distinctly acid. The taste of distilled water containing free CO_2 became suspicious at 126 mgrms. per litre and this uncertainty continued up to about 260 mgrms. The earlier suspicions of taste were described by the term "refreshing."—J. H. J.

Lead poisoning caused by a water-supply. M. Neisser. Gesundheits-Ingenieur, 1913, 920; J. Gasbeleucht., 1914, **57**, 139.

Numerous cases of more or less severe lead poisoning occurring in a village were found to be caused by the water supply containing lead. The mains and service pipes were made of lead and the water was found to contain from 7·7 to 12·5 mgrms. Pb per litre; the pipes themselves were coated inside with a thin white film consisting of 96% of lead carbonate. The lead could be removed from the water by filtration through a Berkefeld filter. The water having this action on the lead pipes contained:—Cl 1·5, N_2O_5 12·0, dissolved O_2 10·1, free CO_2 18·6 mgrms. per litre. The carbonate-hardness of the water was 0·64° (German), and neither nitrite nor ammonia were present.—W. P. S.

Sewages; Biochemical oxygen demand of ——. A. Lederer. J. Ind. Eng. Chem., 1914, **6**, 882—888.

An account is given of co-operative work by members of a sub-committee of the Laboratory Section of the American Public Health Association appointed to consider the standardisation of a test for determining the oxygen-consuming capacity of a sewage. Experiments were made with various modifications of the incubation method recommended by the English Royal Commission on Sewage Disposal (compare this J., 1912, 1197; 1913, 265). No completely satisfactory results were obtained, but the following "Modified English Incubation Test" is to be recommended for adoption as a provisional method at the next annual meeting of the American Public Health Association. A definite volume of sewage or effluent is mixed with aerated distilled water or tap water, free from nitrates and nitrites, in such proportion that between 30 and 60% of the available oxygen is consumed when the mixture is incubated for 10 days at 20° C. The water for diluting should be stored for 1 or 2 days at 20° C. before use. For the incubation a bottle of 250 c.c. capacity, with a seal such as is often used for the Methylene Blue putrescibility test, is employed. If it be desired to use a shorter period of incubation, then the percentage ratio of absorption for 1, 5 and 10 days, at the proper concentration, at various times, must first be determined for the particular dry weather flow sewage, in order to ascertain the factors for calculating results obtained by incubation for 24 hours into those obtainable after 5 or 10 days. The results should be expressed in mgrms. of oxygen absorbed per litre of crude sewage or effluent, and they should be given for periods of 24 hours and 10 days respectively to facilitate comparison of different sewages.—A. S.

Methane; Physiological effect of ——. O. Rybak. Braunkohle, 1914 [5], 72—73. J. Gasbel., 1914, **57**, 624—625.

THE bodies of persons killed in firedamp explosions do not show signs of suffocation. Experiments made with gas from a mine, containing CH_4, 92·5; CO_2, 1·0; O_2, 1·6; and N_2, 4·9%, showed that methane produces a slight narcotic effect, not however sufficient to show marked symptoms unless other predisposing conditions are present, such as lack of oxygen or excess of carbonic acid in the blood.—A. T. L.

Lead and zinc smelters; Working and health conditions of —— in Germany. Metall und Erz, 1914, **11**, 1—9.

FROM 1879—1885 out of 1200 men engaged directly in zinc smelting there were 427 cases of lead colic, with a maximum of 221 in 1881. During 1896—1901 in five large works employing on an average 3780 workers there were 83 cases giving a yearly average of 2·2%. Since 1900 official statistics have been collected of the age and illnesses of smelters. Statistics for the district of Oppeln show that from 1901—1912 the working age has steadily increased, and the cases of lead colic and lead palsy combined are now approximately 1·2% of the workmen engaged. Disease is reduced by providing larger rooms, good lighting and ventilation, abstraction of poisonous gases; by working short hours, and by sobriety. The illnesses which are particularly noted are lead colic and palsy, nephritis, stomach and intestinal catarrh, blood poorness, rheumatism, and affections of the respiratory organs and of the eyes.—W. F. B.

Larkspur seed; Insecticidal value of fluid extract of ——. J. B. Williams. Amer. J. Pharm., 1914, **86**, 414—416.

THE insecticidal properties of larkspur seeds (*Delphinium ajacis* L.) are due to the oil contained therein, and only to a slight extent to the alkaloid. Extracts prepared with solvents which remove the oil, such as alcohol or light petroleum, give the best results.—F. SHDN.

Corrosive action of electric currents on gas and water mains. Herrmann. *See* IIA.

Gas lighting and hygiene. Von Gruber. *See* IIB.

Explosibility of grain dusts. Brown. *See* XIXA.

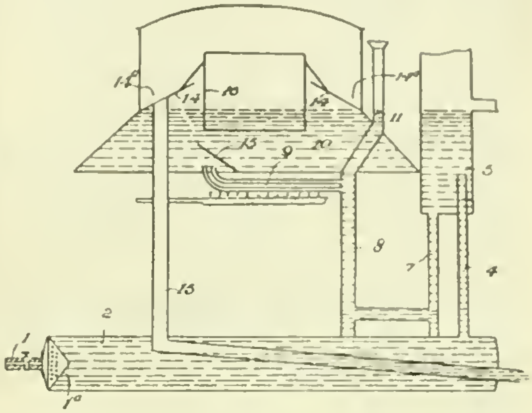
PATENTS.

Water softening plant; Carbonating apparatus for ——. G. W. Bemrose, Bolsover, Derbyshire. Eng. Pat. 12,413, May 20, 1914.

AN apparatus for carbonating the softened water in the Archbutt-Deeley process. In the discharge pipe from the upper softening tank to the lower storage tank is placed a perforated disc for breaking up the flow of water into fine streams. A pipe conveying combustion gases from a coke stove enters the discharge pipe above the perforated disc and is bent downwards to pass through the centre of the disc. The mouth of this pipe is closed and around it are two perforated rings of different diameters, one above the other, communicating with the interior of the pipe. The fine streams of water falling from the perforated disc draw the combustion gases through perforated rings. The water collects in a bucket which closes the end of the discharge pipe, and there solution of the gases takes place. The bucket is situated inside the storage tank and the water overflows from it into the tank.—J. H. J.

[*Water.*] *Distilling apparatus.* R. Bassett and J. H. Staples, Wincanton, Somerset. Eng. Pat. 14,807, June 19, 1914.

WATER enters through the pipe, 1, and the rose, 1*a*, into the cooler, 2, and rises up the pipe, 4, to the constant level chamber, 5. It then passes by the pipes, 7, 8, to the preheater, 9, any gas given off escaping through the pipe, 11. The baffles, 13, 14, 16, prevent the water splashing when it enters the still proper, 10. The vapour given off is partly condensed by contact with the cover and collects in the gutter, 14*a*, and along with any uncondensed vapour passes down the pipe, 15, to the cooler.—W. H. C.



Filtered water from rivers; Apparatus for obtaining ——. M. H. Adams, Whitefield, Lancs. Eng. Pat. 24,284, Apr. 25, 1914.

IN an improved screening apparatus, a basin is made in the river and a rotating disc or wheel placed in the semi-circular entrance to the basin so as to be one-third immersed. Sheets of wire gauze are fitted between the spokes of the wheel. As the wheel rotates the portion of the gauze above the water is cleaned by a water-jet or other suitable method, the material which is removed falling into a trough. A suction pipe conveys the filtered water from the basin.—J. H. J.

Sewage; Treatment of ——. J. O. Böving and Wetcarbonising, Ltd., London. Eng. Pat. 25,056, Nov. 3, 1913.

AN improvement on Eng. Pat. 3247 of 1911 (this J., 1912, 601); the heated sewage or sludge, before being pressed, is passed through a cooling coil to cool it to 30° C., and then into tanks where it is allowed to settle for 4—6 hrs., after which the supernatant liquid is run off. The sludge thus obtained can be pressed more completely and quickly than directly after heating.—J. H. J.

Liquids [sewage, etc.]; Purification of ——. M. Janvier et Cie., Paris. Eng. Pat. 27,775, Dec. 2, 1913. Under Int. Conv., Feb. 3, 1913. Addition to Eng. Pat. 29,192 of 1912 (this J., 1913, 922).

IN apparatus of the kind described in the main specification (*loc. cit.*) the bacterial filter consists of a number of superposed tanks or boxes arranged in a chamber and filled with filtering material; the bottom of each tank is perforated and is turned upwards so as to form one side of the tank, leaving a space between the latter and the inner wall of the chamber. The spaces are arranged alternately on opposite sides so that a current of air may pass upwards and from side to side of the chamber and over the surface of the material in the tanks. A tilting bucket delivers the liquid over a corrugated and perforated plate situated above the uppermost tank.—W. P. S.

Clarifying apparatus for liquids. W. Reid, Hamilton, Lanarkshire. Eng. Pat. 29,184, Dec. 18, 1913.

The clarifying tank is divided into a series of compartments of inverted triangular section, with baffle-boards suspended along the centre of each triangle. The liquid to be clarified enters from a channel along one side of the tank, flows down the sloping side of the first triangle, under the baffle-board, and up the other sloping side into the next compartment. The suspended solids are removed on the sloping sides of the triangles and settle in the apices. Along each apex is a worm conveyor for removing the solids to the end of each compartment and up an inclined plane, and so out of the tank.—J. H. J.

Sewage and analogous liquids; Apparatus for the purification [aeration] of ——. W. Jones and Jones and Attwood, Ltd., Amblecote, Worcestershire. Eng. Pat. 19,915 of 1914; date of appl., Oct. 11, 1913.

A pipe, reaching nearly to the bottom of a tank containing the sewage, extends over a partition to the bottom of a second tank; compressed air is delivered into the end of the pipe in the first tank, thus causing a mixture of liquid and air to pass over into the second tank; the lower end of the pipe in this tank ends in a perforated chamber which distributes the air into the liquid. A supplementary volume of air is introduced into the descending pipe in the second tank.—W. P. S.

Refuse destructor and like furnaces. A. B. Scorer and Meldrums, Ltd., Manchester. Eng. Pat. 28,336, Dec. 9, 1913.

In a furnace having a doorway the full width of the grate, the clinker is withdrawn by means of a rake mounted in front of the doorway; the furnace is also fitted with a movable back plate so that the head of the rake may be placed behind the clinker.—W. P. S.

Alcohol from garbage; Process of manufacturing ——. J. J. Morgan, Chicago, Ill. U.S. Pat. 1,114,017, Oct. 20, 1914; date of appl., Sept. 20, 1909.

The garbage is heated with a dilute acid until the carbohydrates are hydrolysed to dextrose; the acid is neutralised, the dextrose fermented, and the alcohol distilled.—C. A. M.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Belladonna seed; Germination of ——. A. F. Sievers. Amer. J. Pharm., 1914, 86, 483—505.

The germination of belladonna seeds is accelerated by exposure to a freezing temperature indicating the advisability of autumn instead of spring sowing. There appears to be no relationship between the size of the seed and its germinating power. Seeds which sink in water are far better than those which float, only a very small percentage of the latter germinating. When drying the berries should be thinly scattered in a well-ventilated room to avoid mould as far as possible. The vitality of the brown and gray seeds is the same. There is no great advantage in immersing the seeds in concentrated sulphuric acid for 1—10 minutes. Soaking in a 60% solution of commercial hydrogen peroxide for 18—24 hrs. was found to be very effective in increasing the germinating power. Shaking the seeds with powdered glass or rubbing with emery paper has a good effect, which is not nearly so great, however, as that produced by treatment with hydrogen peroxide.—F. Shdn.

Rhamnus Purshiana [Cascara sagrada]; its history, growth, methods of collection and bibliography. C. W. Johnson and E. Hindman. Amer. J. Pharm., 1914, **86**, 387—413.

Rhamnus Purshiana (bearberry, barberry, *Cascara sagrada*) was discovered on one of the tributaries of the Columbia River in Montana in 1805 or 1806. It is found in commercial quantities on the west slope of the Cascade Mts. of Southern British Columbia, Washington, Oregon, and Northern California, at altitudes varying from sea-level to 1800—2000 feet. It grows best on a light sandy soil where there is plenty of moisture, reaching a height of 20—30 ft. and a diameter of 6—8 ins. in about 10 years. Trees of over 4 ins. diameter are felled and the bark peeled during the months of April to September, curing being effected by a few days' exposure to sunshine. The annual production during the decade ending with 1912 averaged about 600 tons. It was first used as a medicine in 1872. —F. Shdn.

Oils of the Coniferae. III. Leaf and twig and cone oils of Western yellow pine (Pinus ponderosa, Laws.) and sugar pine (P. lambertiana, Dougl.). A. W. Schorger. J. Ind. Eng. Chem., 1914, **6**, 893—895. (See also this J., 1914, 1072.)

The results obtained are summarised in the following table:—

	Western yellow pine.			Sugar pine.	
	Leaf oil (10 samples).	Leaf and twig oil (4 samples).	Cone oil.	Leaf and twig oil (7 samples).	Cone oil.
Yield, %	0·040—0·115	0·084—0·126	0·063	0·045—0·120	0·318
Sp. gr. at 15° C.	0·8718—0·8849	0·8755—0·8844	0·8757	0·8676—0·8738	0·8692
Refract. index at 15° C.	1·4789—1·4832	1·4805—1·4838	1·4789	1·4777—1·4795	1·4771
α_D at 20° C.	—15·73° to —19·59°	—15·94° to —17·26°	—11·48°	—11·07° to —16·50°	—23·18°
Acid value	0·85—2·36	0·67—0·87	1·27	0·68—2·38	0·63
Ester value	3·88—7·83	5·89—8·10	7·20	2·22—5·91	3·75
Ester value after acetylation	24·11—35·10	25·14—35·68	22·41	23·25—32·04	17·04
Percentage composition :—					
Furfural	—		trace	trace	trace
l-α-Pinene	2		6	21	22
l-Camphene	—		—	—	21
l-β-Pinene	75		60	51	39—40
Dipentene	6		12—13	12	4—5
Ester, as bornyl acetate	2		2·5	1·5	1·5
Free alcohol (*l*-borneol)	7		4	8	3·5
" Green oil "	3		3—4	1	—
Sesquiterpene (?)	—		—	—	1

—A. S.

Emodin-bearing drugs in presence of phenolphthalein; Detection of ——. L. E. Warren. Amer. J. Pharm., 1914, 86, 444—449.

Phenolphthalein in medicines interferes with the test for emodin-bearing drugs (reddish coloration when the washed benzene extract is treated with dilute ammonia). It can be removed by extracting the evaporated material with ether or acetone, removing the solvent, dissolving the residue in dilute caustic soda and adding iodine solution, followed by hydrochloric acid, which precipitates tetraiodophenolphthalein. After cooling for an hour below 15° C. the tetraiodophenolphthalein is filtered off, excess of iodine in the filtrate removed by sodium sulphite, the solution extracted with chloroform and the chloroform extract treated with caustic soda. The fluid extracts of cascara, rhubarb and senna, but not aloes, give characteristic colorations. Chrysophanic acid may be detected in presence of phenolphthalein by Bailey's method (this J., 1914, 500).—T. C.

Eucalyptus oils ; Determination of the cineol content of ——. H. G. A. Harding. Analyst, 1914, 39, 475—476.

The resorcinol method (see this J., 1908, 90) is unreliable when applied directly to eucalyptus oil ; more satisfactory results are obtained when the portion of the oil distilling between 170° and 190° C. is used, but even then the results are too high when the cineol content exceeds 50%. In such cases the cineol content should be reduced to about 40% by the addition of the fraction of oil of turpentine distilling between 156° and 160° C. ; the use of ordinary oil of turpentine tends to introduce serious errors. The following procedure is recommended :—100 c.c. of the oil are distilled, the portion distilling between 170° and 190° C. being collected separately and diluted to 100 c.c. with the fraction of oil of turpentine, b. pt. 156° to 160° C. A preliminary determination of the cineol in this solution will show whether further dilution is required. Having noted the temperature, from 6 to 10 c.c. of the solution are shaken with warm 55% resorcinol solution in a 100 c.c. flask having a graduated neck : after 5 minutes' shaking, more resorcinol solution is added so as to bring the oil into the graduated neck, the mixture is cooled, and the volume is read.—W. P. S.

Camphor and certain essential oils ; Rapid method for the determination of —— *when in solution in alcohol.* W. B. D. Penniman and W. W. Randall. J. Ind. Eng. Chem., 1914, **6**, 926—928.

For solutions containing 7—15% of camphor or essential oil, 5 c.c. are placed in a Babcock milk bottle, which is then filled nearly to the neck with calcium chloride solution of sp. gr. 1·37. After shaking, 1 c.c. of gasoline (b. pt. 40°—60° C.) is added, the mixture shaken, and made up with calcium chloride solution to near the top of the graduated part of the neck of the bottle. The bottle is then stoppered, shaken violently and whirled in a centrifuge at high speed for 5 mins. If the aqueous solution is still cloudy, the bottle is again shaken and whirled. The volume of the gasoline solution, read off between the lowest point of the lower and the extreme edge of the upper meniscus, is equal to the sum of the volumes of the gasoline and the dissolved camphor or oil. For solutions containing less than 7% of camphor or oil, 10 c.c. are used and a quantity of gasoline not more than twice the volume of the camphor or oil present. Satisfactory results have been obtained by this method with spirit of camphor, and alcoholic extracts prepared from peppermint, lemon, sweet orange, anise and nutmeg oils.—A. S.

Extractions by means of immiscible solvents ; Study of the methods for —— *from the point of view of the distribution coefficients. II.* J. W. Marden and V. Elliott. J. Ind. Eng. Chem., 1914, **6**, 928—934.

Further experiments on the lines described previously (this J., 1914, 501) have shown that for extracting aconitine and codeine from aqueous solution chloroform is preferable to ether ; that chloroform is preferable to mixtures of chloroform and ether for extracting strychnine ; and that ether is a satisfactory solvent for extracting cocaine. In the known methods for the extraction of morphine, it is necessary to shake with the solvent many times in succession to obtain accurate results, but by means of the distribution coefficient it is possible to calculate the total quantity present in the aqueous solution from the amount removed in the first extraction. If *d* be the distribution coefficient, *a* the volume of aqueous solution, and *c* the volume of immiscible solvent, the *fraction* $\left(\frac{x_1}{x_0}\right)$ of material left in the aqueous liquid after one extraction is $\frac{da}{e+da}$, and if W be the weight of substance removed in this extraction, the total quantity present is equal to $\frac{W}{1-\frac{x_1}{x_0}}$. This method gave satisfactory results when applied to the determination of morphine, acetanilide, and saccharin by extraction with a mixture of chloroform and amyl alcohol (3 : 1), chloroform, and amyl acetate respectively.

Experiments with lemon oil and alcohol showed that in the preparation of "terpeneless" lemon extract a larger proportion of citral would be extracted by using 50% in place of 45% alcohol.—A. S.

Radium in therapeutics ; Local application of ——. J. Joly. Scient. Proc. Roy. Dublin Soc., 1914, **14**, 290—296.

To secure better "illumination," small quantities of radium or the purified emanation are sealed in glass capillaries and several of these are applied to the diseased region or inserted by means of needles. Thus instead of a tube containing 200 millicuries of emanation, 20 needles each containing 10 millicuries could be used without any lead screens.—F. Shdn.

Calomel in tablets ; Determination of ——. J. W. Marden and O. E. Cushman. Amer. J. Pharm., 1914, **86**, 511—516.

A quantity of the tablets corresponding to 0·2—1·0 grm. of calomel is triturated with 30 c.c. of water, acidified with nitric acid and sodium peroxide added in small portions till gray metallic mercury separates, when about 1 grm more of the peroxide is added. After heating for a few minutes the mercury is filtered off and washed. The filtrate and washings are made strongly acid with nitric acid, excess of *N*/10 silver nitrate added, the whole shaken well, and the excess of silver titrated with potassium thiocyanate solution.—F. Shdn.

Ash content of drugs ; Proposed limitation of —— *for the United States Pharmacopœia IX.* M. I. Wilbert. Amer. J. Pharm., 1914, **86**, 456—460.

The proposed limitations for the percentage of ash in a large number of drugs for the U.S.P. IX. are tabulated, with the corresponding ash limits in the German, Austrian, Swiss, and Dutch Pharmacopœias, together with the variations in the ash reported in recent literature.—T. C.

Patents.

Chlor-methyl-omega-brom-propyl carbinol and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis. U.S. Pat. 1,114,734, Oct. 27, 1914. Date of appl., July 14, 1913.

A chloromethyl-ω-bromopropylcarbinol of the formula, $ClCH_2.CH(OH).CH_2.CH_2.CH_2Br$, is obtained by condensing bromo-ethyl magnesium bromide, $Br.CH_2.CH_2.MgBr$, with epichlorhydrin. For example, one mol. of magnesium is dissolved in an absolute ethereal solution of ethylene bromide, one mol. of epichlorhydrin is added, and the carbinol is liberated by treatment with a suitable acid. —T. F. B.

Ketone and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis. U.S. Pat. 1,114,735, Oct. 27, 1914. Date of appl., July 14, 1913.

The carbinol described in U.S. Pat. 1,114,734 (see preceding abstract) is oxidised, *e.g.*, by means of potassium bichromate and sulphuric acid, to produce the ketone, $ClCH_2.CO.CH_2.CH_2.CH_2Br$.—T. F. B.

Acetylsalicylic acid ; Process for preparing halogen-alkyl esters of ——. R. Wolffenstein. Ger. Pat. 276,809, Dec. 20, 1911. Addition to Ger. Pat. 245,533 (this J., 1912, 661).

Polyhalogen-alkyl esters of salicylic acid are treated with acetylating agents; for example, the trichloro-tertiary butyl ester of salicylic acid is heated with acetic anhydride and anhydrous sodium acetate at 160°—180° C., and the product is treated with water and sodium carbonate solution and finally extracted with ether, which dissolves the ester. (See also Ger. Pat. 246,383 and Eng. Pats. 27,562 of 1911 and 5811 of 1913 ; this J., 1912, 661 ; 1913, 1169).—T. F. B.

Acidylsalicylic acids ; Process for preparing halogen-alkyl esters of ——. R. Wolffenstein. Ger. Pat. 276,810, March 22, 1912. Addition to Ger. Pat. 245,533.

Polyhalogen-alkyl esters of salicylic acid are treated with acidylating agents other than those which introduce the acetyl group.—T. F. B.

Organic selenium compounds ; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 276,976, Nov. 2, 1912.

Organic compounds containing selenium are obtained by treating unsaturated fatty acids with selenium-halogen compounds. For example, a mixture of 28 parts of oleic acid and 5·6 parts of selenium tetrachloride is heated, and when the reaction is finished the product is extracted with ether and the extract distilled ; a thick, reddish-brown oil is obtained.—T. F. B.

Oleum cadinum ; Preparation of light-coloured, nearly odourless, non-irritant products from ——. I. Bugarszky, L. Török, and Dr. Kereszty, Dr. Wolf es tsa Vegyészeti Gyár R. T. Ger. Pat. 277,061, Dec. 12, 1912.

Oleum cadinum is fractionated in a vacuum of about 20 mm., to obtain the fraction (about one-third of the oil) of b. pt. 220°—300° C. ; this fraction contains the whole of the constituents of medicinal value, and is a yellow, highly viscous oil with a pleasant, non-penetrating odour, which does not possess irritant properties (compare Ger. Pat. 236,446 of 1910 ; this J., 1911, 1088).—T. F. B.

Double salts of gold hydrocyanic acids and process of making same. G. Spiess and A. Feldt, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,115,608, Nov. 3, 1914. Date of appl., Jan. 16, 1914.

See Eng. Pat. 1837 of 1914 ; this J., 1914, 767.—T. F. B.

Dicantharidylethylenediamin-mono-aurocyanide and process of making same. G. Spiess and A. Feldt, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,115,609, Nov. 3, 1914. Date of appl., Jan. 16, 1914.

See Ger. Pat. 269,661 of 1912 ; this J., 1914, 375.—T. F. B.

Salts of the aurothiosulphuric acid and process of making same. G. Spiess and A. Feldt, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,115,610, Nov. 3, 1914. Date of appl., Jan. 16, 1914.

See Eng. Pat. 1869 of 1914 ; this J., 1914, 806.—T. F. B.

Metal colloids ; Production of ——. H. Crookes and L. Stroud, London. U.S. Pat. 1,116,247, Nov. 3, 1914. Date of appl., Dec. 8, 1913.

See Eng. Pat. 28,776 of 1912 ; this J., 1914, 86.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives ; Thirty-eighth Annual Report of H.M. Inspectors of —— *for* 1913. [Cd. 7650.]

In 1913 there were 33 factories and 85 magazines under continuing certificate, and 103 factories and 363 magazine under licence ; 222 visits were paid to factories and 419 to magazines. *Packing and conveyance :* There has been no alteration in the regulations, apart from a circular of Oct. 20 concerning "Explosive Corks" (alarm cork cartridges). *Importation :* The number of licences granted was 178, as compared with 159 in 1912 and 160 in 1911. The importations were :—

		1912.	1913.
Nitroglycerin explosives	lb.	605,281	1,576,081
Non-nitroglycerin explosives	,,	57,321	51
Detonators	,,	147,610	149,201
Fireworks	,,	876,020	814,882

Imported and transhipped to other countries :—1913 : 1,107,927 lb. nitroglycerine explosives, and 20,910 lb. detonators.

Chemical Advisers' Report : 345 samples were passed by Messrs. Dupré out of 506 examined ; 86 were rejected for wrong composition, 19 for failure to pass heat test, and 17 for exudation; 8 were examined in connection with supposed outrages. *Accidents :* There were 498 accidents in 1913 (456 in 1912) :—

	Totals.	Deaths.	Injured persons.	Accidents not causing death or injury.
Manufacture	86	13	50	46
Keeping	6	4	7	1
Conveyance	3	1	1	1
Use and miscellaneous	403	48	427	2
	498	86	485	50

The number of deaths is above the average, 55·1, for the last ten years.—O. E. M.

Sixth report of the Explosions in Mines Committee. See IIa.

Explosibility of grain dusts. Brown. *See* XIXa.

Explosives in the United States ; Production of —— *in* 1913. U.S. Bureau of Mines. Oil, Paint, and Drug Rep., Nov. 16, 1914. [T.R.]

The total production of explosives in the United States during 1913, according to the figures received from manufacturers, was 463,514,881 pounds (231,757 short tons), as compared with 489,393,131 pounds (244,696 short tons) for 1912. This production is segregated as follows :—Black powder, 194,146,747 pounds ; "high" explosives other than permissible explosives, 241,682,364 pounds, and permissible explosives, 27,685,770 pounds. These figures represent a decrease of 36,146,622 pounds of black powder, and an increase of 7,212,872 pounds of high explosives and 3,055,500 pounds of permissible explosives. In 1902 11,300 pounds of permissible explosives were used in coal mining, whereas in 1913 the quantity so used was 21,804,285 pounds. The total amount of explosives used for the production of coal in 1913 was 209,352,938 pounds. The use of permissible explosives in coal mining has had gratifying results, and few, if any, serious accidents can be attributed directly to their use.

XXIII.—ANALYTICAL PROCESSES.

Potassium ; Volumetric determination of small quantities of ——. L. Zaleski. Landw. Versuchsstat., 1913, **83**, 221. Chem.- Techn. Rep., 1914, **38**, 357.

The potassium is precipitated as cobalt-potassium nitrite as recommended by de Konincks. The reagent is made by dissolving 25 grms. of cobaltous nitrate in 500 c.c. of water with 12·5 c.c. of nitric acid, mixing the solution with an equal volume of 30% sodium nitrite solution, and filtering.

The reagent is added, drop by drop, to the potassium solution, a considerable excess being used, and the solution allowed to stand for 12—24 hrs. before filtering. The potassium factor is determined by a parallel experiment. The method is not suitable for the analysis of manures containing very small quantities of potassium.—A. T. L.

Mercury; Volumetric determination of ——. J. E. Clennell. Eng. and Mining J., Oct. 31, 1914, 787—789.

A RAPID and accurate method for the determination of mercury is based on the precipitation of mercuric oxide by excess of sodium hydroxide, re-solution of the precipitate in a measured excess of standard potassium cyanide solution, and titration of the excess of the latter with a standard silver nitrate solution. Potassium iodide added to the solution serves as indicator, and the end point is marked by the appearance of a yellowish turbidity due to silver iodide. The following reactions are involved:—

$$HgO+4KCN+H_2O=K_2Hg(CN)_4+2KOH;$$
$$K_2Hg(CN)_4+AgNO_3=Hg(CN)_2+KAg(CN)_2+KNO_3.$$

In the case of samples containing mercurous oxide, the mercury can usually be completely dissolved by a preliminary treatment with saturated bromine water. The excess of bromine must be completely removed by boiling before adding the sodium hydroxide. Other metals which react with cyanide, such as copper, nickel, or zinc, can be readily eliminated by utilising the insolubility of mercury sulphide in moderately concentrated nitric acid. The presence of iron obscures the end point in the titration with silver nitrate; it is removed by transforming into the ferric state by adding nitric acid to the solution and boiling before neutralising with sodium hydroxide. On adding the cyanide, ferric hydroxide is precipitated and removed by filtration. To obtain accurate results a large excess of potassium cyanide must be avoided, but a moderate excess of alkali does not affect the results, and the loss of mercury salt on boiling the solution for 30 seconds is negligible.—J. N. P.

Radium; Quantitative determination of ——. H. Schlundt. Met. and Chem. Eng., 1914, 12, 709—710.

IN the emanation method, which consists in introducing the emanation from the ore into a standardised air-tight electroscope or an ionisation vessel connected with an electrometer, the solution method (fusion with mixed alkali carbonates, followed by solution and boiling) of obtaining the emanation from rocks, etc., that do not dissolve in acids upon heating gives only 70—80% of the value obtained by the fusion method. This consists in fusion with a suitable flux such as mixed carbonates of sodium and potassium, in a closed, electrically heated furnace, the liberated emanation being freed from carbon dioxide and collected. Fusion with mixed carbonates appears better than with potassium bisulphate except with carnotite. Borax as flux gives low values. Emanation is completely separated from uranite by solution in nitric acid and by fusion with ordinary fluxes.—W. F. B.

Chlorides in albuminous liquids; Simple and accurate method for the determination of ——. C. Gazzetti. Arch. di Fisiol., 11, 81—88. Kolloid-Zeits., 1914, 14, 58.

A SMALL measured quantity of the liquid is diluted with water in a 100 c.c. flask, treated with 3 c.c. of a 30% solution of ferric alum, the precipitated iron albuminate dissolved by addition of concentrated nitric acid, drop by drop, and a measured excess of *N*/50 silver nitrate added to the clear liquid: the colloidal matter present prevents the formation of a precipitate of silver chloride. The mixture is diluted to about 97 c.c. with water and then made up to exactly 100 c.c. by addition of concentrated nitric acid. This causes the flocculation of the albumin and the precipitation of silver chloride. The whole is filtered and in 50 c.c. of the filtrate the excess of silver is determined by titration with *N*/50 potassium thiocyanate. —A. S.

Solubility determination at high temperatures; Method of ——. L. Tschugaeff and W. Chlopin. Z. anorg. Chem., 1914, 86, 151—162.

SATURATION is effected at the boiling temperature of the solution, and this is made to vary in a series of determinations by altering the working pressure. The saturation vessel, which is immersed in an oil bath at 5—10° C. above the temperature adopted, is fitted with one tube carrying a thermometer and another passing into a weighing bottle which depends into the solution. The tubes are furnished with rubber connections and screw clips, and these are adjusted to admit air at such a rate that any desired reduction of pressure is maintained by means of a filter-pump; constancy of pressure is preferably secured by a mercury pressure regulator. When saturation is complete (in about an hour), a sample of the solution is drawn through a filter-tube into the weighing bottle for analysis.—F. SODN.

Comparison of Engler's and Barbey's viscosimeters. Baheux. *See* IIA.

Detection of rosin oil in mineral oils. *See* IIA.

Determination of paraffin wax in mineral oils. Schwarz and von Huber. *See* IIA.

Determination of asphaltic material in petroleum by the so-called excise method. Gurwitsch. *See* IIA.

Some rapid methods for glass analysis. Sullivan and Taylor. *See* VIII.

Laboratory apparatus for leaching experiments. Balderston and Alsop. *See* XV.

Determination of insolubles in the analysis of tannin extracts. Alsop. *See* XV.

Colour valuation of tanning materials. Kerr. *See* XV.

Standard forms for reporting analyses. Alsop. *See* XV.

Preparing neutral ammonium citrate solution. McCandless. *See* XVI.

Use of the refractometer for the analysis of sugar factory products, and the direct determination of the Brix (dry substance) of beet juice. [Comparison between the original and improved types of refractometer.] Pellet. *See* XVII.

Determination of sucrose and lactose in condensed milk by means of acid mercuric nitrate. Revis and Payne. *See* XIXA.

Rapid determination of phosphoric acid in dough, etc. Sobel. *See* XIXA.

Determination of Prussian blue in tea. Knight. *See* XIXA.

Biochemical oxygen demand of sewages. Lederer. *See* XIXB.

Detection of emodin-bearing drugs in presence of phenolphthalein. Warren. *See* XX.

Determination of the cineol content of eucalyptus oils. Harding. *See* XX.

Rapid determination of camphor and certain essential oils when in solution in alcohol. Penniman and Randall. *See* XX.

Study of methods for extractions by means of immiscible solvents from the point of view of the distribution coefficient. Marden and Elliott. *See* XX.

Determination of calomel in tablets. Marden and Cushman. *See* XX.

PATENT.

Calorimeter. S. W. Parr, Urbana, Ill. U.S. Pat. 1,115,238, Oct. 27, 1914; date of appl., June 24, 1912.

THE body of a bomb-calorimeter has a flat bearing rim with a square corner at its inner edge, and the cover has a flange which bears on a gasket placed on this rim. The cover itself makes a sliding fit in the top of the bomb, so as to protect the packing from the hot gases, and is held down on the bomb by a flanged collar screwed down on the body of the calorimeter. The crucible is supported by one of two parallel conductors suspended from the cover. The ignition wire is held in clips which can slide along the parallel conductors to bring the wire into a suitable position.—A. T. L.

XXIV.—MISCELLANEOUS ABSTRACTS.

Adsorption. D. Schmidt-Walter. Kolloid-Zeits., 1914, **14**, 242—252.

Davis (this J., 1907, 1217) found that when solutions of iodine were treated with charcoal the greater part of the iodine was removed almost instantaneously but that a further slow absorption continued for a long time, and he considered that the initial rapid adsorption was followed by slow formation of a solid solution. The author brings forward evidence in favour of the view that the apparent slow absorption is due to chemical reactions by which iodine is removed from solution. With benzene, toluene, and chloroform as solvents equilibrium could be attained in a very short time. In other cases, also, of slow adsorption, experimental evidence is opposed to the view that solid solutions are formed. The adsorption of acetic acid from 5% aqueous, benzene and toluene solutions and of iodine from solutions in various solvents can be satisfactorily represented by Schmidt's formula :—

$$\left(\frac{a-x}{v}\right)S = Kxe^{\frac{A(S-x)}{S}}$$

in which a is the quantity of substance present at first, x is the quantity adsorbed, v is the volume of the solution, S is the saturation value (maximum quantity which can be adsorbed), and K and A are constants. It is shown, however, that the solvent plays an important part in adsorption, and hence Schmidt's theory, in which the solvent is neglected, cannot be accepted. Acetic acid in benzene and toluene show a strong negative adsorption. —A. S.

Trade Report.

Chemicals in Algiers.

Information has been received from Algiers to the effect that there is a great opening there for chemicals. A league has been formed which is pledged to give England every preference, but unless our manufacturers will conform to the weights, measures, and terms introduced by the Germans and in customary use, it will be very difficult to secure a trade even although the demand is urgent. The Board of Trade and Chambers of Commerce have details from the Consul-General as to what is wanted, but in order to do business a personal visit is necessary. Enquiries should be addressed, in the first instance, to Dr. T. Slater Price, Municipal Technical School, Birmingham.

German chemical industry and the war. O. N. Witt. Chem.-Zeit., Oct. 8 and 13, 1914. Pharm. J., 1914, **93**, 757—758.

German works are now only being carried on for four days a week, and are suffering greatly from lack of labour, especially skilled labour. Many industries are showing greatly reduced profits, and some are working at a loss. The cessation of supplies of raw materials is one of the most important factors in the situation, but it is hoped that efficient substitutes will be found. For example, in the manufacture of sulphuric acid, the Spanish and Portuguese pyrites will be replaced by Norwegian pyrites, and should this fail, Italian sulphur could be used. The loss of Chilean nitrate is very serious, but ammonium salts will take their place in agriculture: sufficient quantities of ammonia to supplement the home production should be obtainable from Norway and Switzerland. The output of hydrochloric acid, which depends on the dye industry, will fall off, and this will affect the glass industry, which uses the sulphates so produced: it is quite possible, however, to use soda instead of sulphate in glass manufacture. The German salt deposits will be sufficient to supply the alkali and the electrolytic chlorine industries with raw material. Compounds of mercury, copper, and nickel are becoming scarce, but supplies of copper and nickel are expected from Norway, whilst the low-grade nickel ores may be able to supplement these. Chromium compounds are also scarce, owing to the shutting off of the supplies of chrome ironstone from the Caucasus.

In the earthenware industry Dalmatian bauxite or German kaolin will take the place of French bauxite, but somewhat modified processes will be required. The increased demand for iodine compounds, for use as antiseptics, is expected to be supplied by Norway. The phosphates and phosphatic manures, previously imported, will probably be replaced by German phosphatic minerals; the supply of Thomas slag will probably increase.

As regards organic products, it is anticipated that the supply will be sufficient to meet the reduced demands. The production of alcohol from potatoes and cereal grains must be limited on national grounds, but molasses and other by-products containing sugar or starch are available for the purpose. A decreased production of acetic acid is probable, owing to the stoppage of the supply of raw materials from America: the demand for acetic acid will probably be greater, and it is suggested that a suitable process will be found by which it can be produced from acetaldehyde obtained from acetylene. The peat and lignite distillation industries should do well, owing to the increased demand for benzine, lighting oils, lubricants, and paraffin. Little apprehension is felt as to the supply of benzol, but toluol and xylol will become scarce, since they cannot be obtained in quantity in by-product coke ovens. On the other hand, the production of phenol from coke ovens has increased considerably, and the supply of naphthalene and anthracene should be sufficient, owing to the diminished activity in the dyestuff factories. The dyestuff and textile industries will suffer, the former from lack of outlets and the latter from the cessation of imports of Egyptian cotton and Australian wool. The shortage of naturally occurring essential oils and camphor will in most cases be met by the increased production of synthetic products or substitutes. The industries connected with fats, oils, soap, and candles are also affected by the war, owing to the increased demand for glycerin, but it is expected that this will be effectually met.—T. F. B.

Calcium carbide; Shipments of ——. London Chamber of Commerce Circular, Dec. 9, 1914.

The Secretary of State for India in Council has decided to withdraw, during the period of the war, the prohibition of the shipment of calcium carbide in vessels carrying Indian Government stores, subject to the observance of certain regulations. The responsibility for complying with the regulations rests entirely with the shipper of the carbide.

Proposed new Customs Tariff of the Territory of Southern Rhodesia, 1914. Board of Trade J., Nov. 19, 1914. Supplement. Price 3d.

Books Received.

Technical Gas-Analysis. By George Lunge, Ph.D., Dr. Ing., Emeritus Professor of Technical Chemistry at the Federal Polytechnic University, Zürich. Gurney and Jackson, 33, Paternoster Row, London, E.C. 1914. Price 15s. net.

Volume (9 by 6 ins.), containing 394 pages of subject matter with 143 illustrations, an appendix of 5 pages, 1 page of addenda, and alphabetical indexes of names of authors and subjects. The text is grouped and classified as follows :—I. General remarks on technical gas-analysis. II. Various methods employed in technical gas-analysis. (*a*), Estimation of solid and liquid admixtures in gases. (*b*), Estimation of gases by absorption. (*c*), Estimation of gases by combustion. (*d*), Gas-analysis by optical and acoustical methods. (*e*), Separation of gases by low temperatures. (*f*). Estimation of specific gravity of gases. (*g*), Measurement of pressure and of draught. (*h*), Determination of the calorific value of gases. (*i*), Determination of the illuminating power of gases. III. Special methods for detecting and estimating various gases and vapours occurring in technical operations. IV. Analysis of gaseous mixtures produced on a large scale. V. Compressed and liquefied gases. VI. Gas-volumetric analysis.

Technical Methods of Chemical Analysis. Edited by George Lunge, Ph.D., Dr.Ing, and C. A. Keane, D.Sc., Ph.D. Volume III. Parts I. and II. Gurney and Jackson, 33, Paternoster Row, London. 1914. Price £3 3s. Part I.—Mineral oils : D. Holde ; *revised by* J. Lewkowitsch. Lubricants : D. Holde ; *revised by* J. Lewkowitsch. Oils, fats, and waxes : J. Lewkowitsch ; *revised by* Author. Special methods of analysis employed in the oil and fat industries : J. Lewkowitsch ; *revised by* Author. Resins, balsams, and gum-resins : K. Dieterich ; *revised by* J. Lewkowitsch. Drugs and galenical preparations : K. Dieterich ; *revised by* F. B. Power. Essential oils : E. Gildemeister ; *revised by* F. B. Power. Tartaric acid : W. Klapproth ; *revised by* W. A. Davis. Citric acid : W. Klapproth ; *revised by* W. A. Davis. Organic preparations : J. Messner ; *revised by* C. A. Keane. Indiarubber and rubber goods : F. Frank and E. Marckwald ; *revised by* W. A. Caspari. Vegetable tanning materials : The late C. Councler ; *revised by* H. R. Procter. Leather : J. Paessler ; *revised by* H. R. Procter. Ink : O. Schluttig ; *revised by* C. A. Mitchell. Part II.—Sugar : E. O. von Lippmann ; *revised by* A. R. Ling and Lewis Eynon. Starch and dextrin : C. von Eckenbrecher ; *revised by* A. R. Ling. Alcohol, potable spirits, and liqueurs : A. Ebertz and G. Schüle ; *revised by* G. W. Monier-Williams. Vinegar : *rewritten by* G. Cecil Jones ; *German by* G. Schüle. Wine : K. Windisch ; *revised by* P. Schidrowitz. Brewing materials and beer : *rewritten by* A. R. Ling and G. C. Jones ; *German by* C. J. Lintner. Paper : W. Herzberg ; *revised by* C. F. Cross, E. J. Bevan, and W. Bacon. Textile fibres : R. Gnehm ; *revised by* J. Hübner. Inorganic colours : A. Eibner ; *revised by* H. J. L. Rawlins and A. Rule.

International Catalogue of Scientific Literature. C. Physics. Twelfth Annual Series. Harrison and Sons, 45, St. Martin's Lane, London, E.C. Price 24s.

The literature indexed in this volume, which covers 416 pages, 8½ by 5½ ins., is mainly that of 1912, but includes some portions of the literature of 1901—1911 omitted from previous volumes, and also entries dated 1913.

Magnetite occurrences near Calabogie, Renfrew County, Ontario. By E. Lindeman. Canada, Dept. of Mines. Mines Branch Report No. 254. Government Printing Office, Ottawa.

Moose Mountain Iron-Bearing District, Ontario. By E. Lindeman. Canada, Dept. of Mines. Mines Branch Report No. 303. Government Printing Office, Ottawa.

A Text-Book of Inorganic Chemistry. Vol. I. Part I.—An Introduction to Modern Inorganic Chemistry. By J. Newton Friend, D.Sc., Ph.D., H. F. V. Little, B.Sc., and W. E. S. Turner, D.Sc. Part II.—The Inert Gases. By H. Vincent A. Briscoe, B.Sc. Charles Griffin and Co., Ltd., Exeter Street, Strand, London. 1914. Price 10s. 6d. net.

Volume (9⅛ by 6¾ ins.), containing 360 pages of subject matter with frontispiece, 88 illustrations and name and subject indexes. The text is classified as follows :—Part I. Introduction to modern inorganic chemistry. I. Fundamentals of chemical science. II. General properties of elements and compounds. III. Solubility, solution, and some properties of solutions. IV. Molecular weight and its determinations. V. Chemical change. VI. Acids, bases, and salts. VII. Determination of atomic weights and equivalent or combining weights. VIII. Classification of the elements. Part II. The inert gases. I. Introduction. II. Helium. III. Neon. IV. Argon. V. Krypton. VI. Xenon. VII. Niton.

Brass-Furnace Practice in the United States. Department of the Interior. Bureau of Mines. Bulletin 73. Mineral Technology 1914. (Joseph A. Holmes, Director.) By H. W. Gillet. Government Printing Office, Washington, U.S.A. 1914. Price 45 cents. First edition, March, 1914.

Volume (6⅛ by 5¾ ins.), containing 289 pages of subject matter, including a bibliography of 2 pages, followed by an alphabetical index of names and subjects. There are 25 illustrations. The text is classified as follows :—I. Introduction. II. Object and method of investigation. III. General types of furnaces in use. IV. Furnace data from literature. V. Detailed results of investigation. VI. General factors affecting operation of brass furnaces. VII. Round furnaces, compared with square, pit, coal, or coke furnaces. VIII. Furnace fuels. IX. Remarks on furnace types and furnace parts. X. Possible improvements in furnaces and accessories. XI. Some furnace problems awaiting solution. XII. Advances possible with present equipment and knowledge. XIII. Causes of disease and danger, and essentials for health and safety.

New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."

I. *Darling*, C. R. : Heat for Engineers : A treatise on heat. 2nd ed. rev. N.Y. : Spon and Co. 14×430 p. il. 8vo. 1914. $3.50 net.

Hiscox, G. D. : Gas, Gasoline and Oil-engines. 21st ed. rev. and brought up to date by V. W. Page. N.Y. : Henley. c. 640 p. il. tabs. figs. diagrs. O. 1914. $2.50 net.

Ivens, E. M. : Pumping of Compressed Air. 8vo. Chapman & Hall. London. 1914. Net 12s. 6d.

Sharp, J. : Some considerations regarding Cast Iron and Steel Pipes. Royal 8vo. pp. 150. Longmans. London. 1914. Net 4s. 6d.

IIA. *Masse*, R. : Le gaz. Historique, approvisionnements de houille. Distillation de la houille. Obtention du gaz par fabrications spéciales. Traitement du gaz. Services accessoires de la fabrication. Groupements et liaisons des divers services d'une usine a gaz. Dispositions d'ensemble. Distribution de gaz sous pression à longue distance ; 784 fig., 3 vol. in-8°. Béranger. Paris. 1914. Cloth 75 fr.

III. *Vignon*, G. : Contribution à l'étude des dihydrorésorcines, synthèses d'acides polybasiques (99p.). in-8°. Rey, Lyon. 1914. 2 fr. 50.

IV. *Wahl*, A. : The Manufacture of Organic Dyestuffs. Cr. 8vo. pp. 352. Bell. London. 1914. Net 5s.

V. *Cross*, C. F., and E. J. *Bevan* : A Text-Book of Paper-making. 3rd. ed. N.Y. : Spon and Co. 10×411 p. il. 1914. $3.50 net.

Dawe, E. A. : Paper and its Uses. 8vo, pp. 170. C. Lockwood. London. 1914. Net 4s. 6d.

VII. *Escard*, J. : Les pierres précieuses. Propriétés caractéristiques et procédés de détermination. Distribution géographique. Principaux gisements. Exploitation, production, exportation. Perles, corail. Travail des gemmes. Utilisation dans l'industrie. Production artificielle. Imitations. Lois et règlements. 372 fig., 24 pl., in-4°. Dunod et Pinat. Paris. 1914. 30 fr.

Mastin, J. : The Chemistry, Properties and Tests of Precious Stones. N.Y. : Spon and Co. 114 p. 16, limp leather. 1914. 80 c. net.

VIII. *Grunwald*, J.: The Raw Materials for the Enamel Industry and their Clinical Technology. 8vo, pp. 238. C. Griffin. London. 1914. Net 8s. 6d.

IX. *Record*, S. J.: The Mechanical Properties of Wood. 8vo. Chapman & Hall. London. 1914. Net 7s. 6d.

X. *Beyschlag*, F., and others: The Deposits of the Useful Minerals and Rocks: Their Origin, Form and Content. Tr. by S. J. Truscott. In 3 vols. Vol. I.: Ore deposits in general; magnetic segregations; contact deposits; tin lodes; quicksilver lodes; with 291 illustrations. N.Y.: Macmillan. 28×514 p. 8vo. 1914. $5 net.

Keppen, A. de: L'industrie minérale de la Tunisie et son rôle dans l'évolution économique de la Régence, 1 carte, in-8°. Dunod et Pinat. Paris. 1914. 6 fr.

Lecomte-Denis, M.: Guide pratique de la prospection des mines et de leur mise en valeur, préf. de M. Haton de La Goupillière, 3e édit., rev. et augm., 331 fig. in-8°. Dunod et Pinat. Paris. 1914. Bds. 26 fr. 50.

Davies, J.: Galvanized Iron: Its manufacture and use. N.Y.: Spon and Co. 8×139 p. 8vo. 1914. $1.50.

Werth, F.: Galvanizzazione, pulitura e verniciatura dei metalli: manuale pratico per l'industriale e l'operaio. 3a ediz. rifatta. Milano. 16° fig., p. xxvii, 700. 1914. Lire 7.50.

Ghersi, I.: Metallocromia: colorazione e decorazione dei metalli per via chimica ed elettrica. 2a ediz. accresciuta. Milano. 16°, pagine xvi, 317. 1914. Lire 3.50.

Escard, J.: Le soudure électrothermique, 19 fig. in-4°. Dunod et Pinat. Paris. 1914. 1 fr. 50.

Massot, P.: La taille économique des métaux par les aciers à coupe rapide, d'après les expériences de F.-W. Taylor, 13 fig. in-4°. Dunod et Pinat. Paris. 1914. 2 fr. 50.

Wraight, E. A.: Assaying in Theory and Practice. 8vo, pp. 336. E. Arnold. London. 1914. Net 10s. 6d.

XI. *Burgess*, C. F., and G. W. *Cravens*: Applied Electrochemistry and Welding: A Practical Treatise on Commercial Chemistry. Part 1: Applied Electrochemistry, by C. F. Burgess. Part 2: Welding, by G. W. Cravens. Chic. Am. Technical Soc. (Drexel Ave. and 58th St.) c. 83×132×8 p. il. O. 1914. $1.50.

Payot, A., et A. *Tobiansky*: Les courants vagabonds. L'électrolyse et les perturbations causées par l'induction et les courants pulsatoires. in-8°. Dunod et Pinat. Paris. 1914. 1 fr. 25.

XII. *Fauchère*, A.: Culture du cocotier et commerce des noix de coco à la Trinité. in-8°. Challamel. Paris. 1914. 0 fr. 75.

XIV. *Ripeau*, F.: Caoutchoucs (*Hevea brasiliensis*) amazoniens et asiatiques. Etude comparative. Le traitement des latex. préf. du Prof. Perrot, fig., in-8°. Larose. Paris. 1914. 4 fr.

XV. *Procter*, H. R.: Leather Industries Laboratory Book. N.Y.: Spon and Co. 480 p. il. pls. 8vo. 1914. $5 net.

Procter, H. R., and others, eds.: Leather Chemists' Pocket-book. A short compendium of analytical methods. N.Y.: Spon and Co. 14×223 p. il. 1914. Limp leather, $1.50 net.

XVI. *Noter*, R. de: La culture moderne avec les produits nouveaux découverts, introduits, sélectionnés ou vulgarisés, ill. (48 p.). in-12. Amat. Paris. 1914. 1 fr.

XVII. *Newlands*, J. A. R., and B. E. R. *Newlands*: Sugar: A Handbook for Planters and Refiners. N.Y.: Spon and Co. 912 p. il. fold pls. 8vo. 1914. $7.50 net.

Roux, E., et C. F. *Muttelet*: Aliments sucrés, sucres, miels, sirops, confitures, sucreries, sucs de réglisse, fig. in-8°. Béranger. Paris. 1914. Bds. 8 fr.

XIXA. *Duval*, E.: Traité général de confiserie moderne desserts, glaces, chocolats, 3e édit., rev. et augm., 12 pl. et 300 gravures. in-8°. Darenne. Paris. 1914. Cloth 12 fr.

XIXB. *Garrigou*, Dr.: Les sources d'eau potable au point de vue de l'hygiène et de l'économie des communes (6 p.). Gazette des Eaux. Paris. 1914. 1 fr. 50.

Massie, C.: Etude sur les eaux thermales de Tercis, près Dax, plan (152 p.). in-8°. Dirion, Toulouse. 1914. 2 fr.

Michaud, Dr.: Des propriétés chimiques et médicales d'une eau minérale a réactions fixatrices d'oxygène directes et indirectes. L'eau du Breuil (Puy-de-Dôme) (10 p.). in-8°. Gazette des Eaux. Paris. 1914. 1 fr. 50.

Saabner-Tuduri, Dr. Al.: Les eaux minérales alcalines de Roumanie (12 p.). in-8°. Gazette des Eaux. Paris. 1914. 1 fr. 50.

Rideal, S., and E. K.: Water Supplies, their Purification, Filtration, and Sterilisation. 8vo. pp. 286. C. Lockwood. London. 1914. Net 7s. 6d.

Lhuillier, M., et E. *Belle*: Manuel pratique de désinfection, préf. de M. Mirman, 118 fig. in-8°. Berger-Levrault. Paris. 1914. Cloth 10 fr.

XX. *Dresch*, Dr.: Salvarsan, mercure et eaux sulfureuses dans le traitement de la syphilis. Cures intensives par introductions variées du médicament (8 p.). in-8°. Gazette des Eaux. Paris. 1914. 1 fr. 50.

Formulaire pharmaceutique des hôpitaux militaires. T. II. Chimie appliquée a l'hygiène et aux expertises dans l'armée. in-8°. H. Charles-Lavauzelle. Paris. 1914. 6 fr.

Hammarstan, O., and S. G. *Hedin*: A Text-Book of Physiological Chemistry. 7th ed. 8vo. Chapman & Hall. London. 1914. Net 17s.

Rossi, A.: Manuale del profumiere. 2a ediz. riveduta e aumentata. Milano. 16°. Fig., p. xxvi, 650. 1914. Lire 6.50.

XXIII. *Noyes*, A. A.: A Course of Instruction in the Qualitative Chemical Analysis of Inorganic Substances. 5th ed. N.Y.: Macmillan. 9×124 p. 8vo. 1914. $1.50 net.

XXIV. *Adam, Capus, Fauchère, François, Gatin, Main, Vaquin, Vuillet*: Les grands produits végétaux des colonies françaises. Caoutchouc, kola, cacao, karité da, kapok, cocotier, café, vanille, palmier, arachide, coton, thé, riz, etc. 1re. partie. Le caoutchouc, par le Prof. Perrot, ill. in-8°. Larose. Paris. 1914. 4 fr.

Wildeman, E. de: Notes sur des productions végétales tropicales. in-8°. Challamel. Paris. 1914. 4 fr.

Delobel, E.: Preuves alchimiques, L'unité de la matière et son évolution (68 p.). in-16. Chacornac. Paris. 1914. 1 fr.

Moore, F. H.: Outlines of Organic Chemistry. A book intended for the general student. 2nd ed. rewritten. N.Y.: Wiley. c. 11×325 p. figs. 12. 1914. $1.50 net.

Weyl, Dr. Th.: Les méthodes de la chimie organique, trad. par R. Cornubert, préface de M. Haller. T. II, 2e partie. Monographies. Oxydation et réduction. Dédoublement des composés racémiques en leurs constituants actifs. Polymérisation et dépolymérisation. Catalyse. Enzymes. Condensation. Peroxydes. Ozonides, fig. (xx-494 p.). in-8°. Dunod et Pinat. Paris. 1914. 25 fr.

Morgan, J. L. R.: The Elements of Physical Chemistry. 5th ed. Cr. 8vo. Chapman & Hall. London. 1914. Net 12s. 6d.

Noyes, W. A.: A Text-Book of Chemistry. Cr. 8vo. Bell. London. 1914. Net 10s. 6d.

Tables annuelles de constantes et données numériques de chimie, de physique et de technologie. Vol. III. Année 1912. in-4°. Gauthier-Villars. Paris. 1914. Cloth 36 fr.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Journal of the Society of Chemical Industry.

No. 24, Vol. XXXIII. DECEMBER 31, 1914. No. 24, Vol. XXXIII.

Canadian Section.

Meeting held at Montreal on Tuesday, January 20th, 1914.

DR. R. F. RUTTAN IN THE CHAIR.

COMMERCIAL HOUSEHOLD AMMONIA IN CANADA.

BY PROF. J. F. SNELL.

The inspections conducted by the Canadian Department of Inland Revenue in the enforcement of the Adulteration Act of 1886 and supplementary legislation are no longer restricted to foods and drugs, the materials which the Act was originally designed to control. Amendments to the Act and special statutes have extended the scope of the control so that it now embraces proprietary medicines, commercial feeding stuffs, agricultural fertilisers, certain paint materials (white lead and turpentine) and certain insecticides (Paris green and arsenate of lead). The extension of the scope of the Adulteration Act to household detergents would, in my opinion, not involve any more radical departure from the original intention of the Act than has already been taken, nor would it add unduly to the work of the Laboratory of the Department.

A chance observation that a package of solid "household ammonia" which had stood open for some days or weeks had lost every trace of ammonia odour suggested to me an investigation of samples of the goods, both liquid and solid, offered for sale under the name of "household ammonia," and purchased in some of the cities of Eastern Canada in 1912 and 1913. The results are set forth in the accompanying tables.

Table I. gives the cost and the results of analysis of 10 brands of clear liquid household ammonia and 5 brands of ammonia rendered cloudy by addition of soap. The differences in ammonia content shown by the various brands are, to say the least, remarkable. For comparison, the wholesale prices of two lots of concentrated ammonia are given, together with the ammonia content as shown by titration. The results for ammonia content in these concentrated samples are probably low, as it is impossible to titrate concentrated ammonia in the ordinary way without loss of gas. The specific gravity indicated about 2% more ammonia than was found by titration. Taking the results by titration, however, we see that the household ammonia sells wholesale at from 4 to 14 times the wholesale value of the ammonia contained in it. The retail price is from 6 to 20 times the wholesale value of the ammonia. The expense of bottling and packing, as well as the transportation charges on the added water, have to be included in its price, but the value to the housekeeper is in the ammonia gas alone. How much more economical it would be to buy commercial concentrated ammonia and dilute it with good soft water!

The non-volatile matter of the liquid ammonias was in almost every instance brown. In the sample which left the largest quantity of residue, however, the colour of the residue was white.

Wool dipped in the clear ammonia, dried, and re-dipped and re-dried until it had received six dippings, remained white except in the case of No. 5, which left it slightly yellow, and No. 6, which coloured it a bluish tinge. Of the cloudy ammonias, No. 12 gave a slight yellow, and No. 14 a deeper yellow coloration.

In the solid household ammonias the following determinations were made: (1) Total alkalinity by titration with N sulphuric acid. (2) Loss on ignition. (3) Non-volatile alkalinity. (4) Chlorides, by Gay-Lussac's volumetric method. (5) Sulphates, gravimetrically.

The non-volatile alkalinity was calculated to sodium carbonate, and the chlorides and sulphates to sodium salts. The difference between total alkalinity and non-volatile alkalinity obviously represents the carbonate of ammonia in the mixture, and the difference between loss on ignition and carbonate of ammonia is assumed to be water.

One would naturally expect solid household ammonia to be essentially carbonate of ammonia. Kahlbaum's ammonium carbonates, both that specially prepared for analytical use and that manufactured to conform to the requirements of the Pharmacopœia Germanica, V. Edition, were found to contain about 21·5% ammonia and accordingly to be really bicarbonate. Merck's bicarbonate has the same composition and is, accordingly, true to

Table I.—Liquid Household Ammonias.

Composition and value.

No.	Price.					Cost of 1 lb. NH_3.	
	Retail per bottle.	Wholesale per doz.	Amount in bottle.	Non-volatile matter.	NH_3 by titration.	Retail.	Wholesale.
I. Clear ammonias.	$	$	c.c.	%	Gms. per 100 c.c.	$	$
1	0.15	1.25	400	0·044	7·15	2.38	1.65
2	0.10	0.90	300	0·670	3·55	4·26	3.20
3	0.15	1.25	475	0·016	6·14	2.33	1.62
4	0.10	0.90	450	0·031	1·67	6.01	4.54
5	0.10	0.90	350	0·012	3·02	4.32	3.22
6	0.10	0.90	400	0·267	3·68	3.08	2.32
7	0.10	0.90	390	0·021	3·15	3.78	2.81
8	0.10	—	370	0·701	3·46	3.54	—
9	0.10	—	410	0·01	2·53	4.38	—
10	0.12	—	415	0·68	1·64	6.67	—
II. Cloudy ammonias.							
11	0.25	2.60	425	0·090	10·92	4.15	2.10
12	0.15	1.60	370	0·024	4·79	3.84	3.42
13	0.17	1.90	325	0·103	6·14	3.87	3.60
14	0.35	4.10	440	0·310	8·26	4.38	4.27
15	0.20	2.25	300	0·037	10·56	2.88	2.70
Concentrated (Carboy)	ammonias	for comparison. per lb.					
A	—	0.08	—	—	24·33	—	0.33
B	—	0.09	—	—	23·14	—	0.39

name. Samples of English manufacture, kindly furnished us by Messrs. Lymans, Ltd., Montreal, and the National Drug and Chemical Co. of Canada, Ltd., Montreal, were found to contain, respectively, 30 and 31% of ammonia. Being advised by both these companies that the English-made carbonate would undoubtedly be used by Canadian manufacturers of household ammonia, we have calculated our volatile alkalinity to a carbonate of ammonia containing 30% NH_3.

According to our analysis, none of the brands of solid household ammonia contained as much as 10% of commercial carbonate of ammonia. One of them ran as low as 2%. The chief constituent was in all instances sodium carbonate, but sodium sulphate ran as high as 13½% in one brand. In estimating the wholesale value of the mixture we have allowed one cent. per pound for the carbonate but nothing for the sulphate, which is worse than useless in a washing compound. The contrast between cost of materials and selling price is not so great as in the case of the liquid preparations, doubtless on account of the lower cost of containers and lower transportation charges. But these solid preparations are clearly "misbranded" and fraudulent.

Table II.

Theoretical Composition of—	NH_3. %	CO_2. %	H_2O. %
Normal ammonium carbonate $(NH_4)_2CO_3$	35·45	45·80	18·75
Acid ammonium carbonate NH_4HCO_3	21·50	55·70	22·80
Ammonium carbamate $NH_2CO_2NH_4$	43·60	56·40	—
Ammonia Content of—			
Kahlbaum's ammonium carbonat "Zur Analyse"	22·52	—	—
Kahlbaum's ammonium carbonat. Ph. G.V.	21·43	—	—
Merck's ammonium bicarbonate	21·51	—	—
English ammonium carbonate A	30·09	—	—
" " " B	31·02	—	—

Table III.

Solid household ammonias.—Composition.

Constituents determined.	Brand.					
	1.	2.	3.	4.	5.	6.
	%	%	%	%	%	%
H_2O ..	18·39	17·57	17·37	16·05	3·08	11·85
Carb. Amm. *	9·63	3·40	5·10	1·97	5·20	7·33
Na_2CO_3	57·50	72·88	70·76	78·18	—	—
Na_2SO_4	13·56	5·85	5·80	3·00	—	—
NaCl ..	0·45	0·45	0·51	0·89	—	—
Total ..	99·63	100·15	99·54	100·09	—	—

* Assumed to contain 30% NH_3.

Table IV.

Solid household ammonias.—Price and value.

Price and Value.

	Brand.			
	1.	2.	3.	4.
	cents.	cents.	cents.	cents.
Retail price per lb.......	5	7·5	5	5
Wholesale price per lb. ..	3·75	—	3·75	3·96
Wholesale value of the alkaline ingredients $(NH_4)_2CO_3$ at 10 cents, Na_2CO_3 at 1 cent per lb.	1·43	1·07	1·22	0·98
Wholesale value of the $(NH_4)_2CO_3$ at 10 cents per lb.	0·96	0·34	0·51	0·20

New England Section.

Meeting held at Engineer's Club, Boston, on Friday, November 20th, 1914.

MR. ALAN A. CLAFLIN IN THE CHAIR.

THE POSSIBILITY OF ESTABLISHING A COMPLETE DYESTUFF INDUSTRY IN AMERICA.

BY DR. D. W. JAYNE.

There has been up to the present time no complete dyestuff industry in America, because hitherto there have been no economic reason for it. The producers of the crude materials had no excess and no other incentive, and the consumers of the dyes offered no inducement, their demands apparently being met satisfactorily by imports.

Until the advent of the by-product coke oven the production of coal tar increased but slowly, being entirely from plants producing coal gas. The first recovery oven in this country was established by the Semet-Solvay Co., about twenty years ago, though at that time by-product ovens abroad were an accepted fact. Besides this, the coal tar from gas plants has always been a factor abroad, especially in England, where as late as 1900 the gas tar alone was more than twice the oven tar of Germany, and seven times the combined production of both gas tar and oven tar in the United States. The small quantity produced in the United States in 1900 was due to the fact that so many plants here manufactured carburetted water gas, the tar from which is not included in these figures, that the tar from coal gas was and still is an exceedingly small item, and even in 1900 the number of recovery ovens was small—the rapid installation period coming after that date. Europe had many years' start of us, because they began to see the desirability, and perhaps the necessity, of providing outlets for the various coal tar products, while we, up to the present time, have found no difficulty in disposing of those coal tar products which might enter into the manufacture of dyes. As a nation we are not apt to plan far in advance, and the tar distiller did not give much thought to the dyestuffs under the existing conditions. The same condition held true in England, for England has no complete dye industry. Germany developed the coal tar dye industry, using not only its own materials but many brought from England, until it has become one of the most complete industries in the world. The German dye manufacturers have also had every advantage of government aid in their development, and they present a united front to all competition. Here, the construction of by-product ovens has gone on until to-day about 25% of the coke is produced in them, and still we have not produced a surplus of coal tar products which could be used for dyes.

The products, which are the basis for dyestuffs, are benzol, naphthalene and anthracene. Benzol and its homologues, toluol and xylol, occur in coal tar in small quantities. The chief source of benzol is the coke oven gases. The Semet-Solvay Co., besides installing the first recovery oven in the United States, also established the first benzol recovery plant in connection with their ovens. They now recover at all their plants, and are the sole producers of that which is available for refining to-day. Several other oven installations which sell gas to cities do remove the benzol from the fuel gas, but use it to enrich illuminating gas. The Semet-Solvay benzol is also used for enriching at some points, so that it is not all available for refining; but even so, there was a surplus of benzol less than two years ago, and the shortage to-day would be less marked had it not been for the depression in steel. Few consumers of benzol realise how fluctuations in steel affect supplies of benzol, but with the lessened demand for coke, less coal is coked, with consequently less by-products.

We are already independent of Europe—negligible quantities only of benzol have been imported during the past few years—the price levels here and abroad being approximately the same. The demand abroad is also heavy, due to the use of benzol for motor fuel, especially during the recent high price of gasoline.

Toluol is of more importance to the nation on account of its use in the explosive field than in the manufacture of dyestuffs, and an increase in supplies of benzol brings increased supplies of toluol, which will help the situation in the manufacture of explosives for our national defence.

An increase in benzol supplies will also make it possible to manufacture phenol synthetically. Phenol is to-day produced in the United States in less proportion to the country's consumption than any of the chemical bodies occurring naturally in coal tar. Our small production of phenol from our tar is primarily due to the small proportion of gas tar produced here, because the tar from coke ovens is deficient in true phenol. England has always been the great factor in phenol, simply because of its large production of tar from coal gas plants.

Naphthalene, the second crude base, occurs in considerable quantities in coal tar. Until recent years the distillate from coal tar in the United States was taken off in only two portions, light oil and heavy oil; the balance, pitch, remaining in the still and the oils taken off to that point which left the correct grade of pitch. This means that pitch was the primary product sought for, and in fact remains so to-day. This is not to be wondered at, since coal tar yields on the average 70% of pitch, used for roofing, paving and waterproofing; and the American tar distiller began, and has remained, essentially a manufacturer of roofing and paving materials. This is quite different from conditions abroad, where practically their only use of pitch was for fuel purposes, until the advent of its use for road construction, which is of recent date. Credit is due to the American tar distillers for their efforts in building up a big business for pitch, this 70% of all the tar—and for that reason we make a distinction between the coal tar industry, which is an American development, and the coal tar *chemical* industry, which is exemplified by the German production.

The heavy oil as produced here was sold just as produced, for creosoting timbers. In it was the naphthalene, and most of the tar acids, notably cresol, and with the ever-increasing demand for creosote oil, there was no reason for reducing the amounts available by removing naphthalene from it. Moreover, refined naphthalene has always come into this market at prices so low that it did not pay the tar distiller to remove and refine it. Certainly no more profit could be obtained by so doing than by its sale in the creosote oil, and large plant investment is required for the separation and refining of naphthalene.

Refined naphthalene has been produced here, however, for many years—practically since the beginning of tar distillation in this country, and our present production of it is nearly one third of the country's consumption. But it is nearly all used as a moth repellent—not, any as far as I know, having been used for the manufacture of any product entering into the dyestuff industry.

Conditions have altered somewhat in the past few years. Specifications have been drawn up for creosote oil which eliminate the lower boiling portion, and now an increasing quantity of middle oil is being separated and the naphthalene and tar acids recovered from it. More naphthalene can be recovered and refined, and no doubt will be, if a demand is assured, at a price commensurate with the added investment and cost of manufacture.

The separation of anthracene from the heavy oil is not now carried on in the United States. About thirty years ago there was a plant which separated small quantities of it for export, but this became no longer remunerative and was discontinued. It is now left in the creosote oil, but the quantity which could be obtained is a much less proportion of the tar than is recovered abroad, because all their tar is run to hard pitch, which is the grade used for fuel, that is, briquettes, while as explained, we run, in the United States, for soft pitch. Thus, some of the high boiling oils containing anthracene remain in the pitch. Some hard pitch is made here, however, and if a steady demand arose at a price commensurate with the investment and manufacturing cost, anthracene could be recovered probably in sufficient amounts for the needs of our dyestuffs.

It is well to remember that less than 10% of tar consists of bodies which can be used for making dyestuffs, the balance being neutral hydrocarbon oils sold, even by Germany, for creosoting purposes only.

It is true we have an American coal tar dyestuff industry. Nearly 20% of our consumption is manufactured here, but until three years ago all the dyes made here were from imported intermediate products; or else were imported in a condition requiring only slight alteration to make them suitable for the trade.

In 1910 the Benzol Products Co. was formed. This company had as a central thought the fact that some day a very considerable amount of benzol would be recovered here, and that it was an opportune time to start operations in order to be ready to take advantage of those conditions when they arrived. Therefore the manufacture of nitrobenzol and aniline oil was undertaken. Thirty years ago the Schoellkopf plant, at Buffalo, had made aniline oil, and more recently the Barrett Manufacturing Co. had tried the manufacture of aniline and toluidine, and had a small plant which, however, had been used almost exclusively for toluidine, as toluol had been a drug on the market, its use for explosives, such as trinitrotoluol, not yet having been started. This previous experience had demonstrated the large part played by sulphuric and nitric acids in the manufacture of aniline oil, many more pounds of acid than of benzol being required for the manufacture of aniline oil; so that in the formation of the Benzol Products Co., the manufacturer of acids was represented. This same condition is evidenced in the plants in Germany, which have built themselves around and in connection with the manufacture of acids, alkalis and heavy chemicals in general.

Since the Benzol Products Co. began it has perfected its manufacturing operations, and no doubt exists as to the quality of the product. The quantity, however, has been limited, primarily, because of the efforts of the foreign convention to nip its operations in the bud, and secondly, because of the shortage of benzol which was felt soon after it was in position to expand. Under these conditions it was deemed unnecessary to sacrifice any more benzol than was necessary to take care of those few buyers who had given visible evidence of their desire to encourage this American industry.

Here we see the attitude of the American consumers of dyestuffs. They were being supplied, at comparatively low prices with a wide variety of dyes, continually improved as to fastness and new shades. They were buying direct from the representatives of the great German firms: why buy one item such as aniline oil from us especially as every offer as to price from us was bettered by their present suppliers? In fact, when a 10% duty on aniline oil and salt was secured in the recent tariff, the European Convention not only absorbed that duty, but made lower prices than before. There were several notable exceptions to this condition, and among them were several of the American dyestuff manufacturers. They no doubt realised more than the consumer how utterly dependent the United States was on foreign makers for our supplies of dyes. For them we continued to make aniline, but that was not enough encouragement to warrant any expansion, so that the outbreak of the war found us still only manufacturing aniline oil, and not enough benzol in sight to warrant immediate steps to enlarge so that we could at least supply the country's demand on that one item.

The reason why we had not a better established and more complete dye industry years ago was essentially a matter of international economics. The United States had no surplus coal tar products to dispose of, and no incentive in additional profits if it did offer refined products to dye makers, as the intermediate products such as aniline oil, beta naphthol, etc., as well as the hydrocarbons themselves, such as naphthalene and anthracene, could be imported more cheaply than the tar distiller cared to attempt to make them. The manufacturers of dyes themselves had to meet very keen competition. In 1880 there was a sufficiently high duty on these dyestuffs and no duty at all on the intermediate products, so that at that time the dyestuff industry, based on imported intermediates, began to thrive; but in 1883, the specific portion of the duty on dyes was abolished, and a considerable duty assessed on the intermediate products, and as such intermediate products that far back could not be produced in this country, primarily on account of shortage of supplies at that time, many of the established factories closed down shortly after. There was again a period during which the intermediate products came in free, but the experience was evidently sufficient to prevent any resumption of this industry by the erection of any new plants, and the few factories who have stuck to their manufacture during the varying periods have made but little profit.

The possibilities and prospects primarily depend on the consumers of dyestuffs. Do they want an American dyestuff industry? Are they willing to help pay the price needed to establish it, and if so, will they come forward and say so?

In the first place, there is sufficient coal tar produced in the United States to-day to give the necessary quantity of naphthalene and anthracene to supply our needs of dyes made from it. Plants to recover them could be erected as soon as plants to use them can be.

Benzol exists in by-product coke oven gases in quantities far exceeding the present needs of both the dyestuff requirements and the trades consuming benzol as a solvent. Efforts have been made, ever since a shortage was seen to be inevitable, to secure the erection of additional recovery plants, but little of the possible supplies can find their way to the dyestuff manufacturer and the other outlets are the controlling factor. However, there seems good reason to hope for partial relief during the next year at least to an extent sufficient to enable the manufacturers of aniline oil to increase their production. It takes time to demonstrate to the owners of the ovens the advisability of investing in such a recovery plant, especially steel companies in times of depression as have existed, and it takes just as long to get the plant erected after the preliminaries are disposed of.

Any thought of prompt relief in the dyestuff situation is out of the question. We can have the whole complete industry for future use, if the consumers want it, but without a strong plea from the consumers, neither the tar distiller, the manufacturer of intermediates, nor the manufacturer of dyestuffs will risk the large amount of capital necessary.

To establish such an industry, to protect the country from a future shortage requires one thing and one only; that is, adequate protection. Adequate protection means a higher duty on *all* dyes, and one-half the duty on dyes to be assessed on intermediates, and it also means protection against competitive methods which are aimed to crush and with which we have had experience. This latter protection can probably be best secured by a proper anti-dumping clause in our tariff.

Nothing else is necessary. We have the materials, we have the technical knowledge, we have the capital, we have sufficient unpatented dyes to make nearly everything actually needed, but we need protection.

The need of protection against unfair competition is obvious, but is the need for a higher duty equally so? Bearing in mind that we have no surplus products as yet, it must be made more profitable for the tar distiller to separate and refine the products needed than to leave them as they are to-day, to be sold in the oils. This means higher prices to the dye manufacturers and they, therefore, need some offset to enable them to sell their output in competition with the imported dyes. This immediately suggests the thought of the ultimate result on the price of materials if dyed with the higher priced dyes. I have been assured that the price of the dye itself is an absolutely negligible item in most costs of finished goods, and cannot possibly affect the price to consumers, and therefore puts the question directly before the users of the dyes. It is a question for them to answer whether they want an American dyestuff industry independent of Europe and are willing to pay the price to have it.

My personal opinion is that the additional price necessary to be paid by the users of dyes, in order to secure this industry, would not be a permanent increased cost. Tariff protection during the period of development only should be considered. Such an industry would be competing with one of the strongest and richest industries in the world, and competing only on products which are free to all as regards patent restrictions, while the German industry has made vast sums on its products during the life of the patents and continues to reap large profits on those items on which the patents have not yet expired. This means competing on those items which are now sold on close margin and having no exceedingly profitable items which have helped the Germans to earn their immense profits. Protection over a term of years to protect a growing industry has already been given by this government. The often cited example is the tinplate-industry, which was given assurances of a continuing protection for at least ten years, and whose development was immediately begun with that promise. To-day it is certainly able to hold its own with anyone. The same would be true of a dyestuff industry.

The initiative lies with the consumers of dyes. Will they make it plain to Congress that they want an American Coal Tar Dye Industry?

Nottingham Section.

Meeting held at Nottingham on Wednesday, October 28th, 1914.

MR. JOHN WHITE IN THE CHAIR.

THE WORK OF THE PUBLIC ANALYST IN RELATION TO MANUFACTURED PRODUCTS.

(CHAIRMAN'S ADDRESS.)

(*Abstract.*)

The object of the address was the discussion of certain points, connected with the preparation or manufacture of articles of food, which arise from time to time in the administration of the Sale of Food and Drugs Acts, and upon which the views of the Public Analyst and the manufacturer do not always coincide.

For example, a matter upon which the Analyst and the manufacturer or trader not infrequently disagree, is the policy euphemistically called "trade custom." This term covers a somewhat wide field, and a multitude of sins, and may include among other practices: (1) the substitution of some article for the particular article asked for by a purchaser, as for example the sale of tapioca as sago; (2) methods of bleaching, dyeing and colouring, as the bleaching of flour, the dyeing of beet-sugar to imitate Demerara sugar and the colouring of milk and butter; (3) the addition of substances known as "improvers," as phosphate of lime and potassium persulphate to flour; (4) methods of "facing" and polishing, such as the facing of rice or pearl barley with talc or French chalk; (5) "grading" articles during their preparation, with the object of leaving in the finished material an undue proportion of some worthless or semi-worthless ingredient, such as cocoa shell in cocoa, pepper husk in pepper; (6) the sale of mixed articles under the name of the article they purport to represent, with an attached label, printed in microscopical characters, notifying the admixture: examples, mustard mixed with starch and turmeric, cocoa mixed with sago and sugar; (7) the addition of salicylic acid as a preservative to unfermented wine.

From this list it may be gathered that gross methods of adulteration are declining, and in fact adulteration is rapidly becoming a scientific operation, carried out methodically by the manufacturer on lines laid down by his chemical advisers.

In further illustration was mentioned the article known as milk-blended butter, a substance originally prepared by blending milk with butter, the product containing some 25% by weight of water, and commanding a large sale under its somewhat alluring name. The Butter and Margarine Act prohibits the use of this name, and the article must now be sold under a fancy name approved by the Board of Agriculture, while the percentage of water, limited to 24, must be stated on the label.

A further notable step was the use of coconut oil, a fat possessing a considerable proportion of volatile fatty acids, as a butter adulterant, and a skilful blend in the right proportions of this and a neutral fat, such as lard, with butter gave a mixture answering to some of the tests for genuine butter.

These practices have been restricted by the Butter and Margarine Act, which gives the Board of Agriculture power to inspect butter factories, that is, places where butter is re-worked or blended, and enforces their registration with the Local Authority for the district. This Act also makes it unlawful to manufacture, sell, expose for sale, or import any margarine, the fat of which contains more than 10% of butter fat. So the death-knell was sounded of the mixtures of about half butter and half margarine which could only have been prepared with fraudulent intent, and which were calculated to deceive even the expert.

The sale of "filled cheese" or margarine cheese as cheese is now rare, but cheese gravely deficient in fat is fairly common, no standard for this existing. The writer has found Dutch cheese containing 1·5% of fat and 56% of water, and when this had dried naturally, it required a hammer and chisel to cut it. It was an ingenious idea to "coat" Gorgonzola cheese with an artificial rind made of barium sulphate coloured pink with oxide of iron, and rendered plastic with tallow; such a rind sometimes weighed one-fifth of the total weight of the cheese.

Rice is "faced" with talc or French chalk in order to polish or glaze the grains, and a limit of 0·5% of such extraneous mineral matter is usually held to be permissible. In the opinion of the writer such "facing" should be entirely prohibited, and as rice itself generally contains only about 0·3% of total mineral matter, the above limit seems unduly liberal. Already this method has been extended to pearl barley, which is also sometimes faced with mineral matter, though the latest idea is to dress the grains of pearl barely with rice flour, a method now largely practised in Holland.

The objectionable practice of bleaching flour by exposure to nitrogen peroxide admits of the use of low grade wheats which ordinarily yield a yellow flour, and thus an enhanced price may be obtained for an inferior article. An equally objectionable trade custom is the addition to flour of "improvers," generally consisting of acid phosphate of lime, phosphoric acid, or potassium persulphate. The object is to increase the "strength" and water absorbing capacity of flour, and bakers are informed that as many as 10 to 14 extra 2 lb. loaves can be obtained from a sack of flour by the addition of about 2 lb. per sack of 280 lb., with of course a corresponding diminution in the actual amount of flour in each loaf, and consequently in its nutritive value.

These processes have long engaged the attention of the Local Government Board and references have been made in reports upon the work of their Inspectors of Foods. It has been shown by these reports that bleaching was found to exercise an inhibitory effect on the salivary digestion of flour, and attention is drawn to the possibility that the changes which occur in the oil and protein during the process may have a prejudicial effect upon the nutritive value of the flour.

In the Report for 1912—13 the following significant passage, dealing with the addition of "improvers," occurred :—" It is a matter for concern that food materials should be liable to admixture with foreign substances of questionable wholesomeness and of no utility from the point of view of the consumer, merely for the purpose of securing trade advantages. This is especially so when an article of food is concerned like flour on which the bulk of the nation depends to a large extent for its nutrition. In such a case the community cannot afford the risk involved in any addition to or alteration of the food material which may at all impair its nutritive qualities."

It is sometimes asserted by the trade that these methods of bleaching and grading to produce a lighter colour are due to the necessity of meeting the demand of the public for whiteness, but the probability is that the public taste has really been trained in accordance with the wishes of the trade, by whom the whiter articles have been pushed forward. In what other way could the custom have arisen of the almost invariable substitution of tapioca, which is white, for sago, which is brown?

Other methods of sophistication to be noted are the packing of sardines in cotton seed oil in substitution for olive oil; and baking powders yielding only 1 or 2% of available CO_2 and which are therefore practically worthless.

A Court of Petty Sessions cannot satisfactorily settle the many complicated legal and scientific points arising in the administration of the Acts, and a Court of Reference, as recommended by the Select Committee on Food Products Adulteration, is now more urgently required than ever. Such a body would constitute an advisory Board to whom difficult questions requiring adjustment would be referred.

Very brief reference may be made to the Fertilisers and Feeding Stuffs Act. A point of material value to the purchaser is that the Act makes it obligatory for the seller of feeding stuffs, subject to certain exceptions, or of fertilisers, to state in his invoices the respective percentages of oil and albuminoids in the one case, and the percentages, if any, of soluble and insoluble phosphates, nitrogen and potash in the other, and that these percentages take effect as a warranty that the actual composition of the goods sold does not differ from the stated figures beyond certain official "limits of error." Generally manufacturers are found to comply loyally with these requirements, delivering an article in accordance with the terms of the guarantee. It is indeed striking to find how remarkably constant in composition some of the brands of oilcake are becoming, evidencing accurate standardisation of the methods of manufacture. Thus the original argument of the trade, that it would be difficult to give even an approximate guarantee for such goods, is refuted by their own improved methods, and it is open to question whether the "limits of error" might not with advantage be made a little more stringent.

DISCUSSION.

Mr. S. J. **PENTECOST** asked whether cotton-seed oil was less nutritive than olive oil. The hydrogenation of some oils was said to make them fit for use in the manufacture of margarine and other products.

Mr. T. F. **HARVEY** asked whether sardines in cotton-seed oil were sold at a lower price than those in olive oil. It seemed to him that the prejudice to the purchaser could only be a financial one. In the new Pharmacopœia what was known as the "Indian and Colonial Addendum" would be included, permission being given at any rate in our Colonies to use either arachis or sesamé oil in the place of olive oil in certain preparations when it was desirable to do so.

Mr. J. H. **DUNFORD** referred to the large quantities of degelatinised bones used by the makers of so-called baking powders and also in the manufacture of phosphated substances used by bakers as adulterants to give more body to flours. The method prescribed by the Fertilisers Act, of classifying as unsatisfactory all manures which did not conform to the guaranteed analysis, within the prescribed limits of error, was not fair nor equitable to the manufacturers. Both those fertilizers under and over the guarantees were classed together as unsatisfactory.

Mr. C. E. B. **MERRIMAN** said in a recent case, pepper had been represented to contain an abnormal amount of husk. As a matter of fact it was graded, one portion containing a large amount of husk and another portion a large amount of pepper starch, but both contained the same amount of the pungent principle. Should both portions be treated as adulterated?

Mr. W. G. **TIMMANS** mentioned that he had a customer who objected to sulphuric acid being water white and he had to darken it. Farmers often objected to having white bone manure, thinking it was adulterated; the real reason was that the benzine method of treating bones extracted the whole of the grease which was formerly not extracted.

Mr. J. M. Wilkie asked why a certain amount of discrimination was allowed to the vinegar manufacturer while similar liberty was denied other manufacturers. In regard to food products, he thought many people genuinely desired whiteness. Bearing in mind that flours might naturally contain nitrites, had it been definitely decided that nitrite-bleached flour, when the process was not carried to excess, was harmful to the organism ?

Mr. White said that he objected to manufacturers and traders setting up so-called trade customs with the view of giving the public an article that the public did not ask for, and doing this repeatedly until the custom became perpetuated. For long the custom of packing sardines in olive oil had existed, but if the manufacturers packed them in cotton-seed oil, the public had cause of complaint. Successful prosecutions had already been instituted for this offence. The question was not whether cotton-seed oil was as nutritious as olive oil, but whether the purchaser was getting what he asked for. In his own opinion he was not. Then with regard to the hydrogenation process, if a malodorous oil could be converted into a white solid odourless fat he had not the slightest doubt it would soon find its way into margarine. The bulk of margarines had coconut oil as their basis. The Fertilisers and Feeding Stuffs Act stated that the article sold must be in accordance with the guarantee stated in the invoice, subject to certain official limits of error. Tapioca and sago were absolutely different; tapioca was obtained from the root of *Manihot utilissima* and sago from the pith of the sago palm; when the substitution of tapioca for sago began it was because at that time, as now, tapioca was cheaper. He was not surprised that farmers objected to white manures if the colour had been grey before, because farmers were ultra-conservative. He did not think that in the first instance the public demanded a white article; it was simply because they had been educated in accordance with the wishes of the trade. The Local Government Board had made the statement, based on the evidence of Dr Monier Williams and Dr. Hamel, that bleached flour did interfere with digestibility, and had it not been for the war a Bill would in all probability have been introduced into the House of Commons one of the main features of which would have been the control of these methods of bleaching and of adding " improvers " to flour.

Mr. Archbutt remarked that there had been a great shortage of olive oil for several years and there was not sufficient to meet the various requirements. Unless it could be shown that cottonseed oil was less nutritious and less useful than olive oil for purposes of that kind, he did not see any reason why the substitution should be objected to, provided, of course, that the fact was stated.

Yorkshire Section.

Meeting held at Leeds, Queen's Hotel, on Monday, November 30th, 1914.

MR. F. W. RICHARDSON IN THE CHAIR.

THE ANALYSIS OF TANNING MATERIALS.

Part I. An Improved Basic Chloride Shake Method.

BY HUGH GARNER BENNETT, M.SC.

It is now nearly eight years since Procter and Bennett published their basic chloride shake method for the analysis of tanning materials, and that method—with trifling modifications—is still in use as the official method of the I.A.L.T.C. It is a considerable tribute to the method that during the last few years little or no alteration has been made to it, and that no marked improvement upon it has yet been suggested.

The shake method as used at present was a great step towards truth. The great number of comparative analyses now available show beyond dispute that the shake method estimates more non-tannins and less tannin, and is therefore so far nearer the actual truth.

At the same time the present official method does not yet properly distinguish between the tannin and non-tannin content of tanning materials, there being still a considerable proportion of non-tanning matters absorbed by the hide powder and reported as tannin. This has been conclusively demonstrated by the analyses of artificial mixtures, as in the experiments of Procter and Blockey [Collegium, 1903, 114, 124], and of Parker and Bennett [this J., 1906, 1193]. In the case of some non-tannins, especially of the gallic acid and catechin type, the error even with the present method must be very considerable. Therefore any further improvement in the method of tannin analysis should be in the direction of higher non-tannin results, and in consequence, lower results in tannin. What leather chemists must continue to search after is a method which detannises easily and yet yields a higher percentage of non-tannins. Important financial interests are involved in this matter, but as long as leather chemists are using a method of analysis which does not yield the actual truth in its results, they must continue their endeavours to improve their method of analysis in such a way as to approach that truth. What is desired is not to estimate leather-forming value, but to determine the percentage of " tannin " in a material, whatever the nature and quality of that tannin. The tannins are a pretty definite group of compounds, and there is no doubt as to what is included in the term. Their relative leather forming value and the leather forming value of some non-tannins are certainly questions not to be forgotten, but are quite distinct from the question of the estimation of the amount of tannin.

Naturally those who sell tanning materials, especially tanning extracts, will not welcome changes which show less tannin present in those materials, but any change towards truth would apply generally; it is only those who have inferior materials to offer, who have any real need to fear an improved method of analysis. Further, it is urgently necessary from the tanners' point of view that any positive improvement and advance towards truth should be adopted as soon as possible.

The question is therefore: *what alterations in the official method will give equally good (or better) concordance, and yet estimate less tannin ?* How can the absorption of non-tannins by hide powder be lessened ? Some previously published experiments by the author supplied a hint towards the answer. In a paper on " The Standardisation of Hide-Powder " [this J., 1907, 455], the influence of the texture and acidity of the powder itself was pointed out, and the importance of the acidity due to chroming was emphasised. Procter and Bennett [this J., 1906, 1203] also pointed out the influence on results of the amount of moisture added with the powder, and hence suggested a fixed amount. On similar grounds they suggested a fixed amount of hide powder. The question arises, therefore, whether the amounts fixed a few years ago were the best, and whether by a judicious alteration we might not be able to show (by substantially the same method of analysis) a distinct improvement in accuracy. The writer now suggests that the shake method would give lower tannin results, and higher non-tannins if modified in any or all of the following ways:—

1. Decreased acidity in the hide powder before chroming.
2. Detannisation in a more dilute infusion.
3. The use of less hide powder.
4. Decreased acidity in the hide powder due to chroming.

1. *Decreased acidity before chroming.* In a previous paper by the writer experiments were recorded with hide powders with acidities up to 12·6, as determined by the method suggested in the same paper. The great influence of this factor on the results was emphasised, and it was demonstrated that the more acid powders gave much lower non-tannin results. It was further pointed out that "if a large quantity of acid were in the powder it would be necessary to have some method of controlling it in the washing, for it would be useless to fix a definite acidity in the unchromed powder, if an indefinite proportion is to be washed out." It is nevertheless precisely this futile method that has been adopted by the I.A.L.T.C. As a first limit, the author suggested an acidity of 5·0 as a *maximum*; later A. T. Hough pointed out that hide powders with greater acidities could be brought down to 5·0 by the addition of the required amount of caustic soda solution; but more recently, on the plea of concordance, the I.A.L.T.C. have adopted the method of acidifying more neutral powders to bring their acidities up to what was previously a maximum. As pointed out above, this cannot be conducive to concordance. If a few c.c. $N/10$ HCl are added to the powder before chroming—how much of this will be left in after washing?

The ordinary test for chlorides in the wash waters is no guide at all. That test was devised as an indication of the rate at which salt (NaCl) was being washed out of the powder. This was just a matter of repeated dilution until its concentration was negligible. Washing free from chlorides when the powder is acidified with hydrochloric acid is another matter altogether. That is a matter of hydrolysis, not of dilution, and in the hands of different operators is liable to be carried out to a widely different extent, with the inevitable difference in the results. The effect of acidifying the hide-powder up to 2·5 to 5·0 acidity has simply been—

1. To render the washing test of little or no value.

2. To give lower non-tans, and higher results in tannin.

3. To produce discordant results between different operators.

If the I.A.L.T.C. think the time is ripe for so standardising the powder that its acidity should be definite and universal, it seems clear that the amount to fix on should be nil. The suggestion of Hough should be carried a stage further, and the powder made neutral by the addition of the required amount of $N/10$ NaOH solution. This would restore the value of the washing test for chlorides, would give far better concordance than acidified powders, and would also contribute towards the object of this investigation, viz., more accurate results. The experiments recorded below confirm completely the author's statement of eight years ago that neutral powders when chromed as usual will detannise as easily and as completely as acid powders. If that be so, what need is there for any acid? It would be perfectly satisfactory to rely solely upon the acidity due to chroming for the attainment of complete detannisation.

Neutralised powder is much easier to manipulate than acidified; it is easier to detach from the linen, easier to wash, and very much easier to squeeze. With acidified powder a press is practically a necessity, but with neutralised powder it is quite unnecessary.

2. *Detannisation in a more dilute infusion.* In the original paper of Procter and Bennett [this J., 1906, 1203] the amount of water to be added with the hide powder was fixed at 50 c.c. to 100 c.c. liquor. To avoid a factor this was later changed to 20 c.c., making the total volume of liquid 120 c.c., of which, half (60 c.c.) were evaporated for weighing. It was observed that when the total volume was made up to 150 c.c. the non-tans were slightly higher than when the total volume was 120 c.c., *i.e.*, if the determination be conducted in a more dilute infusion, there is a lesser absorption of non-tanning matters. In the present work it has been sought to dilute the infusion as much as could be done conveniently, and by adding 100 c.c. distilled water to 100 c.c. liquor, and mixing gently before adding the hide powder for shaking. With the powder 20 c.c. water are added as usual, and in this case the total volume is 220 c.c., of which half, 110 c.c., are evaporated by pipetting successively 60 c.c. and 50 c.c. of non-tan filtrate. This may be done in the usual basin, or, if desired, in special basins to contain 110 c.c. The influence on the results is very marked, as will be seen from the figures below.

3. *The use of less hide powder.* In considering the standardisation of hide powder, stress was laid on the influence of the texture of the hide powder on the result, and comparative work showed that granular powders gave higher non-tannins than fibrous powders. This was doubtless to be explained by the greater surface action of the fibrous powder. Although truer results are yielded by the granular powders, they were ruled out for the sake of general concordance, and also to obtain a closer agreement with the results of the American chemists, who used fibrous powders.

In the present investigation, which seeks only to approximate to truth, another alternative presents itself. If less surface action be the cause of the difference between granular and fibrous powders, it would be an easy matter simply to reduce the amount of hide powder used, so obtain less absorption (or adsorption) of non-tanning matters. The present amount, 6·5 grams dry powder per analysis, was at the time of choice the *maximum* amount used by the American chemists, and was fixed upon by Procter and Bennett to make concordance more certain.

There seems no doubt now that this amount is quite unnecessarily large, and that complete detannisation can be obtained by 5 grams dry powder per analysis, and possibly even less.

A common criticism of our method of analysis has been that in analytical work the hide powder is in distinct excess over the tannin present, whereas in the tannery the tannin is in excess of the hide. Perhaps this criticism will always have some force, for analysis must do its work in a comparatively short time, yet there is every reason to make the difference as small as possible. Less hide powder would mean that the analysis was carried out nearer to tanyard conditions. On this principle, as well as to obtain higher non-tannin results, it is highly desirable that in analysis the hide powder should be in the least possible excess.

The experiments here recorded show that this factor has less influence on the results than might be expected, but it clearly has an influence, and in the required direction. In working with a decreased amount of hide powder the writer observed the convenience involved in such a change. The smaller quantity of powder was more convenient to manipulate, and much quicker to wash. The saving in cost (23%), as well as time and trouble, would be considerable in many laboratories. In short, therefore, less hide powder means truer results, in less time, with less trouble, at less cost.

4. *Decreased acidity due to chroming.* Even the basic salt $Cr_2(OH)_3Cl_3$, which is now in use for chroming, is considerably acid, and it was decided to test the effect of chroming with a more basic salt, and so reducing the acidity due to chroming. The influence of acidity before chroming is considerable, and there seemed no reason to expect the contrary in the acidity due to chroming. This indeed proved to be the case. The chromic chloride for the present experiments was made basic to correspond to the salt $Cr_2(OH)_4Cl_2$. For a few experiments only 1·89 c.c. $N/10$ sodium carbonate may be added to each 1 c.c. of the ordinary 10% stock solution of $Cr(OH)_3Cl_3$. As anticipated, the non-tannins obtained were distinctly higher when the more basic salt was used, and yet the solution was quite satisfactorily detannised. The powder was much more easily washed free from chlorides.

The following experimental results were obtained by testing the same sample of a good chestnut extract in various ways, and illustrate the influence of the various factors discussed above. The results are each a mean of two very closely agreeing duplicates:—

	Method used.				% Non-Tans
	Acidity before chroming.	Amt. of hide powder per "shake."	Total vol. of detannised solution.	Chroming salt.	
One factor changed	5·0	6·5	120 c.c.	$Cr(OH)_3Cl_3$	11·8
	5·0	6·5	220 c.c.	,,	12·9
	0·0	6·5	120 c.c.	,,	12·6
	5·0	6·0	120 c.c.	,,	11·9
Two factors changed	0·0	6·0	120 c.c.	,,	12·6
	0·0	5·5	120 c.c.	,,	12·6
	0·0	5·0	120 c.c.	,,	13·0
Three factors changed	0·0	6·0	220 c.c.	,,	13·4
	0·0	5·0	220 c.c.	,,	13·9
Four factors changed	0·0	5·0	220 c.c.	$Cr(OH)_4Cl_2$	14·9

In each of these experiments the solutions were quite completely and satisfactorily detannised, and the absorption of tan took place with the same case as in the I.A.L.T.C. method. It will be seen that when all tho factors are changed that have been discussed above, the difference from the I.A.L.T.C. method is about 3%. Other extracts and other materials show other differences according to the nature of the material and the quantity of non-tanning matters associated with that particular material.

By altering the above four factors farther in the same sense, it should be possible to obtain still higher non-tannins and still more correct results. If the alterations be carried far enough, of course, the time will come when detannisation will become incomplete. The most correct results will be obtained when these changes are strained almost, but not quite, to the breaking point. What exactly this point will be depends largely on which factor is pushed to the extreme limit. The author, however, regards a further reduction of hide powder to even less than 5·0 grams per shake as the next most desirable step. It is intended to make further experiments on these lines. It is possible that the attainment of the minimum amount of hide powder may involve some extension in the time of shaking. The author would therefore suggest that the basic chloride shake method should be revised officially, and carried out with the following modifications :—

1. The hide powder to be exactly neutralised before chroming.
2. Only 5·0 grams dry hide powder to be used instead of 6·5 grams per analysis.
3. To 100 c.c. ordinary strength infusion, 100 c.c. of distilled water to be added before the prepared hide powder, and the total volume made up to 220 c.c., of which any convenient aliquot part may be evaporated for weighing, preferably 110 c.c., as its use involves no "factor."
4. The chroming liquor to be a solution of the salt $Cr_2(OH)_4Cl_2$ instead of $Cr_2(OH)_3Cl_3$.

These alterations, though perhaps not as near the truth as it is possible to get, would at any rate be a distinct step towards that goal. Though still within the limit as to what is possible in improving the method of analysis, they might well be made part of the official method of analysis as another step towards the ideal method.

It still remains to satisfy "Concordance." The author's own experience with the revised method leads him to expect no difficulty in this direction. The same material analysed in duplicate in successive days has given the same results. There is, however, no perfectly satisfactory way of testing the concordance of a method except by collecting the results obtained by independent observers in different laboratories, and the writer therefore cordially invites collaboration in testing this method. Although the writer considers this revised method well within the limits of complete detannisation, it is just conceivable that with some particular test a trace of tan may be left unabsorbed. Any method which seeks to be nearer the truth must risk this to some extent. If incomplete detannisation should be observed in any instance the defect can easily be remedied. In all the experiments hitherto the usual 15 minutes' churning has been given, but some experiments undertaken in conjunction with Mr. J. R. Blyth a few years ago indicated that the extension of the time of churning has little or no effect on the absorption of non-tannins and upon the result. By extending the time of churning 5 or 10 minutes' complete detannisation together with all the advantages of the improved method could still be easily ensured.

If the objection be urged that the revised method needs longer time for the evaporation of 110 c.c. instead of 60 c.c. it may be pointed out that on the other hand time is saved in washing the powder, which needs more personal attention. Again it is questionable whether the result of the analyses would be at all retarded, for at present the "non-tannins" are quicker to finish than the "total solubles," owing chiefly to the much less time required for drying to constant weight. Further, it is possible that the time required for a whole analysis could easily be shortened by reducing the time for chroming hide powder, the one hour specified is unnecessarily long, especially with the more basic chroming liquor now suggested. In conclusion, it may be of interest to give a few comparative analyses with different tanning materials. The differences here noted vary according to the source and methods of manufacture :—

Material.	Tan % (official method).	Tan % (Bennett).	Difference.
	%	%	%
1 Sumach	24·5	23·0	1·5
2 Valonia	29·2	25·2	4·0
3 Myrabs...........	33·3	31·6	1·7
4. Myrabs Extract ..	30·1	26·1	4·0
5. Chestnut	28·0	24·9	3·1
6 Oakwood	26·4	23·2	3·2
7. Quebracho (sulphited)	65·1	52·8	12·3
8. Quebracho (bleaching extract)	35·6	27·6	8·0
9. Cube Gambier ..	46·3	36·9	9·4
10. Block Gambier ..	31·1	23·9	7·2

THE ANALYSIS OF TANNING MATERIALS.

Part II.—Tannery Liquors.

BY HUGH GARNER BENNETT, M.SC.

The results of the analysis of used tan liquors, when obtained by the official method of the International Association of Leather Trades' Chemists for tanning materials, are far from trustworthy. The author has given considerable attention to this question, which has been much neglected in the past.

It has been found a great advantage to utilise the improved basic chloride method suggested in the preceding paper. The gain in accuracy is even greater with liquors than with tanning materials, on account of the relatively higher non-tannin content of the former. In reducing the proportion of hide powder employed and in working at a greater dilution, the improvement in accuracy is considerable. In the matter of the acidity of the hide powder, due either to its original acidity or to the chroming, the arguments have even greater force for liquors than for materials, because liquors are always so acid themselves that any acidification of hide powder is superfluous. The only point of chroming is to render the powder insoluble.

However the I.A.L.T.C. regard the improved method with respect to tanning materials, there can be no arguments of financial interest against the immediate adoption of these improvements for tannery liquors.

In the ordinary analysis of yard liquors the determination of insoluble matter is usually not required. The most convenient plan, therefore, is to filter the liquor through filter paper before dilution. If it is required to determine the insoluble matters, special care must be taken in sampling, as the distribution of the mud in a pit of liquor varies enormously. It is incorrect, moreover, to dilute the liquor and then filter it, for what is required is the amount of insoluble matter in the liquor itself, not in the liquor if it were diluted. For the "total solids," the same volume of liquor as is taken for the "solubles" and "non-tannins" should be diluted into another flask.

In the tannery, results stated in percentage by volume are of far more value than those in percentage by weight. Hence the amounts of liquor taken for dilution should be measured. The "barkometer strength" of the liquor is usually noted before analysis so that by the specific gravity it is always possible to calculate the results into percentage by weight. For the weaker liquors there is no advantage in accuracy in making one litre of diluted liquor, and there is much gain in convenience and speed by making up only half a litre, and for the weakest liquors only a quarter of a litre. Sometimes, indeed, no dilution at all is necessary. Pipettes are the best means of measuring the liquors and it is very convenient to have a set of pipettes delivering 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 75, 100, 150 and 200 c.c. respectively. The liquors are delivered into the dilution flasks containing cold distilled water and made up to mark with cold distilled water. Hot water is unnecessary as the liquor is clear and dissolves without difficulty. In the case of strong liquors odd quantities are necessary, and a 10 c.c. graduated pipette is useful in addition to those mentioned above.

As the detannisation is to be carried out at a dilution of 0·2% tannin approximately it is best to dilute to this strength direct and use this solution both for the determination of the "soluble solids" and of the "non-tans."

This halving of the usual quantities involves no loss of accuracy in weighing for the residues from 50 c.c. of a 0·2% tan solution of even the newest liquors of a tanyard is greater than that obtained from the "non-tannins," of some quebrachos. In the case of the older liquors this extra dilution is a great advantage as the amount of solid matter in a 0·2% tan solution increases rapidly as the liquors become older.

It is convenient also to use the same bottles, churn, and other apparatus as in the I.A.L.T.C. method, so that 100 c.c. of the liquor is employed, and to detannise this only 2½ grms. dry hide powder will be required. This will weigh 7—9 grms. when washed and pressed, so that the 100 c.c. are conveniently made into 110 c.c. by the addition of distilled water. To avoid a factor it is convenient to evaporate 55 c.c. of the non-tan filtrate, which is equivalent to 50 c.c. of the original liquor solution. Duplicate analyses, such as are usual in extract analysis, are unnecessary for liquors so that it is possible for one operator to undertake more than twice as many liquors as extracts.

Even with the improvements suggested the gravimetric method is still open to grave criticism when applied to old tan liquors which have been worked down the yard in the usual way. If solutions containing 0·2% tannin are used and 50 c.c. evaporated for "soluble solids," the results are still unreliable, for it is impossible to get constant weight. Basins and residues lose from 10—30 mgms. at each re-weighing and the residue obviously decomposes, becoming quite black. Results in soluble solids may vary over a range of 1½%, which is absurd when one is attempting to estimate ½ to 1% of tan. The same inconstancy is observed in weighing the non-tannin residue, rendering the tannin result doubly uncertain. The reasons for this difficulty are not far to seek. There is too much residue to dry effectively in the ordinary way. Well over 1 gram of residue is sometimes obtained from 50 c.c. of solution even when diluted to the extent suggested above, and it is quite impossible to dry a layer of this on the bottom of even a flat-bottomed basin. The best and simplest plan is to evaporate a smaller quantity than the usual 50 c.c. For nearly spent liquors 20 c.c. and 10 c.c. are convenient alternatives. The gain in accuracy in this respect involves a further gain also, because the evaporation taxes only a very short time comparatively and thereby eliminates the possibility of much decomposition in the heated liquor. There is also a considerable gain in speed. The author recommends as a general rule that the residues to be weighed should never exceed 0·25 gram. Whatever volume is employed for the total solids, should, for the same reasons and for convenience in calculation, be employed also for the non-tannins.

Loss of weight on drying is also connected with the chemical action of the constituents of the residue. Experiments made by the author in conjunction with Dr. J. G. Parker some years ago (this J., 1908, 1193) showed that it is impossible to evaporate mixtures of tannin and calcium acetate and obtain the theoretical results. The tannin not only expels the acetic acid, but the calcium tannate rapidly oxidises. It may be suggested that in liquors there is excess of various acids; this is not always the case, especially in the first liquors of a yard, which often receive a great amount of lime in the course of a day's work. Furthermore, if the liquor is acid, the excess of volatile acids is driven off in evaporation, and the non-volatile acids—such as gallic acid—are just as susceptible as the tannin to similar oxidation. A simple remedy for this difficulty is to acidify the liquors (soluble solids and non-tannins) just before evaporation (not before analysis) with tartaric acid, of which 5 c.c. of a ½% solution is employed. This acid assists materially in the complete expulsion of the volatile acids, both free and combined. It also keeps the liquor always acid and so prevents the alkaline oxidation due to lime salts with weak acids. Similarly it ensures an acid residue and so prevents the oxidation of any tannate of lime. Tartaric acid is non-volatile, and the weight used, 25 mgrms., can be deducted from the weight of the residue. The difference in colour in residues evaporated with and without the acid is very noticeable. Oxalic acid seemed at first more suitable than tartaric acid for this purpose on account of its calcium salt being insoluble even in acid solution, but with oxalic acid, however, it is impossible to obtain a residue of constant weight. Tartaric acid, on the other hand, does not decompose at 100° C., has no water of crystallisation, and gives a crystalline residue of constant weight after half an hour's drying at 100° C.

Apart from the lime and other alkali salts present in tan liquors, there is probably a greater tendency to oxidation in liquor residues than in those from fresh materials, and there is therefore a strong objection to heating at 100° C. for any great length of time. The presence of tartaric acid is again of some value, for it is also a mild reducing agent and would tend to retard any such oxidation of the tannin and non-tannin residues. The author has found it a great advantage to concordance of results to limit to a definite extent the time which shall be allowed for drying residues, and has made a practice of giving one hour's drying exactly and no more. Whilst this is an advantage to concordance it is in all probability an advantage also in correctness of result, for after one hour at 100° C. the error due to water is of far less importance than the error due to decomposition and oxidation. This desirability for limited time in drying justifies also the employment of small residues.

The author therefore recommends that the analysis of tannery liquors should be carried out as follows:—

The liquor is passed through filter paper until clear. A solution of the filtered liquor is made to contain between 0·17 and 0·23% tannin. The volume of clear liquor necessary for this is pipetted into a litre, half-litre, or quarter-litre graduated flask containing some distilled water. The flask is filled up to the mark with distilled water and mixed well.

To determine the *total soluble matters*, 50 c.c. or less of this solution should be evaporated to dryness in flat-bottomed basins, into which 5 c.c. of a ½% solution of tartaric acid has previously been pipetted. The weight of residue so obtained must not exceed 0·25 gram. When the solution is evaporated to dryness, the basin is dried in a steam oven for one hour only, and then cooled and weighed. From the weight of the residue 25 milligrams must be deducted before the percentage is calculated.

To determine the *non-tannin matters* the procedure is as follows:—The moisture of the air-dry hide powder is determined and the quantity equal to 2½ grams actual dry hide powder is calculated. Any multiple of this quantity is taken, according to the number of analyses to be made, and wet back with 10—12 times its weight of distilled water. The acidity of the hide powder is determined in the usual manner, and the volume of $N/10$ caustic soda necessary exactly to neutralise 2½ grams of dry hide powder is calculated. Any multiple of this quantity, according to the number of analyses being made, is added to the wet hide powder and well mixed until the mass gives no pink colour when one drop of a 0·1% alcoholic solution of phenolphthalein is added. The chroming solution is then added.

For chroming, 2% of chromic chloride ($Cr_2Cl_6 12H_2O$) on the weight of the dry hide powder is employed, its solution being made basic to correspond to the formula $Cr_2Cl_2(OH)_4$ by the addition of sodium carbonate. A 10% stock solution of this chroming liquor is very convenient and is made by dissolving 100 grams of the chromic chloride crystals in a little distilled water in a litre flask and very slowly adding a solution 40 grams of anhydrous sodium carbonate, with constant stirring, finally making up to mark with distilled water and well mixing. Of this solution ½ c.c. should be used for 2½ grams dry hide powder, *i.e.*, for each analysis.

The hide powder and chrome solution are churned slowly for one hour, and the powder is then washed free from chlorides and soluble matter, as in the Procter-Bennett shake method. The silver nitrate test should be similarly employed. The hide powder is then squeezed to contain about 70% of water and the whole weighed. The amount M, containing 2·5 grams dry hide powder is thus found, weighed out, and added immediately to 100 c.c. of the diluted solution of the liquor, along with (12·5—M) c.c. of distilled water. The whole is corked up and agitated in a rotating churn for 15 minutes, and then squeezed immediately through linen. The liquor obtained is again filtered through filter paper, the filtrate is returned till clear, and 55 c.c. or less (according to the amount used for the total solids) is evaporated to dryness in flat-bottomed basins into which 5 c.c. of a ½% solution of tartaric acid has been previously pipetted. When the solution is evaporated the basin should be dried at 100° C. for one hour, cooled, and weighed. From the weight of the residue 25 milligrams must be deducted before calculation.

If the official hide powder is to be employed, the quantities to take for batch B1 are given in the following table:—

No. of liquors to be analysed.	Weight of official hide powder to take.	No. of c.c. $N/10$ NaOH required.	No. of c.c. $Cr_2Cl_2(OH)_4$ solution required.
	%	%	%
1	2·85	1·4	0·5
2	5·70	2·8	1·0
3	8·55	4·2	1·5
4	11·40	5·6	2·0
5	14·25	7·0	2·5
6	17·10	8·4	3·0
7	19·95	9·8	3·5
8	22·80	11·2	4·0
9	25·65	12·6	4·5
10	28·50	14·0	5·0
11	31·35	15·4	5·5
12	34·20	16·8	6·0

The advantages claimed for this method of analysis over the I.A.L.T.C. method are—

(1) A considerable improvement both in accuracy and in concordance. This applies to the estimation of soluble solids, and of non-tannins also. The method shows distinctly less tannin than the official method.

(2) A much greater ease of execution. Both in washing the hide powder and in weighing the basins, 5 tan liquors involve less work than 1 extract done in duplicate.

(3) A considerable saving in cost. As only 2½ grams of hide powder are used per analysis, the cost is little more than ⅕ that of the official method.

NOTE ON THE TANNINS OF VALONIA, OAKWOOD, AND CHESTNUTWOOD.

BY HUGH GARNER BENNETT, M.SC.

For some time the author has been engaged in an investigation for distinguishing better the various tanning materials, more especially those of the "pyrogallol group." The various tests suggested have each been confirmatory of the classification first proposed, viz., that valonia, oakwood, and chestnut tannins form one closely allied section, whilst sumac, myrabolans, and algarobilla fall into another section together. This arrangement is suggested by the following tests previously devised by the author, viz., the chromate test, the iodine test, the aqueous ferricyanide test, the ammoniacal ferricyanide test and the ammonium cobaltate test. This arrangement is also in harmony with other tests devised by Procter and other workers, viz., the lime water test, the sodium sulphite test, the copper sulphate and ammonia test, the lead acetate test, and the lead acetate and acetic acid test.

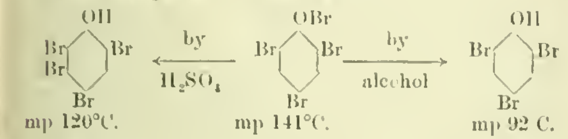
These two sections are now fairly sharply marked and can easily be distinguished. There remains the important problem of distinguishing the different individual members of each section. To solve this in connection with the valonia section is the object of this investigation. So far as the author is aware, the behaviour of valonia, oakwood, and chestnut tannins is practically the same towards every known test. The only slight differences are:—(1) In the lead acetate and acetic acid test, the precipitation of the tannin is complete with valonia and oakwood and *almost* complete with chestnut. (The sumac section and mixed tannins give partial precipitation and catechol tans no precipitation.) (2) In the formaldehyde test valonia gives a slight turbidity, whilst the other two remain clear.

These differences are too slight to be of great practical value, and it is clear that some new methods must be devised. That there is actually a difference between these three materials is evident from the fact that valonia makes a different leather from chestnut, whilst oakwood may be considered to be intermediate between valonia and chestnut in its practical effect.

The author has found that it is possible to distinguish these three materials easily by the action of bromine water upon a solution of the products obtained when solid extracts of these materials are subjected to dry distillation. The extracts are evaporated to dryness on the steam bath, powdered, and dried further at about 30° C. if convenient. For the dry distillation an inexpensive retort is easily made from a piece of tubing about 6 inches long and rather over ½ inch in internal diameter, closed at one end, which receives a layer of the dried extract. The open end of the tube is fitted with a cork through which passes a delivery tube leading into a test-tube acting as the receiver. This delivery tube acts as an air condenser. It is best to keep the wide tube horizontal and to bend the delivery tube at right angles. The extract is gradually heated until blackened and is then strongly heated till no more distillate is received. This only takes 5—10 minutes. The distillate is shaken with 10—15 c.c. distilled water and filtered from the tarry matters which remain undissolved. An excess of fairly strong bromine water is added to the filtrate and the mixture is shaken up well.

Under this treatment valonia yields a dense yellow crystalline precipitate, which after filtering, washing with cold water and drying, appears under the microscope as a mass of yellow plates. This precipitate has been found to be tetrabromophenol ($C_6H_2Br_3.OBr$) and exhibits the following properties:—It is insoluble in water and cold alcohol, and is best purified by washing with these reagents successively. The melting point of the crude substance varies according to the conditions of precipitation, but is generally between 120° C. and 136° C. After purification by washing repeatedly with cold alcohol it melts fairly sharply at 139°—141° C. with decomposition, bromine being evolved. Watts' "Dictionary of Chemistry" gives the m. pt. of these substances as 118° C., which led the author to think at first that the product he had obtained was an impure tribromophloroglucinol, $C_6Br_3(OH)_3$, m. pt. 151°. An experiment with pure phenol, however, showed that the 118° C. was an error, and that tetrabromphenol, $C_6H_2Br_3(OBr)$, melts at 139°—141° C. like the product obtained from valonia. This product liberates iodine from potassium iodide, a reaction which appears typical of compounds containing the radicle—OBr. It cannot be recrystallised from alcohol, as hot alcohol decomposes it fairly easily, yielding tribromphenol, $C_6H_2Br_3(OH)$. From very dilute alcohol this may be crystallised easily, yielding a felted mass of white needles, which after repeated recrystallisation from dilute alcohol, give a melting point of 92° C. The product is also acted upon by warm sulphuric acid, undergoing intra-molecular change into its isomer tetrabromphenol, $C_6HBr_4(OH)$, which on recrystallisation from dilute alcohol yields white needles with a m. pt. of 120° C.

These changes are indicated thus :—



Under similar treatment the tannin of chestnut yields no precipitate with bromine water and hence none of the above products. The two materials are thus very easily distinguished, and there seems little doubt that this difference involves a radical difference in the constitution of the respective tannin molecules. It is clear also that it would be an easy matter to detect the presence of valonia tannin in mixture with chestnut or any other tannin which under this treatment yields no precipitate with bromine water.

Under this treatment the tannin of oakwood yields a distinct turbidity with bromine water, but in the author's first experiments he failed to filter this precipitate for purposes of investigation. Repeated attempts, however, and larger quantities yielded a small quantity of a dark product melting at 107°—112° C. This dissolves in hot alcohol, which upon dilution and cooling yielded white felted needles, m. pt. 86°—89° C. There can be little doubt that these are the same products (only impure) as were obtained in the case of valonia, but the quantities obtained were so exceedingly small that further purification and investigation were impossible. This indicates that oakwood also contains at any rate a small quantity of that tannin which yields phenol on dry distillation. This behaviour justifies the statement made above that the practical effects of oakwood are between those of valonia and chestnut.

Under a similar treatment myrobalans behaves like chestnut, and yields no precipitate with bromine water. This gives some chemical justification to the tanner, who, when he desires to substitute "extract" in his tannage for "dry material," uses oakwood to replace valonia, and chestnut to replace myrobalans.

This distillation process has been repeated a good many times with each of the materials mentioned, and that there is little doubt that the result is the characteristic behaviour of each of the materials in question. The results, moreover, are somewhat encouraging to the view that in this way it is possible not only to differentiate the different tannins, but also to throw some light upon their chemical constitution. The work is being continued with the tannins of other groups, upon which it is hoped to report later. The results, so far, indicate that the other members of the pyrogallol group of tannins (myrobalans, gallotannic acid, etc.) yield no precipitate with bromine water; whereas the catechol tannins (quebracho, gambier, mimosa bark, etc.) yield a precipitate which is *not* tetrabromphenol, but a sticky, tarry product which the author has failed to crystallise or purify.

Another line upon which it is hoped to obtain fruitful results is to apply other reactions to the products of dry distillation. The distillates from valonia, oakwood and chestnut, for example, give a precipitate with lead acetate, which may be due either to pyrogallol or catechol. They also give *feebly* the potassium cyanide reaction and the iodine reaction for pyrogallol. As these last are very delicate reactions there seems no doubt that pyrogallol is a minor product in the distillation, and it becomes a question whether valonia, oakwood, and chestnut can really be regarded as pyrogallol tannins, for neither their infusions nor their dry distillates give the reactions which are peculiar to the pyrogallol grouping. The exception is the purple colour obtained with copper sulphate and ammonia precipitate. This is given by pyrogallol itself but is not given by the other pyrogallol tannins. The alternative conclusion, therefore—which is perhaps more probable—is that these three tannins are actually pyrogallol derivatives but that the pyrogallol grouping has a different place in the molecule, or a different relation to the rest of the molecule, than is the case with the other pyrogallol tannins.

Lectures.

ORGANIC ARSENIC COMPOUNDS.

A Chapter in Applied Chemistry. A. A. Boon. Inaugural Sessional Address delivered before the North British Branch of the Pharmaceutical Society, on Nov. 27, 1914. Pharm. J., 1914, 93, 836—838. (See also Martindale, this J., 1909, 907—911.)

For some months now our attention has been called to the shortage of dyestuffs, and we were lately informed of the efforts which are being made to meet and overcome this difficulty. When we recall the fact that the manufacture of synthetic drugs is the latest development of the coal-tar colour industry, I need hardly say that pharmacists ought to be interested in any steps that are being taken to put the colour industry on a firm basis in Britain, for progress in the one branch of applied chemistry means progress in the other.

One of the most recent chapters dealing with synthetic drugs is that relating to organic compounds containing arsenic and antimony. I propose now to give a very brief account of the chemistry of some of these so-called arsenicals. Apart from their chemical interest, some of them, as you know, are regarded as chemical specifics in diseases due to protozoa.

The problem relating to the nature of the liquid which is obtained when a mixture of white arsenic and potassium acetate is distilled was undertaken in the early part of the last century. As a matter of fact, that investigation led to the discovery of cacodyl and its derivatives, which thus became the first examples of compounds in the aliphatic series of hydrocarbons containing arsenic.

The physiological action also of these aliphatic arsenicals was undertaken by their discoverer. It was found that although cacodyl and its oxide were very poisonous, yet cacodylic acid, which contains 54 per cent. of soluble arsenic, was practically harmless. It is interesting in this connection to note that in cacodylic acid the arsenic is pentavalent, and in the other derivatives just mentioned the arsenic is trivalent.

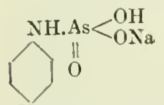
As a sodium salt cacodylic acid has been used in medicine, but at present the *aromatic* compounds containing arsenic have practically displaced the *aliphatic* arsenicals.

Two general methods are employed for preparing the aromatic compounds containing arsenic. One is effected by the action of arsenious chloride on mercury diaryl derivatives—products which result from the interaction of sodium amalgam and the bromo-derivatives of the aromatic hydrocarbons; and the other is accomplished by the addition of sodium to an ethereal solution of arsenious chloride on chlorobenzene and analogous aryl halides. By means of these two methods primary, secondary, and tertiary aryl arsenicals and their derivatives have been prepared. From one of these derivatives, viz., *phenyl arsenious oxide*, *arsenobenzene* can be obtained by the reduction of the oxide with phosphorous acid, this being carried out in alcoholic solution. *Arsenobenzene*, which crystallises in yellow needles, is theoretically very important. It is the parent substance of "Salvarsan," and is really the analogue of *azobenzene*, the mother substance of the azo-dyes.

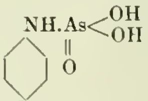
For the manufacture of magenta from aniline containing o- and p- toluidines arsenic acid has been now employed for a number of years as an oxidising agent. This use of arsenic acid was the outcome of a study of the action of various oxidising agents on aniline and its homologues after the discovery of mauve (the first so-called "aniline dye") about the middle of last century.

In 1863 it was shown that arsenic acid had another action on aniline, for when aniline arsenate was heated (190°—200° C.) one of the products was a colourless compound, which was regarded by its discoverer as an anilide of arsenic acid. A number of salts of this compound were also described, and amongst them was the sodium salt. The constitutional formula assigned to the anilide referred to is given below (I.). The sodium salt derived from it was introduced into therapeutics under the commercial name of "atoxyl," and to it was ascribed the structural formula II. These formulæ, however, proved to be erroneous, for in 1907 it was shown that the action of arsenic acid on aniline was exactly comparable with that of sulphuric acid on this aryl-amine. The product obtained from the latter reaction is usually known as sulphanilic acid (III.), and so by analogy that resulting from the former was called arsanilic acid (IV.).

$$C_6H_5NH_2+AsO(OH)_3-H_2O \rightarrow C_6H_5NHAs(OH)_2$$



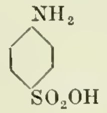
II.



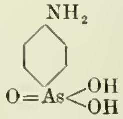
I.

$$C_6H_5NH_2+H_2SO_4-H_2O \rightarrow C_6H_4{<}\begin{matrix}NH_2(1)\\SO_2OH\,(4)\end{matrix}$$

$$C_6H_5NH_2+AsO(OH)_3-H_2O \rightarrow C_6H_4{<}\begin{matrix}NH_2\,(1)\\AsO(OH)_2(4)\end{matrix}$$



III.



IV.

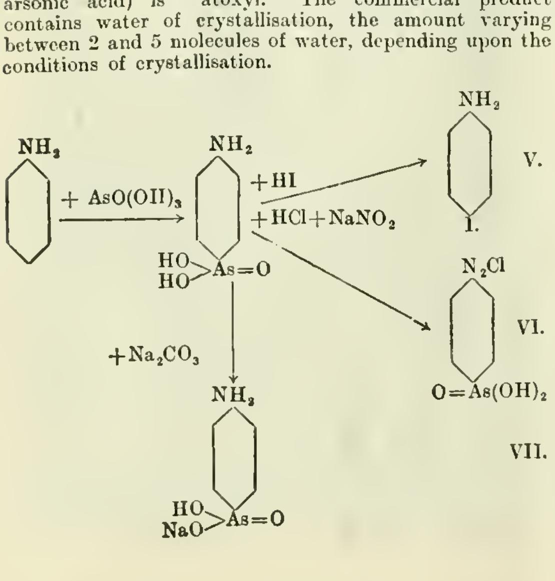
That arsanilic acid had the above constitution was proved by the following experimental facts :—

(1) It could not be decomposed into arsenic acid and aniline by any of the ordinary reagents which are used to hydrolyse anilides.

(2) By boiling it with hydriodic acid, p-iodoaniline (V.) was obtained, thus indicating that the "arsonic" group (the arsenic atom in the nucleus) was in the para-position with respect to the amino group.

(3) It could be diazotised (VI.), thus showing the presence of a free amino group.

The sodium salt of arsanilic acid (or para-amino-phenyl-arsonic acid) is "atoxyl." The commercial product contains water of crystallisation, the amount varying between 2 and 5 molecules of water, depending upon the conditions of crystallisation.



V.

VI.

VII.

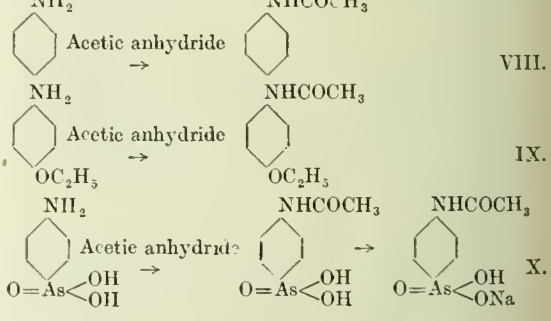
"Atoxyl" (VII.) is prepared by heating arsenic acid with excess of aniline (180°—190° C.), then extracting with sodium carbonate, and re-crystallising from water. The pure salt, which contains 5 molecules of water, is known commercially as "Soamin."

These colourless sodium salts have been used in the treatment of sleeping sickness, syphilis, and other diseases of protozoal origin, but on account of their unpleasant or dangerous by-effects they must be employed with caution.

The elucidation of the constitution of "atoxyl" was followed by the synthetical preparation of *aromatic* compounds containing arsenic with a view of obtaining a series of compounds of lower toxicity to the host and of a higher toxicity to the parasites. At first compounds containing *pentad* arsenic were prepared, but more recently attention has been directed to the syntheses of those containing *trivalent* arsenic, for experiments proved that the latter were, from the pharmacological point of view, of more value than the former. It would obviously be impossible to treat such a series in a systematic way. I will therefore select just a few of the interesting bodies, the production of which depends on reactions familiar either in the study of synthetic drugs or dyestuffs.

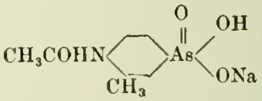
It was already known that such toxic compounds as aniline and phenetidine could be rendered less toxic by introducing an acetyl group into either of them. As a result we have now the well-known drugs, acetanilide, from aniline (VIII.), and phenacetin, from phenetidine (IX.).

Accordingly arsanilic acid was subjected to the process of acetylation by treating with acetic anhydride. An acid was thus obtained, the sodium salt of which constitutes the "arsacetin" (X.) of commerce. This drug, as was expected, was less toxic than atoxyl; being chemically more stable, its solutions can be sterilised by boiling.

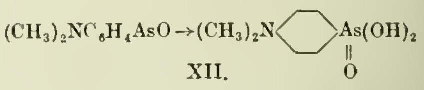


Substances which were exactly analogous to those derived from aniline were prepared from o-toluidine as a starting-point. One of these, commercially known as "Orsudan" (XI.), is the o-tolyl analogue of "arsacetin," and resembles that compound in its therapeutic action.

Alkyl derivatives of atoxyl were also investigated. One of these, dimethylarsenilic acid (XII.) is produced by oxidising dimethylaniline arsenious oxide either with mercuric oxide or alkaline permanganate. These various alkyl derivatives have, however, proved to be of no value therapeutically.



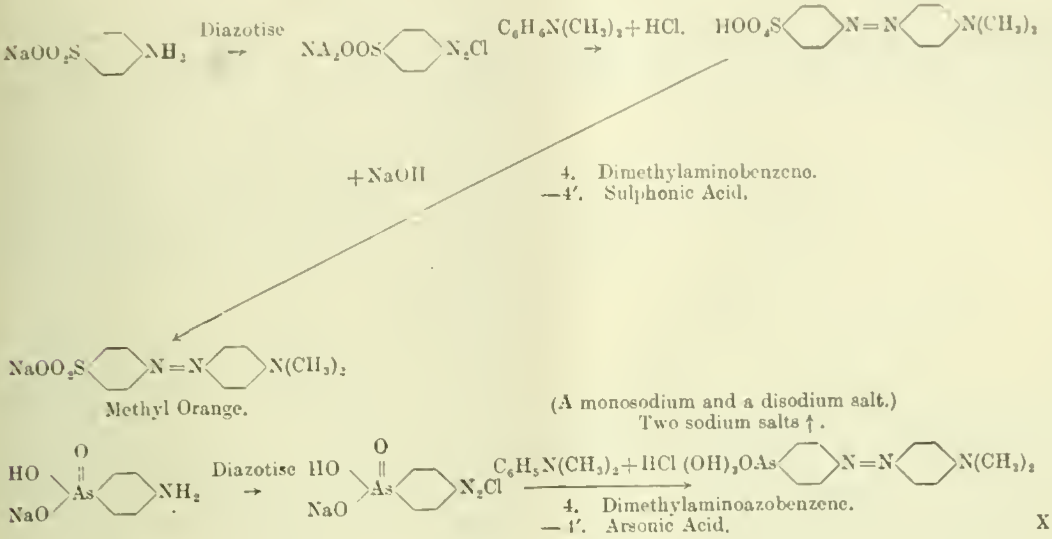
XI.



XII.

Atoxyl and its homologues can be converted through the diazo-reaction into compounds comparable with the azo-dyestuffs. These latter, which include a very large number of dyestuffs, are in general prepared by diazotising an amine and "coupling" with a phenol or an aromatic amine. The reactions concerned in the preparation of Methyl

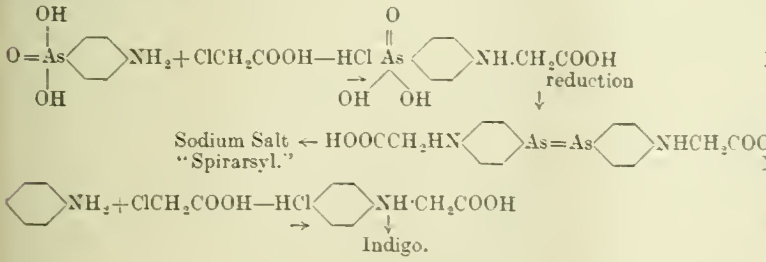
Orange and those of the analogous compound containing arsenic may be represented by the following schemes :—



XIII.

Two sodium salts of the arsenical compound (XIII.) have been prepared, a mono-sodium and a di-sodium salt. Both of these are scarlet compounds. Various similar arsenical compounds have been examined, but as a class they are only of chemical interest.

The several derivatives of "atoxyl" to which I have just called your attention contain arsenic in the *pentavalent* condition. I must now refer to the more important compounds in which arsenic possesses triad functions. In the investigation of aryl arsenicals containing pentavalent arsenic, a derivative of arsenilic acid was discovered, viz., phenylglycine para-arsonic acid, which may be obtained by the interaction of chloracetic acid and arsanilic acid (XIV.). This reaction reminds one of the first step in the commercial synthesis of indigo starting with aniline as raw material. For this purpose the base is condensed with chloracetic acid, and the resulting phenylglycine (XV.) is subsequently converted into indigo. In practice phenylglycine para-arsonic acid is prepared by mixing solutions of atoxyl with chloracetic acid in hot aqueous solution. Phenylglycine para-arsonic acid is important, for on reduction with sodium hydrosulphite, caustic soda and magnesium chloride, it yields arsenophenylglycine (XVI.), which is a reddish brown powder, soluble in sodium carbonate solution. The sodium salt thus obtained is known as the drug "Spirarsyl" ("418"). It is less toxic than atoxyl, and has been used in syphilis with favourable results. Its administration is said to have no harmful by-effects.

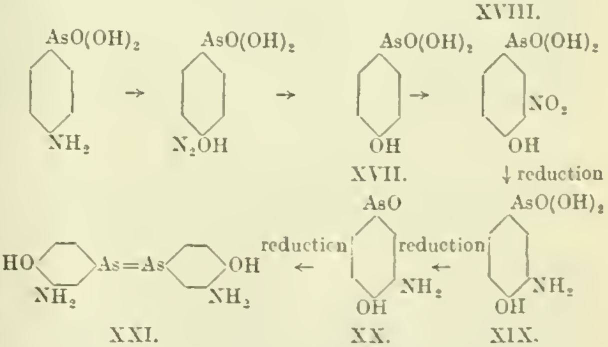


XIV.

XVI.

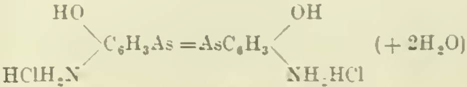
XV.

By means of the diazo reaction arsanilic acid can be converted into p-hydroxyphenylarsonic (XVII.) acid. This compound was obtained shortly after the study of the aryl arsenicals was begun. It could also be prepared by the action of phenol on arsenic acid (at 150° C.). In practice the first method consists in boiling a solution of atoxyl, after diazotising, and separating the compound from the sodium chloride formed in the reaction by means of acetone. Parahydroxyphenylarsonic acid is not used therapeutically, but through it some important derivatives can be secured, amongst them "Salvarsan." The following steps indicate the process of preparing Salvarsan from p-hydroxyphenylarsonic acid. The latter compound is first nitrated, whereby a nitro derivative is obtained, the nitro group entering the ortho position to the hydroxyl group, or the meta position with respect to the arsonic group. The resulting nitro compound (XVIII.) is then reduced (XIX.-XXI.).



The last product in the reduction XXII. is 4 : 4'-dihydroxy-3 : 3'-diaminoarsenobenzene. The dihydrochloride of this compound constitutes the drug "Salvarsan" (XXII.).

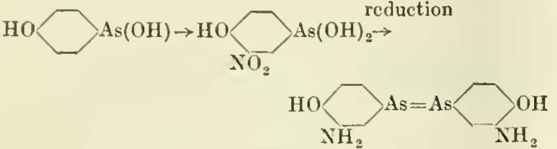
Salvarsan is used as a specific for syphilis. It is a bright yellow powder, kept in contact with an indifferent gas so as to prevent the compound from oxidising.



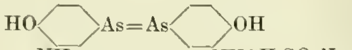
$\mathrm{(HO)(HClH_2N)C_6H_3As=AsC_6H_3(OH)(NH_2.HCl)\ (+2H_2O)}$

XXII.

The hydrosulphites, which are employed in operations connected with the dyeing industry as reducing agents, are also useful in the preparation of arsenicals. Mention has already been made of sodium hydrosulphite in connection with "Spirarsyl;" the same salt has been employed in the preparation of Salvarsan. Thus, after nitrating p-hydroxyphenyl-arsonic acid, mentioned above, the resulting nitro-derivatives can be reduced with sodium hydrosulphite in presence of caustic soda and magnesium chloride (XXIII.).



XXIII.



XXIV.

Further, by means of the hydrosulphite formaldehyde-sulphoxalate "Salvarsan" itself has been reduced with the production of an acidic compound, which, when neutralised with soda, forms a sodium salt, known as the drug Neosalvarsan (XXIV.). Neosalvarsan dissolves in water to a neutral solution, and has decided advantages over solutions of Salvarsan, for the latter are not only easily oxidised, but are also acidic, and this acidity has to be neutralised before the drug can be administered intravenously.

From this brief sketch you would have noticed how in the application of chemical science to the production of aniline dyes there has been opened up a series of new and highly potent arsenical compounds possessing remarkable therapeutic value. They are applied by a method of treatment termed chemotherapy, the principle of which is to employ chemical substances in infectious diseases which hinder the development of the parasites giving rise to such diseases without being harmful to the patient —at least, in doses required to destroy the parasites. The organic chemical compounds thus obtained are called parasitotropic chemicals. Further investigations, which are at present being undertaken in connection with these arsenicals, have for their object not only the discovery of synthetical methods for the preparation of new drugs, which may prove more potent than those which have already been found to be therapeutically useful, but also the improvements of the methods which are employed in the production of the latter.

THE RESULTS OF THE STUDY OF COLLOIDS.

T. Svedberg. Delivered before the German Chemical Society, Nov. 29, 1913. Ber., 1914, **47**, 12—38. [Abstract.]

The term colloid was used by Graham to denote a class of substances possessing a very small power of diffusion; and in cases where a substance was found capable of existing both as a colloid and as a crystalloid, the two forms were regarded by him and his successors as allotropic modifications. This view was, however, gradually displaced and more recently it has been recognised that the distinctive properties of colloids are due, not to their intramolecular, but to their extramolecular or physical structure. The truth of the latter view was conclusively established in 1903, when examination of colloidal solutions with the ultramicroscope of Siedentopf and Zsigmondy (compare Michaelis, this J., 1906, 715) showed that they are heterogeneous. Colloidal solutions may hence be defined as systems composed of minute particles suspended in a gaseous, liquid, or solid medium. In accordance with a proposal of Wo. Ostwald in 1907, the total mass of the suspended particles is frequently designated the disperse phase, whilst the other component (the continuous phase), is termed the dispersion medium. Following Graham, colloidal solutions are also termed sols, *e.g.*, hydrosols with water as dispersion medium, alcohols with alcohol, and so on. In the ultramicroscope an intense beam of light is directed through the solution and the illuminated field is viewed through a microscope in such a way that only that portion of the light which is refracted by the suspended particles, and which is linearly polarised, is observed. The suspended particles appear as bright points of light, and by counting the number in a known volume of the liquid and dividing by the total mass of the disperse phase in the same volume, the mass of a single particle can be calculated, and from this, assuming the particles to be spherical or cubical, the size of the particle. The smallest particles hitherto definitely detected in this way are metallic particles of the order of 5-millionths of a millimetre ($5\mu\mu$). Another method used in investigating the structure of colloidal solutions, is that of ultra-filtration, devised by Bechhold (this J., 1906, 1177; 1907, 993), the solution being filtered under pressure through paper impregnated with collodion or gelatin solutions of different concentrations. By suitable choice of filters, colloids having particles of different sizes can be separated one from another.

Substances in colloidal solution can be precipitated in various ways, the process being termed coagulation, and the separated substance, the coagulum; or, following Graham, a gel. Until about 2 years ago, gels were mostly regarded as having a fine network structure (Bütschli, 1892—1898) or consisting of very small or invisible "foam cells" with liquid or solid "foam walls" (Quincke, 1901). More recently the work of Zsigmondy and his pupils (this J., 1911, 1056; 1912, 82, 1084) has shown that gels have a minute granular rather than a foam-like structure, and Odén (this J., 1912, 260) has shown that in the case of reversible gels, the particles in the original colloidal solution and in the solution regenerated from the gel are of the same order of size, whence it may be inferred that the particles retain their individual character during coagulation. It has been shown by Zsigmondy (this J., 1911, 1056; see also Anderson, this J., 1914, 829) that the phenomena observed in the dehydration and rehydration of gels can be satisfactorily explained by the extreme fineness of their structure, and he has calculated that the size of the hollow spaces in silicic acid gel is of the order of $5\mu\mu$.

Any process leading to the formation of minute particles may serve as a method of preparing colloids, the chief requirement being that the particles must be practically insoluble in the surrounding medium. For example, in the case of $BaSO_4$, AgCl, AgBr, AgI, the ease of formation of aqueous colloidal solutions increases in the order given, the respective solubilities being $2 \cdot 10^{-4}$, $1 \cdot 10^{-4}$, $1 \cdot 10^{-5}$, and $1 \cdot 10^{-7}$%. Stable colloidal solutions of sodium chloride in benzene, in which its solubility is very small, can be obtained (Paal, this J., 1906, 1066). In many cases stable colloidal solutions can only be obtained if traces of electrolytes are present; and frequently, also, coagulated colloids can be again brought into colloidal solution, or peptised, by addition of traces of electrolytes. Most methods for the formation of colloidal solutions depend upon the condensation of molecules to larger aggregates (colloidal particles), as, for example, in the formation of colloidal metals by reduction, of metallic hydroxides by hydrolysis, etc. In other methods, compact material is disintegrated either electrically or mechanically. Von Weimarn has prepared colloidal solutions by finely pulverising an insoluble substance with an inert soluble substance, such as urea, and dissolving the mixture in water. Electrical disintegration methods are widely used (Bredig, this J., 1899, 50, 281; Svedberg, this J., 1906, 543). In some cases colloidal solutions are formed merely by irradiation of compact metal immersed in a liquid (*e.g.*, silver in water or alcohol) with ultra-violet light. According to unpublished experiments of Nordenson, this is not due to direct disintegration of the metal by the action of the light, but is a purely photochemical process, the metal dissolving in the liquid as a crystalloid and being subsequently reduced with formation of colloidal particles. Traube-Mengarini's statement (this J., 1910, 700; 1911, 219) that compact metals may dissolve directly to colloidal solutions in distilled water is incorrect: the phenomena observed are due to chemical reactions and do not occur—at any rate in the case of silver, gold, and platinum—if the water be sufficiently pure and light be excluded.

The most important method of purifying colloidal solutions is by dialysis, the technique of which has been greatly improved by Zsigmondy (this J., 1910, 1249). Another method consists in the coagulation and re-solution of the colloid, but is only applicable in special cases.

Zsigmondy (Z. physik. Chem., 1906, **56,** 65) first prepared colloidal solutions with particles of approximately uniform size, by adding a previously prepared colloidal gold solution to a mixture of a gold solution and a reducing agent: the reduced gold was deposited entirely on the ready-formed colloidal particles and by varying the conditions, sols with particles of different but approximately uniform size were obtained. Other methods of preparing such solutions are by fractional centrifuging (Perrin, Kolloidchem. Beihefte, 1910, **1,** 242), ultra-filtration (Bechhold, *loc. cit.*), and fractional coagulation (Odén, *loc. cit.*).

It was considered formerly that a clear distinction could be drawn between colloidal and true solutions by reason of the former possessing very small osmotic pressures. Einstein has pointed out, however, that the concentration of colloidal solutions varies not according to the weight of the disperse phase but according to the number of particles therein, a $N/1$ colloidal solution being one in which the number of suspended particles per litre is the same as the number of molecules in a $N/1$ true solution or in 2 grms. of hydrogen, viz., $6{\cdot}10.10^{23}$; and a considerable amount of experimental evidence has been accumulated from diffusion experiments and study of the Brownian motion, showing that if the osmotic equivalence of molecules and suspended particles be accepted, van't Hoff's formula for expressing the osmotic pressure may be applied to dilute colloidal solutions.

The suspended particles of a colloidal solution frequently carry an electric charge and such solutions hence possess greater electrical conductivity than the dispersion medium (intermicellar liquid). Under the influence of a difference of potential the charged particles travel in a similar manner to ions. The velocity of migration of the particles is of the same order as that of ions, and in many cases is strongly affected by addition of electrolytes. By the aid of Stokes' resistance-formula, Zsigmondy has calculated that in the case of a silver sol having particles of $50\mu\mu$ diam. and a mobility of 2μ, the charge on each particle is 297.10^{-10} electrostatic units, which is about the same as that which would be carried by an ion having a valency of 62. With increasing concentration, above a certain limit the electrical conductivity of colloidal solutions also increases and more rapidly, colloidal solutions differing in this respect from true solutions.

As the sum of the limiting surfaces between the suspended particles and the dispersion medium in colloidal solutions is very large, adsorption phenomena play a great part, and it has been shown independently by Ostwald (van Bemmelen-Festschrift, 1910, 267) and by Lottermoser and Maffia (Ber., 1910, **43,** 3613) that an adsorption-equilibrium exists in colloidal solutions. Hardy (J. of Physiol., 1899, **24,** 288) found that in many colloidal solutions spontaneous coagulation occurred when the electric charge carried by the suspended particles was neutralised in any way; and most colloidal solutions are considerably less stable at the isoelectric point. The most important method of effecting coagulation is by addition of an electrolyte. When the electrolyte is added gradually, coagulation takes place suddenly at a certain concentration—the so-called saturation value ("*Schwellenwert*")—which varies with different colloids and with different electrolytes. According to Freundlich (this J., 1907, 646) coagulation is due to neutralisation of the charge carried by the suspended particles by adsorbed ions. As showing the effect of adsorbed ions it may be mentioned that Lottermoser (J. prakt. Chem., 1905, **72,** 39; 1906, **73,** 374) obtained a negative silver iodide colloid by using 40 c.c. of $N/20$ $AgNO_3$ and 50 c.c. of $N/20$ KI and a positive colloid from 50 c.c. of $N/20$ $AgNO_3$ and 40 c.c. of $N/20$ KI, the charges being due to iodine ions and silver ions respectively. In a study of the reversible coagulation of colloidal sulphur solutions Oden (*loc. cit.*) found that the coagulating power of an electrolyte increases with its degree of dissociation: and that the "saturation value" becomes better defined with increasing uniformity of the size of the colloidal particles and also increases with rise of temperature. In the case of irreversible colloids the "saturation value" is not so well-defined, and coagulation frequently takes place at some distance from the isoelectric point. A colloid can be coagulated by addition of another colloid of opposite electric charge, but complete precipitation occurs only when the two colloids are present in a definite proportion. Irreversible colloids can be converted into reversible ones by addition of a small quantity of a reversible colloid of like electric charge. Metal sols can be made reversible, for example, by addition of gelatin, albumin, or the like.

Intimately connected with the extensive surface of colloids is their catalytic activity, one of the chief factors in which is probably adsorption by the colloidal particles. Bredig (this J., 1900, 1155; 1901, 376) pointed out the great similarity between the catalytic action of colloidal platinum and that of enzymes, the catalytic decomposition of hydrogen peroxide by colloidal platinum, for instance, being inhibited by certain substances (hydrocyanic acid, hydrogen sulphide, phosphorus), which also act as poisons to organic enzymes. The colloidal solutions of the platinum metals prepared by Paal (this J., 1902, 994; 1904, 208) by addition of organic protective colloids possess great catalytic activity, and with the aid of colloidal palladium and, more especially, of palladium-hydrogen, a large number of important reductions has been effected by Paal, by Willstätter (this J., 1908, 642, 829) and by Wallach (Nachr. Kgl. Ges. Wiss. Göttingen, 1910, Math.-phys. Kl.). Reduction is effected merely by exposing a mixture of colloidal palladium solution and a neutral aqueous or alcoholic solution of the substance to be reduced to the action of hydrogen gas, and the method has already acquired considerable importance for the synthesis of hydrogenised organic compounds and the detection of double linkages.

The study of colloidal systems having a gaseous dispersion medium has been pursued most successfully in England. As a result of the work of Townsend (1897), J. J. Thomson (1893—1899) and, especially, of C. T. R. Wilson (1897—1912), it has been demonstrated that the formation of fog is due chiefly to condensation of water vapour on gaseous ions, and the experimental formation of mist or fog in this way has proved one of the most valuable methods of investigating ionisation in gases.

Of colloids with solid dispersion medium, ruby glass has been thoroughly investigated by Zsigmondy and Siedentopf (Ann. der Physik, 1903, [4], **10,** 2). It is noteworthy that many of the most beautiful colour phenomena known are caused by the presence of colloids. The magnificent play of colours frequently observed at sunset is due to colloidal particles of dust and moisture in the atmosphere; and the colour of ruby glass and of many precious stones is due to colloidal metal particles. The colour of blue rock salt, for example, is due to colloidal sodium; sapphire and amethyst are solid colloidal solutions, and opal is a solid silicic acid gel. It is also extremely probable that the finer structure of many metals is due to solid colloidal solutions.

Practical applications of the results of the investigation of colloids are numerous. In the case of biology and medicine, for example, the work of M. H. Fischer on nephritis (*Die Nephritis*, Dresden, 1912) may be cited, which led to a simple method of treating this disease. The value of colloid-chemical considerations in geology and mineralogy has been shown by Doelter (Kolloid-Zeits., 1909—1912) and by Cornu (Kolloid-Zeits., 1905). The study of colloids is of great importance for agriculture, for some of the most important properties of soils, *e.g.*, their power of retaining moisture and fertilising salts, are due to the presence of colloids. Lüppo-Cramer's colloid-chemical studies of the photographic process (*Kolloidchemie und Photographie*, Dresden, 1908) have shown that it is probable that the latent image consists of ultramicroscopic silver particles, which serve as nuclei in the subsequent development. Results obtained in investigations of the mutual precipitation of colloids have thrown a considerable amount of light on the problem of sewage purification. The study of colloids will undoubtedly become of increasing importance in such branches of industry as dyeing, brewing, soap-making, ceramics, and rubber, in which the products dealt with are mainly colloids (see Arndt, *Die Bedeutung der Kolloide für die Technik*, Dresden, 1911).—A. S.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Power production from gas engines. Utilisation of waste fuels. Coster. *See* IIA.

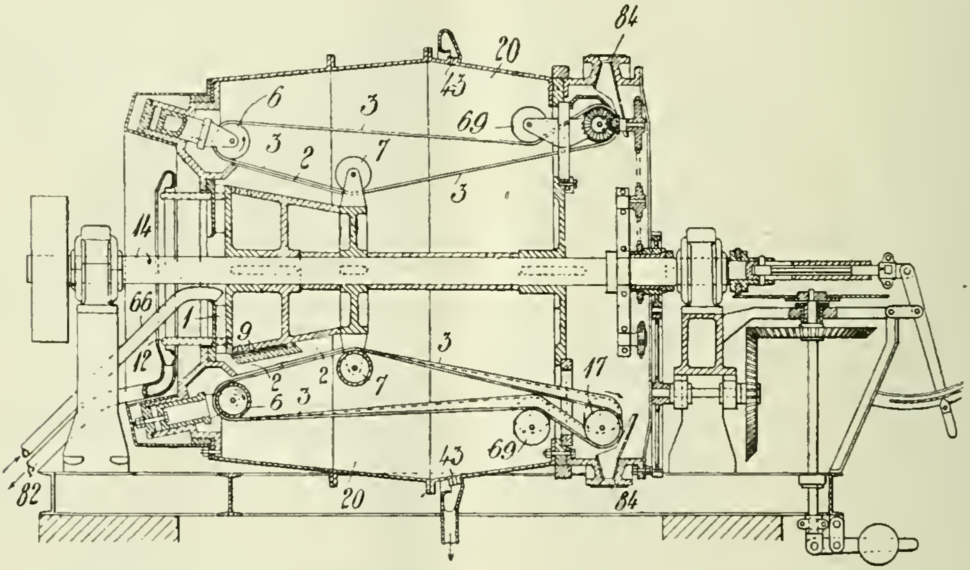
PATENTS.

Pressure filters. J. A. Muirhead, Tadcaster, Yorks. Eng. Pat. 24,768, Oct. 31, 1913.

THE joint between the elements of a cylindrical pressure filter for beer and the like is made by a rubber ring of circular cross-section which fits into a corresponding recess formed on one side of the plates near the periphery. A circular rib formed on the opposite side of the adjacent plate presses against the rubber ring.—W. H. C.

Separators or dryers; Centrifugal ——. K. and A. Ward, Stockholm, Sweden. Eng. Pat. 10,783, May 1, 1914. Under Int. Conv., May 8, 1913.

THE mixture of solids and liquid enters the separator through the pipe, 66, and passes through the channel, 1, to the separation chamber, 2. The inner wall of this chamber is rotated on the shaft, 14, and the outer wall is formed by a series of endless bands, 3, which pass over the rollers 6, 7, 17, 69, the angle at which the band is set being adjustable. The whole is enclosed in the outer drum, 20, which is also rotated on the shaft, 14. The greater part of the liquid passes through the ports, 9, and away by the pipes, 12, 82. The solids are carried forward by the bands, 3, more liquid being separated, which is finally discharged through 43. The solids are carried forward over the roller, 17, and are discharged through 84.—W. H. C.



Stone, grit, sand, etc. ; Drying and heating of ——. T., A., T., and F. Coleman, Derby. Eng. Pat. 3103, Feb. 6, 1914.

THE material is fed to the middle, and is thrown off the periphery, of a dished rotating disc surrounded by a funnel which leads it to the middle of a second disc on the same vertical shaft as the first. It meets an ascending current of hot gases passing up through a casing containing a system of discs and funnels.—O. E. M.

Drying apparatus. E. B. Stone, Assignor to The American Hardware Corporation, New Britain, Conn. U.S. Pat. 1,117,720, Nov. 17, 1914 ; date of appl., Dec. 30, 1913.

THE articles to be dried are conveyed by a worm along a horizontal perforated tube while being sprinkled with drying material contained in a surrounding rotating casing furnished with internal wings.—O. E. M.

Oils and other liquids ; System for cleaning and purifying ——. R. S. Johnson, Cleveland, Ohio, Assignor to S. F. Bowser & Co., Fort Wayne, Ind. U.S. Pat. 1,115,827, Nov. 3, 1914. Date of appl., July 23, 1913.

A NUMBER of settling tanks are connected in series and the dirty oil is passed through them by means of a pump. Pipe connections and valves are provided so that any of the tanks may be cut out of the series and the oil may be transferred by the pump from one tank to any other. —A. T. L.

Evaporating apparatus. T. F. Sanborn, New York. U.S. Pat. 1,116,927, Nov. 10, 1914 ; date of appl., April 19, 1913.

EVAPORATING cells are made polygonal in plan so that they may be grouped together to give a single cell of larger capacity.—O. E. M.

Still. A. G. Duncan, Joliet, Ill. U.S. Pat. 1,116,578, Nov. 10, 1914 ; date of appl., June 16, 1913.

THE still is divided into sections by horizontal plates upon which the liquid is retained by damming walls. Sealing walls attached to the under side of the partition above, and dipping into the liquid, constrain a current of gas forced into the section to pass through the liquid. —O. E. M.

Gas-fired furnaces; Apparatus for increasing the temperature of combustion in ——. H. L. Doherty, New York. U.S. Pat. 1,117,172, Nov. 17, 1914; date of appl., April 4, 1912.

A gas-heating recuperator above an air-heating recuperator is placed on each side of a furnace or generator. —O. E. M.

Suspended matter: Means for removing particles of —— from bodies of fluid. W. W. Strong, Pittsburgh, and A. F. Nesbit, Wilkinsburg, Assignors to R. B. Mellon, Pittsburgh, Pa. U.S. Pat. 1,117,531, Nov. 17, 1914; date of appl., Feb. 11, 1913.

The fluid is passed up an earthed central tube and out through lateral extensions in which high-potential electrodes are fixed.—O. E. M.

Drying of liquids and vapours. Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. Eng. Pat. 27,239, Nov. 26, 1913. Under Int. Conv., Nov. 30, 1912.

See Fr. Pat. 465,504 of 1913; this J., 1914, 643.—T. F. B.

Separator; Centrifugal ——. E. Köpke, Honolulu, Hawaii. U.S. Pat. 1,117,195, Nov, 17, 1914. Date of appl., Jan. 17, 1914.

See Fr. Pat. 467,981 of 1914; this J., 1914, 1023.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Gas coke for steam-raising. E. W. L. Nicol. J. Gas Lighting, 1914, **128**, 424—425.

The results of analyses and determinations of calorific value are quoted, showing the comparative fuel values of various kinds of coal and coke obtained in London. The figures for coals varied from 95,760 B.Th.U. per penny cost for a Welsh coal, containing 87·3% fixed carbon, 3% ash, 4% hydrogen, and costing 29s. 6d. per ton, to 111,000 B.Th.U. per penny for anthracite, containing 92% fixed carbon, 3% ash, 3% hydrogen, at 25s. per ton, and 129,800 B.Th.U. per penny for washed bituminous nuts, with 45·6% carbon, 10% ash, 5·45% hydrogen, and about 10% moisture, at 17s. 6d. per ton. For gas coke, from good quality coal, broken and graded, the figures ranged from 121,800 to 146,700 B.Th.U. per penny cost, according to price (16s. 8d. to 20s. per ton): in each case the coke contained 88% fixed carbon, 8% ash, and 0·5% hydrogen; "average" gas coke gave values from 111,600 to 134,400 B.Th.U. per penny according to price (same limits); this contained 86% fixed carbon and 0·5% hydrogen. The London Coke Committee recommend for use with coke in boilers fitted for coal firing, a forced-draught apparatus working on the steam-jet injector principle. That coke can replace coal with advantage for steam-raising is shown by the case of an electric lighting station, which had previously obtained an average evaporation of 5·9 lb. of water per pound of fine coal slack; using broken coke under similar conditions, an average of over 8 lb. of water per pound of fuel has been obtained.—T. F. B.

Power production from gas engines. The utilisation of waste fuels. A. V. Coster. Times Eng. Suppl., Nov. 27. 1914, 157.

The author pointed out the advantages of the gas engine, owing to its ability to utilize waste fuels and gas, for the production of power, and urged the need for manufacturers in this country to follow Germany in making the utmost use of such resources. Calculations based on an output of 10,000,000 tons of pig iron annually, show that power resources which would yield fully 1,000,000 electrical h.p. for power and lighting purposes are being wasted, and that of the 30,000,000 tons of coal used annually in the British iron and steel industries a large proportion is wasted. On the other hand, in the iron districts of Westphalia and Rhineland practically no power gas is wasted, and cheap electrical power is available for all manufacturing purposes. At the Krupp works there are 26 gas engines running on blast furnace gas and developing 36,000 electrical horse-power per hour. Under working conditions the following consumptions have been obtained with gas engines and producers per b.h.p. per hour.—Coke-breeze and charcoal, 1 lb.; peat briquettes, 1·25 lb.; lignite, 1·75 lb.; cotton seed, 2·5 lb.; peat, 3·3 lb.; and bark refuse containing up to 50% H_2O, 4 lb. But the thermal advantages of the gas engine are not confined to the utilization of waste products. With ordinary grades of coal and coke, if the calorific value of the fuel as supplied to the boiler or producer is taken as 100, then 25·8% of the heat is converted into useful work in the gas-engine, against 13% in the steam-engine, so that with engines working at from three-quarters to full load the thermal efficiency of the former is about twice that of the latter. The reduced weight of fuel that must be handled per h.p. and the reduced attention required at the gas producer are also in favour of gas. Standby losses, again, are at least 75% less than in a steam installation, the admission of air through a 1-in. hole being sufficient to maintain combustion over a long week-end in a 500 h.p. gas producer; and the cost in wages involved in starting up a power plant is also greatly reduced, as gas sufficient to start the engine can be obtained in about a quarter of an hour.

When blast-furnace or coke-oven gas is available the advantages of the gas-engine become enormous. At the Cockerill works, near Liége, all the power is developed from blast-furnace gas, and allowing annual depreciation equal to 13% of the cost of the installation, with 4380 working hours a year, corresponding to a load factor of 50%, the total cost per kw. is 0·183d. In a blast furnace having a capacity of 20 tons a day and consuming 10 tons of coke an hour the waste gas produced is sufficient to generate 10,000 b.h.p. by gas-engines. Of this 2500 h.p. are required for air supply, transport, lighting, etc., and the remaining 7500 h.p. are available for driving rolling mills or generating electricity, which may be sold. A coke-oven with a capacity of 200 tons per 24 hours and consuming 10 tons of coke an hour generates enough gas to develop 1800 to 2000 b.h.p. in gas-engines; and, further, by using the waste coke (coke smalls) in a gas-engine 900 b.h.p. are obtained in addition, so that close upon 3000 h.p. are available continuously.

Anthracite; Preservation of —— under water. R. D'Estape. L'Ind. Chim., Min. e Met., 1914, **1**, 446—447.

A circular magazine of reinforced concrete provided with pipes for drawing off water and a door for removing the coal was filled to about two-thirds of its capacity (3200 tons) with ungraded coal, the remaining portion being divided into three parts filled respectively with ungraded coal containing 40% slack, small pieces, and large lumps. After 20 days under water the coal had only absorbed 0·7% moisture, while the amount of water adhering to the surface was 15 to 20% in the case of the slack, 2 to 3% on the small pieces, and 1·5% on the large lumps. After several months' storage the water was drained off for 7½ days, and the coal at the bottom of the magazine then contained 8·8% water and 5% when it reached the sheds. After 10½ days' drainage the respective quantities before and after reaching the sheds were 6·2 and 5·2%. The conclusion is drawn that coal that has been stored under water is ready for use within 3 to 4 days after the water has been drained off.—C. A. M.

Catalysis in the gas industry. R. Lessing. J. Gas Lighting, 1914, **127**, 570—573.

Coal dust or the mineral matter in coal appears to act as a catalyst in effecting oxidation of coal at ordinary temperatures, and this action becomes much more marked at the high temperatures of gas retorts. The types of reactions and decompositions which occur in these retorts are known to be liable to catalytic influence. Catalytic material is amply furnished by the mineral matter of the coal, the composition of which has been little investigated except in the oxidized state in which it appears in the ash. The retort material probably has a catalytic action, depending on its chemical composition and whether its surface is smooth or porous or more or less covered with retort carbon. The lime which, according to Cooper's process, is added to coal before carbonization doubtless acts catalytically in accelerating the primary formation of permanent gas and of tar vapours which do not readily decompose, as well as in increasing the yield of ammonia. In water-gas plant lime and other catalysts may promote the hydrogenation of the oxides of carbon into methane. Catalysis also plays an important part in gas purification, especially in the process perfected by Carpenter in collaboration with Evans and Franks, by which the carbon bisulphide in the gas is converted into hydrogen sulphide by nickel at about 430° C. Examples are also quoted to show that catalysis comes into play in the working up of many by-products of gas manufacture and in many modes of application of gas.

Fuels; Review of recent work on ——. D. Meneghini. Annali Chim. Appl., 1914, 2, 251—275.

The separation of unconsumed coal, etc., from furnace ashes and cinders by utilising the different specific gravities of the mineral (2·5—3) and carbonaceous constituents 1·3—1·5) respectively, has been tried successfully (Velten, Rev. Gén. d. Sci., 1913, 216), 38 tons of coke containing 84% of combustible matter and having a heating value of 6500 cals. being recovered from 2000 tons of furnace residues. A product of lower calorific value, but which can be utilised in gas producers, can also be recovered.

Schilling (Z. Ver. deuts. Ing., 1913, 668) has compared the results obtained with the older and more modern types of gas retorts :—

	Date.	Per furnace for 24 hours.			Per 100 tons (metric) of coal per 24 hours.			
		Coal carbonised.	Gas produced.	Coke for heating.	Gas produced.	No. of furnaces.	No. of workmen.	Coke for heating.
		metric tons.	cb. metres.	metric tons.	cb. metres.			metric tons.
Inclined retorts	1884	10·8	3240	1·6	30,000	10	15	14
Dessau vertical retorts :—								
Old type	1903	12·0	4000	1·7	33,000	8	9	14
New type ..	1911	23·0	8000	3·2	35,000	4·4	4	14

Ab-der-Halden (Soc. Techn. du Gaz, June, 1913) found that by extracting soft pitch with petroleum ether, 42% of high-boiling oils could be removed, and by repeated extractions with petroleum ether, toluene, and carbon bisulphide, a residue consisting of a brown powder (H 94·32, C 4·06%), m. pt. 193° C., was obtained. This substance plays an important part in the formation of tar, serving to emulsify the "free carbon." It decomposes at 400° C., leaving a hard, dense, carbonaceous residue.

To overcome the difficulties attending the use of American coals in gas producers owing to the fusibility of their ash, it has been proposed to produce an endothermic reaction (*e.g.* decomposition of carbon dioxide) in the zone of maximum temperature, and this has been effected by mixing combustion gases with the air supplied to the producer; in practice a mixture of air and combustion gases containing 9% CO_2 is used (Rev. Gén. Sci., 1913, 334).—A. S.

Inflammability of mixtures of methane and air; The limits of ——. M. J. Burgess and R. V. Wheeler. Chem. Soc. Trans., 1914, 105, 2591—2596.

Mixtures of purified methane and air were ignited by sparking in a large glass globe, and in sealed glass cylinders 6 cm. in bore by 200 cm. long. The limits of inflammability were :—

	Methane, %.	
	Lower limit.	Higher limit.
Central ignition in large globe	5·6	14·8
Vertical tube, closed at both ends :—		
(A) Ignition at bottom	Not less than 5·40	Not more than 14·8
(B) Ignition at top	6·0	13·4
Horizontal tube, closed at both ends :—		
Ignition at one end ..	5·4 (flame travels only along top of tube) 5·6 (methane all burnt)	14·3

The appearances of the flames are indicated by diagrams. Under condition (A) flares of flame were produced which travelled increasing distances upwards as the methane-content was gradually raised from 5%, until at 5·4% the whole length of the tube (200 cm.) was traversed; similarly, 5·35, 5·3 and 5·25% CH_4 corresponded to distances of 50, 40 and 30 cm. respectively. From the results obtained with horizontal tubes of 6 and 10 cm. bore it is concluded that in a large space filled with a mixture containing 5·4% CH_4, ignition at the bottom would result in a narrow column of flame travelling upwards and spreading along the upper boundary only of the space. Similarly, slow ascending currents of air containing 3 or 4% of coal-gas conveyed small caps of flame along a tube; such mixtures are potentially dangerous as being capable of firing richer mixtures. The lower limit of inflammability fell below 5·0% in well agitated mixtures of methane and air contained in a 4-litre globe. The criteria of inflammability for downward propagation and propagation throughout a globe are emphasised as preferable to the criterion depending upon upward propagation as recommended by Coward and Brinsley (this J., 1914, 851).—J. R.

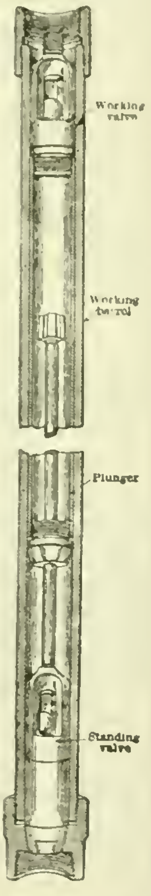
Flames; The propagation of —— *in "limit" mixtures of methane, oxygen and nitrogen.* M. J. Burgess and R. V. Wheeler. Chem. Soc. Trans., 1914, 105, 2596—2605. (See also preceding abstract.)

"Lower-" and "higher-limit" mixtures are defined as "such that a given volume must, under the conditions of its combustion, evolve just sufficient heat to raise an equal volume to its ignition-temperature." The speed of travel of the flame is stated to be constant for horizontal propagation in all limit mixtures of methane, oxygen and nitrogen. Ignitions of such mixtures were carried out in a 2½-litre glass globe, and in each case the flame gases (withdrawn through a capillary tube) and the final gases were analysed. As the oxygen-content was reduced the two limits approached: with air, the limits were 5·60 and 14·82% CH_4, respectively; with 17·00% O_2 (and 83·00% N_2) the limits were 5·80 and 10·55% CH_4; with 13·45% O_2 (and 86·55% N_2) the limits were 6·50 and 6·70% CH_4; and in an atmosphere containing only 13·25% O_2 all proportions of methane were incapable of propagating flame. The essential reaction concerned in the propagation is $CH_4+O_2=CO+H_2+H_2O$. With increasing proportions of oxygen more and more of the methane is completely burnt to carbon dioxide.

Preferential burning of hydrogen over carbon monoxide occurred in all mixtures containing a ratio $O_2 : CH_4$ greater than 1·5. With ratios not less than 2·0 the ignition-temperature is calculated as 650° C., whereas with continued increase in the methane-concentration up to the higher limit, $O_2 : CH_4 = 1·20$, the ignition-temperature rose gradually to 715° C.—J. R.

Oil recovery in California; Methods of ——. R. Arnold and V. R. Garfias. U.S. Bureau of Mines, Techn. Paper 70, 1914, pp. 1—57.

The Californian oil-wells vary in depth from 200 to 4000 ft., and very few of the wells yield oil by natural flow. In a few cases the oil is raised by blowing compressed air into the lower part of the tubing which reaches to the bottom of the well, and this method is suitable for oil and water mixtures containing much sand (not exceeding 20%) which rapidly wears pump valves and barrels. The exhaust steam from the air-compressing plant is used for heating the oil to a temperature at which the water separates from it. The up-keep and operating costs are low. The production of the wells, however, often decreases after a time when the oil is raised by air-lift, and the lowering of the water-level in the strata increases the required lift so that the air-pipe must be submerged further and the working becomes increasingly uneconomical after the air-pipe has been lowered to the bottom of the well. In the great majority of wells, the oil is raised by plunger pumps. The working barrel (see fig.) is 66—84 in. long and 1¾—3¾ in. inside diameter, and is screwed to the lower end of tubing which extends down into the well. The plunger is a seamless steel tube, ground to fit the barrel. Cup or other packing is used when the barrel has become worn. The plunger carries a tool-steel ball valve at the upper end, and a similar valve for the suction is provided at the bottom of the barrel and can be removed with the plunger for renewal without removing the tubing. The plunger is operated by steel tension rods, screwed together in 20 ft. lengths, or sometimes by wire rope or wooden rods. The life of the tubing under ordinary conditions is usually 4 years. The pumping stroke is 20—35 ins. (average 23 ins.) and the speed 15—30 strokes per min. (average 20). The average capacity of a 2¾ in. pump is theoretically 400 barrels per day, but lower results are obtained in practice owing to leakage. Of 5759 wells using plunger pumps, 2631 use steam engines, 869 use electric power (generated from mountain streams), and 2259 use gas engines. The fuels used for steam raising are oil, natural gas, and wood. Natural gas is however used much more economically in gas engines, the consumption of gas per I.H.P.-hour being 13 cb. ft. in an ordinary gas engine, and 130 cb. ft. with steam-power plant as ordinarily used for pumping oil-wells. Diesel engines are very seldom used.—A. T. L.



Flames; The propagation of —— *in mixtures of methane and air. The "uniform" movement.* R. V. Wheeler. Chem. Soc. Trans., 1914, 105, 2606—2613.

When mixtures of methane and air contained in a horizontal tube closed at one end are ignited at the open end, the flame travels for a short distance at a uniform speed; but eventually this "uniform movement" is always succeeded by a "vibratory movement." For the slowest flames investigated a tube of at least 5 cm. bore was necessary in order to avoid retardation due to cooling by the walls. The duration of the uniform movement depended upon the composition of the mixture and increased with the diameter and length of the tube up to a definite maximum: in a tube of 5 cm. bore the extent of the movement was 150 cm. in a 6-metre tube and only 50 cm. in a 2-metre tube. The speed was 35·5 cm. per second at both the lower and the higher limit of inflammability (see preceding abstracts); from each of those limits it rose, in mixtures with intermediate methane-content, first slowly then rapidly to a maximum value of about 112 cm. per second; this value remained practically constant for mixtures with 9·45 to 10·55% CH_4. The velocity was measured by means of a chronograph actuated electrically by the successive fusion of thin copper screen-wires placed in the path of the flame at distances of 50 cm. apart. In a tube of 9 cm. bore the speeds were from 5 to 10 cm. per second greater.—J. R.

Natural gas mixtures; Explosion limits of ——. Z. Z. Biluchowski and Z. Lahocinski. Petroleum, 1914, 9, 605—606.

The explosion limits were determined by sparking mixtures of gas and air in a Hempel pipette. Mixtures containing 7·55 to 9·1% of combustible gas were explosive; the corresponding limits for methane were 3·7—9·0, and for petrol vapour (from a light spirit of sp. gr. 0·622), 2·9—8·1%. —A. T. L.

Petroleum; Researches on the products of destructive distillation of crude Bustenari —— *and its derivatives.* C. Petroni. Diss., Bucarest, 1914. Petroleum, 1914, 9, 1377—1378.

The oils subjected to destructive distillation were crude (Roumanian) petroleum (from the "Vega" works in Ploesti), and the crude benzine, lamp oil, and solar oil fractions, together with the extract obtained from the lamp oil fraction by means of liquid sulphur dioxide. Minimum yield of gas and maximum of tar were given by the sulphur dioxide extract and the solar oil fraction; maximum gas and minimum tar by the benzine; the lamp oil fraction and the crude oil gave intermediate yields. In the case of benzine and lamp oil light liquid hydrocarbons were carried off with the gases, reducing the amount of tar; moreover, the presence of these fractions in the crude oil, together with the coke produced from certain heavy oils present, account for the low yield of tar from the crude oil. The solar oil tar contained much more benzene and toluene than the tar from the sulphur dioxide extract, which was composed mainly of aromatic hydrocarbons with side-chains, the latter, with the exception of the methyl group, being split off from the benzene nucleus at 740°—770° C. The yield of hydrocarbons boiling between 115° and 205° C. was, from the extract-tar, 24·33%, and from the other tars only 8—10%. The differences in the yields of naphthalene and anthracene were not very great; naphthalene varied from 8 to 12%, anthracene from 1·5 to 2%. Lubricating oil tars and residues yielded 3 to 4% of naphthalene and 0·5 to 0·6% of anthracene. From the commercial standpoint the sulphur dioxide extract would appear to be the most suitable product for destructive distillation. The 26·2% of liquid aromatic hydrocarbons obtainable from its tar have considerable commercial value, and in addition naphthalene and anthracene are obtained in large quantities. As compared with coal-tar the yield of light hydrocarbons is ten times, that of naphthalene twice, and that of anthracene equally as great, and the purity of these three products is much greater than that of those derived from coal-tar.—E. W. L.

Gasoline: Testing of ——. A. P. Lidoff and G. W. Petroff. Neftjanoje Djelo, 1913, No. 13. Petroleum, 1914, 9, 614—615.

The specific gravity is not a sufficient indication of the suitability of a sample of gasoline for any given purpose, since the chemical composition of samples of the same specific gravity is different for oils of different origin. The constituents may include, besides the normal saturated hydrocarbons, C_nH_{2n+2}, the isomerides of these hydrocarbons and the naphthenes, C_nH_{2n} (cyclo-pentane, etc.). The best method of examination at present available is by fractionation. A rough test of inflammability may be made by determining the flash-point of a mixture containing 20—5% gasoline and 80—95% of refined paraffin oil.—A. T. L.

Oil-cooled transformers; Formation of deposits in ——. A. C. Michie. J. Inst. Elect. Engineers, 1913, **51**, 213—218.

Samples of sludges from transformers contained lead or traces of manganese derived from the varnish of the windings, but in most cases they had apparently been formed by oxidation and polymerisation of the oil itself. One sample contained: C 76·0, H 7·1 and O 16·9%. To test the liability of transformer oils to become oxidised, 100 c.c. of the sample were placed in a 200 c.c. flask with a neck 11½ in. long, which was surrounded by a tube through which was passed a current of cold water. The flask was immersed in an oil-bath kept at 150° C., whilst a current of purified air was drawn through the oil for 45 hours or longer at the rate of 0·07 cb. ft. per hour. Usually a piece of copper foil (4½ sq. in.) was placed in the flask to promote the oxidation, and the resulting deposits (0 to 2·5%) were separated, washed with petroleum spirit and weighed. The composition of the deposits closely resembled that of the transformer deposits, and, like them, they were nearly insoluble in petroleum spirit but soluble in benzene. Their m.pts. ranged from about 70° to 220° C. A heavy deposit was obtained in a relatively short time at 90° C. when ozonised air was drawn through the flask. The rate of formation of the deposit was accelerated by the presence of certain metals, notably copper. Thus the following amounts separated in 45 hours from an oil treated as described above in the presence of the following metals (area, 4½ sq. in.):—Air alone, 0·28; Cu, 0·94; Fe, 0·88; Sn, 0·7; Pb. 0·57; Ni, 0·3; and Zn, 0·28%. The deposit formed in the presence of copper was free from that metal, but in the case of lead the deposits were of a pale yellow colour and contained lead (*e.g.* 36%). The amount of sludge separating depends upon the degree of purity of the oil. Treatment with sulphuric acid or caustic soda, or filtration through fuller's earth, removed unsaturated or readily oxidisable substances from the oils. Thus after such refining the amount of deposit formed by an oil was reduced from 1 to 0·1%. Numerous commercial oils gave no deposit in the oxidation test after 45 hours at 150° C., and one sample withstood the test for 150 hours. To prevent or minimise the formation of deposits in transformers it is necessary to avoid over-heating, undue access of air to the oil, conditions leading to the formation of ozone, and contact of the oil with clean surfaces of copper, iron or lead. (See also this J., 1913, 1000; 1914, 951.) —C. A. M.

Asphaltums; Methods for determining the melting points of ——. J. G. Miller and P. P. Sharples. Proc. Amer. Soc. Testing Materials, 1914, **14** [Reprint.] 6 pages.

Comparative determinations of the m.pt. of different samples of asphaltum showed that the method of heating a half-inch cube of the material in an oil-bath is not satisfactory owing to the small range of temperature, and the fact that certain samples are heavier than the oil. Hubbard's method (*Dust Preventives and Road Binders*, p. 351) of heating the cube suspended from wire (No. 12 B. and S. gauge) at a height of 1 in. from the bottom of an air-bath at the rate of 9° F. (5° C.) per min. gave good results both with pitches and asphaltums. Various modifications of the "ring and ball" method are used in commercial specifications. In these the m.pt. is taken when a steel ball (⅜ or ½ in. in diameter) touches the bottom of the apparatus. The discrepancies between the results given by these modifications were found to be due to essential differences in detail, such as the dimensions of the apparatus and the rate of heating; and standardisation of all details is necessary if comparable results are to be obtained. It is suggested that the rate of heating should be 5° C. per min. (see also this J., 1914, 470).—C. A. M.

Naphthenic acids; Study of the ——. (*Preliminary communication.*) I. Pékoff. J. Russ. Phys.-Chem. Soc., 1914, **46**, 178. Bull. Soc. Chim., 1914, **16**, 784—785.

From the naphthenic acid fraction having a b. pt. corresponding to the hexahydrotoluic acids, amides were produced which, after crystallisation from water, had a m. pt. of 124°—128° C.; by fractional crystallisation of the latter an amide melting at 221°—221·5° C. was obtained. The amide of *m*-hexahydrotoluic acid obtained by Markownikoff in 1893 (m. pt. 156°—155° C.) was found to consist of two stereo-isomerides, one of which fused at 221°—221·5° C., and was identical with that prepared from the naphthenic acids.—W. E. F. P.

Detection and determination of solid hydrocarbons in admixture with fatty acids. Verona-Rinati. *See* XII.

Methods for the preparation of artificial rubber from different raw materials, including petroleum. Pyhala. *See* XIV.

Separation of mixtures of saturated and unsaturated hydrocarbons by means of permanganate. Nametkine. *See* XXIII.

Viscosity measurement and a new viscosimeter. Flowers. *See* XXIII.

Patents.

Coal or other fuel; Apparatus for preparing and sorting comminuted or powdered ——. T. M. Coyle, St. Louis, U.S.A. Eng. Pat. 25,291, Nov. 5, 1913. Under Int. Conv., Sept. 3, 1913.

Powdered coal from a grinder is taken up by the suction of a fan or blower and delivered with the air current into a cyclone or other dust separator. The air escapes from this separator into a chamber, enclosed by cheese-cloth or fine gauze, arranged beneath the air-inlet bell on the suction side of the fan. The dust from the separator discharges into a sorter, which comprises a rectangular casing divided into two compartments by a vertical partition having openings regulated by flap-valves. A fan connected with the outlet of the sorter draws a current of air from adjustable orifices in the outer wall, transversely through one compartment and through the openings in the partition into the second compartment. The dust entering the first compartment falls on to deflecting plates which are inclined downwards alternately from the opposite walls, and the lighter particles are carried by the air current into the second compartment, where part is deposited, the remainder being collected in a cyclone separator. The heavy particles which collect in the first compartment of the sorter are returned to the grinder. —A. T. L.

Fuel and other briquettes and of briquette and other binders; Manufacture of ——. D. J. Davis, Balham, J. T. Armstrong and J. Mordan, Hughenden, and Petroleum Solid Fuel (Parent) Co., Ltd., London. Eng. Pat. 22,738, Oct. 8, 1913.

A binder suitable for the manufacture of fuel briquettes or for road-making purposes is made by mixing the natural bitumen, gilsonite, with crude Mexican, or other suitable bituminous oil, or with tar. A hardening substance, *e.g.*, iron chloride, may be added if desired.—W. H. C.

Fuel blocks. J. E. G. M. de Jouffrey, Chasselay, France. Eng. Pat. 14,589, June 17. 1914. Under Int. Conv., June 18, 1913.

Finely ground coal is mixed with 4—6% of an agglomerant capable of vitreous fusion at about 200° C., heated with high-pressure steam to about 170° C. and briquetted. The agglomerant is composed of fine glass maker's sand

5 parts, sodium carbonate or other salt capable of forming a flux with the sand, 10 parts, and extra fine Portland cement, 18 parts.—W. H. C.

Lignum vitae sawdust ; Method of utilising ——. [*Manufacture of firelighters*]. J. Forshaw, West Kirby, Cheshire. Eng. Pat. 1292, Jan. 17, 1914.

Lignum vitae sawdust is compressed into moulds and heated to 160° F. (71° C.) whereby the natural resin exudes and converts the sawdust into a coherent mass which ignites and burns easily.—W. H. C.

Steam generated by quenching coke ; Method of and means for utilising ——. H. Koppers, Essen-on-the-Ruhr, Germany. Assignor to H. Koppers Co., Chicago, Ill. U.S. Pat. 1,116,297, Nov. 3, 1914. Date of appl., Oct. 28, 1913.

The steam is used for heating water which is afterwards brought into intimate contact with the air supply of a gas producer.—A. T. L.

Gas-producers. C. M. Garland, Chicago, Ill. U.S. Pats. (a) 115,804 and (b) 1,115,805, Nov. 3, 1914 ; dates of appl., Dec. 19, 1913, and May 2, 1914.

(a) The producer has a rotary intermediate generator chamber, and on the upper part of the fixed cover of this a fuel-supply chamber of flattened or oval section is mounted eccentrically so that as the intermediate chamber rotates an annular gas passage of triangular section is left above the fuel. This passage communicates with a gas discharge pipe also mounted eccentrically on the upper plate. (b) A fixed stepped ash-supporting table is surrounded by a rotary shell. The stepped table is provided with openings for the introduction of the blast and has saw-teeth mounted on the steps which serve to agitate the fuel as the shell rotates.—W. H. C.

Gas-producer. P. G. Schmidt, Olympia, Wash. U.S. Pat. 1,116,131, Nov. 3, 1914 ; date of appl., March 26, 1913.

In a producer having an intermediate rotary fuel chamber, air is supplied through a central pipe at the bottom and gas led off through an outlet pipe which depends from the top into the centre of the bed of fuel. A secondary supply of air is delivered through a water-sealed blast pipe to the periphery of the chamber above the level of the lower end of the gas-exit pipe.—W. H. C.

Gas from bituminous fuel ; Process of producing ——. O. C. Berry, Glendale, Ohio. U.S. Pat. 1,116,216, Nov. 3, 1914 ; date of appl., May 6, 1908.

The fuel is charged into a producer having the gas outlet intermediate between the top and bottom, and a sufficient proportion of the hot gas is drawn through the upper part of the producer to distil off the tarry vapours from the raw fuel. The mixture of vapours and gas is returned to the combustion zone either alone or mixed with air. —W. H. C.

Petroleum emulsions ; Treating ——. R. E. Laird and J. H. Raney, Taft, Cal. U.S. Pat. 1,116,299, Nov. 3, 1914. Date of appl., July 22, 1914.

The emulsion is "broken" by passing it upwards between electrodes which are brought intermittently to a sufficiently high potential difference to cause the conducting particles to coalesce in chains. When the potential difference is removed, these chains break up into "globules of free water."—A. T. L.

Briquette [*of coke dust*]. J. Alexander, Altona, Germany. U.S. Pat. 1,117,125, Nov. 10, 1914. Date of appl., Dec. 3, 1913.

See Fr. Pat. 461,065 of 1913 ; this J., 1914, 67.—T. F. B.

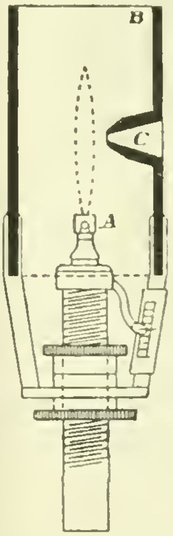
System for cleaning and purifying oils and other liquids. U.S. Pat. 1,115,827. *See* I.

Making ammonium phosphate [*for fertilising purposes, from gas liquor*]. U.S. Pat. 1,115,044. *See* XVI.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Light source ; New standard ——. L. A Jones. Amer. Illuminating Engineering Soc. J. Gas Lighting, 1914, 128, 430–431.

An acetylene burner of the type illustrated has been found to make a serviceable secondary photometric standard when accurately adjusted, though it is not reproducible to the precision necessary for a primary standard. The tip, A, is of the Bray air-mixing type, consuming 0·25 cb. ft. of gas per hour, giving a cylindrical flame about 3 mm. in diameter and 50 mm. high. The cylindrical metal hood, B, has a rectangular opening at C. from the edges of which metal leaves extend inwards to within about 2 mm. of the flame, forming an aperture, about 3 mm. high by 10 mm. wide. The acetylene used was purified by passing through bleaching powder and potassium chromate, and then carried through a regulator which kept the line pressure constant to within 2%. The advantages claimed for this type of standard are that it gives a good quality light of constant intensity, with but little attention.—T. F. B.



Patents.

Wood ; Apparatus for the destructive distillation of ——. S. E. Seaman, Brooklyn, N.Y. U.S. Pat. 1,115,590, Nov. 3, 1914. Date of appl., Dec. 27, 1913.

The wood is delivered into an inclined rotary retort from a separate hopper by means of a screw conveyor. The gases from the retort are cooled and passed through a condenser, and the uncondensed gases are passed through the hopper in order to remove air from the charge. —A. T. L.

Electric incandescence bodies suitable for use in glow lamps, and methods of manufacturing same. C. O. Bastian, London. Eng. Pat. 22,331, Oct. 3, 1913.

Closely-wound spiral filaments are formed by winding a coated wire or filament with successive turns in contact with one another, and removing the coating after the filament has been mounted on its final support in the lamp. A tungsten or molybdenum filament may be coated with oxide before winding ; the oxide being removed by passing current through the filament while the lamp bulb is being exhausted. A coating of copper deposited electrolytically may be used, and other suitable coatings are lime, cotton, varnish and collodion.—A. T. L.

Metallic filaments for electric lamps ; Manufacture of ——. A. Lederer, Vienna. Assignor to Westinghouse Lamp Co., Philadelphia. U.S. Pat. 1,116,450, Nov. 10, 1914. Date of appl., Nov. 11, 1910.

See Eng. Pat. 5388 of 1910 ; this J., 1911, 410.—T. F. B

III.—TAR AND TAR PRODUCTS.

Tar prices. J. Gas Lighting, Dec., 1914.

The Joint Committee of the Institution of Gas Engineers, representing tar producers and distillers (see this J., 1914, 1150), report that their efforts to fix the minimum price of pitch have failed, and therefore the proposed conditions for delivery of, and payments for tar during the war crisis are withdrawn. The Committee therefore recommend tar producers to make their own arrangements in regard to their tar contracts.

Phenol ; Compounds of calcium hydroxide with ——. F. F. Seliwanoff. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1535—1556. Bull. Soc. Chim., 1914, **16**, 224—225.

The most stable compound of lime and phenol is obtained as white flattened needles or square prisms by the action of aqueous phenol on calcium hydroxide or carbonate or metallic calcium. It becomes brown under the influence of moisture and light, but may be kept indefinitely in a sealed tube in absence of air. When dissolved in water, benzene, alcohol, ether, etc., it is decomposed into its components and it must be regarded as having the formula, $2C_6H_5OH,Ca(OH)_2$. When heated to 105°—120° C. in a dry inert gas, it loses one mol. of phenol ; the second mol. of phenol is displaced only at a higher temperature. The constitution, $HO.Ca.O.C_6H_5$, is ascribed to the monophenol compound, which is decomposed by water. It was not found possible to replace the hydrogen of the phenolic hydroxyl group by calcium ; metallic calcium has no appreciable action on fused phenol. Hydrates of the di-phenol-compound were prepared by various methods : they had the general formula : $2Ca(OH)_2,4C_6H_5OH,(2n+1)H_2O$, there $n=0$ to 4. By evaporating a solution containing 6·6 grms. CaO and 59·9 grms. C_6H_5OH per 100 c.c. in a vacuum exsiccator at 5°—8° C., crystals of $Ca(OH)_2,4C_6H_5OH$ were obtained, whilst solutions richer in phenol yielded crystals of $Ca(OH)_2,6C_6H_5OH$. Solid solutions of calcium hydroxide in phenol and also of magnesium hydroxide in phenol and of calcium hydroxide in thymol were also obtained.—A. S.

Pyridine ; Determination of ——. G. Malatesta and A. Germain. Boll. Chim. Farm., 1913, **53**, 225. Annali Chim. Appl., 1914, **2**, 277.

The official German method for the determination of pyridine is based on the formation of the cadmium chloride double compound, to which the formula, $CdCl_2,2C_5H_5N$, is ascribed. The authors find that this gravimetric method gives good results only if solutions of high alcohol concentration (at least 90%) be used and the formula, $CdCl_2,C_5H_5N$, be accepted for the double compound.—A. S.

Chlorination by means of aqua regia. Chlorination of benzene, thiophene, toluene, and mesitylene. R. L. Datta and F. V. Fernandes. J. Amer. Chem. Soc., 1914, **36**, 1007—1011.

Aqua regia is a convenient reagent for chlorinating hydrocarbons and other substances not easily oxidised by nitric acid. The mixture of hydrocarbon and *aqua regia* is warmed, with occasional agitation, the conditions being varied accordingly to the product desired. From 100 c.c. of benzene and 450 c.c. of *aqua regia* ($2HCl : 1HNO_3$) there were obtained by fractionation of the reaction product : unchanged benzene, 50 c.c. ; monochlorobenzene, 15 grms. ; *o*-dichlorobenzene, 4 grms. ; and *p*-dichlorobenzene, 18 grms. Thiophene yielded a mixture of about equal quantities of the mono-, di-, and tri-chloro-derivatives. From toluene, benzyl chloride and o- and *p*-chlorotoluene were obtained. Mesitylene yielded mainly the di- and tri-chloro-derivatives.—A. S.

Chlorination and oxidation by means of aqua regia ; Simultaneous ——. *Preparation of chloroanil from p-phenylenediamine and quinol.* R. L. Datta. J. Amer. Chem. Soc., 1914, **36**, 1011—1013. (See preceding abstract.)

Chloroanil can be prepared from *p*-phenylenediamine more simply and rapidly by the action of *aqua regia* than by the action of potassium chlorate and hydrochloric acid, according to Graebe's method (this J., 1891, 691). 15 grms. of *p*-phenylenediamine are added to 100 c.c. of *aqua regia* ($2HNO_3 : 3HCl$), the mixture being ultimately heated on the water-bath until all acid fumes are expelled. The product is washed with water, dried and sublimed : the yield is 10 grms. Quinol is also converted into chloroanil by the action of *aqua regia*.—A. S.

Colour reactions of the phenols. Carrancio and Gomez. *See* XXIII.

Colour reactions of phenols. [*Detection of zinc.*] Del Campo. *See* XXIII.

IV.—COLOURING MATTERS AND DYES.

Colour industry ; The artificial —— *and its position in England.* F. M. Perkin. J. Soc. Dyers and Col., 1914, **30**, 339—346.

After a brief review of the history of the coal-tar colour industry (compare W. H. Perkin, this J., 1885, 427), the causes which led or contributed to the decline of the industry in England are summarised thus :—The exploitation of the work of English chemists in Germany owing to the imperfect British patent laws and the lack of patent laws in Germany during the earlier stages of the industry ; slackness on the part of the early British manufacturers, after a certain period of prosperity ; industrial chemical research carried out in Germany but neglected in England ; German business organisation ; restrictions on the use of alcohol. The steps now being taken to establish the industry on a large scale in England are referred to (see this J., 1914, 1084), and it is suggested that the firms now manufacturing colours should enlarge their output and obtain leave to work certain German patents ; that many of the raw and intermediate products, such as benzene, naphthalene, anthracene, and their derivatives, should be manufactured at one or two of the great gas-works ; and that a few new companies should be started, preferably with capital furnished, at least in part, by colour users. In an industry such as that of the artificial colours, a number of highly-trained research chemists must be employed, as success will rest with the works capable of turning out the largest number of new colours and, at the same time, improving the methods of manufacture and the quality of the older ones and devising means of profitably utilising by-products. In this connection it is pointed out that the great profits made in the earlier stages of the industry by German firms were employed in the first case to write off capital expenditure and secondly to reconstruct their works and provide well-equipped laboratories staffed with skilled research chemists. The restrictions on the use of alcohol have been considerably mitigated (see this J., 1914, 1119), largely owing to the efforts of T. Tyrer, but it is stated that there is room for considerable improvement in the administration of the Government Acts. The use of pure alcohol is of even greater importance in the manufacture of drugs and photographic chemicals—an industry almost entirely in German hands before the war—than in the colour industry.—A. S.

Aminoazo-compounds ; Some ——. L. Casale and M. Casale-Sacchi. Gaz. chim. ital., 1914, **44**, II., 395—403.

The authors prepared by the usual method, aminoazo-compounds from α-naphthylamine and the diazo-compounds of some o-substituted aniline derivatives. The azo group proved to be in the para position with regard to the amino group of the naphthylamine. In the preparation of 4-*o*-tolylazo- and 4-*o*-anisylazo-1-naphthylamine, it was necessary to avoid excess of nitrite in preparing the diazo-compounds ; otherwise the free nitrous acid left in the solution diminished the yield of aminoazo-compound owing to secondary reactions, among which the formation of the corresponding hydroxyazo compound was observed. The preparation of 4-*o*-tolylazo-, 4-*o*-anisylazo-, 4-*o*-phenetylazo-, and 4-*o*-nitrophenylazo-1-naphthylamine, of their acetyl and benzoyl derivatives, and of *p*-naphthylenediamine by reduction of the tolylazo-compound with zinc and acetic acid is described.—A. S.

Eosin ; The copper lakes of ——. H. N. Gilbert. J. Phys. Chem., 1914, **7**, 586–618.

On mixing copper sulphate and sodium eosinate in aqueous solution, the copper lake was produced as a clear red solution, in suspension, as a precipitate, or as a jelly, depending on the conditions. When solutions containing equivalent quantities were mixed and allowed to stand, monoclinic crystals of copper eosinate were formed, and these could also be obtained by bringing together, in water, equivalent quantities of colloidal copper hydroxide and colloidal eosin (tetrabromofluorescein) : the crystals formed after three days. They were difficult to decompose by acids, and differed in properties from the ordinary amorphous copper lake of eosin. The latter is considered to be an adsorption compound of copper hydroxide with eosin, and eosin may be extracted from an aqueous suspension of the lake by shaking with ether. This is found to be due to the greater attraction of the copper hydroxide for the anions of certain salts. On shaking with acetone or alcohol the same change occurred and a precipitate of copper hydroxide formed.

A rapid and accurate method for the estimation of eosin compounds consists of adding sulphuric acid, extracting the liberated eosin with ether and estimating the amount by use of Wolff's colorimeter. A solution of cobalt nitrate containing 17·84 grms. $Co(NO_3)_2$ per litre has exactly the same colour as a solution of sodium eosinate containing 0·00125 grm. of eosin per litre, and was used as a standard.—G. H. F.

Anthocyanins and anthocyanidins ; Production of ——. A. E. Everest. Proc. Roy. Soc., 1914, B, **87**, 444—452, and **88**, 326—332. (See also this J., 1914, 18.)

Although quercitrin gave only anthocyanidin by reduction with zinc and acetic acid in the cold, yet the yellow glucosides of the flavonol class obtained from the yellow wallflower, yellow daffodil, crocus, tulip, jasmine, primrose, etc., yielded directly anthocyanins (glucosidal) without any intermediate production of anthocyanidins (non-glucosides). Provided the reduction was not carried too far no subsequent oxidation was in any case necessary for the production of the anthocyanin pigment. Contrary to the views of Willstätter the red pigments thus obtained by reduction are held to be identical with the natural anthocyanins, since they show a complete similarity of behaviour, being stable in acid solution, unstable in alkaline solution, decolorised by both oxidation and reduction, and also in neutral solution owing to isomerisation, the colour being reproduced on the addition of acids, with which they form red oxonium salts. The absorption spectra of the artificial and natural pigments are also similar.—G. F. M.

Colouring matters of Rhamnus catharticus. J. Oesch and A. G. Perkin. Chem. Soc. Trans., 1914, **105**, 2350—2357.

The colouring matters present in the berries of *Rhamnus catharticus* (Hungarian berries) are found to consist mainly of kaempferol, $C_{15}H_{10}O_6$, with a kaempferol methyl ether, $C_{16}H_{12}O_6$, and rhamnetin, $C_{16}H_{12}O_7$, and a small quantity of quercetin, $C_{15}H_{10}O_7$. The first three of these are believed to be identical with the colouring matters isolated from *Rhamnus catharticus* by Tschirch and Polacco (Arch. Pharm., 1900, **238**, 459) and described by them as rhamnolutin, $C_{15}H_{10}O_6$, rhamnocitrin, $C_{15}H_{10}O_5$, and β-rhamnocitrin, $C_{15}H_{10}O_5$. Krasowski (this J., 1909, 326) only succeeded in isolating rhamnetin and quercetin from these berries. Compared with Persian berries, the berries of *Rhamnus catharticus* gave much paler and duller shades on mordanted woollen cloth.—G. H. F.

British manufacture of aniline dyes. Manchester Guardian, Dec. 9, 1914. [T.R.]

Lord Moulton, at a meeting of representatives of the textile trades of Lancashire and Yorkshire, held at Manchester on December 8th, referred to the need for the manufacture of aniline dyes in this country.

England consumed £2,000,000 worth of dyes a year ; of this amount barely one-tenth was produced in this country. Stocks of dyes were rapidly diminishing, and practically Switzerland was the only nation from whom we could expect help, but Germany was threatening—and carrying out the threat—to stop all the supplies of intermediate products unless the Swiss manufacturers undertook not to export any of the dyestuffs to this country. Some English firms were manufacturing successfully, but their productions were altogether inadequate.

Assuming that the war was brought to a successful issue for the Allies in a political and military sense, the position, in his opinion, would not be equally favourable from an industrial point of view. They knew how the two dye trade rings in Germany, while competing at home, worked together against the foreigner. If peace were declared at this moment, the English textile industry would be so much under the domination of the German dye-producing industry that it could boycott it and overcharge it in the supply of dyes and it could hamper the industry pending the time when it could challenge its very existence. The contemplation of such a prospect made him feel that it was his business to sound a warning against the idea that this trouble was only temporary. The danger threatened more in peace than in war.

The sole cause of England's falling-back and Germany's progress in this great industry was that the Germans were perfectly prepared to undertake the intellectual study necessary to master a new science. The English could do it just as well ; in their great works there were English chemists fully as efficient as the Germans. But unfortunately the holders of capital in England had had little sympathy with knowledge that they did not themselves possess. The consequence had been that great inventions had fallen dead in England. They had been offered in Germany, and accepted, and the consequence had been great industrial production. Because the masters, the capitalists, had no sympathy with this self-preparation for a difficult task, there was no career for the young men who were willing to study. They were paid salaries quite insufficient for the training they had gone through ; that was why we were so poorly represented in the industrial ranks by chemists. As regards natural possessions, we were as well placed as Germany. The one thing was the difference in the human element ; it was not in intellectual capacity, but in the industry and the willingness to study to the bottom the subject which was in hand. We should not get a chemical industry like the Germans unless we trained ourselves for it, had faith in it, and embarked our capital in it.

Many objections had been urged against the scheme for the manufacture of dyes in this country. To the objection that there was a lack of technical skill, he had difficulty in returning a polite answer, for we had the command of abundant technical skill to create an industry. The processes were mostly well known, although a practised man might get a better yield of a particular product. The whole of the dyes of the class to which he referred, could certainly be produced in this country if proper plant and direction were provided.

It had been objected that it was impossible to compete with the German producers, but even in Germany individual firms were able to compete against the combines and maintain a profitable export business ; there were also some firms in this country : that proved that competition in production was not impossible. If manufacture took place on an economical unit—that was, on a scale which was adequately great—the advantages from production on an enormous scale were very small in comparison. Certainly England, with its great demand for dyes—and much of its demand was limited to comparatively few dyes—could start an industry which could challenge if not equal the economy of the biggest works.

Another objection had been that if the scheme were carried out, consumers might be supplied with dyes at less than cost price. He did not think that would happen, because if the Germans invaded the English market, the English producer would be able to retaliate by invading the Eastern markets where the Germans derived the profits which enabled them to attack the English industry.

There must be a great national effort to create a company, working under the conditions of other companies, suffering from its blunders, and profiting by its wisdom, but there were three conditions to be satisfied, or it would be a failure. The first condition was that it must be large, and, therefore, independent and beyond attack. It must also be national in the sense that it will be removed for ever from the temptation of listening to the voice of the charmer inviting it to enter a combine. The company must be not only powerful but one the loyalty of which was necessarily beyond all doubt, and that could only be got by Government assistance on such terms that the Government could stop it ever entering the backward path which would ruin its national unity. It must also be co-operative. The producer must be the consumer, and they would never link up all those industries unless those who used the dyes were interested in the production and therefore supplied a preferential market.

If a company were formed under those conditions it would be assured a long and successful existence, but if any one of the three essentials was omitted, it was predoomed to failure.

In reply to a question, Lord Moulton expressed a hope that associated industries would rise round this company to produce the raw materials, the manufacture of which was more akin to the heavy chemical trade than to the dye trade. He therefore thought that this work would fall into the hands of other industries, and that it would be to the benefit of all.

A resolution was carried unanimously approving a national effort on the general lines laid down by the Government.

British dye industry. Times, Dec. 23, 1914.

A CIRCULAR issued on Dec. 22nd by the Board of Trade Committee on Aniline Dyes, states that at a meeting of representatives of important firms and associations making use of artificial dyes, held on Tuesday, Nov. 10th, a Committee was appointed as representing the trades concerned, with authority to confer with the representatives of the Board of Trade with a view to the elaboration of a scheme on the lines of the memorandum submitted. The committee appointed was:—Mr. Lennox Lee (Calico Printers' Association, Ltd.), Mr. Milton S. Sharp (Bradford Dyers' Association, Ltd.), Mr. H. W. Christie (United Turkey Red Company, Ltd.), Mr. Chas. Diamond (English Sewing Cotton Company, Ltd.), Mr. G. Marchetti (John Crossley and Sons, Ltd.), Mr. R. D. Pullar (J. Pullar and Sons, Ltd.). This committee has been engaged upon the elaboration of the scheme already referred to, which involves the formation of a joint stock company having for its object the manufacture and supply of synthetic colours. The Government are prepared to assist such an effort on the following lines:—A limited company to be formed under the Companies Acts with a share capital of £3,000,000, divided into 3,000,000 shares of £1 each. The Government to advance to such company £1,500,000, bearing interest at the rate of 4% per annum and secured as a first charge on the assets and undertaking of the company, and be repayable in 25 years. The company shall remain British.

It is proposed to take over certain existing colour works and use the plants to their full capacity for the manufacture of such dyes as are essential. Arrangements have been made with Read Holliday and Sons, Ltd., for the extension of their plant to increase their output, and it is proposed that the new company shall take over the business and undertaking of Read Holliday and Sons, under an option which has been obtained. It is intended to negotiate for the acquisition of other businesses in the same way, and also to take steps to acquire a suitable site and erect works thereon. The Committee also hope that it will be possible to make arrangements on co-operative lines with existing concerns in Switzerland.

New interest in natural indigo. Oil, Paint and Drug Rep., Nov. 30, 1914. [T.R.]

THE crippling of the synthetic indigo industry has been turned to account by the British and Indian trade press as an occasion to revive interest in the restoration of natural production. The movement to break the German synthetic monopoly was started in London two years ago, but despite all efforts the vegetable dye failed to gain headway. Many dyers and consumers would now lend their support to the restoration of the natural industry, but the crop season is now so advanced that arrangements to secure an increased outturn in the near future cannot be made. Latest advices from Calcutta indicate that the area for the cultivation of indigo will prove about 20% less than that of last season. In 1895–6 exports reached their maximum at 187,337 cwt.; in 1902–3, a period following the establishment of the synthetic dye in Europe, the exports fell to 65,337 cwt.; while in 1912–13 they only reached 11,857 cwt. The United Kingdom has been most faithful among the principal consuming countries to retain the natural dye, although the country's requirements have been steadily curtailed.

Among the strongest merits of the artificial dye were the more uniform character of its effects and the easier methods of its operation. The percentage of indigotin in vegetable indigo had often proved difficult to determine. Wool takes more readily to the natural dye, but while the artificial does not yield quite so bright an effect, its colour is constant. To encourage the development of the natural industry, two proposals have been made: (1) to subsidise the industry in India, and (2) to restore the obligatory natural indigo clause in all government contracts. This clause is said to have been deleted under pressure of the German monopoly combined with representations on the part of English dyers. The indigo planters are urged to do their share for the industry by a more systematic method of cultivation of the best varieties, a better system of dye extraction and more rigid economy. References are made to the opportunities for the development of a British synthetic indigo industry, and laboratories of the United States are not likely to remain idle.

Report of Chemicals and Dyestuffs Committee to New York Section of Amer. Chem. Soc. *See* Trade Report.

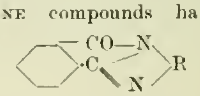
PATENTS.

Azo dyestuffs. H. Levinstein, J. Baddiley, and Levinstein, Ltd., Blackley. Eng. Pat. 25,547, Nov. 8, 1913.

THIS invention relates to dyestuffs of the general formula, $R.N_2.D.N_2.M.N_2.G.N_2.E$, where R represents the residue of resorcinol or *m*-aminophenol, D that of a *p*-diamine, M that of a middle component capable of further diazotisation after combination with a diazo compound, G that of 2-amino-8-naphthol-6-sulphonic acid, and E the residue of α-methylindole or a pyrazolone. They may be obtained by diazotising a monoacetyldiamine such as 4-acetamino-1-naphthylamine-6- or 7-sulphonic acid, combining with M, which may be 1-naphthylamine-6- or -7-sulphonic acid or a *m*-aminocresol ether, re-diazotising and combining with 2-amino-8-naphthol-6-sulphonic acid, diazotising and combining with the methylindole or pyrazolone, hydrolysing, again diazotising, and finally combining with resorcinol or *m*-aminophenol. Fast green shades are obtained by treating with formaldehyde fibres dyed with the products. —T. F. B.

Sulphur dyes. K. P. Grälert, M. Buff, and J. Flachslaender, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,112,445, Oct. 6, 1914. Date of appl., Dec. 6, 1913.

PHTHALOPERINONE compounds having the formula,



in which R represents a naphthalene nucleus, are treated with alkali polysulphides and copper or copper compounds. The products dye cotton brown shades, fast to light. (Compare Ger. Pats. 253.239 and 253.934; this J., 1913, 16, 80.)—T. F. B.

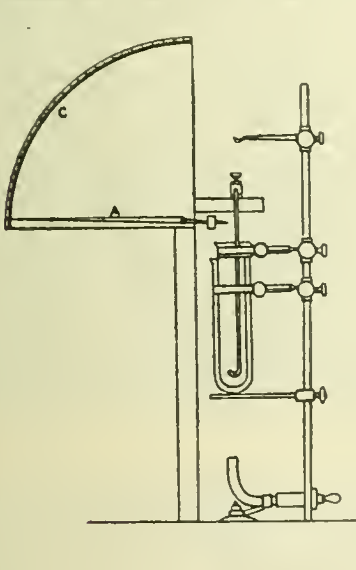
V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Artificial silks ; Damage caused by acid to —— and its prevention. P. Weyrich. Farber-Zeit., 1914, **25**, 114—118.

The damage known as "*Saurefrass*," caused by the presence of unstable sulphuric acid esters in artificial silks made by the collodion process (see this J., 1913, 80), is particularly troublesome in the case of silks dyed from baths of basic dyestuffs containing acetic acid. The sulphuric esters are extremely sensitive to hydrolysis by hot dilute acids, even acetic acid, with formation of free sulphuric acid. This migrates during drying to those parts where evaporation is most intense and becomes concentrated at those points. The damage may be prevented by drying the silk directly from a final bath containing 8—12% of a salt capable of combining with the free sulphuric acid, *e.g.* sodium acetate, lactate or formate, or borax. Dyed artificial silks finished in this manner will stand the stability test and can be heated to 140° C. without loss of strength or colour. It is desirable that the manufacturer of the silk should undertake the stabilisation of the goods before delivering them to the dyer. The unstable sulphuric esters may be decomposed by heating the silk impregnated with sodium acetate at 140° C., then washing and drying without heat.—J. F. B.

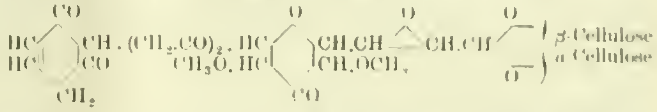
Textile fibres ; Swelling of —— on immersion in water. E. Justin-Mueller. Assoc. gén. des Chim. de l'Ind. Text., Paris, May, 1914. J. Soc. Dyers and Col., 1914, **30**, 354—355.

The author has devised "a turgometer" (see fig.) for measuring the degree of swelling, or "turgescence," of solid substances ("turgoids"), particularly organic substances, on immersion in water or aqueous solutions under certain conditions. Textile fibres are best examined in the form of threads ; whilst with woven material, threads of warp and weft are preferably examined separately, although narrow strips may be used. The thread is fastened at one end to a glass or metal rod and at the other to a movable lever, A, the longer arm of which indicates the degree of swelling on a graduated scale, C ; the larger portion (10 cm.) of the thread is immersed in the liquid. With cold liquids the pointer is adjusted to zero before the liquid is introduced, and the movement of the pointer is observed at intervals first of 1 min., then of 5 mins., and later of 10 mins., the temperature of the solution being also noted. When the behaviour in warm liquids is to be examined, the pointer is adjusted to zero immediately before warming. The method is useful for determining the most suitable concentration of caustic soda and time of immersion for mercerising cotton ; the critical temperature at which the fibre has the greatest turgescence—a point frequently of importance in dyeing ; and the determination of the degree of bleaching of vegetable fibres and detection of certain faults which occur in manufacture. In the case of cotton in caustic soda solution, the pointer rises to a certain height in a shorter time the less pure is the sample. A. S.



Cellulose and lignocellulose. C. F. Cross. J. Soc. Dyers and Col., 1914, **30**, 346—351.

The lignocellulose complex is composed of two or more celluloses in union with a lignone complex, the constituent groups of which may be represented by the general schematic formula :



$$\begin{array}{llll} \mathrm{CO} & \mathrm{O} & \mathrm{O} & \mathrm{O} \\ \mathrm{HC}\diagup\;\diagdown\mathrm{CH}.(\mathrm{CH_2.CO})_2.\mathrm{HC}\diagup & \diagdown\mathrm{CH.CH}\wedge & \mathrm{CH.CH}\diagup & \Big\}\ \beta\text{-Cellulose} \\ \mathrm{HC}\;|\quad|\;\mathrm{CO}\qquad \mathrm{CH_3O.HC}\;| & |\;\mathrm{CH.OCH_3} & & \mathrm{O}\ \Big\}\ \alpha\text{-Cellulose} \\ \mathrm{CH_2} & \mathrm{CO} & & \end{array}$$

The lignone and cellulose preserve their relationship unaltered through such reactions as hydration and hydrolysis, in which both complexes are equally attacked, and esterification, in which only the OH groups of the cellulose are directly involved. Attention is called to the specific colour reactions of lignocelluloses with aniline salts, diamine bases, and phloroglucinol (see this J., 1899, 616 ; 1907, 941, 942) and with ferric ferricyanide (this J., 1893, 104) ; of these there is some evidence that the former may be due to hydroxyfurfural formed from and within the lignone complex ; they are not given by lignocellulose which has been subjected to prolonged digestion with highly diluted sulphurous acid. It has been shown previously (this J., 1908, 802 ; also Eng. Pat. 5016 and Fr. Pat. 383,064 of 1907 ; this J., 1908, 330) that the lower acetates of cotton cellulose resist dyeing with substantive dyestuffs. Tests by H. Lyster Jameson have now demonstrated that whilst all other known textiles—in their natural condition, bleached, or treated by various methods—were completely disintegrated after periods varying from a few days to 6 weeks when immersed in sea water under natural conditions, acetylated cotton (monoacetate) was unchanged externally, had retained its strength, and had not lost weight, even after immersion for 8 months. The acetylated cotton is generally prepared in the form of yarn but can also be produced in the form of cloth.—A. S.

Pulp industry ; Progress in chemical ——. A. Klein. Papierfabrikant, 1914, 22, 601—603, 634—636.

The majority of the materials used for paper-making in Germany are derived from wood and straw, only about 5% of rags being employed. In Europe fir, spruce, pine, and larch woods are principally used, together with some poplar and beech. Formerly the losses amounted to 20% from peeling and boring out branches, with 15% due to sawing into discs, 3 cm. thick ; these losses are now reduced to 5—6% by hand-peeling and 10—12% by mechanical peeling. Formerly only 22—35% yields of pulp were obtained ; the sulphite process now yields 45—48%, the sulphate process 35—38%, and the soda process 30—38%. By increasing the pressure in the digesters the time required in the sulphite process has been reduced from about 36—48 hrs. to 9—10 hrs., while the use of mechanical stamps to ram the material in the digesters has increased the capacity to 85—95 kilos. per cb. metre. Vertical digesters have replaced the earlier horizontal type with improvement in speed of filling. Sulphite liquors containing large amounts of free acid are employed ; and the incidental sulphuric acid is reduced by thorough cooling of the gases and absorption surfaces ; the injurious effects of selenium in the pyrites used is almost wholly avoided by preventing formation of dust in roasting. Mechanical pyrites roasting furnaces are employed and rotary instead of stationary sulphur furnaces. The tower system of liquor preparation is now used more frequently than the tank system. By the recovery of waste gases and by reducing losses of gas and fibre the consumption of sulphur has been decreased considerably; formerly 100 kilos. of unbleached pulp required 45—90 kilos. of pyrites or 18—20 kilos. of sulphur: at the present time 25—26 kilos. of pyrites or 10—11 kilos. of sulphur suffice.

The older soda process using 5—5½% caustic soda solutions has been largely displaced by the sulphate process. This process uses liquors such as the following: 1·5% Na$_2$CO$_3$, 6·2% NaOH; 2·2% Na$_2$S, 0·3% Na$_2$SO$_3$; pressures up to 8 atm. being employed. The introduction of improved machinery and processes have led to the recovery of up to 90% of the soda instead of 58% as in former times. Of the numerous proposals for the utilisation of waste liquors for the manufacture of *e.g.* tanning materials, fertilisers, feeding stuffs, dyes, alcohol, etc., the author states that none have given practical results; the most promising are the processes devised for alcohol production (see this J., 1910, 810, 1052, 1265). Strehlenert's process (this J., 1913, 652) seems to be practicable, in this the sulphite liquor yields alcohol, plaster of Paris, sulphur dioxide and a fuel with a calorific value of 7000 cals. By Rinmann's process (see this J., 1914, 307) 500 kilos. of "carbon," 100 kilos. of spirit and acetone and 100 kilos. of motor spirit are said to be recovered per ton of cellulose.

Bleaching of pulp is carried out by means of hypochlorites, or by electrolytic chlorine; formerly 100 kilos. of pulp required 30—35 kilos. of bleaching powder, 10% or less now suffices with a loss of only 4—9% of fibre. Attention is called to the possibility of utilising such materials as broom rice and flax straw, bamboo, Savannah grass, maize stalks, etc.—R. G. P.

Mechanical pulp ; The grinding of spruce for ——. J. H. Thickens. U.S. Dept. of Forests Bull.; Papierfab. 1914, **12**, 275—281.

THE results previously reported (this J., 1913, 132) are republished with fuller details and additional matter. The coefficient of friction between the stone and the wood varies according to the nature of the wood, being lower for steamed than for raw wood; it decreases gradually as the pressure of grinding is raised. In industrial practice the wood is nearly always seasoned for a long period before grinding, but in addition to appreciable loss by rotting the pulp prepared from seasoned wood is shorter in fibre than that from green wood; steaming the wood before grinding gives longer fibres and stronger pulps but darkens the colour. At low pressures of grinding the consumption of power per ton of pulp is higher for seasoned than for steamed wood, while at high pressures the reverse is the case. For green wood the power-consumption per ton is lower than for either seasoned or steamed wood. The power supplied to the grinder under like conditions of speed and pressure is the same for green as for seasoned wood, but it is less for steamed wood. The rate of production of pulp from green wood is more rapid than from seasoned or steamed wood. The yield of pulp per 100 cub. ft. of solid wood of various species is directly proportional to the dry weight per cub. ft. It is approximately the same for seasoned as for green wood, but if taken on the basis of a cord of rough wood, there is probably more loss with seasoned wood owing to decay. The yield of pulp from steamed wood is considerably lower, owing to decomposition and solvent action, and it falls as the severity of the treatment is increased. The quality of the pulp is not greatly influenced by the moisture in the wood or the weight per cub. ft. With wood of rapid growth the yield per 100 cub. ft. is lower and the pulp is softer than with slow-grown wood but the strength is practically the same. Some valuable manufacturing data are obtained by comparing the power consumption per ton per unit of strength: the efficiency in this respect reaches a maximum and then decreases. The yield of pulp from trimmed wood is 88% by weight; the balance lost is divided between the screenings (2—7%) and the waste waters (5—10%) including both soluble and insoluble matters.—J. F. B.

Sulphite cellulose ; Resin in ——. Papierfab., 1914, **12**, 282.

TROUBLES due to the separation of the resin on the fibres in the digester were found to be more frequent in winter than in summer and were avoided by washing the pulp with water at 10°—20° C. forced in from below upwards by a centrifugal pump. The rinsing from above downwards, which is also necessary, was performed with warm water at 40° C. collected by condensing the steam blown off from the digesters and utilising other sources of waste heat.—J. F. B.

Pulp chests and the regulation of pulp. G. Janata. Papierfab., 1914, **12**, 186—189, 219—221.

FOR general purposes when two pulp chests are provided for a paper machine each may have a capacity equivalent to one hour's working or may hold the contents of two beaters diluted to a concentration of 3% of dry pulp. An average capacity is 22 cb. m. In German paper-mills chests with horizontal shafts and semicircular bottoms are preferred to the vertical cylindrical type; the pulp should always enter at the end opposite the outlet. The stirring is performed by two spiral bars connected by arms to the main shaft with a clearance of 5—10 cm. from the walls of the chest. The shaft is journaled outside the chest and passes through stuffing-boxes in the ends; it is driven by worm-gearing at a speed of 5—10 revs. per min. If the chest is placed at a low level, the stuff must be withdrawn by a pump discharging into a feed-box to the machine with an overflow back to the chest. Bucket-wheels are more common than pumps and require less attention; these are attached to the stirrer shaft and empty the pulp into a feed-box situated in the chest at a level from which it can run on to the machine. If the chest is placed sufficiently high the buckets can be designed to lift an excess of pulp and an overflow be provided back to the chest; generally, however, the scoops are arranged without an overflow. Pumps have the advantage that the quantity of dry pulp fed to the machine is less affected by variations in the concentration and height of the stuff in the chest than the older type of bucket-wheel. These advantages, however, may be obtained also with bucket-wheels by working with an overflow, as indicated, and by fitting Steinbock's buckets in which the quantity lifted is automatically kept constant whatever the height of the stuff until the latter falls below the level of the recess in which the buckets dip. In any form of chest, regular working can only be ensured by maintaining a steady concentration of the stuff; for this purpose an automatic measuring tank for the water employed to wash down the beaters is very useful. Feed-boxes with overflow are provided with a sensitive regulating valve for passing the stuff to the machine; an independent, quickly-closing sluice should be provided for stopping the flow without interfering with the adjustment of the valve.—J. F. B.

Oxford India-paper. Papierfabrikant, 1914, **22**, 605—606.

THIS paper, formerly made only in England, is now made in other countries; it must be as thin as possible, weighing under 30 grms. per sq. metre, non-transparent, and very resistant to ink penetration. It is made principally from linen rags, a "standard receipt" being 80% of best bleached white linen; 10% of best white bleached cotton; 5% of bleached straw pulp; 2% of finest white loading (*e.g.*, talc); 3% of waste. The rags are boiled with 1—2% of soda for 3 hrs. at 3 atm. pressure, washed carefully and bleached with 1—2% of chlorine until snow-white. Ultramarine is used for colouring and Indanthrene Blue R.S. for tinting. Beating is carried on for 20—34 hrs. in engines of up to 100 kilos. capacity, with sharp blades so as to obtain a short non-transparent whole stuff. Cone engines have proved very suitable; sand traps must be used on pulping and beating machines. Paper machines of 150—170 cm. width are most satisfactory;

running at not more than 40 metres per min. ; wire about No. 90. The strainers should be first a rotary strainer followed by a flat one, having slots 0·4 mm. wide and fitted with an automatic cleaning device. Shaking should be severe and short. Suction should be weak and couchers and presses lightly loaded so that the paper may have a thick handle. Stone rollers should be employed for the wet-press. The paper must be lightly calendered ; moist calendering is not used.—R. G. P.

[Paper.] Sizing ; Detection of rosin and animal ——. Kollmann. Papierfabrikant, 1914, **22**, 371—372.

Of the numerous proposed tests the author considers that Raspail's and the tannin tests are the only ones useful for rosin and animal sizing respectively. *Raspail's test for rosin.*—The paper is moistened on a microscope slide with concentrated sucrose solution, the fibres are teazed out and the excess of liquid removed by blotting paper ; on applying concentrated sulphuric acid a distinct red colour indicates rosin sizing. *Tannin test for animal sizing.*—The paper is warmed on a microscope slide with water, the paper is then removed and tannin solution added to the extract ; a brownish amorphous precipitate indicates animal sizing. Both tests should be applied only in absence of casein or fat.—R. G. P.

Kapok and akon, and the bitter principles, wax and resin contained therein. Matthes and Streicher. *See* XII.

Patents.

Cloth ; Process of preparing —— for testing its resistance to wearing. A. Kertesz, Mainkur, Germany. U.S. Pat. 1,116,077, Nov. 3, 1914 ; date of appl., March 14, 1914.

The material is prepared by wetting and pressing, boiling, treating with alcoholic, hydrocarbon or ethereal liquids and raising and pressing.—J. F. B.

Vegetable fibres ; Process of preparing ——. G. D. Burton, Assignor to The Burton Co., Boston, Mass. U.S. Pats. (A) 1,115,500 and (B) 1,116,343, Nov. 3, 1914 ; dates of appl., April 6, 1914 and March 27, 1913.

(A) Degummed fibrous material is treated with an oily substance in the form of minute particles in presence of an acid, or is immersed in a liquid carrier containing an acid and minute oily particles in suspension. The liquid may be produced by partially saponifying an oily substance with an alkaline saponifying agent and adding thereto a vegetable acid. (B) The oily substance in the form of minute particles is applied without the addition of an acid, and if used in the form of an emulsion the latter may be made by partial saponification by means of a weak volatile saponifying agent.—J. F. B.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Bleaching of wool fibre. A. F. Musgrave. Textile Colorist, 1914, **36**, 337—338.

Oxidising agents, as sodium and hydrogen peroxide, totally destroy the natural colouring matter of wool, while reducing agents, as sulphur dioxide, reduce the colouring matter, which is slowly oxidised back to its original colour in air. Hence in practice a double bleach is used, first with peroxide and then with sulphur dioxide. Sodium peroxide is superior to hydrogen peroxide in that it is less bulky and owing to its greater stability, is less dangerous to store, but in the labour involved in making up the bleach baths the advantage lies with hydrogen peroxide. By adding soap to the bleach bath it is possible to scour and bleach at the same time.—G. H. F.

Silk hank dyeing ; Hydrolytic dissociation assisted by air and light (photolysis) in relation to ——. E. O. Sommerhoff. Färber-Zeit., 1914, **25**, 171—173.

Hydrolytic dissociation plays an important part in many operations of the silk-dyeing industry. Dissociation is considerably intensified by the application of heat, and the similar influence of air and light has been recognised in practice by the custom of working the yarn in and out of the liquor. Two special instances of this type of reaction are quoted : (1) The method of degumming raw silk in a soap-and-air lather instead of in the liquid bath enables the process to be completed in a shorter time and with less expenditure of soap. The influence of the air and light increases the activity of the hydrogen ions of the water, intensifying the hydrolysis of the sodium-fatty acid salt and consequently the efficiency of the soap bath. In the exposure of soaped goods to the action of air and sunlight in laundry work, reactions of a similar order play a part. (2) The washing of silk treated with stannic chloride in a machine provided with revolving rollers is another instance of hydrolysis. The cold water quickly decomposes the stannic chloride into oxychloride and hydroxide ; in a short time no more hydrochloric acid can be detected with methyl orange. If the washed silk be then exposed to air and light a further quantity of hydrochloric acid makes its appearance owing to the further hydrolysis of the oxychloride. Hence it is advantageous not to wash continuously but to stop the machine from time to time to expose the goods.—J. F. B.

Vat-dyestuffs ; The action of "solution salt" on ——. Haller. Färber-Zeit., 1914, **25**, 8—10, 26—29.

Lichtenstein (this J., 1913, 134) regards the action of sodium benzylsulphanilate ("solution salt") on vat dyestuffs as being comparable with that of the protective colloids such as sodium protalbinate. The author, while confirming Lichtenstein's capillarity results, concludes from ultramicroscopic observations that their action is quite different. "Solution salt" greatly increases the degree of dispersion of the colloidal micellæ of Hydron Blue and its leuco derivative but sodium protalbinate has the reverse effect and gives a turbid dye-vat. Hydron Blue when suspended in water shows a large proportion of coarse particles and a few micellæ ; reduction by hydrosulphite slightly increases the degree of dispersion and the addition of sodium carbonate very considerably increases it. In practice, in order to obtain the maximum deflocculation of the coarse particles of dyestuff, it is therefore advantageous to add the "solution salt" and dyestuff together to the water, then the alkali and finally the hydrosulphite. A reduced dye-vat is not a solution of the sodium salt of the leuco compound but is still a colloidal solution and the dyeing results, as regards intensity, are directly proportional to the degree of dispersion of the micellæ. Thus with equivalent dye-vats, the vat containing "solution salt" gave the deepest shade on cotton, the ordinary vat gave lighter shades, while the vat containing sodium protalbinate, owing to the suppression of adsorption phenomena, gave very pale dyeings. Sodium chloride acts as a typical electrolyte causing aggregation of the micellæ. The action of "solution salt" is quite specific : it has an effect the reverse of that of an electrolyte, but on the other hand it does not act as a protective colloid, since the baths containing it, unlike those to which sodium protalbinate has been added, are still sensitive to dilute solutions of electrolytes. Its action is physical and not chemical, since the whole of the "solution salt" may be removed unchanged from the bath by dialysis.—J. F. B.

Naphthol AS and its use in calico printing. A. Lomanowitsch. Färber-Zeit., 1914, **25**, 175—177.

Naphthol AS is the anilide of 2.3-hydroxynaphthoic acid which when developed on cotton with certain diazo salts gives very bright and fast colours. For printing, the cloth is padded with a solution of Naphthol AS in caustic soda, with castor oil soap and sodium acetate. The goods are dried and printed : for blue, with thickened diazotised dianisidine; for red, with diazotised *p*-nitro-*o*-toluidine. The addition of aluminium sulphate to the diazo solution is necessary but the use of copper chloride, recommended by the makers, is considered to be injurious. The colours obtained are superior to those produced with *β*-naphthol and faster to steaming: a mixture of the two naphthols may sometimes be used to modify the shade. The whites of the printed cloth are difficult to clear in the ordinary way, but if a little caustic soda be added to the soaping bath at 62° C. the clearing is satisfactory; if other colours are also present, dyestuffs fast to caustic soda must be employed. For dyeing piece goods, Naphthol AS, developed with diazotised dianisidine with aluminium acetate, gives full indigo blue shades. A printed discharge is obtained on these by means of hydrosulphite NF and anthraquinone, but the discharge is more difficult than on *β*-naphthol colours. The goods must be strongly steamed for at least 5 minutes and the white cleared in alkaline soap solution followed by bleach liquor. White and coloured reserve effects are obtained by printing on the Naphthol AS ground with tin salt mixture containing basic dyestuffs if desired, drying and then developing with the diazo solution. Yarn treated with a mixture of Naphthol AS and formaldehyde may be dyed with diazo salts without intermediate drying.—J. F. B.

Swelling of textile fibres on immersion in water. Justin-Mueller. *See* V.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Acids; Exportation of —— from Italy. L'Ind. Chim., Min. e Met., 1914, **1**, 449. (See also this J., 1914, 897.)

In reply to a petition of the Turin Chamber of Commerce the Italian Minister of Finance has stated that it may be possible to allow definite quantities of sulphuric and hydrochloric acids to be exported after consideration of the circumstances in each instance.—C. A. M.

Potash salts. Summary for 1913. Compiled by W. C. Phalen, U.S. Geol. Survey. Chem. Eng., **20**, [3]. Chem. News, 1914, **110**, 219—221, 231—233, 241—244, 251—252, 261—262.

The saline potash deposits of California, Oklahoma, and Texas were examined, and it is estimated that at Searles Lake, Cal., potassium compounds, equivalent to 6,000,000 tons of chloride, are available. A process has been devised by Chappell (this J., 1913, 910) for obtaining potassium sulphate and alumina from alunite which is widely distributed in certain of the Western States, and attention is drawn to the fertilising value of this mineral, whether raw or roasted, and also of the kelp found along the Pacific coast (see also Skinner and Jackson, this J., 1913, 618). Further investigations on kelp were made, and several companies formed for making potash and fertiliser from this source (see this J., 1912, 227, 1177: 1914, 1086). Processes for the extraction of potash salts from silicate rocks (this J., 1913, 487, 699, 977) are reviewed, and one process (this J., 1911, 955) is said to be in experimental operation. The shipments of potash salts and potash fertilisers, in metric tons, from the German potash mines, for native and foreign consumption, during 1911 and 1912, were:—

TABLE I.

	1911.	1912.
Muriate of potash	443.357	471,435
Sulphate of potassium	110,123	115,728
Sulphate of magnesium and potassium		
48% K_2SO_4	49,014	55,987
40% K_2SO_4	144	173
Manure salts—		
Minimum, 38% K_2O	38.620	48,059
Minimum, 20% K_2O	169,812	174,867
Minimum, 30% K_2O	57,502	64,514
Minimum, 40% K_2O	379,790	483,877
Kainit and sylvinit	3,312,632	3,251,003
Carnallite, etc.	80,660	70,462
Total	4,641,654	4,736,105

TABLE II.

Exports of German potash salts in 1911 *and* 1912.

Potash salts.	1911.		1912.	
	Total.	To United States.	Total.	To United States.
Muriate of potash	329,751	229,431	286,528	190,775
Sulphate of potassium	109,529	56,893	85,452	35,366
Sulphate of potassium-magnesium	282,574 (*a*)	143,775 (*a*)	48,540	14,172
Carnallite, with at least 9% and less than 12% K_2O	1,167,972		6,853	——
Raw potash salts, with from 12 to 15% K_2O			852,984	461,279
Raw potash salts, with more than 15% and less than 20% K_2O			35,529	29,533
Manure salts, including potash salts with 38% K_2O			373,665	149,907
Abraum salts, Stassfurter salts, etc.			31,322	9,578
Total	1,889,826		1,720,837	890,610

(*a*) Includes manure salts.

TABLE III.

Potash salts imported into United States for the calendar years 1910–1913, *in pounds.*

Potash.	1910		1911.		1912.		1913.	
	Quantity.	Value (dols.)	Quantity.	Value (dols.)	Quantity.	Value (dols.)	Quantity	Value (dols.)
Carbonate of..	18,963,619	616,371	20,332,990	636,356	20.530,846	658,343	21.436,533	652,635
Caustic, not including refined ..	8,304,696	346.388	7,069,837	287,116	9,578,437	365,860	8,590,120	335,147
Cyanide of	——	——	(*a*) 2,114,684	(*a*) 316,027	1,138,569	169,627	1,023,167	143,999
Chloride of	381,873,875	5,252,373	509,119,193	7,651,684	482,265,665	7,229.109	478,826,857	7,120,055
Nitrate of (saltpetre), crude..	11,496,904	333,854	7,945,747	265.061	7,315,531	216,492	9,876,910	262,575
Sulphate of	86,162,874	1,426,975	121,039,192	2.227,820	97,161,010	1,769,676	88,565,073	1,633,114
All other	3.389,684	387,662	4,583,940	442,042	3,509,444	316,989	6,114,748	554,637
Total ..	510,191.652	8.363.623	672,205,583	11,826,106	621,499.502	10,726,096	614,433,408	10,702,162

(*a*) Figures cover period since July 1.

Table IV.

Potash salts imported for consumption into the United States for the calendar years 1911 1913, in pounds.

Potash.	1911.		1912.		1913.	
	Quantity.	Value (dols.)	Quantity.	Value (dols.)	Quantity.	Value (dols.)
Carbonate of, crude . . .	8,604,855	255,096	7,625,382	234,868	9,715,878	272,974
Caustic, not including refined ..	7,072,093	287,097	9,690,494	370,506	8,648,753	(a) 342,056
Cyanide of	2,649,040	294,141	726,659	109,134	1,395,987	205,037
Chloride of	506,570,661	7,651,693	482,529,396	7,229,121	475,261,595	7,075,745
Nitrate of (saltpetre), crude	7,911,757	265,061	6,511,298	202,893	9,652,366	261,078
Sulphate of	121,710,568	2,240,631	98,237,150	1,783,846	88,698,193	1,677,429
All other	15,570,411	689,662	16,858,875	761,611	19,067,144	959,595
Total	670,122,385	11,783,381	622,179,164	10,692,285	612,139,916	10,793,913

(a) Including refined.

Table V.

Fertilisers imported and entered for consumption in the United States, 1909-1913, in "long tons."

Fertiliser.	1909.		1910.		1911.		1912.		1913.	
	Quantity.	Value ($).	Quantity.	Value ($).	Quantity.	Value ($).	Quantity.	Value ($).	Quantity.	Value ($).
Apatite	2,925	10,013	-	—	20	300	100	1,400	2,962	22,471
Bone-dust (or animal carbon) and bone ash, fit only for fertilising purposes..........	29,035	685,291	48,979	1,110,176	36,856	913,472	117,717	878,686	35,012	851,136
Calcium cyanamide or nitrolim	(a)	(a)	3,540	177,552	5,292	292,496	9,311	493,519	26,729	1,410,248
Guano	44,197	772,674	33,565	667,870	36,869	774,315	19,128	329,624	16,074	518,129
Kainit	163,913	854,998	582,197	2,798,198	563,957	2,748,140	511,976	2,386,362	465,336	2,201,730
Manure salts, including double manure salts ..	(b) 52,958	601,804	147,242	1,013,000	159,796	1,660,010	171,757	1,797,057	223,687	2,245,509
Phosphates, crude	3,983	99,060	21,706	23,040	16,153	157,391	28,821	231,255	17,121	121,815
Slag, basic, ground or unground ..	690	5,880	10,774	93,650	12,622	87,991	12,596	111,300	13,186	130,455
All other substances used only for manure	184,850	2,879,845	195,991	3,394,279	197,810	4,098,321	127,932	2,660,887	151,729	3,314,460
Total	488,581	5,918,565	1,043,994	9,520,074	1,029,375	10,762,472	999,338	8,893,090	955,436	10,819,253

(a) Not separately classified. (b) From August 5 to December 31.

—F. Sodn.

Salts which contain two solvents of crystallisation ; A class of ——. J. E. Marsh. Chem. Soc. Trans., 1914, **105**, 2368—2370.

Crystals of $KHgI_3,H_2O,3(CH_3)_2CO_3$ were obtained by cooling a solution of potassium and mercuric iodides (molecular proportions) and water in hot methyl carbonate and by crystallising $KHgI_3,H_2O$ from the same solvent. The salt, $NH_4HgI_3,H_2O,2(CH_3)_2CO_3$ was similarly prepared, and $RbHgI_3,H_2O,2(CH_3)_2CO_3$, by adding $RbHgI_3,H_2O$ to methyl carbonate. Molecular proportions of silver iodide and sodium or potassium iodide, dissolved in a mixture of methyl carbonate and water, yielded crystals of $NaI,AgI,2H_2O,2(CH_3)_2CO_3$ or $KI,AgI,H_2O,(CH_3)_2CO_3$.—F. Sodn.

Ferrous chloride and nitric oxide ; A supposed crystalline compound of ——. I. Bellucci. Gaz. chim. ital., 1914 **44**, II., 384—389.

Thomas (Bull. Soc. Chim., 1895, [3], **13**, 385) claimed to have obtained a crystalline compound, $FeCl_2,NO,2H_2O$, by the action of nitric oxide on a saturated ethereal solution of ferric chloride. The author finds that dry nitric oxide has no action on a solution of anhydrous ferric chloride in anhydrous ether, if moisture be excluded. In presence of water reaction occurs: the solution becomes dark green and a small quantity of nitric acid is formed. If the solution be evaporated *in vacuo* over sulphuric acid, the original yellow colour is restored, and a yellow microcrystalline residue is obtained as described by Thomas. This consists, however, not of the compound described by him, but of ferric chloride together with a small quantity of nitric acid. (See also Manchot, this J., 1914, 642, 643.)

—A. S.

Metals ; Displacement of — *from aqueous solutions of their salts, by hydrogen at high temperature and pressure.* W. N. Ipatieff and A. K. Starynkevitch. J. Russ. Phys.-Chem. Soc., 1914, **46**, 172 173. Bull. Soc. Chim., 1914, **16**, 753.

From a saturated solution of mercurous nitrate, hydrogen under a pressure of 130 atmospheres caused the deposition of bright yellow crystals of $2HgO,N_2O_5,H_2O$ (in which globules of mercury were visible under the microscope) at 160° C., and metallic mercury alone at 225° C., the solution becoming acid in the latter case: from a solution of mercuric nitrate with hydrogen at 120 atm., crystals, similar to the above but mixed with HgO, were obtained at 110° C., and metallic mercury, with crystals of HgO, at 240°—250° C., the latter solution also becoming acid. At 220° C. with hydrogen at 195 atm., white needles of $Cd(NO_3)_2,CdO,2H_2O$ were deposited from a 2*N*-solution of cadmium nitrate, the deposit obtained at 250°—260° C. with hydrogen at 220 atm. being similar but containing crystals of cadmium. From a 2*N*-solution of cadmium sulphate with hydrogen at 250 atm., $CdSO_4,H_2O$ and occasionally cadmium were obtained at 220° C., and yellow needles of CdS at 270°—285° C. A basic salt was deposited from a 2*N*-solution of zinc nitrate at 290° C. by hydrogen at 140 atm., and crystals of ZnO at 320°—330° C.: the deposit obtained at 350° C. with hydrogen at 360—380 atm. was similar to the preceding but contained microscopic crystals of zinc. Crystals of ZnS were deposited from a 2*N*-solution of zinc sulphate at 290° C. by hydrogen at 250 atm. From a 2*N*-solution of magnesium nitrate crystals of MgO were deposited at 340° C. by hydrogen at 230 atm.; while a basic solution of MgS was obtained from a 2*N*-solution of magnesium sulphate at 340° C. with hydrogen at 340 atm. Heated in a quartz tube, a 2*N*-solution of nitric acid was completely converted into NH_3 at 370° C. by hydrogen at 300 atm., while a similar solution of sulphuric acid was almost completely decomposed into H_2S at 350° C. by hydrogen at 238 atm. In the presence of water, freshly precipitated zinc oxide was not reduced at 380° C. by hydrogen at 320 atm.—W. E. F. P.

Nitric oxide and chlorine; Rate of combination of gaseous ——. I. J. E. Coates and A. Finney. Chem. Soc. Trans., 1914, **105**, 2444—2452.

Nitric oxide and chlorine were allowed to mix in equivalent proportions and the rate of decrease of pressure, at constant volume, was observed. Velocity constants, calculated from the results obtained at 0° and 14·8° C., indicate a reaction of the third order, as required by the equation $2NO + Cl_2 = 2\ NOCl$. The temperature-coefficient was approximately 1·23 for an increase of 10° C.—F. Sodn.

Nitrogen trioxide; Dissociation of gaseous ——. B. M. Jones. Chem. Soc. Trans., 1914, **105**, 2310—2322. (Compare H. B. and M. Baker, this J., 1907, 1276.)

The vapour density of a sample of nitrogen trioxide, which had been dried for two years over phosphorus pentoxide, was determined at a series of temperatures, pressures, and volumes ranging from 15°—138° C., 106—818 mm., and 1·05—0·2 litres respectively. The results obtained (35·07 to 24·00) are in agreement with the assumption that the liquid is mainly in the form of N_4O_6 molecules, which increase in number on drying and are blue; a certain number of NO_2 (or N_2O_4) and NO molecules are also present, owing to incomplete drying. On vaporisation, the N_4O_6 molecules dissociate (almost completely at 140° C.) to give N_2O_3, NO_2, and NO in equal volumes (the reverse change taking place on cooling). Both N_4O_6 and N_2O_3 are colourless or nearly colourless in the gaseous state.—F. Sodn.

Cerium and hydrogen; Reciprocal action of ——. I. I. Joukoff. J. Russ. Phys.-Chem. Soc., 1914, **45**, 2073. Bull. Soc. Chim., 1914, **16**, 531.

Cerium when heated in an atmosphere of hydrogen rapidly absorbed the gas at about 350° C. Between 450° and 510° C. the dissociation pressure was about 1 mm. so long as the proportion of hydrogen did not exceed that corresponding to CeH_2; beyond this the dissociation pressure increased with the hydrogen concentration. It is concluded that the hydride, CeH_2, is formed, and that this hydride is capable of dissolving hydrogen.—A. S.

Sulphur and selenium; Preparation of colloidal solutions of —— in glycerol and erythritol and mixtures of the same. P. P. von Weimarn. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1689—1690. Bull. Soc. Chim., 1914, **16**, 180.

Solutions of sulphur or selenium in glycerol or erythritol when cooled to very low temperatures, *e.g.*—80° C., yielded colloids of varying degrees of dispersion according to the rate of cooling and the concentration. When added to cold water, these products yielded colloidal solutions, those of sulphur being colourless and transparent, or more or less opalescent, and those of selenium being orange, red or pink. The solutions possess considerable stability: the orange selenium sol showed no perceptible change after 10 days. Above 160° C. the sulphur glycerinosols acquired a deep blue colour.—A. S.

Lead and the end product of thorium. Part I. A. Holmes and R. W. Lawson. Phil. Mag., 1914, **28**, 823—840.

It has been suggested recently that the end products of the disintegration of uranium, thorium, and actinium are all isotopic with (*i.e.* indistinguishable chemically from) ordinary lead. This view has been practically established so far as the end product of uranium (uranium lead or radium G) is concerned, the ratio Pb : U being constant in minerals of the same geological age and increasing with the age in the case of minerals of varying age. Analysis of a number of Devonian minerals and comparison of published analyses of minerals of varying geological age has now shown that there is no constancy in the Pb : Th ratios for minerals of the same age, and hence that thorium E (thorium lead) cannot be a stable isotope of lead, but must disintegrate slowly, losing radiations which have so far escaped detection (the half-period of decay has been calculated to be 6×10^5 years by R. W. Lawson, Nature, July 9, 1914). It is suggested that the stable end products of thorium and actinium are respectively bismuth and thallium.—A. S.

Thorium D; Volatility of ——. Note on the relative β-activities of thorium C and D. A. B. Wood. Phil. Mag., 1914, **28**, 808—818.

An active deposit of Th D, untreated, or treated with nitric acid, volatilised at 520° C., but at 270° C. after treatment with hydrochloric acid. This is in accord with the views of Schrader (this J., 1912, 685), Russell (this J., 1912, 685), and Barratt and Wood (Proc. Phys. Soc., London, June, 1914), that active deposits of radioactive substances are capable of forming definite chemical compounds. Th D recoils in the atomic state from Th C, whether the latter be free or combined with acids, but from thorium active deposit dissolved in hydrochloric acid, a portion of the recoiling atoms of Th D appears to recombine with chlorine liberated by the disintegration of molecules of thorium chloride.

Thorium D is completely volatilised above 700° C., whilst Th C volatilises only at about 780° C. This method was used to obtain Th C free from Th D, and pure Th D. The relative β-activities of the two products were found to be 1·5 : 1.—A. S.

Radium in India. [T.R.]

M. C. A. Crump, of Bombay, while on the Singar estate in the Gaya district, states that: The pitchblende mine on Abrakhi Pahar, a small hill situated about half a mile due east of the village of Bhanekhap, is now being worked. It is only 42 feet deep, as without aid of any mechanical contrivances progress is necessarily slow. Over 8 cwt. of pitchblende has been won, and there is every prospect of finding further segregations at a depth yielding a richer supply of the precious mineral. Outcrops of triplite (a ferrous manganous fluophosphate that seems to be associated with pitchblende) have been found in other parts of the estate. Both pitchblende and uranium ochre have been known for many years to occur in the Gaya district at the Singar mica mines, though very little has been done to ascertain the amount available.

Saltpetre in Texas. Oil, Paint, and Drug Rep. Nov. 23, 1914. [T.R.]

A supply of nitrate of potash is reported to have been discovered near Alpine, Texas. A company will be formed to place the product on the market.

Japan's drug and chemical trade. Oil, Paint and Drug Reporter, Nov. 23, 1914. [T.R.]

Since the beginning of September many large orders for chemicals and drugs have been received in Japan from Russia. These articles had formerly been obtained in Germany, and more recently from England and the United States. The demand for iodine compounds, acetic acid and other chemicals has been particularly large, and they are being exported from Kobe firms to Russia.

Hungarian chemical industry. Chem. and Druggist, Dec. 4, 1914. [T.R.]

Of all branches of Hungarian industry the chemical factories have suffered most from the war; 70 per cent. of the dye and general chemical manufactories have been stopped, the only exception being the mineral oil works, which are furnishing benzine for the army. The stocks of raw material for this industry, however, will soon be exhausted. Only three sugar factories are at work, the others being stopped because of lack of railway facilities for the conveyance of the beets. The glass industry is also seriously affected; only four of eighteen glass factories are at work, the others having had to stop on account of lack or raw material or of capital.

Patents.

Burner gases; Method of separating water from ——. J. B. F. Herreshoff, Assignor to General Chemical Co., New York. U.S. Pat. 1,113,437, Oct. 13, 1914; date of appl., Feb. 17, 1911.

Burner gases which have been treated with dilute sulphuric acid are rapidly cooled from 200° to 100° F. (93° to 38° C.) and the condensed liquid removed.
—F. Sodn.

Sulphuric acid; Apparatus for the concentration of ——. R. Bithell and J. A. Beck, Belfast. Eng. Pat. 25,526, Nov. 7, 1913.

A hollow column, heated internally, is provided on the outside with a number of superposed gutters through which the acid gravitates successively. The inner walls of the troughs are constituted by the column itself, whilst the outer walls, which are curved in vertical section, have each a cut to allow the overflow of acid into the trough immediately below. A valve regulates the flow of acid into the uppermost trough, and the bottom trough has a curved outlet. The column is constructed of iron or other material and may be built up in sections.—F. Sodn.

Sulphuric acid; Tray or dish for use in the concentration of —— [*by the cascade system*]. J. A. Beck, R. Bithell, and J. A. Beck and Son, Ltd., Belfast. Eng. Pat. 25,802, Nov. 11, 1913.

A shallow vessel, with a flange at its upper part, designed to rest upon the brickwork of the flue, so as to allow the body of the vessel to fit completely into the aperture provided, and thus expose a relatively extended surface to direct contact with the heating gases. (Reference is directed to Eng. Pats. 2205 of 1872 and 2839 of 1879.)
—F. Sodn.

Sulphuric acid; Tubular apparatus for treating corrosive liquids more especially for concentrating —— *by steam heat.* P. M. Pritchard and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 29,542, Dec. 22, 1913.

The joints between the protective coverings of the tubes and the lining of the evaporation vessel are so made that they are not subjected to the pressure of the fluid (*e.g.*, steam) passed through the tubes, and the joints of the tubes with the chests, for the inlet and outlet of the heating fluid, are so arranged as to be out of contact with the liquid under treatment. In apparatus for concentrating sulphuric acid, for example, the leaden lining of the evaporation vessel is turned in at each tube-plate hole, so as to form a seating against which the flanged end of a leaden sleeve, fitting over the tube-covering, is forced by means of a nut manipulated from the outside, and the ends of the sleeve and cover are burned together in a space provided between the tube-plate of the evaporation vessel and that of the steam-chest, whilst the ends of the tubes are expanded into nuts screwed into openings in the inner walls of the steam-chests. The tubes are readily removed and replaced.
—F. Sodn.

Ammonia still. W. H. Wright, Duluth, Minn. U.S. Pat. 1,114,843, Oct. 27, 1914; date of appl., Aug. 29, 1910.

A column comprises a series of superimposed rectangular segments, having weirs, and a lower series of segments each containing a number of parallel connected canals, formed by dams projecting alternately from opposite walls. The liquor is heated in the upper segments by ascending hot gases and then passes to the lower segments. Vapour "risers," with saddle-shaped seal bonnets, in the walls of the canals, allow heated vapours to pass through the liquor, which overflows from the canals, through removable ducts, to a lime-box and thence to the canals of a lower segment, means being arranged for the supply of steam to the lowest segment. The seal bonnets are adapted to slide longitudinally from the risers and to be removed by hand through openings in the walls.—F. Sodn.

Ammonia and alumina from aluminium nitride; Process of producing ——. E. Milde, Goldschmieden, Germany, Assignor to Aluminium Industrie Aktienges., Neuhausen, Switzerland. U.S. Pat. 1,115,003, Oct. 27, 1914; date of appl., June 10, 1913.

Aluminium nitride is converted by boiling with the hydroxide of an alkaline-earth metal into ammonia and an alkaline-earth aluminate, and the latter is boiled with a highly concentrated solution of alkali carbonate, the resulting alkali aluminate being treated for the production of pure alumina. Or, the nitride and alkaline-earth hydroxide are boiled simultaneously with the solution of alkali carbonate, and alumina prepared from the concentrated solution of alkali aluminate thus obtained.
—F. Sodn.

Cyanogen compounds; Process of preparing ——. J. E. Bucher, Coventry, Assignor to Nitrogen Products Co., Providence, R.I. U.S. Pat. 1,116,559, Nov. 10, 1914. Date of appl., March 9, 1914.

See Eng. Pat. 11,797 of 1913; this J., 1914, 749.—T. F. B.

VIII.—GLASS; CERAMICS.

Chemically resistant glass lacquer. Fox. *See* XIII.

Patents.

Glass-melting furnace. T. L. Holle, St. Louis, Mo. U.S. 1,111,258, Sept. 22, 1914. Date of appl., April 9, 1913.

In a furnace of the non-reversible regenerative type, burner and down-take flues are disposed alternately on each side of the furnace body, connecting this with a regenerator. Each burner flue and down-take flue on one side are opposite a down-take flue and a burner flue respectively on the other side of the furnace, whereby the products of combustion are drawn in several directions through the interior of the furnace and are equally distributed to the several outlet flues.—A. S.

Brick dryers; Gas furnace for ——. G. M. Raymond and G. R. Mumma, Assignors to C. W. Raymond Co., Dayton, Ohio. U.S. Pat. 1,117,905, Nov. 17, 1914; date of appl., June 18, 1914.

The front wall of the dryer has a pocket in the inner face with a burner tube mounted in it, and extending into the furnace. The communicating air passages extend longitudinally through the furnace, and connect the pocket with the atmosphere through the front wall and the chequer work mounted in the furnace on each side of the air passages.—G. W. McD.

Enamel; White ——. I. Kreidl, Vienna. U.S. Pat. 1,117,197, Nov. 17, 1914. Date of appl., Oct. 30, 1912.

See Fr. Pat. 450,228 of 1912; this J., 1913, 488.—T. F. B.

IX.—BUILDING MATERIALS.

Patent.

Manufacture of fuel and other briquettes and of briquette and other binders. Eng. Pat. 22,738. *See* IIa.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Specifications adopted by the American Society for Testing Materials, 1914; *Standard* ——. Year-Book of the Society, 1914.

Carbon-steel rails. Inspection.—Inspectors representing the purchaser shall have free entry to the works of the manufacturer at all times while the contract is being executed, and shall be afforded all reasonable facilities to ascertain that the rails have been made and loaded in accordance with the terms of the specification. All tests and inspections shall be made at the place of manufacture, prior to shipment, and shall be so conducted as not to interfere unnecessarily with the operations of the mill. *Material.*—The material shall be steel made by the Bessemer or open-hearth process, as provided by the contract. *Chemical requirements.*—The chemical composition of the steel from which the rails are rolled shall be within the following limits:—

	Weights, lb. per yd.			
	50–69 incl.	70–84 incl.	85–100 incl.	101–120 incl.
Bessemer steel.				
C%	0·37—0·47	0·40—0·50	0·45—0·55	0·45—0·55
Mn%	0·80—1·10	0·80—1·10	0·80—1·10	0·80—1·10
P% max. ..	0·10	0·10	0·10	0·10
Si% max. ..	0·20	0·20	0·20	0·20
Open-hearth steel.				
C%	0·50—0·63	0·53—0·66	0·62—0·75	0·62—0·75
Mn%	0·60—0·90	0·60—0·90	0·60—0·90	0·60—0·90
P% max. ..	0·04	0·04	0·04	0·04
Si% max. ..	0·20	0·20	0·20	0·20

Average carbon.—It is desired that the percentage of carbon in an entire order of rails shall average as high as the mean percentage between the upper and lower limits specified. *Analyses.*—Analyses shall be furnished as follows:—For the Bessemer process, the manufacturer shall furnish to the inspector, daily, determinations of carbon for each heat before the rails are shipped, and analyses of the average amount of the elements, C, Mn, Si, P, and S, for each day and night turn. These analyses shall be made on drillings taken from the ladle test ingot not less than ⅛ in. beneath the surface. For the open-hearth process the manufacturer shall furnish the inspector with a chemical analysis showing the amounts of the elements, C, Mn, Si, P, and S, for each heat. On request of the inspector, the manufacturer shall furnish a portion of the test ingot for check analysis. *Physical requirements.*—Tests shall be made to determine:—Ductility or toughness as opposed to brittleness; and soundness. The physical qualities shall be determined by the standard drop-testing machine of the American Railway Engineering Association. The tup shall weigh 2000 lb. and have a striking face with a radius of 5 in. The anvil block shall weigh 20,000 lb. and be supported on springs. The supports for the test pieces shall be a part of, or firmly secured to, the anvil, and shall be spaced 3 ft. between the centres for rails 100 lb. per yd. or less in weight and 4 ft. for rails over 100 lb. per yd. in weight. The bearing surfaces of the supports shall have a radius of 5 in. *Pieces for drop tests.*—Drop tests shall be made on pieces of rail not less than 4 ft. and not more than 6 ft. long. These test pieces shall be cut from the top end of the top rail of the ingot, and marked on the base or head with gauge marks 1 in. apart for 3 in. each side of the centre of the test piece, for measuring the ductility of the metal. *Temperature* of the test pieces to be between 60° and 100° F. (15·5°—38° C.). *Height of drop.*—The test piece shall ordinarily be placed head upwards on the supports.

Weight of rail. lb. per yd.	50—60	61—79	80—90	91—100	101—120
Height of drop. ft.	15	16	17	18	21

Under impacts, the rail under one or more blows shall show at least 6% elongation for one inch or 5% each for two consecutive inches of the 6 in. scale marked as described in the above section on "*Pieces for drop tests.*" A sufficient number of blows shall be given to determine the complete elongation of the test piece of at least every fifth heat of Bessemer steel, and of one out of every three test pieces of open-hearth steel. It is desired that the permanent set after one blow under the drop test shall not exceed that in the following table, and a record shall be made of the information:—

Section.	Weight, lb. per yd.	Moment of inertia.	Permanent set, inches (measured by middle ordinate in a length of 3 ft.).	
			Bessemer process.	Open-hearth process.
A.R.A.—A.	100	48·94	1·65	1·45
A.R.A.—B.	100	41·30	2·05	1·80
A.R.A.—A.	90	38·70	1·90	1·65
A.R.A.—B.	90	32·30	2·20	2·00
A.R.A.—A.	80	28·80	2·85	2·45
A.R.A.—B.	80	25·00	3·15	2·85
A.R.A.—A.	70	21·05	3·50	3·10
A.R.A.—B.	70	18·60	3·85	3·50

Test pieces which do not break under the first or subsequent blows shall be nicked and broken, to determine whether the interior metal is sound. One piece shall be tested from each heat of Bessemer steel.

Open-hearth steel girder and high tee rails:—The chemical composition shall conform to either of the following requirements:—

	Class A.	Class B.
C%	0·60—0·75	0·70—0·85
Mn%	0·60—0·90	0·60—0·90
Si%	not over 0·20	not over 0·20
P%	not over 0·04	not over 0·04

Analyses are to be made by the manufacturer from a test ingot taken during the pouring of each melt. *Drop tests* shall be made on a machine of the type recommended by the American Railway Engineering Association.

Low carbon steel splice bars.—The steel may be made by the Bessemer, open-hearth, or any other process approved by the purchaser. If made by the Bessemer process it shall contain not more than 0·10%, and by the open-hearth process not more than 0·05% P. The tensile strength shall be 55,000—65,000 lb. per sq. in. and the elongation, min., in 8 in., 25%.

Medium carbon steel splice bars.—The steel shall be made by the open-hearth process and shall contain: C not less than 0·3 and P not more than 0·04%. It shall have a tensile strength of 68,000 lb. per sq. in., and an elongation, in 2 in., equal to $\frac{1,000,000}{\text{tensile stress}}$ but in no case under 20%.

High carbon steel splice bars.—The steel shall be made by the open-hearth process, and contain: C not under 0·45%; P. not over 0·04%, minimum tensile strength, 85,000 lb. per sq. in., elongation in 2 in., 14%. *Bend tests.*—A specimen of ½ sq. in. section shall bend cold through 90 deg. around a pin the diameter of which is equal to three times the thickness of the specimen, without cracking on the outside of the bent portion. If preferred by the manufacturer and approved by the purchaser, the following bend test may be substituted for the above. A piece of the finished bar shall bend cold through 45 deg. around a pin the diameter of which is equal to three times the greatest thickness of the section, without cracking on the outside of the bent portion.

Extra high carbon steel splice bars.—Steel to be made by the open-hearth process and to contain not over 0·04% P. The minimum tensile strength to be 100,000 lb. per sq. in. and elongation in 2 in., 10%. A specimen of ½ sq. in. section to bend cold through 60° around a pin the diameter of which is equal to 3 times the thickness of the specimen, without cracking on the outside of the bent portion.

Structural steel for bridges.—Steel to be made by the open-hearth process and to conform to following requirements :—

	Structural steel.	Rivet steel.
Composition :		
P acid	not over 0·06%	not over 0·04%
P basic	not over 0·04%	not over 0·04%
S	not over 0·05%	not over 0·045%
Physical properties :		
Tensile strength, lb. per sq. in.	55,000—65,000	46,000—56,000
Yield point, min., lb. per sq. in.	0·5 tens. str.	0·5 tens. str.
Elongation in 8 in. min., %	$\frac{1,500,000}{\text{Tens. str.}}$	$\frac{1,500,000}{\text{Tens. str.}}$
Elongation in 2 in. min., %	22	—

Structural nickel steel.

Composition.	Structural steel.	Rivet steel.
C	not over 0·45%	not over 0·30%
Mn	not over 0·70%	not over 0·60%
P acid	not over 0·05%	not over 0·04%
P basic	not over 0·04%	not over 0·03%
S	not over 0·05%	not over 0·045%
Ni	not under 3·25%	not under 3·25%

Physical properties.	Rivet steel.	Plates, shapes and bars.	Eye bars and rollers, unannealed.	Eye bars and pins, annealed.
Tensile strength, lb per sq. in.	70,000—80,000	84,000—100,000	95,000—110,000	90,000—105,000
Yield point, min., lb. per sq. in.	45,000	50,000	55,000	52,000
Elongation in 8 in., min., %	$\frac{1,500,000}{\text{Tens. str.}}$	$\frac{1,500,000}{\text{Tens. str.}}$	$\frac{1,500,000}{\text{Tens. str.}}$	20
Elongation in 2 in., min., %			16	20
Reduction of area, min., %	40	25	25	35

Structural steel for buildings.

	Structural steel.	Rivet steel.
Composition :		
P Bessemer	not over 0·10%	
P Open-hearth	not over 0·06%	not over 0·06%
S	—	not over 0·045%
Physical properties :		
Tensile strength, lb. per sq. in.	55,000—65,000	46,000—56,000
Yield point, min., lb. per sq. in.	0·5 tens. str.	0·5 tens. str.
Elongation in 8 in., min., %	$\frac{1,400,000}{\text{Tens. str.}}$	$\frac{1,400,000}{\text{Tens. str.}}$
Elongation in 2 in. %	22	

Structural steel for locomotives.—P to be not over 0·05, and S not over 0·05%. Tensile strength, 55,000—65,000 lb. per sq. in. Minimum yield point 0·5 tens. str. Minimum elongation in 8 in., $\frac{1,500,000}{\text{Tens. str.}}$%.

Structural steel for cars.

Composition :	Structural steel and plates for cold flanging	Rivet steel
P acid	not over 0·06%	not over 0·04%
P basic	not over 0·04%	not over 0·04%
S	not over 0·05%	not over 0·045%
Physical properties.	**Structural steel.**	**Rivets, and plates for cold flanging**
Tensile strength, lb. per sq. in.	50,000—65,000	48,000—58,000
Yield point, min., lb. per sq. in.	0·5 tens. str	0·5 tens. str
Elongation in 8 in., min., %	$\frac{1,500,000}{\text{Tens. str}}$	$\frac{1,500,000}{\text{Tens. str}}$

Structural steel for ships.—Steel to be made by the open-hearth process and to be of the chemical composition specified above for structural steel for cars. Tensile strength to be 58,000—68,000 lb. per sq. in. Minimum yield point, 0·5 tens. str. Min. elongation in 8 in., $\frac{1,500,000}{\text{Tens. str.}}$%.

Rivet steel for ships.—S not to exceed 0·045%. The rivet shank shall bend cold through 180 deg. flat on itself without cracking on the outside of the bent portion, and the rivet head shall flatten, while hot, to a diameter 2½ times that of the shank without cracking at the edges. The chemical and physical requirements are otherwise as specified for structural steel for bridges.

Carbon-steel bars for railway springs.—The steel shall be made by the open-hearth, crucible, or electric process, and shall be of the following composition :—

	Class A.	Class B.
	Elliptical and helical springs.	Helical springs.
C, %	0·90—1·10	0·95—1·15
Mn, max %	0·50	0·50
P, max. %	0·05	0·05
S, max. %	0·05	0·05

Billet steel concrete reinforcement bars.—P not to exceed 0·10% in steel made by Bessemer process, and not above 0·05% in open-hearth steel. The bars shall be made from new billets. Cold twisted bars shall be twisted cold with one complete twist in a length not over 12 times the thickness of the bar. The requisite physical properties vary according to the different grades of plain, deformed, and cold-twisted bars.

Blooms, billets, and slabs for carbon steel forgings.—These are divided into 5 classes of varying carbon ranges according to the purpose to which the steel is to be applied. C ranges from 0·08 to 0·60 %. Mn from 0·30 to 0·70, P, max., 0·045, and S, max., 0·05%.

Carbon steel and alloy steel forgings. Small variations in the Mn and Ni content are allowed according to the particular application of the forgings. The lower limit of Mn varies from 0·30 to 0·40, and the higher limit from 0·55 to 0·80. P not over 0·04 to 0·05. S not above 0·05%. Ni, not under 3·00%.

Quenched and tempered carbon steel axles, shafts, and other forgings for locomotives and cars.—C, lower limit 0·25—0·35%, higher limit 0·60—0·70%, in each case according to classification : Mn 0·40—0·70, P not over 0·05, and S not over 0·05%.

Carbon steel forgings for locomotives.—Mn 0·40—0·70%. P not over 0·05%. S not over 0·05%.

Carbon steel car and tender axles.—C 0·35—0·55%. Mn not over 0·70, P not over 0·05, S not over 0·06%.

Cold-rolled steel axles.—C not over 0·40, Mn 0·40—0·80, P not over 0·05, and S not over 0·05%. The axles shall conform to the following minimum requirements as to tensile properties:—Tensile strength, 70,000 lb. per sq. in.; elastic limit, 60,000 lb. per sq. in.; elongation in 2 in., 18%; reduction of area, 35%. The test specimen shall bend cold through 180 deg. around a 1 in. pin or mandrel, without cracking on the outside of the bent portion.

Forged and rolled, forged, or rolled solid carbon-steel wheels for engine-truck, tender, and passenger service, or for freight-car service, and wrought solid carbon steel wheels for electric railway service.

Composition.	Acid.	Basic.
C %	0·60—0·80	0·65—0·85
Mn %	0·55—0·80	0·55—0·80
Si %	0·15—0·35	0·10—0·30
P %	not over 0·05	not over 0·05
S %	not over 0·05	not over 0·05

Steel tyres.—Mn not over 0·75, P not over 0·05, S not over 0·05, and Si not over 0·35%.

Tensile properties.	Class A.	Class B.	Class C.
	Tyres for passenger engines.	Tyres for freight engines and for engine truck, tender truck, trailer and car wheels.	Tyres for switching engines.
Tensile strength, lb. per sq. in.	105,000	115,000	125,000
Elongation in 2 in., %	12	10	8
Reduction of area, %	16	14	12

Steel castings.—P and S to be below 0·05%.

Tensile properties.	Hard.	Medium.	Soft.
Tensile strength, lb. per sq. in.	80,000	70,000	60,000
Yield point, lb. per sq. in.	36,000	31,500	27,000
Elongation in 2 in., %	15	18	22
Reduction of area, %	20	25	30

Lap-welded and seamless steel boiler tubes, safe ends, and arch tubes.—C 0·08—0·18, Mn 0·30—0·50, P not over 0·04, and S not over 0·045%.—J. N. P.

Cast iron; Some notes on chilled ——. E. B. Tilt. Proc. Amer. Soc. Testing Materials, 1914. [Advance proof.]

The variations in the properties of cast iron according to its composition and the effect of chilling were examined with a view to determining the most suitable material for car wheels. Wheels were tested by allowing weights to fall repeatedly from definite heights until the flange was broken off, and also by submitting them to a rapid temperature change. The nature of the defects to which the wheels are subject is discussed. Satisfactory metal can be obtained both from charcoal pig iron, and from material prepared from coke pig iron, steel scrap, and ferro-manganese. The carbon content should not exceed 3·5%. The metal was found to be brittle in proportion to the degree of chilling.—J. N. P.

Slag inclusions in open-hearth steel. I. Effects of slag inclusions on the structure of a nickel-steel. F. Giolitti and S. Zublena. Annali Chim. Appl., 1914, **2,** 218—245.

Test-pieces of an acid open-hearth steel containing C 0·38, Mn 0·60, Si 0·22, S 0·008, P 0·02 and Ni 2·02%, and showing slag inclusions, were heated for varying periods (1½ to 15 hours) at various temperatures (1000° to 1190° C.), in some cases under slightly oxidising (decarburising) and in others slightly reducing (carburising) conditions, produced by means of carbon monoxide in contact with soft iron and with carbon respectively (compare Giolitti, this J., 1910, 1456). It is concluded from the results that the direct physical action of slag inclusions is negligible, for by appropriate heat treatment the characteristic injurious effects may be notably diminished and in some cases eliminated. Micrographic examination showed that ferrite which separated during or immediately after a process of carburisation by gases dissolved in the metal was independent of, and separate from, the slag inclusions, whereas that separated during or after decarburising conditions was found, at least in part, around the slag particles and to a greater extent the greater the degree of decarburisation and the less distorted (*e.g.* by mechanical treatment) the crystallisation of the ferrite. In the manufacturing process a condition of equilibrium of oxidation exists between the metal, the slag and the gases, depending upon the temperature. In cooling through the temperature range corresponding to the separation of ferrite, the included slag probably causes decarburisation of the metal immediately in contact therewith and thus induces separation of ferrite, the particles of which act as nuclei for that separating subsequently. Photomicrographs are given in support of the authors' views, which, for the present, are expressly limited to acid open-hearth steel of the kind used in the investigation. Following is an example of the improvement which may be effected by appropriate heat treatment of metal containing slag inclusions:—

	Tempered at 800° and annealed at 500° C.	Subjected to special heat treatment under carburising conditions.
Tensile strength, kilos. per sq. mm.	70·2	71·3
Elongation, %	15	26
Contraction, %	18	47

(See also Matweieff, this J., 1910, 822, 1385; Hibbard, 1911, 898; Ziegler, 1911, 1214; Fischer, 1912, 987; Rosenhain, 1913, 87; Oberhoffer, 1913, 605.)—A. S.

[*Steel.*] *A failed axle: study of an internal transverse fissure.* R. Job. Proc. Amer. Soc. Testing Materials, 1914. [Advance proof.]

A fault in a steel axle which during working on the lathe led to the development of a transverse crack and longitudinal fissures, was examined microscopically. The fractured section showed evidence of the presence of intense strains produced by unequal cooling of the steel in or after removal from the annealing furnace. Local porosity and slag inclusions pointed in addition to imperfect milling.—J. N. P.

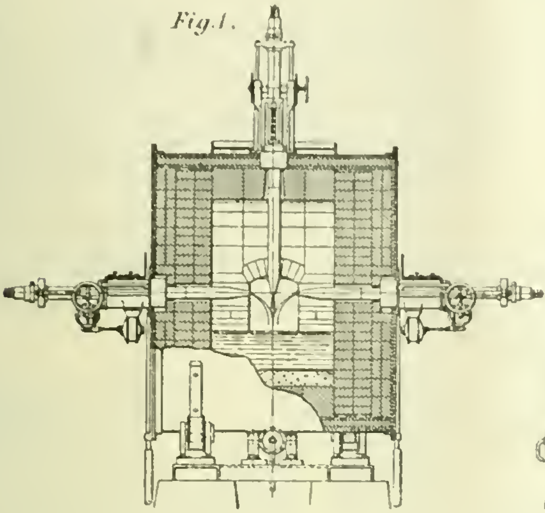
Alloy steels; Magnetic habits of ——. J. A. Mathews. Proc. Amer. Soc. Testing Materials, 1914. [Advance proof.]

The magnetic properties of hardened alloy steels are shown to vary with the physical characteristics of the metal. Alloys hardened by quenching in oil give a lower permeability and residual magnetism but a higher coercive force than those quenched in water. The size of the cross-section of the metal also has an influence, varying according to the hardness of the metal.—J. N. P.

The Rennerfelt electric furnace. Engineering, 1914, **98,** 638—641.

Rennerfelt electric furnaces are now being used on the Continent, and also in England, in the manufacture of steel and iron castings, tool steel, electro-steel from pig iron and ore, etc. The general construction is shown in the accompanying figures. The furnace is usually built with a horizontal, cylindrical steel shell, which can be tilted round a horizontal axis. It is lined first with asbestos, then with silica or "first-quality" bricks, and finally with carbon, silica, or magnesite brick. The charging or casting door may be provided in the side or end of the shell (see Fig. 2). The electric current is brought to the furnace by two horizontal electrodes and one vertical one; the energy is applied in the form of a two-phase current, the vertical electrode being common to the two phases. This arrangement results in the production of an arc which is deflected downwards to the charge in the form of a brush, ensuring uniform heating. The horizontal electrodes may be adjustable vertically as well as horizontally, so that charges of various sizes may be treated in one furnace. The points of the electrodes are usually fixed from 6 to 12 in. from the surface of the bath. The electrodes are composed of Acheson graphite, and are made continuous by means of threaded sockets and dowels; they vary from 1½ in. diameter for the 100 kilo. furnaces to 7 in. for the largest sizes. The 1½ in. electrodes have a capacity of about 70 ampères per sq. cm., whilst the larger sizes can carry 30 to 40 amps. per sq. cm. The voltage at the electrodes should be from 50 to 125 volts, according to the size of the furnace. The electrode consumption in a 600 kilo. furnace, working continuously on charges of cold scrap and pig, has been found to average 2·8 kilos. per ton of steel. A 600 kilo. furnace will melt and refine a full charge of cold scrap with about 700 kw.-hours per ton: the normal rating of such a furnace is 125 kw., but 82 to 90 kw. have been found sufficient to complete a 600 kilo. heat in 5 hours; this indicates a furnace efficiency of about 70%, but the thermal efficiency has been from 85 to 90%. The largest size furnaces of this type, capable of receiving the entire charge of steel from a Bessemer converter or open-hearth furnace up to 75 tons, are subdivided into smaller units by using several sets of electrodes. A 75 ton refining furnace requires about 7500 kw.—T. F. B.

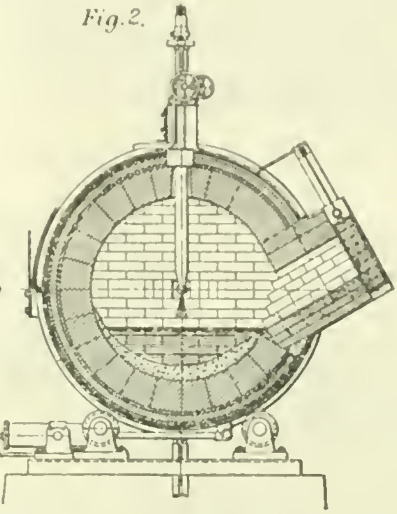
Fig. 1.



Silver ores; Assay of Cobalt ——. A. M. Smoot. Eng. and Min. J., 1914, **98**, 965.

Four portions of the ore, each ¼ or ½ A.T. according as the sample contains more or less than 2000 oz. Ag per ton, are treated separately with strong nitric acid (75 c.c. for ¼ and 100 c.c. for ½ A.T.) and heated until brown fumes cease to be evolved. Each solution is then diluted with 200 c.c. of water, allowed to stand over night, filtered, and the residue washed; any deposit on the beaker is removed with sodium hydroxide, the latter acidified with nitric acid and washed on to the filter paper, which is then dried, treated by "pot assay" or scorified with lead, and the resulting lead button reserved. To the nitric acid solution, sufficient sodium chloride is added to precipitate the silver, the liquid stirred until the precipitate is agglomerated, allowed to stand for 1 hour, and filtered through a double filter; the latter, with the precipitate, is placed upon a disc of assay lead in a glazed scorifier, heated in a closed oven (250°—300° C.) until the paper is completely charred, fine test-lead sprinkled over the residue, the lead button from the treatment of the insoluble residue added, and the whole scorified to produce a lead button (15 grms.) which is then cupelled, both furnace operations being conducted at a low temperature. The method yields higher and more concordant results than are attainable by any all-fire process in which no corrections are made for slag and cupel losses: in 4 assays (¼ A.T. portions) of the same sample the average result was 3293·1 oz. per ton and the maximum difference 8·4 oz. Many brands of test lead contain sufficient bismuth to impair the accuracy of silver assays; the metal employed should be free from this impurity.—W. E. F. P.

Fig. 2.



Alloys of zinc and silver quenched or annealed; Electrical conductivity of ——. G. I. Pétrenko. J. Russ. Phys.-Chem. Soc., 1914, **46**, 175—176. Bull. Soc. Chim., 1914, **16**, 746.

The existence of AgZn (at Zn 36—42%) was indicated on the conductivity and temperature-coefficient curves but not on that of electrical resistance; by prolonged annealing below the transformation temperature (266 C.) AgZn was converted into a phase of variable composition. Ag_2Zn_3 was also indicated on the curve of temperature coefficients; but the phases, Ag_2Zn_5 and $AgZn_6$, appeared to be only solid solutions. $AgZn_1$ was not indicated on the resistance curve.—W. E. F. P.

Hardness of the systems (A) *Ag-Zn and* (B) *Ag-Al.* G. I. Pétrenko. J. Russ. Phys.-Chem. Soc., 1914, **46**, 176. Bull. Soc. Chim., 1914, **16**, 738—739.

(A) The maximum hardness, 220·02 (Brinell), occurred at Ag_2Zn_3, the values for Ag and Zn being 23·2—26 and 30·1, respectively; the phases of variable composition, Ag_2Zn_5 and $AgZn_6$, are indicated as transition points on the hardness curve. (B) The curve consisted of four branches. The maximum hardness (83·6) occurred at $AlAg_2$: at Al 70% the hardness was 49·19, and at Al 14·3%, 75·99. The existence of $AlAg_3$ was not indicated on the diagram.—W. E. F. P.

[*Copper-zinc alloys.*] *Non-ferrous materials; Some considerations affecting specifications for wrought* ——. W. R. Webster. Amer. Soc. Testing Materials, June—July, 1914. [Advance proof.] 14 pages.

The methods employed in producing Cu-Zn alloys in sheets, strips, rods, wire and seamless tubes are briefly described, and the effects of the various operations, and also of certain impurities, upon the properties of the finished materials discussed. The effects of varying proportions of Cu and Zn, of varying amounts of cold rolling, and of varying annealing temperature, are shown by means of curves. Although largely surmountable by the employment of appropriate mill practice and inspection, considerable difficulty is experienced in controlling, within close limits, the large number of variables involved, chiefly because the alloys are produced in comparatively small lots.—W. E. F. P.

Bronze and Monel metal; Effect of acid solutions on ——. S. Croasdale. Eng. and Min. J., 1914, **98**, 873.

THE losses in weight sustained by Krupp bronze and Monel metal, by immersion for 2½ and 3 months in dilute sulphuric acid (H_2SO_4 from 0·12 to 1·50%), varied from 3·22 to 4·55 and from 3·89 to 10·07%, respectively. The corresponding losses, over the same periods, in acidified copper sulphate solutions (Cu from 0·05 to 0·50%) varied from 1·22 to 0·10 and from 14·50 to 2·17%, the copper being completely precipitated by the bronze from all but the two strongest solutions. The losses sustained by Monel metal by immersion for 6 weeks in solutions of sulphuric acid (10%), copper sulphate (10%), and sulphuric acid with copper sulphate (each 10%), were 2·81, 1·99 and 4·88%, respectively.—W. E. F. P.

Non-ferrous castings; Study of the strength of ——; *comparison of different test specimens.* L. P. Webbert. Amer. Soc. Testing Materials, 1914. [Advance proof.] 14 pp.

TENSILE tests of Cu-Sn and Cu-Zn alloys were made on test-pieces respectively cast on the outsides of big castings and cut from different portions of solid castings. With Cu-Sn alloys (typically Cu 88, Sn 10, Zn 2) greater tensile strength and elongation were obtained on metal which had cooled quickly, than on that taken from the inside of a solid casting, the highest results being given by the cast test-pieces. The use of externally cast test-pieces may therefore give misleading (high) results. Similarly, where little machining was required to make the finished test-piece, the thinner specimens gave the higher results, owing to the cross-sectional proportion of quickly-cooled "skin" being greater. With the Cu-Zn alloys the differences observed with test-pieces taken from different positions were much smaller, and an externally cast specimen represented very closely the strength of the casting as a whole.—T. ST.

Zinc; Polymorphism of ——. G. I. Pétrenko. J. Russ. Phys.-Chem. Soc., 1914, **46**, 176—178. Bull. Soc. Chim., 1914, **16**, 740.

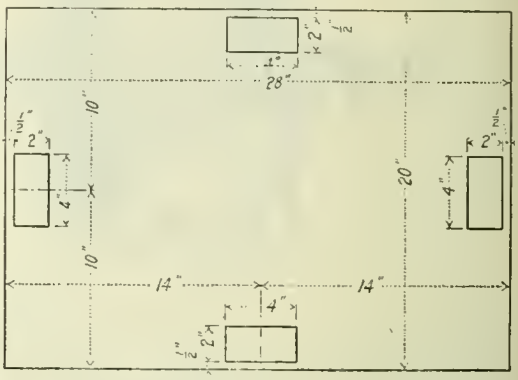
THE polished surface of zinc cooled slowly from above its melting point to 180° C. exhibited large polyhedra (separate or interpenetrating) upon which comparatively few small ones were disposed promiscuously; the small polyhedra were more abundant when the metal was quenched at 360°—330° C., but completely covered the surfaces of the large crystals when the metal was cooled to just below 300° C. The phenomenon was reversible and is regarded as indicating the occurrence of an allotropic transformation between 290° and 300° C.—W. E. F. P.

Nickel-copper-lead alloys; Ternary ——. N. Parravano. Gaz. chim. ital., 1914, **44**, II., 375—384.

WHILST nickel and copper form a continuous series of solid solutions, lead is only partially miscible with nickel and with copper in the molten state, and this condition of partial miscibility is found also in the ternary alloys. Eighty-four alloys were examined, and the isotherms of the beginning of solidification (975°—1390° C.) and of the formation of two liquid strata (970°—1290° C.) are plotted in triangular diagrams. In all cases the temperature of complete solidification was practically identical with the solidifying point of lead. The constituents of the alloys are solid solutions of copper and nickel and nearly pure lead. The results elucidate the method of removing copper and nickel from crude lead by heating it a little above its melting point, when the metals named separate as a crust which can be skimmed off.—A.S.

Tin, terne and lead-coated sheets; Method of sampling and analysis of ——. J. A. Aupperle. Proc. Amer. Soc. Testing Materials, 1914, **14**. [Reprint.] 7 pages.

ONE sheet from each grade or shipment is taken for analysis, and an average sample obtained from it by cutting out four pieces, each 4×2 in., as shown in the figure. After being cleaned with chloroform or other solvent, each piece is cut in halves (2×2 in.), marked A and B respectively, the four "A" halves being weighed together, cut into pieces about ⅛ in. square, mixed and used for the determination of tin and lead, while the four "B" halves are used for determining the weight of coating (as a check) and for the analysis of the base metal. To determine tin, 5 grms. are completely dissolved in 75 c.c. of hydrochloric acid (with the usual precautions against oxidation) and the cold solution titrated with $N/20$ iodine previously standardised against 0·1 grm. of pure tin and 4 grms. of iron filings dissolved together under the same conditions as the assay. For lead, 10 grms. are dissolved in 150 c.c. of nitric acid (1 : 1), brown fumes expelled, and the solution diluted to 1000 c.c.: to 100 c.c. of the solution 10 c.c. of strong nitric acid are added and the liquid electrolysed at 50°—60° C. with a current of 1—2 amp. at 2·3—2·5 volts, the lead being weighed as PbO_2; if manganese be present in the base metal to an appreciable extent, the lead is determined as sulphate. The result for each metal is usually calculated to lb. per case of 112 sheets, 20×28 in. To determine the weight of coating, the four "B" halves, each wrapped with a stiff wire of platinum or nickel, are immersed, horizontally and successively, for exactly 1 min. in 60 c.c. of concentrated sulphuric acid heated to at least 250° C., then momentarily in 50 c.c. of water, and finally rubbed during washing with a further 50 c.c. of the latter. The stripped pieces are dried, re-weighed and used for the analysis of base metal, the loss in weight representing the coating and some iron. The sulphuric acid solution and washings are mixed, 200 c.c. of hydrochloric acid added, the mixture boiled, cooled and diluted to 500 c.c.: of this solution 100 c.c. are used for the determination of iron (being successively oxidised by permanganate, reduced with stannous chloride and titrated with $N/10$ permanganate in the presence of manganese sulphate and phosphoric acid); and 100 c.c. for tin, by reduction with powdered metallic antimony and titration with $N/20$ iodine. The weight of coating as calculated from the data thus obtained should agree very closely with that ascertained in the first determination.—W. E. F. P.



Tin: Artificial twin crystals of ——. P. Gaubert. Comptes rend. 1914, **159**, 680—682.

IF melted tin be allowed to solidify between plane glass surfaces and the polished face be then etched with hydrochloric acid the outlines of the crystals, some rectangular

and others triangular, may be recognised. If solidification has been slow, single crystals may extend over several sq. cm. If the lamina be punctured by a sharp blow with a needlepoint, there is produced :—(1) on the opposite side a cross in relief with branches equal or unequal in length according to the orientation of the crystal surface; (2) two or three series of shining parallel bands, 0·5 mm. in width, extending from the point pressed to the edges of the crystal and making an angle of several degrees with the surface of the lamina. The angle between these bands varies with the crystalline orientation of the surface. Whatever the form of the outline of the crystal (*e.g.* rectangular) as revealed by etching with hydrochloric acid, these bands always bound triangular areas, so that molecules originally arranged in a prismatic face of the crystal undergo re-orientation so as to bound a pyramidal face. The formation of similar bands occurs when a sheet of tin is bent, and is probably the cause of the "cry" of tin. (See also Ewing and Rosenhain, this J., 1900, 1115.)
—J. H. L.

[*Metals.*] *Hardness tests; Relation between Brinell ball-test and scleroscope readings.* J. J. Thomas. Amer. Soc. Testing Materials, 1914. [Advance proof.] 3 pp.

Brinell and scleroscope readings were both taken on each of a large number of metals and alloys, and the results plotted with a view to obtaining a conversion factor. The Brinell tests were made with an "Alpha" machine, having a steel ball 10 mm. in diameter, with a pressure of 3000 kilos. for 30 seconds, and the scleroscope readings were taken with a Shore instrument having a diamond-tipped hammer. The factor for converting the scleroscope reading into the Brinell hardness number is 6·67 for steels, 5·25 for cast-iron and bronzes, about 6 for aluminium, and 7·7 for nickel steels. Metals with a Brinell hardness number above 300, or scleroscope number above 45, were found difficult to machine. Tempered steels gave Brinell numbers from 150 to 300. The scleroscope readings varied more than the ball tests on a given sample, due probably to the very small area actually tested by the scleroscope.—T. St.

Metallic protective coatings; A rational test for ——. J. A. Capp. Amer. Soc. Testing Materials, June—July, 1914. [Advance proof.] 5 pages.

The durability and uniformity of metallic coatings, such as those applied to iron and steel by galvanising, sherardising, etc., are tested by exposure to a "salt fog" produced by projecting into the test chamber an atomised spray of water saturated with sodium chloride. Efficient coatings last for at least a week, while poor ones break down in a few hours (generally less than 24), failure being indicated by the development of spots or patches of rust.
—W. E. F. P.

Metals; The colour of ——. L. V. Martiouchek. J. Russ. Phys.-Chem. Soc., 1914, **46**, 174. Bull. Soc. Chim., 1914, **16**, 751—752.

The following facts are quoted in support of the view that all metals are naturally silver-coloured, the yellow tints of some being due to traces of foreign substances: certain metals (*e.g.* calcium), formerly regarded as yellowish have proved to be white when pure; according to Heine's researches, copper assumes a paler hue (less red) when specially purified, the reddish tint being apparently an oxidation effect due to the presence of lead oxide in the metal: potassium, sodium and rubidium, obtained by reduction of the chlorides with calcium, are coloured yellow when traces of air are present, the colouring effect being due to nitrogen and not to oxygen.—W. E. F. P.

Electrostatic fume precipitation at Anaconda. E. M. Dunn. Eng. and Min. J., 1914, **98**, 873—874. (See also this J., 1914, 1054.)

Experiments were made with a pipe, 20 ft. long and 3 ft. in diameter, containing a central discharge-electrode of nichrome wire (No. 29), the velocity of the gases being 5 cb. ft. per sec. and the e.m.f. 150,000—160,000 volts. The results for blast furnace gases, were not so good as those for mixed roaster and converter gases, but were considered sufficiently promising to justify the erection of an experimental plant in which a pipe 4 ft. in diameter will be employed with an e.m.f. of 220,000 volts. Fractional electrostatic precipitation was effected by passing arsenical gases from a roasting furnace through two treaters in succession; in the first, which the gases entered at about 310° C., practically all the dust was precipitated, while in the second, in which the gases were cooled to 90° C. by admission of air, white arsenic of 99·7% purity was deposited.—W. E. F. P.

Sodium amalgams; specific volumes and electrical conductivities. E. Vanstone. Chem. Soc. Trans., 1914, **105**, 2617—2623.

The volume-concentration diagram of solid sodium amalgams showed discontinuities at 83·0, 73·5, 63·0, 47·5, 32·5 and 20·0 atoms % Na, and confirmed the existence of the inter-metallic compounds shown by the thermal diagram (Vanstone, Trans. Faraday Soc., 1911, **7**, 42). Since the existence of only one compound—$NaHg_2$, at 33·3 atoms % Na (m. pt. 360° C.)—was indicated by measuring the electrical conductivities of the liquid amalgams at high temperatures (Bornemann and Müller, this J., 1910, 884), and no evidence of others could be obtained at temperatures (110° and 135° C.) not far removed from the m. pts. of the alloys, it is concluded that the remaining compounds are completely dissociated in the liquid condition.—W. E. F. P.

Antimony trichloride; Electrolysis of —— in presence of colloids. A. Mazzucchelli. Gaz. chim. ital., 1914, **44**, II, 404—419.

According to Cohen (this J., 1905, 819) the "explosive antimony" obtained by electro-deposition from solutions of antimony chloride consists of a metastable form of antimony in which antimony chloride is present in the form of a solid solution. This metastable form readily changes into the stable form, with evolution of heat, which causes volatilisation of the chloride. The author found that resorcinol, tannin, molybdic acid, starch and gum arabic had no appreciable influence on the nature of antimony deposited electrolytically from chloride solutions. In presence of quinine, casein, peptone, and, especially, of gelatin, brighter and more brittle deposits were obtained, which were nearly incapable of explosion by percussion but exploded on heating; besides the usual content of chloride, they contained a relatively large quantity of organic matter. The results indicate that the antimony chloride in the deposited metal is present as a true solid solution rather than as a colloidal solution.
—A. S.

Zinc concentrates. Chem. Tr. Jnl., Dec. 12, 1914. [T.R.]

At the present moment there are large quantities of zinc concentrates at the Swansea Docks diverted there as prizes of war, but no interest seems to be taken in their utilisation, owing, it is said, to the fact that local spelter makers have no means of treating these concentrates, as they produce their makes from calamine and blende ores only. It should pay our smelters to investigate and adapt their works accordingly.

Copper goods. Board of Trade Bulletin No. 24.

May be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Quick method of precipitating tin electrolytically. Humphreville. *See* XXIII.

Patents.

Iron and alloy product; Metallic —— and process of manufacturing same. C. A. Allison, London. From International Metal Products Co., Newark, N.J., U.S.A. Eng. Pat. 27,966, Dec. 4, 1913.

A modification of Eng. Pat. 27,201 of 1909 (see U.S. Pats. 940,784 and 940,785; this J., 1909, 219, 960) 0·05 to 0·5% P being left in the steel, or added to it, if necessary, as an alloy, which may contain Cu, Ni, Co, V, or Cr in addition.—O. E. M.

Annealing wire coils, iron castings, etc.; Kilns for ——. G. B. A. Gibbons, Lower Gornal, R. Masters, Dudley, and M. van Marle, Lower Gornal. Eng. Pat. 7399, Oct. 28, 1913.

Circular pots containing the objects to be annealed are rolled by gravity through an inclined tunnel heated externally and provided with a water-sealed hood at each end. The pots may have guide flanges to engage rails in the tunnel; a hinged arm lifts the pots up through the inlet hood, and a checking device releases them as required at the outlet end.—O. E. M.

Roasting furnace; Horizontal mechanical ——. P. Sarrasin, Dijon, France. Eng. Pat. 26,915, Nov. 22, 1913.

A horizontal water-cooled shaft with pallets rotates and simultaneously moves from front to back of the furnace, while the ore is fed from back to front. Rotation is stopped, and the pallets clear the ore, on the return stroke. The slots in the furnace sides are closed by an endless belt with an inner asbestos lining sliding in grooves, the lower of which is sealed with refractory sand.—O. E. M.

Copper; Process of extracting —— from carbonate and oxide ores. H. R. Ellis, Salt Lake City, Utah. U.S. Pats. (a) 1,115,521, (b) 1,115,522 and (c) 1,115,523, Nov. 3, 1914; date of appl., June 4, 1914.

The ore is treated with a solution containing an alkaline carbonate or bicarbonate, from which the copper is subsequently recovered (a) by agitation with granulated lead, (b) electrically by the use of a mercury (or amalgamated) cathode and an insoluble anode, (c) by means of a finely divided amalgam of an alkali- or alkaline-earth metal.—W. E. F. P.

Copper; Coating steel or iron with ——. J. E. Sheaffer, Burnham, Pa. U.S. Pat. 1,115,870, Nov. 3, 1914; date of appl., Dec. 3, 1912.

A hollow ingot of copper is made by pouring off the central core while still molten; it is filled up with molten steel or iron, yielding a compound ingot which may be rolled or drawn.—O. E. M.

Tin from waste tinned metal; Process of obtaining the ——. G. von der Linde, Crefeld, Germany. U.S. Pat. 1,116,176, Nov. 3, 1914; date of appl., May 6, 1914.

Air and chlorine are thoroughly mixed before allowing them to act on the scrap.—O. E. M.

Alkali and alkaline-earth metals; Process of producing ——. C. E. Acker, Ossining, Assignor to The Nitrogen Co., New York. U.S. Pat. 1,116,865, Nov. 10, 1914. Date of appl., Aug. 5, 1910.

See Fr. Pat. 420,744 of 1910; this J., 1911, 369.—T. F. B.

Aluminium and the like; Method of insulating wire of ——. E. Presser, Berlin. U.S. Pat. 1,117,240, Nov. 17, 1914. Date of appl., May 31, 1911.

See Fr. Pat. 425,532 of 1911; this J., 1911, 905.—T. F. B.

Alloy of aluminium and process of making. T. A. Bayliss, Warwick, and B. G. Clark, London. U.S. Pat. 1,117,308, Nov. 17, 1914. Date of appl., Aug. 15, 1913.

See Eng. Pat. 19,452 of 1912; this J., 1913, 948.—T. F. B.

Melting-furnace. I. Hall, Birmingham. U.S. Pat. 1,117,666, Nov. 17, 1914. Date of appl., Nov. 13, 1913.

See Eng. Pats. 15,323, 23,493, and 24,081 of 1913; this J., 1914, 835.—T. F. B.

Metal-melting furnace. I. Hall, Birmingham. U.S. Pat. 1,117,667, Nov. 17, 1914. Date of appl., Nov. 13, 1913.

See Eng. Pat. 21,158 of 1913; this J., 1914, 425.—T. F. B.

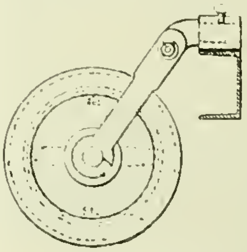
XI.—ELECTRO-CHEMISTRY.

Formation of deposits in oil-cooled transformers. Michie. *See* IIa.

Electrolytic determination of nickel. Marsh. *See* XXIII.

Patent.

Electrolytic apparatus. A. Herrmann, Leipzig-Gohlis, Germany. U.S. Pat. 1,115,671, Nov. 3, 1914; date of appl., Apr. 23, 1914.



"A contact wheel (fig.) having spokes, a narrow, conductive rim, side-discs of non-conductive material, and hook-connections for said discs engaging said spokes."—W. E. F. P.

XII.—FATS; OILS; WAXES.

Halphen's reaction for cottonseed oil; Utz's modification of ——. E. Gastaldi. Annali Chim. Appl., 1914, 2, 203—207.

Utz's modification (Chem. Rev. Fett-Ind., 1913, 291) consists in mixing the oil with an equal volume of a 1% solution of sulphur in pentachloroethane, with or without addition of amyl alcohol, and heating the mixture to boiling. It is shown that the coloration produced (yellow to orange or brown or almost black) varies according to the temperature or time of heating, and that the reaction is not characteristic of cottonseed oil but is given also by other oils and by palmitic, stearic and oleic acids. The rapidity of the author's modification of Halphen's reaction (see this J., 1912, 934) may be increased and the quantity of carbon bisulphide necessary diminished by using a higher temperature. Five c.c. of the oil are treated with 5—6 drops of a solution of sulphur in carbon bisulphide and 3—4 drops of pyridine and heated for 4—5 minutes over a direct flame to not above 140° C.: the characteristic wine-red coloration is obtained if cottonseed oil be present.—A. S.

Hydrocarbons; Rapid method for the detection and determination of solid —— in admixture with fatty acids. G. Verona-Rinati. Annali Chim. Appl., 1914, 2, 201—202.

Solid fats and fatty acids are readily soluble in α-dichlorhydrin whether this be anhydrous or saturated with water, whereas solid hydrocarbons (paraffin wax, ceresin, ozokerite, etc.) whilst appreciably soluble in the anhydrous solvent on heating above their melting point, are practically insoluble in α-dichlorhydrin saturated with water. To detect solid hydrocarbons in solid fats or fatty acids, 7 c.c. of α-dichlorhydrin are mixed in a graduated test-tube with 1·2 c.c. of water and 1·43 grm.

of the substance under examination, and the tube is corked and heated in a water-bath at 65° C., with occasional agitation: each 0·1 c.c. of insoluble matter corresponds to 5% of mineral hydrocarbons in the original substance. To distinguish between paraffin and ceresin, 0·2 grm. of the dried insoluble matter is dissolved by heating with 10 c.c. of anhydrous α-dichlorhydrin, the solution allowed to cool and the temperature at which a turbidity appears noted: this is 80°—92° C. for paraffin and 112°—115° C. for ceresin.—A. S.

Kapok and akon and the bitter principles, wax and resin contained therein. H. Matthes and L. Streicher. Arch. Pharm., 1913, **251**, 438—452. Bull. Soc. Chim., 1914, **16**, 115—116.

Kapok and akon fibres contain respectively 8·6 and 7·2% H_2O. Crude kapok yields 3·58% and purified kapok 0·93—2·62% of ash: purified akon yields 3·61%. A mixture of equal parts of alcohol and benzene extracts 4·97% of wax from kapok and 4·63% from akon. The characters of the waxes from kapok and akon respectively are: m. pt. 24° C., 30·5° C.; n_D^{33} = 1·4618, 1·4682; a_D = 0, acid value, 59·85, 65·09; saponif. value, 170·14, 171·52; iodine value, 69·41, 70·52; Reichert-Meissl value, 2·02, 1·76; Polenske value, 0·97, 1·05. The waxes contain respectively 28% (kapok) and 31% (akon) of unsaponifiable matter, composed chiefly of phytosterols and melissyl alcohol, together with 0·6% of a hydrocarbon, $C_{21}H_{42}$, m. pt. 69° C., identical with laurane: the crude phytosterol from akon wax contains stigmasterol, m. pt. 170° C., and a phytosterol of m. pt. 136° C. The fatty acids of kapok wax consist of 15% of solid and 85% of liquid acids: those of akon wax contain 20% of solid and 80% of liquid acids. The solid acids appear to consist entirely of palmitic acid: the liquid acids contain oleic acid 61, linolic acid 38, and linolenic acid 1%. (See also this J., 1913, 917.)

Kapok and akon contain from 4·74—9·74% of substances soluble in water, among which is a very poisonous, non-nitrogenous, bitter substance, which gives a blue coloration with sulphuric acid and potassium bichromate: the bitter principle of akon resembles picrotoxin in some respects. —A. S.

Palmnut kernel cake. Murray. *See* XIXa.

Viscosity measurements and a new viscosimeter. Flowers. *See* XXIII.

Patents.

Grease and other substances; Presses for extracting ——. T. W. and G. H. Mays, Bourne, Lincolnshire. G. Fortescue, and E. S. and G. Cowen, Nottingham. Eng. Pat. 24,622, Oct. 30, 1913.

The casing comprising the body of the press is provided with a hinged door, a rib passing round the door fitting into a recess filled with packing material on the casing so as to form a tight joint when the door is closed. The piston is fitted on to a screw shaft passing through the top of the casing and operated by a rotating nut. A grid plate for supporting the material rests on ridges at the bottom of the casing, which form channels for the expressed grease. Steam under pressure is admitted into the upper part of the casing and, after passing through the material being pressed, escapes with the grease, etc., through an outlet at the lower part.—W. P. S.

Soap; Manufacture of ——. C. Pleines, Utrecht, Holland. Eng. Pat. 24,795, Oct. 31, 1913. Under Int. Conv., Nov. 6, 1912.

See Fr. Pat. 464,335 of 1913; this J., 1914, 557.—T. F. B.

Glycerine containing salt; Means for distilling ——. F. J. Wood, Brooklyn, U.S.A. Eng. Pat. 24,920, Nov. 1, 1913.

See U.S. Pat. 1,089,383 of 1914; this J., 1914, 363.—T.F.B.

System for cleaning and purifying oils and other liquids. U.S. Pat. 1,115,827. *See* I.

Catalytic hydrogenation. Eng. Pat. 21,815. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Lacquer; A chemically resistant glass ——. P. J. Fox. J. Phys. Chem., 1914, **18**, 759—761.

Fifteen grms. of pure, firm unvulcanised rubber are treated with 100 c.c. of carbon bisulphide, and after a few hours 30 grms. of white ceresin, cut into small pieces, and 100 c.c. of carbon bisulphide, are added to the homogeneous mixture. The resulting lacquer should be less viscid than glycerin. The cleaned glass vessel is rinsed with absolute alcohol, drained, one-third filled with lacquer, shaken gently round, and immediately drained. A smooth, translucent coat is thus obtained, especially if the process is modified by applying two layers of a somewhat thinner lacquer with an intermediate interval of 1 to 5 hours. Carbon tetrachloride may be substituted for carbon bisulphide if the lacquer is made thicker and applied hot. The protective coating is very effective with careful usage: a bottle so treated was filled with distilled water of conductivity 2·45 reciprocal megohms and rotated for 70 hours in a thermostat at 20° C. whereby the value rose only to 2·98, whilst a similar unlacquered bottle gave the value 58·0 under identical conditions.—J.R.

Use of poisons for plants in agriculture and industry. Crivelli. *See* XVI.

Oxidation of the nopinene (β-pinene) in Spanish oil of turpentine. Madinaveitia. *See* XX.

Patents.

Metallic paint; Process for the manufacture of a [quick-drying] ——. A. Finkler, Moscow. Eng. Pat. 8126, March 31, 1914.

A dry mixture of powdered zinc-white, white lead, and aluminium is added to a solution of shellac so as to form a thin paste, which is made up to the proper consistency by adding a solution of celluloid in acetone. For example, 1 kilo. may contain 700 grms. of celluloid solution, 30 of aluminium, 100 of shellac solution (in spirit), 130 of white lead, and 40 of zinc-white. The paint is not affected by humidity or high temperatures. Colouring matters may be added to the shellac solution.—F. Sodn.

Coating compositions; Manufacture of ——. G. Cuneo, Genoa, Italy. Eng. Pat. 5432, March 3, 1914. Under Int. Conv., March 3, 1913.

See Fr. Pat. 469,144 of 1914; this J., 1914, 973.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber and the war. J. McEwan. India Rubber J., 1914, **48**, 941.

The existing serious shortage of raw rubber in Germany is referred to, and also the steps taken by the British Government, upon representations from the trade in this country, to prevent supplies entering Germany. The importance of rubber in the conduct of modern warfare is emphasised. Tyres: aeroplane and airship fabrics: ground-sheets, waterproof capes, cloaks, saddle-covers; "Wellingtons"; rubber swimming collars; hot-water bottles and other surgical goods are among the more obvious articles involving the use of rubber. But large quantities are employed for more obscure purposes, such as rubber packings, washers, linings, etc., in warship construction, particularly in submarines, to ensure perfect watertightness. The possibility of making up the deficiency of natural rubber by means of a synthetic product is a somewhat remote one.—E. W. L.

Rubber ; Methods for the preparation of artificial —— from different raw materials, including petroleum. E. Pyhäla. Neftjanoje Djelo, 1913, No. 17. Petroleum, 1914, **9**, 1376.

The fraction of Baku petroleum boiling between 98° and 106° C. yields up to about 20% of its weight of adipic acid, which, by way of the amide, can be converted into butadieen and synthetic butadiene-rubber. This method of preparation is however hardly possible from a commercial standpoint. If, however, the butadiene hydrocarbons could be obtained from the petroleum hydrocarbons by a simple, direct process this route to synthetic rubber would be a a good one.

The author is of opinion that use might be made of the emulsions obtained with the turpentine-like and other hydrocarbons of petroleum by the aid of certain emulsifying agents, which emulsions are very similar to rubber latex, and, like the latter, can be worked up into rubber-like products.—E. W. L.

Studies on polymerisation : diethylenic hydrocarbons. Polymerisation of allene, hydrocarbons of the diallyl series, and hydrocarbons of the divinyl and allene series. Lebedeff. *See* XX.

Polymerisation of some hydrocarbons of the divinyl series. Lebedeff and Skavronskaia. *See* XX.

Methylenecyclopropane [and divinyl]. Merejkowsky. *See* XX.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Precipitated bone. Jenkins and Street. *See* XVI.

Patents.

Leather ; Manufacture of ——. O. Röhm, Darmstadt, Germany. U.S. Pat. 1,117,912, Nov. 17, 1914 ; date of appl., May 7, 1914.

Leather is softened by impregnating it with a mixture of sulphonated oil or fat (free from soap) and unaltered oil or fat.—G. W. McD.

Keratin compound; Indurated ——. B. B. Goldsmith, New York. U.S. Pat. 1,114,981, Oct. 27, 1914 ; date of appl., Jan. 4, 1912.

Keratin is subjected to the combined action of a converting and an indurating agent, *e.g.*, β-naphthol and formaldehyde, and the mass is mixed whilst heating, preferably under pressure.—F. Sodn.

XVI.—SOILS ; FERTILISERS.

Potash ; Ashes of hedge-clippings and trimmings as a source of ——. E. J. Russell. J. Board Agric., 1914, 21, 694—697.

Ashes obtained from the green and dead woods, the grass and weeds from hedging and ditching, burned in the open in the customary manner, contained on an average 10·9% K_2O. The waste material from threshing floors yielded an ash containing 11% K_2O. The potash is present as carbonate which is very readily dissolved by rain ; a heap of ash, after a wet night, had lost half its potash. The amount of ash obtained from the trimmings of 100 yds. of hedge is about 15 lb. The cost of obtaining this is about 8d. per lb., charging the whole cost to the ash. The ash after sifting is a very light powder which mixes well with superphosphate, but has not the keeping qualities of kainite.—J. H. J.

Calcium cyanamide and Chili saltpetre ; The fertilising effect of a mixture of ——. P. Bolin. Meddelande No. 79 från centralanstalten f. jordbruksförsök, 1913, 1—18. Biedermann's Zentr., 1914, **43**, 160—162.

No generalisation with regard to the comparative manurial actions of the two fertilisers is possible, but in the numerous cases in which the two are approximately of equal value, a mixture of the two gives higher yields both of grain and straw than either constituent alone. The addition of Chili saltpetre does not increase the manurial power of calcium cyanamide, where the latter by itself has little fertilising action.—O. R.

Nitrogenous fertilisers. P. Wagner. Hess. landw. Zeits., 1913, No. 14. Biedermann's Zentr., 1914, **43**, 162—166.

Comparisons were made during three successive years on crops of winter rye, sugar beet, and barley, in rotation. Of the fertilisers used, Chili saltpetre and calcium nitrate gave the best results, crude calcium cyanamide (nitrolim) had only from one-third to one-quarter of the manurial value of the nitrates, and calcium nitrite proved irregular and unsatisfactory. Ammoniacal superphosphate was about equal to the nitrates in the case of beet, but had only about 65% of their efficiency in the case of barley. —O. R.

Magnesia ; Fertilisation of sugar beet with ——. F. Strohmer and O. Fallada. Oesterr.-ungar. Z. Zuckerind. und Landwirtschaft, **42**, No. 2, 221. Biedermann's Zentr., 1914, **43**, 170—174.

The formation of sugar in the sugar beet depends on the quantity of chlorophyll present, and chlorophyll, according to Willstätter and Hug, contains about 3% Mg. A dressing of 150 kilos. of magnesium sulphate per hektare (about 134 lb. per acre) produced no increase in the root or leaf growth of the beet nor in the content of chlorophyll and sugar.—O. R.

Bone ; Precipitated ——. E. H. Jenkins and J. P. Street. Thirty-seventh Report of The Connecticut Agric. Exper. Stat., 1913, 117.

"Precipitated bone," a by-product of glue manufacture, is a white neutral powder, which is chiefly used as a tobacco fertiliser. Analyses of seven varieties on sale showed that it contains : water-soluble P_2O_5, 0·94 to 1·31 ; citrate-soluble P_2O_5, 33·16 to 38·08 ; total P_2O_5, 34·38 to 39·40%.—W. P. S.

Poisons for plants ; Use of —— in agriculture and industry. E. Crivelli. L'Ind. Chim. Min. e Met., 1914, **1**, 409—413.

Bertrand does not admit that the use of colloidal silver or copper claimed by Lumière (this J., 1911, 1463) has any stimulative action upon the growth of plants. On the other hand, Javillier (see this J., 1914, 563) has found that metallic zinc promotes the growth of *Aspergillus niger.* Fungicides in the form of precipitates sparingly soluble in water are more effective for plants than solutions, since they are only slowly removed from the leaves. *Destruction of weeds :*—In America a solution of copper sulphate containing 5 to 15% iron sulphate is used to kill the weeds in cereal crops, whilst in tropical countries arsenical weed-killers are used on the railway tracks. A typical preparation used by a South American railway company consists of 72 grms. of arsenious anhydride and 15·5 grms. of caustic soda per 100 c.c., coloured with phenolphthalein. This has a sp. gr. of 1·746 and is used at a 10% dilution (1 litre per sq. m.), every 3 months for the first year, and subsequently every 6 months. The railway companies of Columbia and Ecuador employ a mixture in equal parts of 17% sodium nitrate and 20% arsenious acid solutions. Sodium sulphide being too dear the use of barium or calcium sulphide is suggested for this purpose (compare also U.S. Pat. 1,076,818 ; this J., 1913, 1165).

Submarine paints: According to Carbonelli (*Indust. Chim.*, VIII. [23 and 24]); paints for ships' bottoms, etc., usually contain one or more of the following toxic agents :—Nicotine, strychnine, thiocyanic acid, mercury, copper, lead, arsenic, antimony, etc.: whilst the most common substance is mercury arsenite. Collignier gives the following analysis of a submarine paint in great demand: Crystallised copper sulphate, 40·0; iron oxide, 13·78; lead oxide, 1·51; and mercuric chloride, 8·97%.—C. A. M.

Potash salts. Summary for 1913. Phalen. *See* VII.

Fish meal and fish manure. See XIXa.

Patents.

Seed grain; Treatment of ——. C. E. De Wolf, London, and H. E. Fry, Dorchester. Eng. Pat. 10,202, April 24, 1914. Addition to Eng. Pat. 22,151, Oct. 1, 1913 (this J., 1914, 1067).

Grain (one bushel) is steeped in a solution of manure or nitric acid (6 galls.), and placed in a wooden box fitted with iron electrodes in the form of sheets covering the ends of the box. A current of 200 volts and 1¼ ampères is used at not above 27° C. The solution is then drained off, and the grain is sprayed with one quart of petroleum or benzoline.—G. W. McD.

Superphosphates; Method of manufacturing double ——. T. L. Willson; Ottawa, Canada. Eng. Pat. 25,856, Nov. 11, 1913.

See U.S. Pat. 1,078,887 of 1913; this J., 1914, 35. Ammonia, or a compound of ammonium or potassium, may be added to the product.—T. F. B.

Ammonium phosphate [for fertilising purposes, from gas liquor]; Process of making ——. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,115,044, Oct. 27, 1914; date of appl., June 9, 1914.

Gas liquor (preferably concentrated) is added to boiling crude phosphoric acid, whilst steam is passed through the mixture to remove volatile impurities.—F. Sodn.

XVII.—SUGARS; STARCHES; GUMS.

Beet; Formation of sugar in the ——. H. Colin. Comptes rend., 1914, **159**, 687—689.

The sugar transferred from the leaves to the root consists not only of ready-formed sucrose but also of reducing sugar which is converted into sucrose in the root. The root is never free from reducing sugar, but the ratio of the latter to the sucrose present diminishes (*e.g.*, from 0·178 : 1 to 0·011 : 1) as the plant develops. This ratio sometimes attains 0·2 : 1 in the upper extremity of the root, and usually exceeds 1 : 1 in the base of the leaf-stalks. The disappearance of sucrose from the leaves at night (*i.e.*, in absence of light) is not simply due to its transference to the root, for it undergoes decomposition in the leaves themselves which contain inverting agents. The double function of the root, *viz.*, to store sucrose and to produce it from reducing sugar, renders it possible for different varieties of beets having leaves which elaborate different quantities of sucrose, to have roots equally rich in this sugar.—J. H. L.

Sugar beet; Relation between the weight and sucrose content of the —— *and the surface of the soil.* H. Pellet. Sucr. Indig., 1914, **84**, 59—61, 84—88, and 104—108.

Experiments made by Munerati, Mezzadroli, and Zapparoli of the Beet Cultivation Station, Rovigo (Italy), have shown that there exists no relationship between the surface of soil at the disposal of a sugar beet and its weight. At times so-called "giant" roots weighing 10 to 15 and even 20 kilos. are found, but these are produced more frequently in very fertile than in moderately fertile or poor soils and during seasons of considerable rain (as, *e.g.*, 1913). It has moreover been noticed that the presence in the field of fodder beets amongst sugar beets in no way hinders the growth of the latter.—J. P. O.

Enzymes of honey. F. Gothe. Z. Unters. Nahr. u. Genussm., 1914, **28**, 273. Pharm. J., 1914, **93**, 809.

Lactase, proteases (peptic and tryptic enzymes), and lipases cannot be found in honey, but probably there is an inulase. The invertase of honey is of vegetable as well as of animal origin. The quantities of catalase and diastase are not proportional; often a high diastase corresponds with a low catalase figure. The diastase figure is very important for the valuation of honey because it is not dependent on the food, the diastase being a secretion of the body of the bee. A high diastase figure excludes suspicion of adulteration. A medium diastase figure, in combination with the reaction of Fiehe and other chemical reactions, confirms suspicion of adulteration; and a sample with a low diastase number is either adulterated or overheated.

Sugar beet culture. Times, Dec. 23, 1914.

An attempt is being made by the London and South Western Railway Company to encourage sugar-beet culture in the south-western counties, where it is declared that large areas are thoroughly suitable for the cultivation of beet. It has been announced that, given the requisite production of beet, the capital for the foundation of a factory (some £130,000) would be forthcoming, and every accommodation in the way of sidings and carriage facilities would be provided.

Fertilisation of sugar beet with magnesia. Strohmer and Fallada. *See* XVI.

Patents.

Starch; Manufacture of —— *[and a foodstuff].* C. C. Moore, Washington, D.C. Eng. Pat. 530, Jan. 8, 1914.

Succulent materials such as potatoes, cassava, etc., are reduced to fragments, dried rapidly at a temperature below the gelatinising point until they become brittle, ground dry to a powder which will pass through a 80- or 100-mesh sieve and then ground with water and the starch separated in the usual manner. The effluent may be evaporated to produce a foodstuff.—J. F. B.

Sugar; Process of bleaching ——. M. Barrios, Habana, Cuba. U.S. Pat. 1,117,154, Nov. 17, 1914. Date of appl., May 2, 1912.

See Fr. Pat. 447,206 of 1912; this J., 1913, 248.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Patents.

Malt; Apparatus for producing ——. R. E. Chichester, Norwich. U.S. Pat. 1,117,323, Nov. 17, 1914. Date of appl., July 28, 1913.

See Eng. Pat. 17,904 of 1912; this J., 1913, 804.—T. F. B.

Alcohol; Apparatus for continuously distilling ——. A. L. Obrador, Hagonay, Philippine Islands. Eng. Pat. 12,142, May 16, 1914.

See U.S. Pat. 1,106,832 of 1914; this J., 1914, 978.—T.F.B.

Pressure filters [for beer and the like]. Eng. Pat. 24,768. *See* I.

XIXa.—FOODS.

Cheese; The lactose content of ——. J. P. Street and L. B. Mendel. Thirty-seventh Report of The Connecticut Agric. Exper. Stat., 1913. 95.

Cheeses which have not been ripened, such as cottage, cream, and Neufchatel, contain from 0·8 to about 2·5% of lactose, whilst those which have been subjected to a long ripening process, such as Roquefort, Camembert, Edam and cheddar, are free from lactose.—W. P. S.

Chocolate and cocoa preparations [for diabetics]. J. P. Street and L. B. Mendel. Thirty-seventh Report of The Connecticut Agric. Exper. Stat., 1913. 64—66.

Seven brands of chocolate, four of cocoa and one of chocolate-coated almonds, all recommended for consumption by persons suffering from diabetes, were examined. The chocolates contained from 10 to 50% of carbohydrates, 11 to 25% of protein, and 25 to 61% of fat; added protein appeared to be present in all the samples, but in only three cases did the percentage of carbohydrates fall much below that found in ordinary plain chocolate, namely, about 25%. The cocoas contained from 21 to 51% of carbohydrates, 18 to 53% of protein, and 11 to 24% of fat. The chocolate almonds contained only about 16% of carbohydrates.—W. P. S.

Palmnut kernel cake. J. A. Murray. J. Board Agric., 1914. **21**, 697—701.

The modern method of making the cake is to separate the kernels from the pericarp of the fresh fruits, to partially cook the kernels in order to destroy the enzyme that causes the oil to go rancid, and then to crush the kernels heavily to express the oil. As a result the cake contains much less woody fibre and oil than formerly, the other constituents being increased correspondingly. A recent sample contained: proteins 18·5, oil 5·5, carbohydrates 50·0, crude fibre 10·0, moisture 12·2, and ash 4·0%.—J. H. J.

Fish meal and fish manure. J. Board Agric., 1914. **21**, 688—694.

English fish meal in general has a content of 55—65% of protein, 3—6% of fat and 14—18% of calcium phosphate. The feeding value of the meal depends upon its high content of proteins, of which 90% are digestible. The calcium phosphate and also the salt (0·7% and upwards) are indispensable in the feeding of animals, but the proportion of salt should not exceed 5%. Recent English experiments seem to show that the addition of fish meal to other foods will lead to a marked increase in weight in the animals fed.

Fish manures depend for their manurial value upon their content of nitrogen and phosphate, and in lesser degree upon potash and lime. The variations in these contents are great, depending upon the class of material from which the manure is made. In 19 samples the amounts of nitrogen varied from less than 1 per cent. to over 11 per cent., the phosphates varied from about 8—34%, and the potash from 2—4%. Correspondingly the money values of the samples varied from £2—£10 per ton. Most of the nitrogenous constituents of fish manure resist attack to a greater or less degree, so that the manurial action is gradual throughout the season. The manure is injurious to germinating seeds and plant rootlets until the first active fermentation is over. It does not keep well in storage. (See also this J., 1914, 1066.)—J. H. J.

Manganese in mineral springs of the Central Plateau. F. Jadin and A. Astruc. J. Pharm. Chim., 1914, **10**, 412—416.

A litre of the mineral water was evaporated to dryness and the manganese in the residue estimated colorimetrically after conversion into permanganate by Marshall's method (see this J., 1911, 650). The amounts found in a litre of the water from 72 different springs varied between 1·200 mgrms. (Saint-Galmier, Source Badoit) and 0·020 mgrm. (Royat, Source Velleda). The manganese content can be used to identify rapidly the source of a mineral water or to judge of the genuineness of a sample.—F. Shdn.

Enzymes of honey. See Gothe. XVIII.

Ozonisation of air. Franklin. *See* XIXb.

Portable apparatus for measuring the electric conductivity of saline solutions. Saviron. *See* XXIII.

Patents.

Emulsions [for margarine, etc.]; Production of ——. S. H. Blichfeldt, Southall. Eng. Pat. 25,265, Nov. 5, 1913.

A horizontal cylindrical casing, mounted on a hollow central shaft fitted with agitators, is divided into compartments by perforated partitions. One ingredient of the emulsion is introduced through an opening at the end of the cylinder, and the emulsion is discharged at the other end. The second ingredient (usually the fatty one) is admitted through a pipe passing down the central shaft. This pipe is perforated and, when the perforations come opposite similar ones in the rotating shaft, the ingredient mixes intermittently with the contents of the cylinder. A valve device, such as that described in Eng. Pat. 7499 of 1912 (this J., 1913, 763) or 23,653 of 1913, may be used for the intermittent supply of the second ingredient. —W. P. S.

Emulsions [for margarine, etc.]; Production of ——. S. H. Blichfeldt, Southall. Eng. Pat. 18,048 of 1914; date of appl., Oct. 18, 1913.

A rotating disc provided with slots is mounted on a hollow shaft in a casing the walls of which closely approach the sides of the disc. One of the ingredients of the emulsion is admitted through the hollow shaft whilst the other (usually the fatty ingredient) may enter through a tube extending transversely across the casing and communicating with the interior through small openings at different distances from the axis. The emulsion leaves the apparatus through an outlet near the periphery of the casing. A similar apparatus is described for rendering a partially formed emulsion homogeneous.—W. P. S.

Baking preparations. E. C. R. Marks, London. From Victor Chemical Works, Chicago, U.S.A. Eng. Pat. 5111, Feb. 27, 1914.

See U.S. Pat. 1,113,632 of 1914; this J., 1914, 1109. A tartrate, metaphosphate, or pyrophosphate may be used in place of the disodium phosphate.—T. F. B.

Flour; Process of making dry-shortening ——. A. W. Estabrook and H. E. Weaver, Kansas City, Kans., Assignors to The Larabee Flour Mills Co., Hutchinson, Kans. U.S. Pat. 1,117,011, Nov. 10, 1914; date of appl., June 16, 1913.

Flour is mixed with powdered sodium stearate and an equivalent amount of calcium acid phosphate (see also this J., 1914, 938).—W. P. S.

Flour; Dry-shortening ——. A. W. Estabrook, Kansas City, Mo., Assignor to The Larabee Flour Mills Co., Hutchinson, Kans. U.S. Pat. 1,117,012, Nov. 10, 1914; date of appl., Nov. 24, 1913.

Wheat flour is mixed with finely-divided hydrogenised cottonseed oil, and leavening and seasoning substances. —W. P. S.

Separators for liquids [milk]; Centrifugal drum ——. J. Melotte, Remicourt, Belgium. Eng. Pat. 7839, March 28, 1914.

The bowl of the separator is provided with a false bottom having a peripheral, vertical rim perforated with small holes, through which the denser portion of the liquid (milk) is discharged along with only a minimum quantity of the lighter liquid (cream).—W. H. C.

Fish and other food substances; Method of and apparatus for cooling and freezing ——. N. Dahl, Trondhjem, Norway. Eng. Pat. 6711, March 17, 1914. Under Int. Conv., March 19, 1913.

A liquid is cooled below 0° C. by circulating it through a chamber divided into a number of compartments each containing a mixture of ice and salt or provided with refrigerating pipes. The partitions forming the compartments in this chamber have openings so arranged that the liquid takes a zig-zag course through the chamber and has its level lowered in each successive compartment. Siphon-like pipes distribute the cooled liquid from the delivery pipe on to the fish, etc., and a collecting channel provided with a screen returns the liquid to the cooling chamber.—W. P. S.

Cocoa and chocolate substances; Method for roasting ——. F. E. F. Neumann, Wandsbek, Germany. U.S. Pat. 1,117,594, Nov. 17, 1914. Date of appl., March 28, 1913.

See Fr. Pat. 463,325 of 1913: this J., 1914, 371.—T. F. B.

Manufacture of starch [and a foodstuff]. Eng. Pat 530. *See* XVII.

XIXb.—WATER PURIFICATION; SANITATION.

Air of railway tunnels; Gaseous impurities in the ——. A. Seidell and P. W. Meserve. U.S. Public Health Service, Hygienic Lab., Bull. No. 92, June 1914, 1—47.

Methods for the determination of sulphur dioxide based on the aspiration of the sample of air through a small volume of liquid followed by a gravimetric or volumetric determination of the retained sulphur dioxide could not be used, but satisfactory results were obtained by direct titration with $N/1000$ iodine solution, after applying a correction (see this J., 1914, 499). When samples of air were kept in moist bottles, practically the whole of the sulphur dioxide disappeared within 1 hour; in dry bottles the loss during the first 2 hours was usually inconsiderable, although with very small quantities an appreciable loss may take place within 30 minutes. Of quite small amounts of sulphur dioxide liberated in a closed room only about 30 to 60% could be recovered. The iodine pentoxide method (see this J., 1907, 1251; 1908, 595; 1909, 1170; 1914, 499) was used for the determination of the carbon monoxide, special bulbs, having narrow connecting tubes, being employed for the absorption of the resulting carbon dioxide and liberated iodine, and the closed aspiration system was adopted in passing the sample of air through the apparatus. Analyses of test mixtures of very small amounts of carbon monoxide with air showed that from 88 to 98% of the former could be recovered. Eighty-eight samples of air from tunnels were examined; those from tunnels through which steam locomotives passed contained on an average 15·1 parts SO_2 and 267 parts CO per million, whilst the corresponding figures for the tunnel on the electric railway were 2·9 and 25 parts, respectively. A review of the available literature on the physiological effects of small amounts of these two gases showed that the concentrations of the gases which produce an unmistakable harmful effect upon man are somewhat greater than the maximum amounts which were found in any of the tunnel-air samples examined.—W. P. S.

Air; Ozonisation of ——. M. W. Franklin. J. Ind. Eng. Chem., 1914, **6**, 850—855.

Ventilation.—The modern practice of ventilation is concerned only with the absorption of the heat produced by the inmates of a room, with removal of the expired moisture, and destruction of the odours of men, animals and organic substances. Ozone is most useful in those places where perfect ventilation is impossible. It does not simply mask the organic odours, but destroys them. Onions, decayed fish, decomposed meat, etc., treated with ozonised air had a strong smell of ozone, and after treatment with ferrous sulphate solution to remove the ozone, the substances were free from their natural odour. Chemical compounds produced in the decomposition of organic matter, as skatole, and valeric and butyric acids, are destroyed also. No instance of harm to individuals from the use of ozone in proper concentration in air has been recorded; the workers in the London tube railways and those on water-sterilisation plant have shown no ill effects. The use of ozone in quantity to sterilise the air of rooms involves irritation to the respiratory tract. Experiments to determine its germicidal action have given inconclusive results. Its usefulness is not due to any beneficial effect on the human economy but to the fact that it destroys harmful organic emanations in the air. *Odour destruction.*—Disagreeable odours are given off in the manufacture of casein. Experiments with undried commercial casein showed that the odour was destroyed in the presence of ozonised air and that the least quantity of ozone required was 1·84 mgrms. per litre of air contaminated with the odour from 15 grms. of casein. In experiments with tobacco smoke, it was found that ozone combined only with the volatile components of the smoke, rendering the smoke odourless, tasteless and non-irritative, but that it did not oxidise the carbon particles. There was however a slight diminution in the smoke density when the air was ozonised: equal weights of tobacco were burned and the smoke collected with equal volumes of air and ozonised air, and in the bottle containing the latter mixture a marked clearing was effected in 4 hrs. as compared with the other bottle. Pieces of different kinds of cloth were exposed to tobacco smoke until they had a strong odour; they were then treated with ozonised air and were thoroughly deodorised within half an hour. *Food preservation.*—The effect of ozone on egg-albumin was examined and it was found that considerable coagulation took place and the albumin turned a yellowish-grey colour. Eggs were placed in bottles which were exhausted and then filled with ozonised air. After 10 days, all the ozone had disappeared and the bottles were recharged and examined every ten days. After 60 days the eggs ceased to taste fresh; the loss in weight was about 1·5%. In a control series in the absence of ozone, the eggs began to turn stale after 20 days when the loss in weight was 0·5%. The action of the ozone is to lessen the number and activity of the bacteria which penetrate the shell during evaporation under ordinary conditions.—J. H. J.

The campaign against smoke. English and American results. Times Eng. Suppl., Nov. 27, 1914, 146.

One of the chief obstacles in the past to the progress of the smoke-abatement movement has been the lack of accurate scientific data relating to the character and amount of the pollution of the atmosphere from smoke, and to the extent of the damage and losses arising from this cause in the more important cities and industrial centres.

A central body or committee was required which should formulate and carry out a scheme of co-operative work and investigation, based on the use of scientific and uniform methods and apparatus. This need has now been met by the work of the Committee for the Investigation of Atmospheric Pollution, appointed by the London Smoke Abatement Conference of 1912, and in America by the Commission of Experts, appointed by the Mellon Institute of Industrial Research attached to the University of Pittsburgh.

Work of the London Committee.—During the past two years the London Committee has carried out useful preliminary work:—(1) By selecting and drawing up the specification for a standard method and form of apparatus for the collection of the soot and other impurities of the atmosphere; (2) by formulating the conditions under which this apparatus should be used, and the collected soluble and insoluble impurity examined; and (3) by obtaining the co-operation of the health authorities of many of the larger towns and cities of the country for the investigation. The method selected for the observations is based on the collection of the whole of the rainfall for one month in one or more large bottles, and the determination of the weight and character of the suspended and dissolved impurities, by subsequent filtration and evaporation of the collected water. This method was employed for the observations upon the sootfall of London, carried out by the Coal Smoke Abatement Society and the "Lancet" in 1910, and also for the observations by Prof. J. B. Cohen, in Leeds. It does not give the amount of suspended air pollution in the strictest meaning of the term, but only the proportion of it which falls, or is carried down by the rain and snow in a given time; but the latter is the weight which is most important from a practical point of view, in respect of air pollution.

Apparatus employed.—The apparatus used for collecting the rainfall with its suspended and dissolved impurity, is a large circular enamelled iron funnel, having a collecting area of 4 sq. ft., and holding large glass bottles, in which each month's rainfall is stored for examination. The collecting funnels are placed on the ground-level in places free from abnormal smoke and dust, as near as possible to the centre of the town or district, the air of which is to be examined. Before removing the bottles on the last day of each month, the inside of the collecting funnel is washed down with some of the water already collected, a squeegee being used to remove any soot or dust that adheres to the interior of the funnel. The details recorded include volume of water collected, total solids, total soluble matter, total insoluble deposit, tarry matters, non-tarry carbonaceous matter, sulphates, chlorides, ammonia, and lime.

In response to the circular letter sent out by the London Committee early in 1913, the Health authorities of 21 towns and cities agreed to join in the observations. In some of these places several gauges will be employed at different centres. Owing to some delay, however, in obtaining the necessary supply of large enamelled gauges, only London was equipped with three gauges when the observations were started in March last.

Table I.

Fall of solid matter.

Name of town or city.	Metric tons per sq. km. in August.	
	Total solids.	Tar, soot, and ash.
Sheffield (Attercliffe)	21·34	14·55
Oldham	19·01	11·67
Bolton	18·02	9·12
Liverpool	15·87	8·23
Manchester (School of Technology)	14·33	9·26
Birmingham	14·20	10·10
Newcastle	13·44	10·52
Paisley	12·82	6·83
Kingston, Hull	11·70	6·89
Sheffield (average of four stations)	10·59	6·30
York	8·79	5·69
Leith	8·78	6·13
Greenock	8·64	4·36
Manchester (average of six stations)	7·99	4·10
London (average of two stations)	7·94	3·88
Exeter	6·21	3·35
Malvern	2·01	·71

Table I. contains a summary of the more important figures for August, the last month for which the reports have been published. The difference between the figures in col. I. and col. II. gives the soluble portion of the solid matter brought down with the rainfall. The results in Table I. are expressed as metric tons per sq. km.; they must therefore be multiplied by 2·56 to obtain the soot and dust fall in tons per square mile, which is the form in which the results of earlier investigations have been expressed. If this calculation is made for the worst and best results given in Table I., it appears that Sheffield (Attercliffe) had a total soot and dust-fall in August equal to 640 tons per sq. mile per annum, though the average for the whole city (four stations) was only 317 tons. Malvern had a fall of less than one-fifth this amount, or 60 tons per sq. mile per annum.

The constituents of the solid matter which falls upon our towns and cities are of great interest, and in Table II., the totals given in the second column of Table I. are separated to show the relative proportions of tar, soot, and ash. It will be seen that the relative position of the towns is slightly altered in this table, and that Sheffield (Attercliffe), Oldham, Newcastle, Birmingham, Manchester, Bolton, and Liverpool in the order given are the dirtiest towns, when judged by their respective falls of what is generally known as "soot."

Table II.

Tar, soot, and dust fall.

Name of town or city.	Metric tons per sq. km. in August.			
	Tar.	Carbon.	Ash.	Total.
Sheffield (Attercliffe)	·48	3·45	10·62	14·55
Oldham	·16	3·25	8·26	11·67
Newcastle	·12	3·87	6·52	10·51
Birmingham	·10	2·60	7·50	10·20
Manchester (Technical School)	·07	3·23	5·93	9·23
Bolton	·20	2·94	6·15	9·29
Liverpool	·08	1·63	6·52	8·23
Kingston, Hull	·08	3·26	3·55	6·89
Paisley	·11	2·57	4·15	6·83
Sheffield (average)	·47	1·24	4·59	6·28
Leith	·10	1·76	4·27	6·13
York	·11	1·89	3·67	5·67
Greenock	·03	1·64	2·69	4·36
Manchester (average)	·04	1·66	2·38	4·08
London (average)	·03	1·52	2·32	3·87
Exeter	·03	1·08	2·25	3·36
Malvern	·01	·25	·45	·71

London may be regarded as possessing a standard of atmospheric cleanliness and purity, to which the northern industrial cities and seaports might strive to attain.

The Pittsburgh inquiry.—From a summary of the results of the inquiry into the losses arising from smoke in Pittsburgh, as given in Bull. No. 4 published by the Mellon Institute, it appeared that the total loss was estimated at £1,998,950 per annum. A report on the meteorological aspect of the smoke problem signed by Prof. H. H. Kimball, of the U.S.A. Weather Bureau, is given in Bull. No. 5. A number of papers on the effects of smoke and soot on building materials are collected in Bull. No. 6, edited by Dr. R. C. Brenner, the chief chemist of the commission. The effects of the soot in smoke on vegetation are dealt with in Bull. No. 7, which is a record of experiments carried out by J. F. Clevenger in certain public parks of Chicago, and in Pittsburgh and its environs.

Engineering aspects.—Bull No. 8, the last published, deals with the engineering aspects of the smoke problem in Pittsburgh.

The contents of this bulletin include descriptions of all the different forms of furnace used in Pittsburg for steam-raising purposes, and it gives the following rules for abating smoke and increasing the efficiency of hand-fired furnaces:—1. Fire evenly and regularly. 2. Fire moderate amounts of coal at a time, and place the coal where it is needed. 3. Keep the fire clean, even, and bright all over; do not allow it to burn into holes or thin spots. 4. Break up the lumps and have the coal as nearly as possible uniform in size. Do not fire any lumps larger than a man's fist. 5. When a fire has burned into holes do not throw green coal on the bare grates, but push incandescent fuel into these spots before firing. 6. Regulate the draft and air supply to suit the fire. 7. Watch the condition of the fire and the steam-gauge together. Do not fire large quantities of coal. 8. Do not level or stir the fires unless absolutely necessary, and then use the utmost care. 9. Do not allow ashes and clinkers to accumulate on the side or bridge walls, as this cuts down the effective grate area, and causes other troubles. 10. Do not allow too long intervals between firings. A series of photographs with which the bulletin is illustrated goes far to support the view that Pittsburgh must be considered one of the smokiest and dirtiest cities in the world. (See also this J., 1914, 499.)

Portable apparatus for measuring the electric conductivity of saline solutions. Saviron. *See* XXIII.

Erratum.

Page 1110, col. 1; l. 23 from bottom *for* "capable" *read* "incapable."

Patents.

Collecting and discharging solid matter when pumping liquids [sewage] containing same; Means for ——. R. H. L. Pennell, Khanka, Egypt, and J. Orten Boving, London. Eng. Pat. 21,374, Sept. 22, 1913.

The sewage on its way to the pump passes into a sump through a trap which retains the solid matter. When the sump is full the clear liquid from the delivery of the pump is passed through the trap in the reverse direction and carries forward the solid matter which is thus transported without having to pass through the pump.—W. H. C.

Sludge or solid matter recovered from sewage; Apparatus for drying ——. A. B. Ogden, Manchester. Eng. Pat. 6260, March 12, 1914.

A drying chamber for the sludge is heated by means of steam introduced into the space below the false bottom of the chamber; the steam pipe, which is perforated extends across one end of this space, a drainage channel being provided at the other end. The interior of the chamber is also supplied with a current of air which has been heated by passing through pipes arranged in the flue of the boiler furnace; this flue extends across one end of the chamber, along the side, and then across the other end. The wagons containing the sludge may be run into a space at the heated side of the chamber so that a preliminary drying of the sludge is attained.—W. P. S.

Sewage disposal and water purification apparatus. A. T. Nabstedt, New York. U.S. Pat. 1,115,857, Nov. 3, 1914; date of appl., March 2, 1914.

A settling tank, provided with the usual outlet for the effluent, is situated above a sludge tank, the two being connected by a channel of relatively small cross-section. Means are provided for closing this channel and for maintaining the pressure in the sludge tank equal to the head of liquid in the settling tank. A number of settling tanks may be arranged above one sludge tank.—W. P. S.

Water and other liquids; Apparatus for effecting the sterilisation of —— by ozonation or the like. E. L. Joseph, London. Eng. Pat. 25,503, Nov. 7, 1913.

The water is passed through a centrifugal or rotary pump, to which is also admitted a supply of ozonised air, and then delivered into a tank through a pipe extending to the bottom of the same. The air is dried by passing through a refrigerating apparatus before it enters the ozonising apparatus. (Reference is directed to Eng. Pats. 2707 of 1881, 9741 of 1899, 20,750 of 1905 and 16,128 of 1908; this J., 1900, 369, 1906, 1114; 1909, 742).—W. P. S.

Fluids; Apparatus for the sterilisation of —— [by ultra-violet rays]. W. R. Walkley and Tubex Engineering Co., Ltd., London. Eng. Pat. 14,689, June 18, 1914.

The liquid is passed as a thin film over the inner surface of corrugated plates which are curved so as to form a cylindrical vessel; lamps emitting ultra-violet rays are suspended inside this cylinder. The plates may be curved in various shapes.—W. P. S.

Water; Process of removing oxygen from ——. R. Gans, Berlin-Grunewald, Germany. U.S. Pat. 1,117,831, Nov. 17, 1914. Date of appl., Sept. 15, 1913.

See Fr. Pat. 462,446 of 1913; this J., 1914, 331.—T. F. B.

Sewage and the like; Treatment of ——. N. Testrup, Assignor to Wet-Carbonizing, Ltd., London. U.S. Pat. 1,116,953, Nov. 10, 1914. Date of appl., Feb. 7, 1912.

See Eng. Pat. 3247 of 1911; this J., 1912, 601.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Lloyd's reagent; Precipitating alkaloids by ——. *Preliminary note.* S. Waldbott. J. Amer. Chem. Soc., 1913, **35**, 837—838.

This reagent is essentially hydrous aluminium silicate derived from fuller's earth, and it has the property of precipitating alkaloids completely from neutral or acid solutions thereof. The alkaloid may be recovered by treatment with a base and an alkaloidal solvent. The reagent as examined by the author had the following composition: H_2O, 17·41; SiO_2, 55·50; Al_2O_3, 9·82; Fe_2O_3, 14·18; CaO, 1·58%. Heating the material to about 130° C. did not destroy its power, but a red heat expelled water, and rendered the reagent inert. When the reagent is exhausted with hydrochloric acid, the residual earth is still effective. Neither nitric acid nor *aqua regia* impair the activity of the reagent. After removal of the alkaloid from the reagent, the residual earth retains its full effect. A jelly is obtained difficult to filter and slow to settle; it is precipitated readily by adding an acid, or an alkaloidal salt. In drying, the jelly shrinks to a very small bulk; conversely, the solid expands remarkably in contact with water. The jelly precipitates inorganic salts also, *e.g.* barium chloride, lead acetate, zinc sulphate, etc. Clearly, the phenomenon is one of colloidal chemistry. It was found that colloidal silicic acid, or colloidal arsenious sulphide precipitate quinine sulphate. (See also this J., 1913, 161, J. U. Lloyd.)

Morphine and strychnine; Precipitation of ——. H. M. Gordin and J. Kaplan. Amer. J. Pharm., 1914, **86**, 461—464.

Attempts were made to shake out morphine from its aqueous solution with a mixture of alcohol and chloroform after saturating with potassium carbonate. The solvent separated well but the amount of morphine found by titration after removing the solvent, exceeded the amount originally taken by 2 to 15%, even after washing the residue with a saturated aqueous solution of morphine to remove traces of potassium carbonate. Morphine is completely precipitated by Lloyd's reagent (see preceding abstract) from acid solution. 90% of the morphine present can be extracted from the dried precipitate by boiling ammoniacal methyl alcohol. Strychnine is also completely precipitated by Lloyd's reagent. The precipitate is almost tasteless and is only slowly decomposed by shaking repeatedly with ammonia and chloroform. It behaves physiologically like strychnine diluted with an inert substance but it cannot be decomposed into free alkaloid outside the organism by pepsin in acid solution or by ptyalin or trypsin in ammoniacal solution.—T. C.

Morphine and codeine; Investigation of some derivatives of ——. A. Pitini. Annali Chim. Appl., 1914, **2**, 208—213.

Morphine oxide sulphonic acid, $C_{34}H_{40}O_{15}N_2S_2$, was obtained by Freund (see Herminghaus, Inaug. Diss., Hildesheim, 1914) by the action of acetic anhydride and sulphuric acid on morphine oxide. It yields morphine sulphonic acid, $C_{17}H_{21}NO_7S$, on treatment with sulphur dioxide. Codeine oxide sulphonic acid, $C_{18}H_{21}O_7NS$, and codeine sulphonic acid, $C_{18}H_{20}NO_3SO_3H,2H_2O$, were obtained by Freund and Speyer (Ber., 1911, **44**, 2339) in a similar manner to the morphine derivatives. A better yield of codeine sulphonic acid can, however, be obtained by dissolving codeine oxide sulphonic acid in caustic soda, adding sodium hydrosulphite, and allowing to stand for a short time. Morphine oxide sulphonic acid (sodium salt) and codeine oxide sulphonic acid (potassium salt) proved to be physiologically inactive, whilst morphine sulphonic acid and codeine sulphonic acid (sodium salts) were less toxic than the alkaloids themselves but produced similar effects, and hence may prove useful therapeutically. The codeine derivatives behave like the alkaloid itself with Frohde's reagent, and with a mixture of concentrated sulphuric acid and formaldehyde, giving a green coloration changing to blue with the former, and a blue coloration with the latter. The reactions of the morphine derivatives are different from those of the alkaloid, morphine, morphine sulphonic acid and morphine oxide sulphonic acid giving respectively a violet, a green, and a green coloration slowly becoming bluish with Frohde's reagent, and a reddish purple changing to violet, a green, and a violet coloration with sulphuric acid and formaldehyde.—A. S.

Aminopyridines: Pharmacological study of ——. *I. α-Aminopyridine and its acetyl derivative.* A. Pitini. Annali Chim. Appl., 1914, **2**, 213—217.

To prepare α-aminopyridine, quinolinic acid, $C_5H_3N(COOH)_2$ was converted into its anhydride by boiling with acetic anhydride and the anhydride was dissolved in benzene and treated with dry ammonia gas. The ammonium salt of the amide of quinolinic acid was thus precipitated, and the free acid, $C_5H_3N(COOH)CO.NH_2$, liberated from this by sulphurous acid, was dissolved in dilute caustic soda, treated with sodium hypobromite, heated on the water-bath, and then treated with sulphurous acid, which precipitated α-aminonicotinic acid, $C_5H_3N(COOH)NH_2$, which was converted into α-aminopyridine, $C_5H_4N.NH_2$, by heating to 310° C. Both α-aminopyridine and its acetyl derivative are capable of producing local anæsthesia, the acetyl derivative being somewhat more active in this respect. Aminopyridine is about as poisonous as stovaine, whilst the toxicity of its acetyl derivative is between that of nirvanine and novocaine.—A. S.

Gentian root: Chemical composition of Japanese ——. Y. Asahina and S. Yoda. Yakugakuzasshi, Aug. 1914. J. Pharm. Chim., 1914, **10**, 376—378.

Extraction of the fresh roots of Japanese gentian (*Gentiana scabra* Bunge var. *Buergeri* Maximowicz) with hot methyl alcohol in the presence of calcium carbonate gave a yield of 4·38% of gentianose and 2·3% of gentiopicrin.—F. Shdn.

British Pharmacopœia, 1914; *Analytical processes of the* ——. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5**, 409.

Clove oil. The official sodium hydroxide solution (20 grms. per 100 c.c.) used to determine the eugenol is too concentrated. A 5% solution of sodium or potassium hydroxide gives satisfactory results. *Cinnamon oil.* A flask with a narrow graduated neck should be used as in the determination of eugenol in clove oil. *Lemongrass oil.* The neutral sulphite process recommended for the determination of the citral gives results 4—5% lower than the bisulphite process generally used for the commercial test. *Balsam of Tolu.* The tests are not satisfactory on the whole and the requirement of 25% of total balsamic acids is somewhat high. The residue obtained on evaporating the carbon bisulphide extract seldom crystallises unless the balsam is old. The test for total balsamic acids soluble in water is better carried out on the balsam itself by the process described under "Styrax" as the esters volatilise with the carbon bisulphide to some extent.—F. Shdn.

Essential oils; Cultivation of plants for the production of ——. W. F. Cooper and J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5**, 407.

Clayey ground overlying chalk was manured and dug for three years, after which plants yielding essential oils were grown thereon. From 60 sq. yds. planted with *Lavandula vera* 2200 stalks and blooms and 4500 blooms of the second year's growth were obtained, the total yield of essential oil being 107 grms. or 1·5%. The characters were: sp. gr. 0·909, optical rotation —5°, esters 5·6%, refr. index at 25° C. 1·4710, soluble in 3 volumes of 70% alcohol. The first year's growth of Mitcham lavender from 98 sq. yds. gave 2050 blooms yielding 92 grms. of oil or 4·5%. The characters were: sp. gr. 0·906, optical rotation —8°, esters 17·7%, refr. index 1·4685, soluble in 3 vols. of 70% alcohol. Common thyme grown on 98 sq. yds. of ground gave 77 lb. yielding 0·106% of oil with the characters: sp. gr. 0·919, optical rotation —2°, phenols 38%. Lemon thyme yielded 0·08% of oil with the characters: sp. gr. 0·891, optical rotation —10°, aldehydes 18%. 3,839 sq. yds. planted with peppermint gave 4,800 grms. of material in the first year, the yield of oil being 0·49%. The characters were: sp. gr. 0·891, optical rotation —28°, esters 14·0%, alcohols 69·6%, refractive index at 25° 1·4502, soluble in 3 vols. 70% alcohol. 1457 sq. yds. planted with wormwood gave 13,550 grms. of material in the first year yielding 0·043% of oil with sp. gr. 0·926, refractive index 1·4572, and soluble in 3 vols. of 80% alcohol.—F. Shdn.

Citronella: Effect of climatic conditions on ——. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5**, 398.

Samples of Burmese citronella oil distilled from grass that had been under water several days owing to floods differed from an oil distilled from dry grass grown in the same locality. The sp. gr. was much higher and the geraniol content was reduced by 7—8%. The odour was somewhat disagreeable. The solubility was not affected.—F. Shdn.

Helichrysum saxatile (Moris.): Oil of ——. L. Francesconi and E. Sernagiotto. Gaz. chim. ital., 1914, **44**, II., 419—421.

The yellowish oil, obtained from plants growing at Lanusei, Sardinia, has a pleasant pungent odour, which at great dilution resembles that of the rose. It has the sp. gr. 0·9020, $n_D = 1·4769$, $[α]_D = —11·71$ (in alcoholic solution), and distils chiefly at 240° C., the distillate containing C 79·50 and H 12·11%.—A. S.

Barosma venusta; Volatile oil from the leaves of ——. E. Goulding and O. D. Roberts. Chem. Soc. Trans., 1914, **105**, 2613—2617.

The leaves of *Barosma venusta*, Eckl. and Zeyh., grown in South Africa yielded 2—2·7% of volatile oil the characters of which were: sp. gr. 0·865—0·867 at 15° C.; $α_D$ at 22°—24° C. 0° 47′ to 1° 4′, acid value 5·6, ester value 6·2, ester value after acetylation 55. The composition of the oil was: hydrocarbons, principally myrcene, 43·0%; aldehydes, principally anisaldehyde, 0·5%; phenols 0·2%; methylchavicol 21·4%; alcohols, partly linalool, 14·3%; the remainder consisting of esters and sesquiterpenes. No evidence of the presence of diosphenol was obtained.
—F. Shdn.

β-Phellandrene; Action of alcoholic hydrochloric acid on ——, *and mechanism of the transformation of terpenes by means of acids.* L. Francesconi and E. Sernagiotto. Gaz. chim. ital., 1914, **44**, II., 456—462.

By the action of cold alcoholic hydrochloric acid on β-phellandrene there is produced, in addition to an oily hydrochloride, the solid dihydrochloride of α-terpinene, m.pt. 51—52° C. The action of acids on other terpenes is recapitulated and it is pointed out that all other mono- and bi-cyclic terpenes in which the side chain is in the para position of the hexamethylene ring are capable of isomerisation into α-terpinene by the action of mineral acids.
—A. S.

Alkylidenehydrazines: Catalytic decomposition of ——. *Hydrocarbons obtained from citral and citronellal.* N. Kijner. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1779—1787. Bull. Soc. Chim., 1914, **16**, 337—339.

The hydrocarbon, $C_{10}H_{18}$, obtained by decomposing the compound of citral and hydrazine (see this J., 1912, 46) consists of a mixture of limonenic and terpinolenic hydrocarbons, the former being in the larger proportion. The limonenic hydrocarbon boils at 162°—163° C. at 760 mm., has the sp. gr. 0·7677 at 20°/0° C., and $n_D = 1·4422$. The terpinolenic hydrocarbon boils at 163°—165° C. at 760 mm., has the sp. gr. 0·7699 at 20°/0° C., and $n_D = 1·4439$, and when oxidised with permanganate yields acetone and the hydrocarbon boiling at 162°—163° C. The hydrobromide of the limonenic hydrocarbon, $C_{10}H_{20}Br_2$, when boiled with aniline yields the terpinolenic form, but when decomposed by boiling with alcoholic potassium hydroxide yields an unsaturated alcohol, $C_{10}H_{19}OH$, boiling at 190°—195° C. Treatment with oxalic acid converts this into linaloolene, $C_{10}H_{18}$, b.pt. 166°—168° C. at 748 mm., sp. gr. 0·7872 at 20°/0° C., and $n_D = 1·5000$. Reduction of the limonenic hydrocarbon by Sabatier's method at 150° C. yields dimethyl-2·6-octane, $C_{10}H_{22}$, which when purified boils at 161°—162° C. at 772 mm., has the sp. gr. 0·7399 at 20°/0° C., $n_D = 1·4146$, and is optically inactive. The corresponding dextro-rotatory dimethyloctane is obtained by reducing the hydrocarbon obtained from citronellal with hydriodic acid, and its characters are: b.pt. 159°—159·5° C. at 742 mm., sp. gr. 0·7313 at 20°/0° C. $n_D = 1·4110$, and $[\alpha]_D = +1·75°$. The hydrocarbon, $C_{10}H_{20}$, obtained from citronellal, when reduced by Sabatier's method at 170° C. gives decane, b.pt. 160°—161° C. at 772 mm., sp. gr. 0·7301 at 20°/0° C., $n_D = 1·4109$, and $[\alpha]_D = +6·27°$, and when the hydrobromic acid addition product is decomposed by means of quinoline it yields a hydrocarbon, $C_{10}H_{20}$, b.pt. 164°—164·5° C. at 782 mm., sp. gr. 0·7521 at 20°/0° C., $n_D = 1·4319$ and $[\alpha]_D + 8·59°$.

—F. Shdn.

Camphor as a solvent. N. N. Efrémoff. J. Russ. Phys.-Chem. Soc., 1913, **45,** 1683—1689. Bull. Soc. Chim., 1914, **16,** 183—184.

The results of a thermal and micrographic investigation of mixtures of camphor with various other substances were:—

Second component of mixture.	Eutectic.		Mols. % of camphor held in solid solution by second component.
	M. pt.	Composition, mols. % of second component.	
	° C.		
p-Toluidine	—	42	18
Naphthalene	31·5	43·5	—
Methyl mustard oil (methyl isothiocyanate)	34·2	50	—
Acetamide	66	88·5	11
p-Dibromobenzene ..	40·5	40·5	4
o-Nitraniline	6·0	51·2	3
m-Nitraniline	50	31·5	—
p-Nitraniline	76·2	31·0	5
Benzoic acid	56·5	37·5	5·3
Phthalic anhydride ..	84·7	31·3	9·5
Cinnamic acid	71·5	35·5	12·5
Salicylic acid	55·1	33·5	9·6
Anthracene	116·5	19·5	12

—A. S.

Turpentine; Oxidation of the nopinene (β-pinene) in Spanish oil of ——. A. Madinaveitia. Ann. Soc. Espan. Ph. Ch., 1914, **12,** 259—264. Bull. Soc. Chim., 1914, **16,** 785.

Spanish oil of turpentine, b. pt. 155°—156° C., was treated with permanganate and soda (Wallach's process), the product steam-distilled, and the non-aqueous portion of the distillate rectified in a current of carbon dioxide. Oxalic acid and a little sodium nopinate (1·5% as against 5% obtained by Wallach) were obtained, the smaller yield of the latter being ascribed to the existence of less β-pinene in Spanish than in French or American turpentine.

—W. E. F. P.

Nopinic acid; Reaction of ——. B. Dorronsoro and E. Fernandez. Ann. Soc. Espan. Ph. Ch., 1913, **11,** 441—443. Bull. Soc. Chim., 1914, **16,** 300.

The intense colour reaction given by nopinic acid and resorcinol in sulphuric acid solution has already been made known, and on the strength of this it has been stated that nopinic acid is produced by the oxidation of pinene with alkaline permanganate (see preceding abstract). The substance obtained however is merely sodium oxalate, the colour reaction with resorcinol being equally characteristic of oxalic acid, and moreover very sensitive.—G. F. M.

Acetanilide; Preparation of —— in the laboratory. Haussermann. J. Pharm. Alsace-Lorraine, 1914. J. Pharm. Chim., 1914, **10,** 375—376.

A mixture of equal weights of aniline and acetic acid together with 2—3% of zinc chloride is gently boiled under a reflux condenser for 3 hrs., when the whole is poured into water and the acetanilide recrystallised from water. The use of pure aniline in place of the commercial variety obviates the necessity of decolorising with animal charcoal.—F. Shdn.

Chloral. The polymerisation of ——. J. Bœseken and A. Schimmel. Rec. trav. chim. Pays Bas, 1913, **32,** 112—127. Bull. Soc. Chim., 1914, **16,** 50—51.

An immediate polymerisation of chloral to metachloral is produced by the addition of a small quantity of pyridine or sulphuric acid of 10% strength, the transformation being in the latter case almost complete, whilst in the former it is arrested by the absorption of the catalyst by the colloidal metachloral. By the addition of a large quantity of catalyst the equilibrium chloral ⇄ metachloral is displaced completely to the left, an addition product with the chloral being formed in the case of sulphuric acid which on warming dissociates with the liberation of carbon monoxide, hydrochloric acid and tetrachloroethylene. Aluminium chloride forms with chloral a crystalline addition product which dissociates in a similar way. Pyridine does not cause this dissociation of chloral.—G. F. M.

Chloroform; Presence of acetone in commercial ——. B. Dorronsoro and O. Fernandez. Ann. Soc. Espan. Ph. Ch., 1914, **12,** 191—202. Bull. Soc. Chim., 1914, **16,** 672.

Ten samples of commercial, and two of medicinal chloroform gave the reactions of Legal, Claissen, Kutscheroff and Denigès for acetone. The quantitative determination was made by a comparison of the specific gravity with that of known mixtures, or by the formation of the semicarbazide, but neither of these methods was very exact. The best results were obtained by Fuller's process, the formation of the oxime by the action of hydroxylamine hydrochloride, and titration of the liberated hydrochloric acid. The amount of acetone indicated was about 2% lower than by the density method, and varied from 10 to 23%.—G. F. M.

Isopropyl alcohol; Synthesis of ——. Reduction by hydrogen in the presence of aluminium. F. Lavilla Llorenz. Ann. Soc. Espan. Ph. Ch., 1914, **12,** 236—239. Bull. Soc. Chim., 1914, **16,** 631.

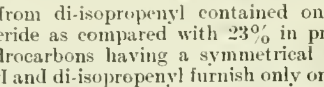
For the preparation of isopropyl alcohol from acetone Sabatier's method is preferable, other processes giving pinacone and condensation products. The action of sodium gives, according to Delacre, 40% of pinacone and only 12% of isopropylalcohol. The addition of aluminium in small pieces to a mixture of acetone and sodium hydroxide produces a slow evolution of hydrogen, and the yield of the alcohol varies from 45 to 50%. At the same time a small quantity of mesityl oxide is formed, but no pinacone.—G. F. M.

Polymerisation; Studies on ——. Diethylenic hydrocarbons. S. V. Lebedeff. J. Russ. Phys.-Chem. Soc., 1913, **45,** 1249—1295. Bull. Soc. Chim., 1914, **16,** 78—80.

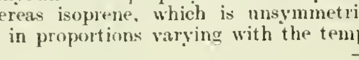
All unsaturated organic hydrocarbons are capable of polymerisation under suitable conditions and the velocity of polymerisation may be markedly influenced by catalysts. Aliphatic aldehydes, for example, apparently quite stable under ordinary conditions polymerise rapidly in presence of traces of sulphuric or hydrochloric acids. In most cases cyclic compounds are formed, and the ring always contains an even number of carbon atoms. Polymerisation is indicated by increase of viscosity, which is usually greater the lower the temperature of polymerisation. Isoprene and di-isopropenyl polymerise even below 0° C. The most suitable temperature is 100°—150° C.: at higher temperatures the reactions are more complex. In the author's experiments the hydrocarbons were heated in sealed tubes at 100°—150° C., and the product distilled in a current of hydrogen : the unaltered substance passes over at ordinary pressure and the dimeride at 8—15 mm. pressure, whilst the polymeride remains behind. The higher the temperature the higher is the ratio of the dimeric to the polymeric forms, whilst at constant temperature this ratio remains constant throughout the transformation. The ratio is also affected by the presence of catalysts : when oxygen was removed from the tubes before heating, the product from di-isopropenyl contained only 16·4% of the polymeride as compared with 23% in presence of oxygen. Hydrocarbons having a symmetrical structure, such as divinyl and di-isopropenyl furnish only one dimeric form ; whereas isoprene, which is unsymmetrical, furnishes two, in proportions varying with the temperature. —A. S.

Hydrocarbons of the divinyl series ; Polymerisation of some ——. S. V. Lebedeff and N. A. Skavronskaia. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1296—1331. Bull. Soc. Chim., 1914, **16**, 80—83.

The dimeride of divinyl is ethenylcyclohexene

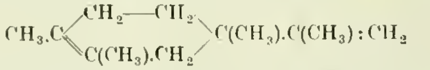


and the ozonide of the polymeride has the constitution



$$\big(.CH_2.\underbrace{CH.CH}_{O_3}.(CH_2)_2.\underbrace{CH.CH}_{O_3}.CH_2.\big)_x.$$

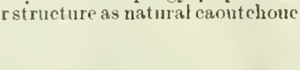
Di-isopropenyl, obtained from pinacone by dehydration in presence of acetic anhydride, was completely converted into an insoluble spongy mass on exposure to light at the ordinary temperature. Polymerisation was also effected at 50°, 100°, and 150° C., and the products separated by distillation (see preceding abstract). The dimeride



is a colourless liquid, b. pt. 205° C. at 750 mm., sp. gr. 0·8597 at 20°/4° C., $n_D = 1·48074$. The polymeride has the constitution

$$[.CH_2.C(CH_3) : C(CH_3).(CH_2)_2.C(CH_3) : C(CH_3).CH_2.]_x$$

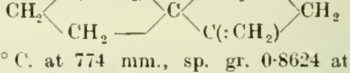
Its ozonide, $C_6H_{10}O_3$, yields acetonylacetone on decomposition with water. Isoprene was prepared by Favorsky's method (hitherto unpublished), the crude product mixed with trimethylethylene, obtained by the decomposition of oil of turpentine, being treated with a cooled solution of hydrobromic acid in acetic acid. From the reaction product amyl bromide was removed by distilling at 52°—53° C. at 100 mm., and the residue was then distilled at 23 mm., the bromide $(CH_3)_2CBr.CH_2.CH_2Br$, passing over at 80°—82° C. This was then heated with powdered potassium hydroxide at 150° C., under a reflux condenser, the isoprene passing over to a cooled receiver. The pure isoprene had the sp. gr. 0·6803 at 20°/4° C., b. pt. 34·5°—35° C., $n_D = 1·42207$. On heating it yielded a viscous mixture of a polymeride and two dimerides, of which one is dipentene, b. pt. 174°—175° C., sp. gr. 0·8454 at 20°/0° C., $n_D^{19·7} = 1·47428$; and the other, dimethyl-1.3-ethenyl-3-cyclohexene-6,



b. pt. 160°—161° C., sp. gr. 0·8331 at 20°/0° C., $n_D^{19·7} = 1·46581$. When isoprene is polymerised at the ordinary temperature, only a white spongy polymeride, having the same molecular structure as natural caoutchouc, is formed. —A. S.

Allene ; Polymerisation of ——. S. V. Lebedeff. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1357—1372. Bull. Soc. Chim., 1914, **16**, 83—85.

When allene was heated at 140°—150° C. in Ipatieff's high-pressure apparatus, the pressure fell in 3 days from 58 to 16 atmospheres, and the hydrocarbon was in part converted into a semi-solid yellowish mass similar to caoutchouc. This polymeride does not resemble those obtained from other allenic hydrocarbons, and possibly the metal of the apparatus exerted a catalytic influence. To avoid this, allene was condensed in glass tubes at —80° C., the air in the tubes was replaced by nitrogen, and they were then sealed and heated in Ipatieff's apparatus, which was filled with hydrogen at 100 atmospheres pressure to prevent bursting of the tubes. After 3½ days at 140° C. one-half of the allene was polymerised. The reaction product was distilled in a current of hydrogen at varying diminished pressures, the approximate yields of the different polymerides being ; dimeride, 5 ; trimeride, 15 ; tetrameride-α, 5 ; tetrameride-β, 22 ; pentameride, 18 ; hexameride, 10 ; and residue (colourless gum-like solid insoluble in the usual solvents), 25%. The dimeride is dimethylene-1.2-cyclobutane, b. pt. 63°—65° C., sp. gr. 0·7698 at 20°/4° C., $n_D^{20} = 1·42317$. It belongs to the divinyl series and polymerises almost completely in a few hours at 150° C., yielding a small proportion of the tetrameride-α of allene but chiefly a transparent solid polymeride. The trimeride,



b. pt. 135° C. at 774 mm., sp. gr. 0·8624 at 20°/4° C., $n_D^{2} = 1·48064$. The tetrameride-α is a colourless liquid having an odour similar to that of turpentine : it boils at 72°—74° C. at 9 mm., sp. gr. 0·8955 at 20°/4° C., $n_D^{20} = 1·53301$. The tetrameride-β, which belongs to the normal type of allenic polymerides, is a colourless liquid with an odour of petroleum : b. pt. 101° C. at 10 mm., sp. gr. 0·9346 at 20°/4° C., $n_D^{20} = 1·52624$. The pentameride is a nearly odourless liquid of b. pt. 131°—132° C., at 10·5 mm., sp. gr. 0·9498 at 20°/0° C., $n_D^{20} = 1·52814$. The hexameride is a nearly odourless liquid, slightly more fluid than glycerol : b. pt. 170° C. at 10 mm., sp. gr. 0·9721 at 20°/0° C., $n_D^{20} = 1·53869$.—A. S.

Hydrocarbons of the diallyl series ; Polymerisation of ——. S. V. Lebedeff. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1372—1373. Bull. Soc. Chim., 1914, **16**, 89.

Diallyl when heated for 8 days at 140°—200° C. remained unchanged, but after 10 days at 250° C., 40% was polymerised : isomerisation also occurred to some extent. The crude reaction product was a mixture of about 15% of a liquid dimeride (b. pt. 97°—98° at 20 mm.) and 85% of a colourless insoluble polymeride resembling caoutchouc. Hexadiene-2.4 when heated at 150° C. yielded a dimeride of b. pt. 86°—90° C. at 20 mm., and after 10 days at 250° C. a dimeride of b. pt. 90°—98° C. (chiefly 96°—98° C.) at 20 mm. ; in both cases the product was different from and more soluble in chloroform than that obtained from diallyl.—A. S.

Hydrocarbons of the divinyl and allene series ; Velocity of polymerisation of ——. S. V. Lebedeff. J. Russ. Phys.-Chem. Soc., 1913, **45**, 1373—1388. Bull. Soc. Chim., 1914, **16**, 89—90.

In the case of divinyl hydrocarbons those in which the terminal carbon atoms of the conjugated system, C : C.C : C, are substituted, polymerise less rapidly than those in which the intermediate carbon atoms are substituted. The velocity of polymerisation increases when ring formation occurs in the chain containing the conjugated system. In a homologous series increase of the mass of the substituents attached to the intermediate carbon atoms of the conjugated system increases the velocity of polymerisation, whilst the reverse is the case if the groups are attached to the terminal carbon atoms. This applies only to aliphatic groups : phenyl, for example, considerably increases the velocity of polymerisation, even when attached to a terminal carbon atom as in phenyl-1-butadiene-1.3. In the case of allenic hydrocarbons, the velocity of polymerisation increases with the mass of the substituting group in a homologous series and the position of the substituents is without influence.—A. S.

Allenic group, C : C : C ; Polymerisation as a means of detecting the ——. S. V. Lebedeff. J. Russ. Phys.-Chem. Soc., 1913, **45,** 1390—1391. Bull. Soc. Chim., 1914, **16,** 90.

ALLENIC hydrocarbons are polymerised almost completely in 1 or 2 days at 150° C., furnishing one or several dimerides of the type,

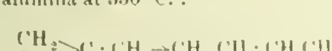
$$\begin{array}{l} C:C-C \\ C:C-C \end{array}$$

When oxidised with permanganate in aqueous acetone solution these yield substituted succinic acids easy to identify. The dimerides are also characterised by their optical exaltation, the observed molecular refraction being usually greater than the calculated by more than 2, whereas the dimerides of other diethylenic hydrocarbons are optically normal.—A.S.

Methylenecyclopropane (and divinyl). B. K. Merejkowsky. J. Russ. Phys.-Chem. Soc., 1914, **45,** 2072. Bull. Soc. Chim., 1914, **16,** 552—553.

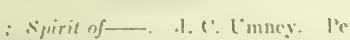
By the action of zinc and 80% alcohol on tetrabromoisobutane a gaseous mixture is obtained which on oxidation with 1% permanganate gives oxalic acid in addition to the ordinary oxidation products of isobutylene. The oxalic acid is derived from methylenecyclopropane which is formed, together with isobutylene, in the first reaction :

$(CH_2Br)_3CBr \rightarrow (CH_2Br)_2C:CH_2$



$$\rightarrow \begin{array}{l} CH_2 \\ CH_2 \end{array}\!\!>C:CH_2 + (CH_3)_2C:CH_2.$$

Methylenecyclopropane is transformed into divinyl when passed over alumina at 350° C. :



$$\begin{array}{l} CH_2 \\ CH_2 \end{array}\!\!>C:CH_2 \rightarrow CH_2.CH:CH.CH_2.$$

—A. S.

Nitrous ether ; Spirit of——. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, **5,** 416—417.

FOR calculating the allowance of drawback on exported spirit of nitrous ether, the percentage of alcohol in the spirit is determined in the Government Laboratory by Thorpe and Holmes' method (this J., 1903, 232). The results obtained by this method are accurate, and are much lower than would be expected from the specific gravity. The loss of alcohol in manufacture amounts to nearly 10% of the quantity used. In the presence of excess of water ethyl nitrite decomposes in a few hours into alcohol and nitrous acid. Solutions should be made in strong alcohol and only diluted when required.—F. SHDN.

Titration of silver in argentum colloidale and argentum proteinicum. A. Korndörfer. Apoth. Zeit., Nov. 11, 1914. Pharm. J., 1914, **93,** 809.

Argentum colloidale.—0·2 grm. is dissolved in 5 c.c. of water, and 5 c.c. of dilute sulphuric acid is added ; the mixture is slightly heated, and subsequently boiled with 10 c.c. of 3% H_2O_2 till it is colourless. On cooling it is diluted with 50 c.c. of water and titrated with *N*/10 NH_4CNS solution, using iron-ammonium-alum as an indicator. One c.c.=0·0108 grm. silver. *Argentum proteinicum.*—0·5 grm. is dissolved in 5 c.c. of water, 5 c.c. of dilute sulphuric acid is added, the mixture slightly heated and subsequently boiled with 15 c.c. of 3% H_2O_2 till the colour is yellow. On cooling, it is diluted with 100 c.c. of water and titrated with *N*/10 NH_4CNS solution.

Drugs and chemicals ; Effect of the War on the supply of ——. Discussion at a meeting of the Pharmaceutical Society, Dec. 8, 1914. Pharm. J., 1914, **93,** 797—804.

PROF. H. G. GREENISH called attention to the progress made during the past 50 years in the cultivation of medicinal drugs (cinchona, coca, ipecacuanha, cloves, vanilla, opium, rhubarb, cubebs, etc.) and stated that the number of medicinal plants cultivated in the various parts of the Empire could be materially extended, and possibly the quality improved as in the case of cinchona. D. Hooper had shown that foxglove and other plants grown in India were equal in efficiency to the European plants. In most cases if the supply of a crude drug became exhausted, a satisfactory substitute could be found.

Mr. E. A. UMNEY dealt mainly with the fluctuation in prices of drugs and essential oils since the outbreak of war and stated that the action of the Government in consultation with the Drugs Advisory Committee, in framing an effective schedule of contraband of war and allowing departure from it only under definite conditions, had done much to prevent clearance of existing stocks and excessive rise of prices. There had not been an actual shortage of any of the essential oils, but supplies of atropine and atropine sulphate and henbane leaves are unavailable at present and the supplies of various other drugs have been considerably restricted. In connection with the position of Russian cantharides, it was pointed out that the new Pharmacopœia includes preparations made from cantharidin, which is produced much more largely from the Chinese than from the Russian flies. The curtailment of the confectionery trade, due to the high price of sugar, has led to a fall in prices of many essential oils used in that trade, notably peppermint and anise oils. The lesson to be drawn from the existing conditions is the necessity for extended cultivation of drugs and aromatic plants throughout the Empire.

Mr. C. A. HILL pointed out that the scarcity of chemicals is not confined to those of foreign origin. Morphine and codeine, for example, the shortage in the supply of which is due to the unusually great demand, are manufactured in England, and now that the supply of Turkish opium is cut off, will be made to a larger extent than hitherto from Indian and Persian opium. Epsom salts, previously imported from Germany, are being made in England from magnesite. There are very considerable stocks of crude potash salts available for the production of pure potassium salts, and a shortage is unlikely since the restricted demand for soap making, fertilisers, etc., due to the high price, will leave a larger supply available for medicinal purposes. Both potash and iodine could be obtained by a resuscitation of the kelp industry, and bromine could, if necessary, be obtained from sea-water. Santonin is obtained from plants grown almost exclusively in Russia under Government control, but the manufacture during the past four years has been entirely in the hands of a German syndicate, and the price has been raised systematically until it reached 115s. per lb. in July last : it has since risen to 220s. owing to the shortage in the supply. Liquid medicinal paraffin was prepared exclusively from Baku petroleum refined at Hamburg. Russia has prohibited the exportation of crude petroleum and the Drugs Advisory Committee has recommended that the Government should endeavour to obtain from the Russian Government a supply of petroleum, which might be refined in the United Kingdom. American and Caucasian petroleums were different in character to Baku petroleum, and might not have the same medicinal effect. Some solvents and reagents not manufactured on a large scale in England, but readily obtained at low prices in Germany are carbonyl chloride, carbon tetrachloride, chlorides and oxychloride of phosphorus, acetic anhydride, acetyl chloride, chloroacetic acids, benzyl chloride, acetoacetic ester, phenylhydrazine, di-, tri-, and tetra-chloroethylene and tetra- and penta-chloroethane (suggested as rubber solvents ; dichloroethylene is used in pharmacy as a solvent for iodine), and ethylene dichloride and ethylidene dichloride (by-products in the manufacture of chloral ; used for the manufacture of lysidine). The production on the large scale of sodium salicylate which will give a colourless aqueous solution is a difficult task, which has not yet been performed in the United Kingdom. The manufacture of synthetic chemicals, except in certain favourable instances, cannot be carried on profitably except on a very large scale, and the industry cannot be established unless security for the future for a sufficient period to admit an adequate return upon capital outlay is ensured.

Mr. F. W. GAMBLE called attention to the dependence upon Continental sources for supplies of laboratory glassware, tubing, scientific instrument and optical glass. The cost of glass tubing has increased 50% and the supply is still short. Having regard to the advantages of Continental countries in respect to raw materials, especially fine sand, England will probably not be able successfully to compete in this industry when normal conditions are restored. Glass of the Jena type does not appear to be made in England, though its manufacture presents no special difficulties. According to analyses made by Prof. Jackson the composition of Jena glass differs essentially from that given in the patent specification covering its manufacture.

Mr. R. R. BENNETT dealt with the supply of chemicals or other medicinal products of which the manufacture is protected by a patent owned by an enemy alien, or which are commonly known by a name in which there exists trade-mark rights owned by an enemy alien. (See also this J., 1914, 1118.)

Prof. A. W. CROSSLEY stated that chloroacetic acid and chlorides of phosphorus could be made in England and that there was no shortage in the supply of acetone.

Mr. E. M. HOLMES considered that the cultivation of medicinal plants in the United Kingdom was not profitable except in cases where there was an enormous demand.

Mr. FINNEMORE said that American liquid paraffin, provided its unpleasant taste were masked by emulsification or by flavouring, could replace the Russian product to some extent, and emulsified soft paraffin might also be used.—A. S.

Camphor production in India. Chamber of Commerce J., Dec., 1914.

THE camphor tree (*Cinnamomum camphora*) has been successfully planted in Burma, Ceylon, and the Federated Malay States. In Burma there are plantations in the upper Chindwin, Myitkyina, Bhamo, and southern Shan States. There are experimental plantations in the Nilghiri Hills and in certain isolated patches of Bombay and Madras. In Ceylon the tree grows only in the more elevated parts; there is a plantation at Hakgala. Great difficulty has always been experienced in getting good seed imported direct from Japan, and there is often wholesale failure to germinate. The seeds sown for the Burma plantations were obtained from Hong Kong. Camphor is also obtained from an evergreen shrub (*Blumea balsamifera*), which is indigenous to the Shan States of Burma. It also grows in the islands of Hainan and Formosa and in South China.

Volatile and essential oils. Board of Trade Bulletin No. 100.

MAY be obtained from the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, E.C.

Report of Chemical and Dyestuffs Committee to New York Section of Amer. Chem. Soc. *See* Trade Report.

PATENTS.

Bacterial preparations and preparations for the treatment of gonorrhœal diseases. C. C. Warden, Los Angeles, U.S.A. Eng. Pat. 22,395, Oct. 4, 1913.

BACTERIA such as the *Gonococcus*, *Pneumococcus*, *Meningococcus*, or *Staphyllococcus albus urethræ* are suspended in 0·01 to 0·02% hydrochloric acid, or 0·04% formaldehyde solutions. Such solutions arrest the enzymatic activity of the bacteria without destroying them, and thus prevent autolysis; they may be injected into animals, from which serum is prepared subsequently in the usual manner.—T. F. B.

Hydrogenation; Catalytic ——. M. A. Adam, London. Eng. Pat. 24,815, Oct. 31, 1913.

INTIMATE contact between the reacting materials in the catalytic hydrogenation of liquids, is secured by bubbling the gas from a number of points into a bulk of liquid; coalescence of gas bubbles from adjacent delivery points is prevented by suitable partitions. In one form of apparatus, the hydrogen is supplied vertically through a number of nozzles at the lower part of an upright cylindrical vessel; each nozzle projects into the lower end of a separate vertical tube, open at each end, and these tubes are preferably packed closely together. The tubes may be insulated from each other at the top and bottom, and so converted into a series of electrical heating elements. By a suitable adjustment of the size of the tubes, the gas flow, and the height of liquid in the tubes, the liquid can be treated in the form of a climbing film or a tall column of froth.—T. F. B.

Magnesium salts of acylated aromatic ortho-oxycarboxylic acids. R. Berendes and E. Rietz, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,113,742, Oct. 13, 1914. Date of appl., Jan. 5, 1914.

THE magnesium salts of acylated aromatic *o*-hydroxycarboxylic acids (especially acetylsalicylic acid) are obtained by treating the acid in aqueous suspension with a magnesium compound, *e.g.*, the hydroxide, oxide, or carbonate, evaporating in a vacuum at a low temperature, and washing the crystalline product with acetone. The salts are more readily soluble in water than the acids from which they are derived, and possess similar medicinal properties.—T. F. B.

Alkali metal salts of 3.3′-diamino-4.4′-dioxyarsenobenzene combined with copper and process of making same. P. Ehrlich and P. Karrer, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,117,352, Nov. 17, 1914. Date of appl., Jan. 24, 1914.

SEE Eng. Pat. 1247 of 1914; this J., 1914, 942.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Monobromoquinolsulphonic acids and their conversion into monobromoquinonesulphonic acids. A. Seyewetz and J. Paris. Bull. Soc. Chim., 1914, **15**, 121—125.

THE monobromoquinol obtained by treating quinol dissolved in chloroform and ether with a solution of bromine in chloroform, was sulphonated with acid containing 15% anhydride, at a temperature below 50° C.; a colourless monosulphonic acid was obtained, soluble in water, insoluble in organic solvents, and possessing the properties of a photographic developer. On oxidation with sodium bichromate and sulphuric acid it was converted into the corresponding bromoquinonesulphonic acid, a yellow substance unstable in aqueous solution. An isomeric bromoquinolsulphonic acid, possessing similar properties, was obtained by treating sodium quinonesulphonate with hydrobromic acid below 30° C.; at temperatures above 30° C., the known 2.6-dibromoquinol was produced, proving that the monobromosulphonic acid has the constitution, $OH : OH : Br : SO_3H = 1 : 4 : 2 : 6$. Oxidation of this by chromic acid gave rise to the corresponding bromoquinonesulphonic acid, which is deeper in colour and more unstable in solution than its isomeride.—T. F. B.

PATENTS.

Photographic emulsions. J. H. Christensen, Holte, Denmark. Eng. Pat. 25,419, Nov. 6, 1913.

SILVER bromide or chloride is emulsified in collodion, using a solvent which will produce an impermeable film in which the silver salt is distributed evenly, and not mainly on the surface, as is the case when ether-alcohol is used. The emulsion may be made by treating 12 grms. of collodion silver bromide with 40 grms. of amyl acetate and adding 60 grms. of isobutyl alcohol. When thin films prepared in this way are exposed and developed with glycin, *p*-aminophenol, or similar developers not requiring alkali carbonate, the permeability of the finished film will be greater in those parts which contain reduced silver. Addition to the emulsion of small quantities of certain substances (*e.g.*, 0·1 grm. of benzoic acid to 100 c.c.) facilitates development. If these films are applied to gelatin films supported on glass plates, and then immersed in a solution of a dyestuff, coloured gelatin images may be produced; or if the glass is replaced by metal, and the plates are immersed in an etching liquid, the process can be used to produce photomechanical printing plates.—T. F. B.

Cellulose compound [photographic films]. D. E. Reid, Assignor to Eastman Kodak Co., Rochester, N.Y. U.S. Pat. 1,116,627, Nov. 10, 1914. Date of appl., Jan. 31, 1914.

Photographic films are made of "reverted" cellulose with which is incorporated a "filling" of non oleaginous material which is practically insoluble in water, soluble in alcohols and other solvents miscible with water, practically colourless, has no appreciable effect on the photographic emulsion, and does not react with the chemicals used in photography in such a way as to reduce the transparency of the sheet. Triphenyl phosphate may be used as the filling material.—T. F. B.

Colour photography and kinematography. W. F. Fox, W. H. Hickey, and Kinemacolor Co. of America, New York. Eng. Pat. 552, Jan. 8, 1914.

A negative of a particular object, from which certain colour sensations have been omitted (*e.g.*, taken through a red filter), is superimposed in register on a positive from a negative from which certain other colour sensations have been omitted (taken through a green filter). From this negative and positive a printing negative is made by transmitted light, and from this a positive is made, preferably on a transparent film. This positive is immersed first in an acid solution of a green colouring matter or toning bath such as a solution of a vanadium salt, and then in an alkaline red staining bath. This process is said to produce a picture in "substantially" the colours of the original object. If extra brilliancy in the final print is required, it is desirable to coat the reverse side with an emulsion and to print on it successively, in register, from the two original negatives. Reference is directed in pursuance of Sect. 8, Sub-sect. 2, of the Patents and Designs Act, 1907, to Eng. Pat. 7368 of 1913 (this J., 1914, 503).—T. F. B.

Photographic colour processes. W. F. Fox, W. H. Hickey, and Kinemacolor Co. of America, New York. Eng. Pat. 8728, April 7, 1914.

Two negatives are taken of an object through different light filters (*e.g.*, red and green) and positives are prepared from them on transparent material. The red positive is now printed by transmitted light on a print from the green negative, forming the "colour negative," and the green positive is printed on a print from the red positive producing the "monochrome negative." The "colour negative" is now printed on one side of a sensitised film coated on both sides, and the "monochrome negative" is printed on the other side. After development and fixing, the film carrying the print from the "monochrome negative" is fixed and waterproofed, and the film is immersed in an acid green staining bath and then in a red staining bath. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 7368 of 1913 (this J., 1914, 503).—T. F. B.

Photographic film. V. Planchon, Assignor to Soc. des Plaques et Papiers Photographiques, A. Lumière et ses fils, Lyons, France. U.S. Pat. 1,116,479, Nov. 10, 1914. Date of appl., May 13, 1907.

See Fr. Pat. 375,433 of 1907 and Addition thereto; this J., 1907, 1029.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Specific gravity separation applied to the analysis of mining ——. C. G. Storm and A. L. Hyde. Techn. Paper 78, 1914. U.S. Bureau of Mines. 13 pages.

Chemical analysis of a mixture of salts indicates the quantities of the various ions present, but throws no light on the manner in which these were combined in the original mixture. After removal of nitroglycerin and oily matter by means of ether the finely powdered and dried salts can be roughly separated by treatment in a separating funnel with mixtures of chloroform (sp. gr. 1·49) and bromoform (2·83) of specific gravity between those of the salts expected, most of which, as shown in a table, lie between 1·5 and 2·5.—O. E. M.

Report of Chemicals and Dyestuffs Committee to New York Section of Amer. Chem. Soc. *See* Trade Report.

Patents.

Explosive. W. T. Hoynes, Cleveland, Ohio, U.S.A. Eng. Pat. 6755, March 17, 1914.

Spherical grains of an explosive (*e.g.*, a chlorate explosive) are produced by tumbling dry nuclei of explosive material in the presence of a dust-like explosive of the same nature, and adding a small portion of a moistening liquid in the form of mist. These operations are continued until the spheres are of the required size. The apparatus described comprises an inclined rotating drum into which the dry powdered explosive is fed from a hopper, in the outlet of which is a rotating brush. A suitable quantity of grains of the explosive is placed in the drum, and as this is rotated, the dry powdered explosive is distributed over the grains by rotating the brush, and at the same time water is sprayed in, until pellets of the desired size are obtained.
—G. W. McD.

Explosive compounds. F. R. and J. G. Burrows, Port Arthur, Ontario, Canada. Eng. Pat. 11,582, May 11, 1914.

Ammonium perchlorate (6 parts), potassium nitrate (56), aluminium (18) and paraffin wax (2 parts).—G. W. McD.

Black powder; Aluminium glazed ——. F. Sparre, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,116,944, Nov. 10, 1914; date of appl., Sept. 20, 1913.

Granulated black powder is coated with aluminium.
—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Thermostat; A ——, for low temperatures. J. H. Walton, jun., and R. C. Judd. J. Phys. Chem., 1914, 18, 717—721.

The thermostat is capable of working between 0° and —20° C. The primary bath, A, (Fig. 1) of heavy galvanized iron (18 in. square by 14 in. deep) is insulated with a 4-in. layer of sawdust and contains a mixture of ice, salt, and water which is circulated by means of the turbine, C, (1/10 h.p. motor) through a coil, D, passing into the secondary bath, B. The latter contains a mixture of 2 parts of water to 1 part of glycerin and 1 part of alcohol and is insulated in the wooden box, M, by means of a 1-in. layer of felt and a tight cover with an external ¼ in. felt lining. The cold brine is filtered through fine copper gauze at the intake of the pump. The secondary bath contains a screw-shaped stirrer, F. The double

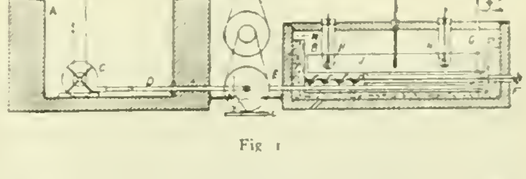


Fig. 1

observation window, J, has an insulating air layer of $\frac{3}{4}$ in. between the panes: this contains the two 4 c.p., 6 volt incandescence lamps, H, H. The lag of the ordinary toluene thermo-regular is avoided partly by using a steel tube, G, filled with mercury, and partly by the slowly rotating wheel, K, which imparts an eccentric motion to the platinum contact wire of the thermo-regulator. Fig. 2 illustrates the automatic cock regulating the influx of cold brine from the primary bath. A wooden wheel, E, is attached to the rod, Y, which operates the cock, Q. The rubber stoppers, S, S, limit the movement of E. The nine-point rocking switch, L, is connected to E by the string, X. In adjusting the thermostat the nut, Z, is loosened so that the consequent opening of the cock brings the temperature to within a fraction of a degree of that required. E is then turned to the right-hand limit and the nut tightened. Rotation of E to the left now causes progressive opening of the cock and consequent inflow of cold brine into the secondary bath. This operation is effected automatically at the proper moment—*i.e.*, when the temperature of the bath becomes too high—through the thermo-regulator throwing the motor, P, into a 110-volt alternating current circuit. The consequent movement of E pulls the rocker of the switch to the left; as soon as the points of the rocker leave the mercury cups on the right the 110-volt circuit is broken: and contact with the mercury cups on the left reverses the fields of the motor. Cold brine now enters the secondary bath till contraction of the mercury in the thermo-regulator breaks the current through the relay and re-starts the motor: E rotates to the right, the cock closes, and the 110-volt current shuts off; and so on. Binding posts or wires bearing the same number in Fig. 2 are connected directly, *e.g.*, 6 on the relay to 6 on the rocker switch. At —12° C. during a run of 6 hours the temperature was constant within 0·03°. The temperature may be kept as low as —25° to —30° C. by using a mixture of ice and calcium chloride in the primary bath; and for high temperatures the latter could be replaced by a boiler generating superheated steam.—J. R.

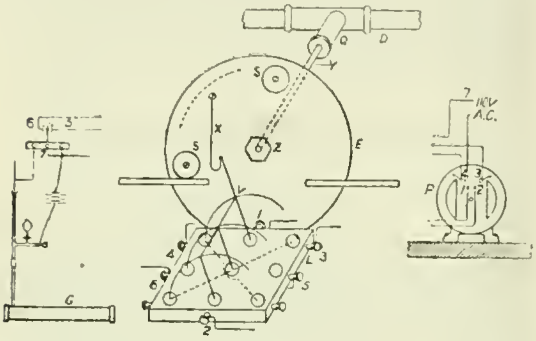


Fig 2

Nickel; The electrolytic determination o ——. W. J. Marsh. J. Phys. Chem., 1914, **18**, 705—716.

Electroanalysis according to Classen's oxalate method is applicable to the determination of tin, but not to that of nickel or cobalt. In the case of nickel the addition of various "dopes" to the solution proved ineffective: small amounts of urea merely resulted in a somewhat more rapid deposition of the metal, while the accompanying carbon deposition was unaffected. Decreasing the size of the anode augmented the tendency of the nickel to deposit as peroxide. The following method gave reliable results: 200 c.c. of a solution containing about 0·2 grm. Ni (as $(NH_4)_2SO_4.NiSO_4.6H_2O$), 15 to 20 c.c. of ammonia (sp. gr. 0·96), and 5 grms. $(NH_4)_2SO_4$, and free from nitric acid, nitrates and chlorides, was electrolysed in a 350 c.c. beaker, using a 10-grm. platinum-wire gauze flag anode (52-mesh and 6 × 4·5 cm.) and a rotating (550—650 revs. per min.) pure copper gauze cathode (50-mesh and 5 cm. high × 3 cm. diam.). With a current of 0·8 amp. ± 0·1 at 3·5 volts ± 0·2, the time required for a determination at the ordinary temperature was about 25 mins. The mean values of 22 experiments were: current, 0·75 amp.; time, 25 mins.; weight of Ni found, 0·1336 grm.; error, +0·0002 grm.—a series of standard determinations being made by the dimethylglyoxime method. The copper-wire gauze cathode was also used successfully in the determination of Cu, Sn, Co, Cd, Bi, Ag and Zn; and for Pb and Mn by deposition as peroxides on a platinum-wire gauze anode. Stiff, twisted copper-wire was used for the stems, and the gauze was riveted with small copper tacks. Such cathodes may be used repeatedly if dipped into nitric acid (1 : 1) for a few minutes after each determination.—J. R.

Tin; Quick method to precipitate —— electrolytically. L. Humphreville. Eng. and Min. J., 1914, **98**, 964.

The tin (0·2—0·3 grm.) is separated as sulphide, dissolved in ammonium sulphide (16 c.c.), 20 c.c. of sodium sulphite solution (40%) added, the liquid diluted to 120 c.c., and electrolysed at 60° C. with a current of 5·5 amp. at exactly 4 volts; cylindrical gauze electrodes are employed, one within the other, and the electrolyte agitated by a stirrer making 600 revolutions per min., the deposition of the metal being effected in 25 mins. Before use, the platinum cathode is either coated with copper and tin in succession or with cadmium alone. The accuracy of the process is sufficient for technical analysis but is impaired by the impurities present in ordinary ammonia solution; for this reason the ammonium sulphide used is prepared by saturating with hydrogen sulphide a solution of ammonia (sp. gr. 0·91) obtained by dissolving the gas (compressed) in water. Sodium sulphite is employed to render the tin solution colourless.—W. E. F. P.

Zirconium; Separation of —— from aluminium. F. Ferrari. Atti R. Istit. Veneto di Sci., 1914, **73**, 445. Annali Chim. Appl., 1914, **2**, 276.

Zirconium can be separated from aluminium by means of cupferron (the ammonium salt of phenylhydroxylamine), which precipitates it quantitatively from acid solution. (See also this J., 1914, 944.)—A. S.

Electric conductivity of saline solutions; Portable apparatus for measuring the ——. P. Saviron. Ann. Soc. Espan. Ph. Ch., 1913, **11**, 495—498. Bull. Soc. Chim., 1914, **16**, 320.

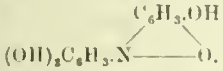
The apparatus has the general arrangement of the Wheatstone bridge with three known resistances. The fourth gap is occupied by a voltameter with separable electrodes, the distance between them being measured on a graduated scale. The voltameter is closed by an ebonite stopper through which passes the insulated stem of the movable electrode, and the whole is protected by a metal case. Conductivities varying between 0·0000670 and 0·00396, representing solutions of potassium chloride containing from 31 to 2·247 mgrms. per litre, can be measured with the apparatus, and its application to the determination of the conductivities of mineral waters has given good results.—G. F. M.

Phenols; Certain colour reactions of the ——. J. G. Carrancio and L. Gomez. Ann. Soc. Espan. Ph. Ch. 1914, **12**, 240—243. Bull. Soc. Chim., 1914, **16**, 672.

The oxidisability of phenols in alkaline solution and the acceleration of the oxidation by metals has wrongfully led to the proposal of certain phenols as reagents for such metals. Copper for example gives a blue colour with phenol and ammonia, but the same colour is produced by nickel and zinc, and, in 24 hours, in the absence of any metal at all. Even the blue coloration of resorcinol with an ammoniacal solution of a zinc salt is produced by nickel, by atmospheric oxygen, and by hydrogen peroxide, and an examination of the absorption spectrum shows that it is the same compound in every case, probably an unstable peroxide.—G. F. M.

Phenols ; Observations on certain colour reactions of the ——. [*Detection of zinc.*] A. del Campo. Ann. Soc. Espan. Ph. Ch., 1914, **12,** 243-247. Bull. Soc. Chim., 1914, **16,** 735—736.

In spite of the researches of Carrancio and Gomez (see preceding abstract) the blue colour reaction produced by the salts of zinc with ammoniacal solutions of resorcinol retains its value from the point of view of the detection of zinc, since it is the only colour reaction of that metal. The coloration is turned to red in the presence of acids, and it is possibly due to the formation of lacmoid,



$$\begin{array}{c} C_6H_3.OH \\ / \quad \backslash \\ (OH)_2C_6H_3.N\text{———}O. \end{array}$$

a condensation accelerated by the catalytic influence of the zinc salts.—G. F. M.

Saturated and unsaturated hydrocarbons ; Separation of mixtures of —— by means of potassium permanganate. S. S. Nametkine. J. Russ. Phys.-Chem. Soc., 1913, **45,** 1423—1429. Bull. Soc. Chim., 1914, **16,** 126.

An exact separation of saturated and unsaturated liquid hydrocarbons (cyclohexane and cyclohexene, normal hexane and hexylene) could not be effected with permanganate, but in the case of gases (propane and ethylene, propane and propylene, trimethylene and propylene) the unsaturated hydrocarbons were removed quantitatively by a saturated permanganate solution, without the saturated hydrocarbons being affected : the error was never more than 0·27%. It is necessary to use a special apparatus, because the permanganate solution attacks mercury.—A. S.

Oxydases ; General reagents for ——. J. Peset. Ann. Soc. Espan. Ph. Ch., 1914, **12,** 220—232. Bull. Soc. Chim., 1914, **16,** 799—800.

Two reagents are employed together, one being colourless but capable of yielding a colour on oxidation (*e.g.*, various leuco-bases etc.) and the other capable of oxidising the first in the presence of an oxydase. As a reagent of the former class, benzidine (in the presence of acetic acid) is very sensitive in the examination of blood ; hydrogen peroxide and sodium perborate are the most satisfactory oxidants.—W. E. F. P.

Viscosity measurement and a new viscosimeter. A. E. Flowers. Amer. Soc. Testing Materials, 1914. [Advance proof.] 52 pp.

The new viscosimeter consists essentially of a jacketed slanting tube mounted upon a rotating horizontal axis. Investigations are described which illustrate the laws of the resistance encountered by a sphere rolling down such a tube filled with a viscous liquid. For a given ratio (r) of diameter of sphere to bore of tube the time to roll a given distance at any given slope increases directly with the viscosity, provided that the angle of slope is chosen so that the motion is controlled by the viscous resistance, *i.e.*, so that the inertia of the liquid displaced offers no appreciable retarding force. For distilled water and aqueous glycerin containing from 34% of glycerol upwards the sine of the angle of slope was chosen as 0·132 and 0·5 respectively : the tube was 30 cm. long with a bore of 2 mm. ; and the diameter of the steel sphere was 1 mm. The value of r is conveniently made 0·5 : a sudden increase in rolling resistance occurs for ratios exceeding 0·75. The absolute viscosity (η) $=K.K\gamma.t$ dynes, where $K=$ a constant depending upon the diameters of the sphere and tube, the angle of slope and the distance covered by the rolling sphere ; $t=$ time of rolling in seconds ; and $K\gamma=$ a factor due to the densities of the materials used $= \dfrac{\gamma s - \gamma m}{\gamma s - 1}$, where γs and γm are the densities in grms. per c.c. of the sphere and the viscous liquid, respectively. The values of $K\gamma$ for Jena normal glass, hard steel, and platinum are represented graphically for values of γm ranging from 0·70 to 1·30. The available methods of measuring viscosity are reviewed, and it is suggested that the use of the present flow-type viscosimeters should be discontinued. Among the advantages claimed for the sphere-and-tube type of instrument are general applicability, *e.g.*, to black oils ; small amount of material needed ; protection from evaporation and from exposure to the room temperature between check readings, which are made by simple reversal of slope ; possibility of use at high temperatures and under pressure ; ready adaptation to very viscous liquids by the use of denser spheres, higher slopes, or, more especially, shorter roll distances ; general simplicity of the apparatus ; and economy in time.—J. R.

Testing of gasoline. Lidoff and Petroff. *See* IIa.

Methods for determining the melting point of asphaltums. Miller and Sharples. *See* IIa.

Determination of pyridine. Malatesta and Germain. *See* III.

[*Paper.*] *Detection of rosin or animal sizing.* Kollmann. *See* V.

Assay of Cobalt silver ores. Smoot. *See* X.

Sampling and analysis of tin, terne and lead-coated sheets. Aupperle. *See* X.

Utz's modification of Halphen's reaction for cottonseed oil. Gastaldi. *See* XII.

Detection and determination of solid hydrocarbons in admixture with fatty acids. Verona-Rinati. *See* XII.

Chemically resistant glass lacquer. Fox. *See* XIII.

Analytical processes of the British Pharmacopœia, 1914 Umney. *See* XX.

Polymerisation as a means of detecting the allenic group $C:C:C$. Lebedeff. *See* XX.

Titration of silver in Argentum colloidale and Argentum proteinicum. Korndörfer. *See* XX.

Specific gravity separation applied to the analysis of mining explosives. Storm and Hyde. *See* XXII.

XXIV.—MISCELLANEOUS ABSTRACTS.

Glycerinosols of gold. P. P. von Weimarn. J. Russ. Phys.-Chem. Soc., 1914, **45,** 2075. Bull. Soc. Chim., 1914, **16,** 515.

If a solution of auric chloride in anhydrous glycerol be heated to boiling, the bright yellow colour fades and from the moment the solution becomes colourless (formation of aurous chloride), conversion of the gold into a disperse phase begins, glycerinosols of gold having a steel blue colour by transmitted light being obtained. By using very dilute, nearly colourless solutions of auric chloride in glycerol, and suitably regulating the rate of cooling, glycerinosols of colours ranging from pink to blue can be obtained.—A. S.

Colloidal gold solutions ; Immediate coagulation of —— by gold, silver or aluminium foil. P. P. von Weimarn. J. Russ. Phys.-Chem. Soc., 1914, **45,** 2075—2076. Bull. Soc. Chim., 1914, **16,** 516.

On shaking 5 c.c. of a crimson gold hydrosol (prepared by Gutbier's method ; this J., 1914, 888) with pieces of gold, silver or aluminium foil, decolorisation was effected in 3 mins. with the gold, 1 min. with the silver, and in a few seconds with the aluminium. When the crimson hydrosol was left in contact with gold foil, without agitation, it became blue after 15 days. An alcohosol of barium sulphate which had been kept unaltered for 6½ years, showed no change when shaken for 5 mins. with gold foil, but coagulated on the following day. (See also this J., 1914, 670.)—A. S.

Cool flames with ether. A. Leighton. J. Phys. Chem., 1914, **7,** 619—622.

When ether is projected on to a heated surface in a dark room, a cool blue flame which does not char paper is observed, as was first described by Davy and later by W. H. Perkin and others. This is explained as being due to the slow combustion of a mixture of ether vapour heated to, or above, its ignition temperature, with a relatively small amount of air. The same effect is obtained by mixing ether with carbon tetrachloride, or with carbon bisulphide in a dish and applying a match, or by passing carbon dioxide through ether, or through carbon bisulphide, in a narrow cylinder and lighting the issuing gases.—G. H. F.

Oxidation by catalysts; Comparative study of —— of organic and inorganic origin. A. J. Ewart. Proc. Roy. Soc., 1914, B, **88**, 284—320.

Investigation of the oxydase action of salts of Cu, Fe, Cr, Pb, Mn, etc., and of the Na or K salts of ferro- or ferricyanic, phosphoric and chromic acids, shows a close correspondence between them and organic oxydases. The oxydase action may be accelerated by "sensitisers" such as sodium or potassium phosphates or chlorides, which may, for example, enable a peroxydase to work in the absence of a peroxide. Both organic and inorganic oxydases vary from strong to weak, and there is no justification for any real distinction, other than that of degree, between oxydases, peroxydases, and catalases, one and the same enzyme or metallic salt functioning in various ways according to circumstances such as the presence or absence of a sensitiser, attenuation, etc. Strong metallic poisons arrest the action of organic oxydases (apple, potato, etc.) or destroy them, hence they are probably proteins, with or without oxydase metals, in basic or acid combination. The above-mentioned sensitisers and inhibitors (barium chloride, acids) may in some cases with increasing concentration reverse their effects, whilst a substance which is a sensitiser with one oxidant may act as a reducing agent with another (copper sulphate and salt on indigo carmine). The influence of sodium chloride, etc., on plant metabolism may possibly be due to its behaviour as a sensitiser to oxydase action. Anæsthetics retard or inhibit catalase, but not oxydase action. Dried organic oxydases may retain their properties for three weeks; a glycerin extract for five or more months. The oxydases of beetroot and potato are among the strongest plant oxydases, and the nearest analogues are afforded by ferric salts and ferricyanides. Carrot and parsnip oxydase and malt diastase are oxydases of a feebler character.—G. F. M.

Trade Report.

Export prohibitions. Times, Dec. 8, 1914.

The London Gazette, of December 5th, states that the export of extracts for use in tanning is prohibited to all destinations.

Very few, if any, of the extracts used in tanning in this country are home manufactures or products, the goods of this class, which in the past have been sent abroad, having been exported after importation. France, Corsica, the United States of America, Newfoundland, and Turkey are the countries from which supplies are chiefly imported, whether for home use or re-export.

The Swedish Government has prohibited the export of woollen yarn, indiarubber, guttapercha, balata, refined gum, tinned or leaded ironplates, tinplates, copper, raw worked or electrolytic, copper dross, copper plates, copper wire, and of cup-shaped articles for the manufacture of cartridges of copper or brass.

The Danish Government has prohibited the export of malt and vegetable stearines for the manufacture of margarine, of raw material for the manufacture of powder and explosives, hematite iron ore, raw hematite iron, chrome iron, silicic, iron and nickel ore.

Chemicals and Dyestuffs Committee; Report of —— to New York Section of American Chemical Society. Textile Colorist, 1914, 36, 332—334.

Alterations of the tariff law are necessary to introduce the manufacture of explosives, medicinals, chemicals and dyestuffs into the United States. The United States produces sufficient quantities of raw products to supply a self-contained industry, and such an industry could be brought into being if there were a certainty of output in the nature of a demand from home users. To be independent of all foreign nations at all times as regards the supply of explosives, or to protect the textile industries using chemicals and dyestuffs and make them independent of foreign nations, the nation must bear the burden incident to such expansion.

The recommendations of the Committee are: (A) To prevent the unfair underselling alleged to be practised by foreigners in the United States, an effective anti-dumping clause should be adopted. (B) The so-called coal-tar "intermediates" which are the basis of the coal-tar chemical industry, inclusive of explosives, medicinals and dyestuffs, should be assessed one-half of whatever the finished dyes are taxed for tariff purposes; all coal-tar dyes without exception to be taxed alike, namely, 30% *ad valorem* and 7½ cents per pound specific. (C) Changes in the patent laws such as compulsory licensing or compulsory working clauses are wholly ineffective, do more harm than good and should not be attempted.

—G. H. F.

Contraband of War. Revised list. London Gazette Suppl., Dec. 23, 1914.

A new Royal Proclamation gives a revised list of articles which Great Britain will treat as absolute or conditional contraband. This list is in substitution for the one issued on October 29th. Sulphur and glycerin are now taken out of the category of conditional contraband; and several important additions and alterations are made in the schedule for absolute contraband.

The earlier schedule included the following articles under separate headings:—Sulphuric acid, hæmatite iron ore and hæmatite pig iron, nickel ore and nickel ferro-chrome and chrome ore, unwrought copper, aluminium, ferro-silicon, and rubber. In place of these, the new schedule includes the following:—

Ingredients of explosives—viz., nitric acid, sulphuric acid, glycerin, acetone, calcium acetate and all other metallic acetates, sulphur, potassium nitrate, the fractions of the distillation products of coal tar between benzol and cresol inclusive, aniline, methylaniline, dimethylaniline, ammonium perchlorate, sodium perchlorate, sodium chlorate, barium chlorate, ammonium nitrate, cyanamide, potassium chlorate, calcium nitrate, mercury. Resinous products, camphor and turpentine (oil and spirit). Ferro alloys, including ferro-tungsten, ferro-molybdenum, ferro-manganese, ferro-vanadium, ferro-chrome. Tungsten, molybdenum, vanadium, nickel, selenium, cobalt, hæmatite pig-iron, manganese. Wolframite, scheelite, molybdenite, manganese ore, nickel ore, chrome ore, hæmatite iron ore, zinc ore, lead ore, bauxite. Aluminium, alumina and salts of aluminium. Antimony, together with the sulphides and oxides of antimony. Copper, unwrought and part wrought, and copper wire. Rubber (including raw, waste, and reclaimed rubber) and goods made wholly of rubber.

It is further announced that the export of explosives of all kinds and valonia is prohibited to all destinations.

Books Received.

The Production of Petroleum in 1913. By David T. Day. U.S. Geological Survey, 1914. Government Printing Office, Washington.

The Production of Natural Gas in 1913. By B. Hill. U.S. Geological Survey, 1914. Government Printing Office, Washington.

The Source, Manufacture and Use of Lime. By E. F. Burchard and W. E. Emley. U.S. Geological Survey, 1914. Government Printing Office, Washington.

The Society of Chemical Industry.

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1902. Acker, Chas. E., 80, Main Street. Ossining, N.Y., U.S.A., Manufacturer.

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1903. Acton, J. Rowland, India Store Depôt, Belvedere Road, London, S.E., Civil Servant.

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1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.

1888. Adriance, Dr. John S., Williams College, Williamstown, Mass., U.S.A., Analytical Chemist.

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O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.

1906. Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.

1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.

1909. Alén, Dr. J. E., Stadskemistens Laboratorium, Göteborg, Sweden, Public Analyst.

1899. Alexander, D. Basil W., c/o General Petroleum Co., R.F.D. No. 2, Box 52, Los Angeles, Cal., U.S.A., Chemist.

1913. Alexander, Jas., 2208, Allendale Street, Walbrook, Baltimore. Md., U.S.A., Research Chemist.

1900. Alexander, Jerome, c/o National Gum and Mica Co., N.E. cor. 59th Street and 11th Avenue, New York City, U.S.A., Chemist.

1912. Alexander, Walter, National Gum and Mica Co., 59th Street and 11th Avenue, New York City, U.S.A., Secretary.

1883. Alexander, W. T., Crumnock, Eccles, Manchester, Drysalter.

1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.

1891. Allan, F. H. Tielke, c/o James S. Kirk and Co., Soap Works, Chicago, Ill., U.S.A., Technical Chemist.

1898. Allan, John, 77, Northen Grove, West Didsbury, Manchester, Chemist.

1909. Allan, Maurice, 103, Burford Road, Nottingham, Soapmaker.

1907. Allard, M. L., c/o Dunlop Tire and Rubber Goods Co., Toronto, Canada, Chemist.

1902. Allbright, Wm. B., 4937, Madison Avenue, Chicago, Ill., U.S.A., Chemical Engineer.

O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Woolwich, S.E., Technical Chemist.

1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.

1903. Allen, Chas. A., Overdale, Sunnyhurst, Darwen, Lancashire, Chemist.

1911. Allen, Harry L., 155, Summit Avenue, Summit, N.J., U.S.A., Chemist.

O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.

1913. Allen, Percy T., c/o Partington Steel and Iron Co., Irlam, near Manchester, Coke Ovens Manager.

1893. Allerton, Rt. Hon. Lord, F.R.S., (Journals) Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.

O.M. Allhusen, A., (Jnls.) W. Russell, Allhusen Works, Gateshead-on-Tyne, Chemical Manufacturer.

1886. Allibon, G. H., The Gables, Deramore Park, Belfast, Ireland, Chemical Works Manager.

1913. Allmand, Dr. A. J., Muspratt Laboratory, The University, Liverpool, Lecturer in Chemistry.

1905. Allpass, Jas., 9, Albert Square, Manchester, Secretary.

1912. Almy, Charles, c/o American Vulcanized Fibre Co., Wilmington, Del., U.S.A., Chemical Engineer

1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.

1899. Alsop, Wm. K., Ridgway, Pa., U.S.A., Chemist.

1910. Amin, Bhailal D., The Alembic Chemical Works Co., Ltd., Gorwo Road Camp, Baroda, India, Chemical Agent.

1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.

1910. Anderson, Jas. R. V., School of Mines, Bendigo, Victoria, Australia, Lecturer in Chemistry and Metallurgy.

1900. Anderson, Jas. W., Analytical Chemist.

1889. Anderson. Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow. Technical Chemist.

1894. Anderson, Dr. W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist.

1905. Andreae, Dr. E. P., c/o British Glanzstoff Manufacturing Co., Ltd., Flint, North Wales, Chemist.
1913. Andrews, Cecil G., 1, Lozells Street, Birmingham, Chemist.
1907. Andrews, Chas. T., 14a, Finsbury Square, London, E.C., Chemist.
1889. Andrews, Dr. Clement W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.
1912. Andrews, Ernest R., "Nutfield," Druce Road, Dulwich, S.E., Analytical and Consulting Chemist.
1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works)
1913. Andrews, W. O., P.O. Box 2671, Johannesburg, South Africa, Analytical Chemist.
1903. Anfilogoff, N. A., Thames Haven, Essex, Chemist and Petroleum Refiner.
O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.
1913. Annan, J. G., Elm Cottage, Addiewell, Midlothian, Chief Chemist (Mineral Oil Works).
1892. Annandale, C. J. R., The Briary, Shotley Bridge, Co. Durham, Paper Maker.
1894. Ansbacher, L. A., 527, Fifth Avenue, New York City, U.S.A., Colour Manufacturer.
1913. Anspach, Dr. Richard, Lyckorna, Raynham Avenue, Didsbury, Manchester, Dyeworks Manager.
1902. Anthony, John, 82, Bay Street, Toronto, Canada.
1895. Appleby, Prof. W. R., 911, 5th Street S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.
1907. Appleton, Francis H., jun., P.O. Box 815, Franklin, Mass., U.S.A., Rubber Manufacturer.
1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.
1900. Appleyard, Geo. H., 1, Carlton Terrace, Hornsea, East Yorks, Chemist.
1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.
O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.
1899. Archdale, T. Henry, 38, Whitebirk, Blackburn, Manager of Tar and Ammonia Works.
1904. Archdale, Wm., Sandhutton, Hill Lane, Blackley, Manchester, Manager of Chemical Works.
1901. Ardagh, Edw. G. R., Faculty of Applied Science, University of Toronto, Canada, Chemist.
1900. Ardern, Edw., Holmleigh, Queen's Road, Urmston, Manchester, Chemist.
1907. Armstrong, Chas. F., c/o Cawnpore Sugar Works, Ltd., Marhourah Factory P.O., Chupra, Sarun, India, Technical Chemist.
1902 Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.
1905. Armstrong, Dr. E. Frankland, c/o J. Crosfield and Sons, Ltd., Warrington, Technical Chemist.
1912. Armstrong, Prof. H. E., F.R.S., 55, Granville Park, Lewisham, S.E., Consulting Chemist.
1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.
1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Pennsylvania Salt Manufacturing Co.
1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.
1899. Arnott, Dr. G. W. Campbell, c/o Fertiliser Manufacturers' Association, 68–70, Fenchurch Street, London, E.C., Agricultural Chemist.
1903. Arnott, J. S., Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.
1912. Arny, H. V., 115, West 68th Street, New York City, U.S.A., Teacher and Chemist.
1911. Asahina, Koju, Uyeda Sericulture College, Uyeda, Shinano, Japan, Chemist.
1901. Asano, K., Ashio Copper Mine, Shimozuke, Japan, Consulting Mining Chemist.
1908. Ashbury, J. W., c/o John Brown and Co., Ltd., Laboratory, Atlas Works, Sheffield, Chief Chemist.
1903. Ashley, Frank R., c/o Western Chemical Manufacturing Co., Denver, Colo., U.S.A., Manufacturing Chemist.
1890. Ashton-Bost, W. D. *See* Bost, W. D. Ashton.
1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.
1908. Ashworth, D. Irving, P.O. Box 38, Wappingers Falls, N.Y., U.S.A., Chemist.
1907. Aspey, Urban, jun., New Station Soap Works, School Close, and (Journals) 11, Neville Street, Leeds, Works Manager and Chemist.
1898. Aspinall, Thos., 34, Chorley New Road, Bolton, Analytical and Manufacturing Chemist.
1900. Aston, Bernard C., Box 40, P.O., Wellington, New Zealand, Chemist.
1891. Atkins, C. E., The Heath, Redbourn, Herts., Chronometer Maker.
1885. Atkinson, A. J., 44, Stuart Street, Cardiff, Analytical Chemist.
1912. Atkinson, F. C., 1864, Gent Avenue, Indianapolis, Ind., U.S.A., Chemist.
1911. Atkinson, James E., The Sheffield Testing Works Ltd., Blonk Street, Sheffield, Analytical Chemist.
1900. Atkinson, Jno. W., Betteravia, Santa Barbara Co., Cal., U.S.A., Manager, Union Sugar Co.
1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass. U.S.A., Dyestuff Importer.
1900. Atwood, Frank W., 216, Milk Street, Boston Mass., U.S.A., Chemist.
1895. Auchterlonie, Wm., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.
1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.
1911. Austin, Fred. J., 343, Sixth Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1913. Austin, Wm. L., 113, Church Lane, Charlton, S.E., Analytical Chemist.
1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Works Chemist.
1902. Avery, D., 461, Barker's Road, Kew, Melbourne, Vic., Australia, Teacher of Chemistry.
1910. Ayers, Gilbert F., Dynamite Factory, Modderfontein, Transvaal, Chemist.
1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.

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1908. Babington, Fred. W., Customs Laby., Customs Dept., Ottawa, Canada, Analyst.
1913. Backus, Cecil F., c/o Atlas Powder Co., Wilmington, Del., U.S.A., Chemist.
1912. Bacon, Charles V., 136, Liberty Street, New York City, U.S.A., Consulting and Analytical Chemist.
1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.
1913. Bacon, Raymond F., Mellon Institute of Industrial Research, The University, Pittsburgh, Pa., U.S.A., Associate Director.
1911. Baddiley, James, c/o Levinstein, Ltd., Crumpsall Vale Chemical Works, Blackley, Manchester, Research Chemist.
1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.
1898. Baekeland, Dr. Leo, Snug Rock, Harmony Park, Yonkers, N.Y., U.S.A., Research Chemist.
1912. Bagley, Fred. P., c/o George H. Morrill Co., Norwood, Mass., U.S.A., Ink Manufacturer.
1913. Bailey, Alan M., Winchester House, Singapore, S.S., Analytical Chemist.
1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.
1885 Bailey, Edwin M., Almond Hill, Pumpherston, Mid Calder, Scotland, Technical Chemist.
1908. Bailey, Frank W., 25, Lord Street, Glossop, Derbyshire.

1883. Bailey, Dr. G. H., Kinlochleven, Argyll, Scotland, Chemist.
1903. Bailey, Harold J., 10, Park Road, Pendleton, Manchester, Alkali Inspector.
1906. Bailey, Ralph W., 66, Cherry Street, Elizabeth, N.J., U.S.A., Chemist.
1888. Bailey, Dr. T. Lewis, 21, Shavington Avenue, Chester, H.M. Inspector of Alkali Works.
1910. Baillie, Dr. Thomas B., 5, Mossgiel Avenue, Ainsdale, Lancashire, Analytical Chemist (Love Lane Sugar Refinery).
1902. Bain, Prof. Jas. Watson, Faculty of Applied Science, The University, Toronto, Ont., Canada, Chemist.
1911. Bainbridge, Edmund F., c/o American Alkali and Acid Co., Bradford, Pa., U.S.A., Chief Chemist.
1911. Baird, Douglas H., 14, Cross Street, Hatton Garden, London, E.C., Scientific Instrument Maker.
1908. Baird, M. M., 18, Jedburgh Avenue, Rutherglen, Glasgow, Analytical Chemist.
1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.
1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.
1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.
1903. Baker, Arthur, Mount Nod, Greenhithe, Kent, Chemist.
1913. Baker, Bertram F., 33, Salford Road, Streatham Hill, S.W., Technical Chemist.
1910. Baker, C. Kerslake, 16, Change Alley, Sheffield, Analytical Chemist.
1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.
1901. Baker, F. Guy Stirling, The Brewery, Chiswell Street, London, E.C., Brewer's Chemist.
1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.
1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.
1892. Baker, Julian L., Stainesbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.
1909. Baker, Robert P., Ivydene, Bexley, Kent, Technical Chemist.
1886. Baker, Theodore, 705, Du Pont Building, Wilmington, Del., U.S.A., Analytical Chemist.
1910. Baker, Dr. Thos., Westville, Doncaster Road, Rotherham, Chemist and Metallurgist.
1912. Balch, Prof. Alfred W., 416, Huntington Avenue, Boston, Mass., U.S.A., Professor of Biological Chemistry.
1912. Baldracco, Prof. Dr. Giacinto, R. Conceria Scuola Italiana, Corso Ciriê, ang. Via Biella, Turin, Italy, Leather Trades Chemist.
1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.
1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).
1903. Ball, S. F., 289, East 201st Street, New York City, U.S.A., Analytical Chemist.
1912. Ball, Walter W., "Sunnyside," Daybrook, Notts, Dyer.
1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.
O.M. Ballard, Edw. G., 6, Grey Friars, Chester, Alkali Works Inspector.
1910. Baly, Prof. E. C. C., F.R.S., 14, Sunnyside, Prince's Park, Liverpool, Professor of Inorganic Chemistry.
O.M. Bamber, H. Kelway, Outram House, Addiscombe, Surrey, Consulting Chemist.
1894. Bamber, H. K. G. Ingress House, Greenhithe, Kent, Cement Works Manager.
1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks, Dyer.
1906. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.
1913. Banks, A. J., c/o The Ogilvie Flour Mills Co., Ltd., Montreal, Canada, Analyst.
1890. Banks, Jno. H., 80, Maiden Lane, New York City, U.S.A., Mining Engineer.
O.M. Bannister, W., Dunloe, Bramley Hill, South Croydon, Manufacturing Chemist.
1910. Barbary, J. Ewart, "Vellansaundry," Camborne, Cornwall, Explosives Chemist.
1909. Barber, C. Douglas, Great Nelmes, Hornchurch, Essex, Chemist.
1908. Barber, Percy S., The Reform Food Stores, 84, Whitechapel, Liverpool, Chemist.
1901. Barber, Capt. René R., Georgetown, Ont., Canada, Analytical Chemist.
1911. Barclay, Andrew, Oficina Anita, Antofagasta, Chile, Chemist.
1912. Barclay, William R., 50, Upper Albert Road, Meersbrook, Sheffield, Manager of Electroplate Factory and Lecturer in Electro-Metallurgy.
1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.
1907. Bardorf, C. F., c/o St. Lawrence Sugar Refining Co., Maisonneuve, P.Q., Canada, Chief Chemist.
1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.
1913. Barker, J. D., c/o The Sherwin-Williams Co. of Canada, Ltd., Montreal, Canada, Paint Manufacturer.
1912. Barker, Dr. Jonathan, 18, Sandon Street, Liverpool, Chemist.
1905. Barker, Perry, 93, Broad Street, Boston, Mass., U.S.A., Chemist.
1909. Barker, Richard F., Adams, N.Y., U.S.A., Chemist.
1895. Barlow, Clinton W., 104—112, East 25th Street, New York City, U.S.A., Merchant.
1901. Barlow, John J., Broadway, Accrington, Calico Printer's Chemist.
1899. Barlow, Wm., 23, Alton Terrace, Fairfield, Manchester, Analytical Chemist.
1908. Barnes, Alfred, Box 556, Pretoria, Transvaal, Dealer in Minerals.
1906. Barnes, A. G., c/o Hasland Coking Co., Grassmoor Collieries, Chesterfield, Colliery Proprietor.
1914. Barnes, Edward A., c/o The Giant Powder Co., Giant, Cal., U.S.A., Chemical Engineer.
1905. Barnes, F. V., Gas Works, Todmorden, Engineer and Manager.
1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.
1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.
O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.
1912. Barnett, E. de Barry, 9, Collingham Road, South Kensington, S.W., Chemist.
1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).
1904. Baron, Wm. Briscoe, c/o Vulcan Boiler and General Insurance Co., Ltd., 26, Pall Mall, Manchester, Chemist.
O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.
1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.
1890. Barrett, Arthur A., 139, Viale San Martino, Messina, Sicily, Manufacturer of Essential Oils.
1907. Barrett, John H., 111, Adelaide West, Toronto, Canada, Superintendent.
1907. Barrett, Maurice, 9, Roundhay Mount, Leeds.
1912. Barrow, Jas. V., c/o Messrs. W. H. Holmes and Sons, Portland Road, Newcastle-on-Tyne, Works Chemist.
1900. Barrow, Jos., "Woodhey," Malford Grove, South Woodford, N.E., Chemist.
1906. Barrs, Chas. E., 3A, Downshire Hill, Hampstead, N.W., Analyst.
1905. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.
1893. Barton, G. E., 227, Pine Street, Millville, N.J., U.S.A., Technical Chemist.
1903. Bartrip, Geo. F., 21, Willow Avenue, Edgbaston, Birmingham, Managing Chemist.
1905. Baruch, Edgar, 805-806, Wright and Callender Building, Los Angeles, Cal., U.S.A., Chemical Engineer.

1910. Barwick, F. W., Chamber of Commerce Testing House, Royal Exchange, Manchester.
1909. Barzano, Carlo, 6, Via Gesu, Milan, Italy, Patent Agent.
1895. Baskerville, Dr. Chas., College of the City of New York, New York City, U.S.A., Professor of Chemistry.
1910. Bassett, Frank L., 73, St. Julian's Farm Road, West Norwood, S.E., Analyst.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1908. Bassett, Professor Henry, University College, Reading, Prof. of Chemistry.
1899. Bassett, Wm. H., Main Street, Cheshire, Conn., U.S.A., Chemist.
1890. Bate, William, Upton Villa, Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).
1903. Bateman, A. H., Eridge, Shooter's Hill, Woolwich, S.E., Chemist.
1913. Bateman, James T., 34, Bridge Avenue, Hammersmith, W., Engineer and Works Manager.
1912. Bates, D. M., Lewiston Bleachery and Dye Works, Lewiston, Maine, U.S.A., General Manager.
1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.
1910. Battye, Horace G., 28, Roman Place, Street Lane, Roundhay, Leeds, Chemist and Works Manager.
1903. Baty, E. J., c/o Thermoelectric Ore Reduction Corporation, Cobden Street, High Town, Luton, Beds, Chemist.
1903. Bauer, Geo. W., 660, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1910. Baxter, F. Stanley, 119, Albert Street, Regent's Park, London, N.W., Chemist.
1913. Baxter, Harold R., c/o Aktiebolaget J. and G. Cox, Ostrahamingatan 17, Gothenburg, Sweden, Manager (Glue Works).
1898. Baxter, John G., Glenarm, Lennox Avenue, Gravesend, Kent, Chemist.
1912. Bayley, Francis P., c/o F. S. Bayley, Clanahan, and Co., 79, Mosley Street, Manchester, Chemical Merchant.
1911. Bayliss, Thos. R., Belmont, Northfield, Birmingham, Mechanical Engineer and Managing Director.
1908. Bayly, Percival G. W., Mines Dept. Laby., Spring Street, Melbourne. Victoria, Government Metallurgical Chemist.
1897. Beadle, Alec A., Donington Dene, Newbury, Berks, Electro-Chemist.
1886. Beadle, Clayton, Oakbank, Lansdown Road, Sidcup, Kent, Consulting Chemist.
1911. Beard, Stanley D., Lederle Antitoxin Laboratories, Pearl River, N.Y., U.S.A., Biological Chemist.
1907. Beardsley, Dr. Alling P., 165, Minerva Street, Derby, Conn., U.S.A., Chemist (New Haven Gas Co.).
1909. Bearpark, Arthur F., P.O. Box 497, Durban, South Africa, Works Manager.
1908. Beasley, Fred. G., 44, Green Street, Smethwick, near Birmingham, Metallurgical Chemist.
1905. Beasley, Jno. K., c/o The Borneo Co., Kuching, Sarawak, Metallurgical Chemist.
1897. Beaver, Chas. J., Rangemoor, Crescent Road, Hale, Cheshire, Chemist.
1905. Beckers, Dr. Wm., 105, Underhill Avenue, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1909. Becket, Fredk. M., 31, Sugar Street, Niagara Falls, N.Y., U.S.A., Chief Metallurgist, Electro Metallurgical Co.
1912. Beckett, Dr. E. G., Sylva, Caledonia Road, Saltcoats, Ayrshire, Analytical Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.
1911. Bedforth, G. E., Aspley Dyeware Mills, Huddersfield, Works Chemist.
O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beevers, Clifford J., 12, Parish Ghyll Road, Ilkley, Yorks, Analyst.
1899. Behr, Dr. Arno, Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
O.M. Beilby, Dr. George T., F.R.S., 11, University Gardens, Glasgow, Chemical Engineer.
1912. Belaiew, Captain Nicolai, Chem. Laby., Michael Artillery Academy, St. Petersburg, Russia, Lecturer in Metallurgy and Chemistry.
1906. Belden, A. W., c/o Jones and Laughlin Steel Co., Aliquippa Works, Woodlawn, Pa., U.S.A., Coke Expert.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., c/o Bank of Montreal, Toronto, Canada, Chemist.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1907. Bell, Marcus, Defence Dept., Melbourne, Victoria, Chemist.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.
O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.
1897. Benfey, Dr. Hans, 65, Birchfields Road, Rusholme Manchester, Manufacturing Chemist.
1907. Bengough, Guy D., St. John's Cottage, Chester, Lecturer in Metallurgy.
1903. Benham, Keith, The Woodlands, Rowley Park, Stafford, Analytical and Consulting Chemist.
O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist.
1899. Bennett, Alex. H., Via Giuseppe La Farina, Messina, Sicily, Chemist.
1907. Bennett, H. Garner, 10, Shaftesbury Villas, Beverley, Yorks, Leather Chemist.
1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.
1909. Benson, George F., Edwardsburg Starch Co., Cardinal, Ontario, Canada, President and Managing Director.
1906. Benson, Richard W., c/o Geo. Cradock and Co., Wakefield, Yorks, Analytical Chemist.
1901. Bentley, Wm. H., 12, Cromwell Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 30, Manley Road, Whalley Range, Manchester, Technical Chemist.
1913. Benzian, Dr. Rudolf, Hohe Bleichen 34, Hamburg, Germany, Assayer and Merchant.
1912. Bergius, Dr. Friedrich, Parkstrasse 1, Hannover, Germany, Privatdozent.
1912. Beringer, C. R., Magyar Onmüvek, Nagyteleny, Hungary, Assayer.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1907. Berk, Paul F., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1908. Berlinerblau, Dr. Joseph, 8, Szpitalna Street, Warsaw, Russian Poland, Industrial Chemist.
1900. Bermingham, Jno., jun., 417, Mills Building, San Francisco, Cal., U.S.A., Superintendent.
1889. Bernard, Jas., jun., c/o Parry and Co., P.O. Box No. 12, Madras Presidency, India, Chemical Works Manager.
1897. Berry, Albert E., Abbotsleigh, Wanstead, Essex, Works Manager.
1911. Berry, Arthur G. V., c/o Messrs. B. and R. Redwood, 4, Bishopsgate, London, E.C., Analyst.
1906. Berry, Arthur J., 14, Regent Street, Cambridge, Chemist.
1883. Berry, E. E., Bordighera, Italy, and (Journals) c/o C. H. Grinling, 17, Rectory Place, Woolwich, S.E., Technical Chemist.
1913. Berry, Prof. R. A., The Agricultural College, Blythswood Square, Glasgow, Prof. of Agric. Chemistry.
1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.

1909. Beskow, K. J., Södra Storgatan 19, Helsingborg, Sweden, Head Engineer.
1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.
1901. Betts, Anson G., Stackhouse, N.C., U.S.A., Chemist.
O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.
1900. Bevan, Jno. W., Morriston Spelter Works, Morriston, R.S.O., Glamorgan, Manager of Metallurgical Works.
O.M. Beveridge, Jas., Springfield House, Chatham, N.B., Canada, Pulp and Paper Manufacturer.
1909. Bewick, R. M., "Lynton," Park West, Heswall, Cheshire. Traveller.
1909. Beynon, Donald E., 80, Hogarth Avenue, Toronto, Canada. Chemist.
1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.
1896. Bibby. John, c/o J. Bibby and Sons, Formby Street, Liverpool, Chemist.
O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.
1907. Bickerstaffe, Robt., c/o Thomas and Green, Ltd., Soho Mills, Wooburn Green, S.O., Bucks., Chemist.
1903. Bierwith. L. W., c/o Du Pont Powder Co., Haskell, N.J., U.S.A., Civil Engineer.
1910. Bigelow, Chas. A., c/o Pluto Powder Co., Ishpeming, Mich., U.S.A., Superintendent.
1912. Bigelow, Edward P., Mellin's Food Library, 221, Columbus Avenue, Boston, Mass., U.S.A., Chemist.
1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, Scotland, Analytical Chemist.
1891. Biggart, Wm. L., Rossarden, Kilmalcolm, Scotland, Public Analyst.
1911. Biggins, J. E., c/o Gulf Refining Co., Port Arthur, Texas, U.S.A., Chemist.
1910. Biggs, J. W. H., 318, High Street, Plumstead, S.E., Chemist.
O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.
1896. Billington, Chas., Heimath, Porthill, Longport, Staffordshire, Metallurgist.
1907. Bird, Charles S., jun., Messrs. F. W. Bird and Son, Library Dept., East Walpole, Mass., U.S.A., Paper Maker.
1896. Bird, Jno. B., 3, Brookside, Cambridge, Manure Manufacturer.
1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts., Analytical Chemist.
1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.
1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, Indiarubber Manufacturer.
1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.
1884. Bishop, Fred., c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Technical Chemist.
1903. Bishop, Howard B., 1372, Union Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.
1905. Bixby, Willard G., 46th Street and 2nd Avenue, Brooklyn, N.Y., U.S.A., Blacking Manufacturer.
1905. Bjerregaard, A. P., 10724, Kimberley Avenue, Cleveland, Ohio, U.S.A., Varnish Chemist.
1912. Björnström-Steffanson, G., P.O. Box 51, Windsor Mills, Quebec, Canada, Consulting Engineer.
1909. Blacher, Prof. Carl, Polytechnicum, Riga, Russia, Chemical Engineer.
1904. Black, J. Wyclif, 67, Falcon Road, Edinburgh, Analytical Chemist.
1902. Black, W. Geoffrey, St. John's House, Christchurch Road, Norwich, Chemist.
1910. Blackie, Archibald, 223, James Street, Winnipeg, Canada, Chemist.
1894. Blackmore, H. S., P.O. Box 145, Mount Vernon, N.Y., U.S.A., Industrial Chemist.
1896. Blagden, Victor, 4, Lloyd's Avenue, London, E.C., Chemical Merchant.
1883. Blagden, W. G., Down Lodge, East Harting, near Petersfield, Hants, Chemical Merchant.
1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.
1910. Blakeley, A. G., P. and R. Coal and Iron Co., Pottsville, Pa., U.S.A., Chemist.
1913. Blane, E. R., c/o I. Levinstein and Co., Inc., 115, 5th Street, Chelsea, Mass., U.S.A., Chemist.
1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford Dyer and Calico Printer.
1908. Blichfeldt, S. H., Vine Cottage, Southall, Middlesex, Bacteriologist and Fermentation Chemist.
1905. Bliss, H. J. W., United University Club, Pall Mall East, London, S.W., Chemist.
1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.
1908. Blomeley, Adam Y., c/o Arbuckle Bros. Sugar Refinery, Brooklyn, N.Y., U.S.A., Chemist.
1891. Bloomer, Fred J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.
1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.
1888. Bloxam, A. G., 29, Southampton Buildings, Chancery Lane, London, W.C., Chemist and Patent Agent.
1903. Blumenthal, Lionel, Ravensholme, Merry Bower Road, Broughton Park, Manchester, Chemist.
1886. Blundstone, E. R., 79, York Street, Westminster, S.W., Consulting Chemist.
1906. Blyth, M. Wynter, Lacton House, Tankersley, near Barnsley, Yorks, Analytical and Consulting Chemist.
1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.
1908. Blythe, Jas. R., Craiglea, Audenshaw, near Manchester, Leather Trades Chemist.
O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.
1888. Boake, Edmund J., Widford Lodge, Chelmsford, Essex, Manufacturing Chemist.
1912. Boan, Robt., Laboratory, Government Railway Offices, Spencer Street, Melbourne, Vic., Australia, Engineer-in-charge.
1899. Boehm, Fred., 66, Crutched Friars, London, E.C., Chemical Agent and Merchant.
1910. Boehringer, Dr. R., 79, Milford Avenue, Newark, N.J., U.S.A., Chemist.
1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Professor of Organic Chemistry.
1903. Boissevain, Chas. E. H., 92, Van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.
1903. Bolam, Dr. H. W., Queen Margaret College, Glasgow, Lecturer on Chemistry.
1909. Bolden, Wm., Dalmellington Iron Works, Dunaskin, Ayrshire, Chemist.
1901. Bolton, E. Richards, 46, Stamford Brook Road, Hammersmith, W., Manufacturing Chemist.
1905. Bond, John, Crowlands, Southport, Engineer.
1905. Bond, Josiah, Alto, Arizona, U.S.A., Mining Engineer.
1912. Bone, S. C., 30, Long Lane, Garston, Liverpool, Chemical Works Manager.
1905. Bone, Prof. W. A., F.R.S., "Montrose," Harpenden Road, St. Albans, Herts, Professor of Chemical Technology.
1892 Bookman, Dr. S., 46, East 82nd Street, New York City, U.S.A., Chemist.
1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.
1912. Boorne, Wm. H., 54, Eldertou Road, Westcliff-on-Sea, Essex, Metallurgist.
1908. Booth, Jos. W., Atlantic Mills, Providence, R.I., U.S.A., Superintendent.
1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.

1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.
1897. Borland, C. R., Concord, Mass., U.S.A., Smokeless Powder Manufacturer.
O.M. Borland, W. D., Beacon Lodge, Bean, *via* Dartford Kent, Manufacturer of Explosives.
1903. Boroschek, Dr. L., 24, West 82nd Street, New York City, U.S.A., Chemist.
1908. Bose, R., 92–95, Upper Circular Road, Calcutta, India, Chemical Works Manager.
1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley. Chemical Manufacturer.
1912. Boswell, Maitland C., Chemistry and Mining Building, University of Toronto, Canada, Lecturer on Organic Chemistry.
O.M. Bothamley, C. H., Weston-super-Mare, Somerset, County Director of Technical Instruction.
1890. Bott, Dr. W. Norman. *See* Norman-Bott, Dr. W.
1884. Böttinger, Dr. H. T. von, Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Colour Manufacturer.
1901. Bottomley, Dr. J. Frank, c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.
1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.
O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.
O.M. Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.
1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, London, N., Manager.
1905. Bourne, Lyman M., c/o Goodyear Tire and Rubber Co., Akron, Ohio, U.S.A., Chemist.
1910. Bowater, J. W., Woodville, Beeches Road, West Bromwich, Works Manager.
1905. Bowen, Henry, South Street, East Aurora N.Y., U.S.A., Secretary.
1885. Bowen, S. B., "Caeffair," Llanelly, South Wales, Chemical Manufacturer.
1888. Bower, Frank. Brewery House, Spitalfields, E., Analytical Chemist.
1909. Bower, Joshua, c/o Kynoch, Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.
1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.
1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, London, S.W., Chemical Manufacturer.
1899. Bowley, J. Plunkett, 36, Argyll Mansions, Chelsea, London, S.W., Varnish Manufacturer.
1908. Bowman, Fred C., c/o General Chemical Co., Laurel Hill Works. Maspeth P.O., Long Island, N.Y., U.S.A., Chemist.
1884. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.
1907. Bowman, Richard S., 23, Welldeck Road, West Hartlepool, Chemist.
1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.
1904. Boyce, Framroze H., 86, Hugh's Road, Chaupaty, Bombay, India, Technical Chemist.
1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.
1910. Boyce, James, 225, West 18th Street, Chicago, Ill., U.S.A., Chemist.
1909. Boyd, Dr. Harold de H., c/o The Southern Cotton Oil Co., Ltd., Trafford Park, Manchester, Chemist.
1913. Boyd, Robert, c/o British Columbia Sugar Refining Co., Ltd., Vancouver, B.C., Canada, Chemist.
1909. Boyd, T. D., jr., Los Mochis, Sinaloa, Mexico, Sugar Refiner.
1899. Boyes, Herb. J., c/o Boyes & Kirk, Fabrica de Tecidos Belemzinho, Sao Paulo Brazil, Chemist.
1905. Brabrook, G. Hale, Manhattan, Nevada, U.S.A., Mining Engineer.
1910. Bracewell, Geoffrey A., 20, Heaton Grove, Bradford, Analytical Chemist.
1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.
1902. Bradbury, S., Ferncliffe, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist
1912. Bradford, Francis L. W., 92, Rotton Park Road, Edgbaston, Birmingham, Chemist and Works Manager.
1895. Bradford, Henry, Strettington, Goodwood, near Chichester, Analytical Chemist.
1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.
1891. Braithwaite, Isaac, Ghyll Close, Kendal, Westmoreland, Drysalter.
1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.
1903. Brame, J. S. S., 67, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.
O.M. Brambam, W., Bank Chambers, 300, Mare Street, Hackney, N.E., Chemical Engineer.
1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Produktion, Aussig, Austria, Chemical Manufacturer.
1902. Branegan, Jas. Aug., 712, North 20th Street, Philadelphia, Pa., U.S.A., Chemical Salesman.
O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.
1903. Brassard, Fred A, 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.
1912. Brasse-Brossard, L., 451, Rideau Street, Ottawa, Canada, Agricultural Engineer.
1901. Brearley, Harry, c/o The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Analytical Chemist.
1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.
1908. Bregowsky, Ivan M., c/o Crane Co., 836, South Michigan Avenue, Chicago, Ill., U.S.A., Chemist.
1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.
1894. Breyer, Theodor, 725, Washington Avenue, Wilmette, Ill., U.S.A., Chemist.
1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.
1913. Bridge, Stanley W., c/o Dr. H. G. Colman, 1, Arundel Street, London, W.C., Analytical Chemist.
1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.
1893. Briggs, J. F., Auchmuty Paper Mills, Markinch, Fifeshire, Technical Chemist.
1912. Briggs, O. W. H., Harborough Rubber Co., Day and Night Mills, Market Harborough, Rubber Works Chemist.
1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1914. Brinsley, Frank, 74, Alexandra Road South, Manchester, Demonstrator in Chemistry.
1910. Brisbane, James W., c/o The Leather Cloth Co., Ltd., West Ham, E., Analytical Chemist.
1905. Bristol, Dr. H. Stanley, Elmhyrst, Newport, R.I., U.S.A., Chemist.
1886. Bristow, G. W., c/o Walter J. Crook, 10, Eastcheap, London, E.C., Chemical Manager.
1912. Britland, Wm. J., Pear Tree Cottage, Alvanley, near Helsby, Cheshire, Chemist.
1887. Broadbent, H., c/c Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
O.M. Brock, J., The Cedars, Hoole, Chester, Chairman of United Alkali Co., Ltd.
1910. Brodribb, Noel K. S., Cordite Factory, Maribyrnong, Melbourne, Victoria, Australia, Chemist.
1912. Bromley, Henry S., Chelten and Wissahickon Avenues, Germantown, Philadelphia, Pa., U.S.A., Lace Manufacturer.
1909. Bronnert, Dr. E., Dornach, near Mülhouse, Alsace, Germany Artificial Silk Manufacturer.

1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Opium Factory, Singapore, S.S., Superintendent.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1911. Brookfield, Henry M., 2, Rector Street, New York City, U.S.A., Glue Manufacturer.
1895. Brookman, Fred. W., Dewhirst, Syke, and (Jnls.) Sanitary Works, Rochdale, Manure Works Manager.
1906. Brooks, Cecil J., c/o M. M. Simau, Benkoelen, Sumatra, Ned. Indies, Metallurgist.
1909. Brooks, Theodore, Guantanamo, Cuba. Cane Sugar Manufacturer.
1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.
1911. Brothers, Horace E., York Drive, Latchford, Warrington. H.M. Inspector of Factories.
1909. Brothers, Wm., Meadow House, Tunstead Milton, near Whaley Bridge, Derbyshire, Chemical Manufacturer.
O.M. Brotherton, E. A., City Chambers, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
1902. Brown, A. H. M., Hudson Bay Mine, Cobalt, Ont., Canada, Metallurgist.
1891. Brown, Cæsar R., 141, Victoria Avenue, Prittlewell, near Southend, Works Foreman.
O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1910. Brown, Geo Winslow, Assabet Mills, Maynard, Mass., U.S.A., Chemist.
O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson and Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
1906. Brown, Percy S., c/o B. O. Bowers Co., 136, Liberty Street, New York City, U.S.A., Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 20—26, Brunswick Place, City Road, London, N., Technical Chemist.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, 509, Fisher Building, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 215, East Fayette Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Browne-Cave, E. J. C. *See* Cave-Browne-Cave, E. J.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1902. Brownrigg, Marcus P., c/o Colonial Sugar Refining Co., O'Connell Street, Sydney, N.S.W., Chemist.
1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., King's Norton, Birmingham, and (Jnls.) 109, Oxford Road, Moseley, near Birmingham, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1911. Bruce, Joseph, Jnls. to General Manager. Cape Explosives Works, P.O., Dynamite Factory, West Somerset, Cape Colony, Secretary.
1908. Bruce, Robert, c/o Clark, 191, Morningside Road, Edinburgh, Works Chemist.
1900. Bruce, Wm. T., 3, Lombard Court, London, E.C., and (Jnl.) c/o T. C. Allchin, Longfield, Kent, Director.
1892. Bruckmann, G. T., 109, 22nd Street, Guttenberg P.O., N.J., U.S.A., Chemical Engineer.
1911. Brunet, Louis, "Revue Générale des Sciences," 18, Rue Chauveau-Lagarde, Paris VIII, France, Chemist and Secretary.
O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, The Hollies, Hartford, Cheshire, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond, and Co., Ltd., Caxton House, Westminster, S.W., Chemical Manufacturer.
O.M. Brunner, Rt. Hon. Sir J. T., Bart., Silverlands, Chertsey; and (Journals) c/o Brunner, Mond, and Co., Ltd., Northwich, Cheshire, Chemical Manufacturer.
1910. Brunner, Dr. Philipp, 2, Via Ghega, Trieste, Austria, Merchant.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, Scotland, Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1903. Bryant, V. Seymour, Trelawne, Crowthorne, Berks., Analytical Chemist.
1908. Bryce, Chas. C., 43-45, Great Tower Street, London, E.C., Merchant.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, Scotland, Oil Works Manager.
1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow; retain Journals; Analyst.
1908. Buchanan, Duncan G., 27, Woodlawn Avenue East, Toronto, Canada, Chemist (Rubber Works).
1904. Buchanan, E. F., 128, East Crescent Street, Marquette, Mich., U.S.A., Chemist.
1888. Buchanan, Jas., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, John L., Braehead, Mill Road, Bromborough, Cheshire, Analytical Chemist.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, Scotland, Chemist.
1910. Buchanan, Walter G., c/o Lautaro Nitrate Co., Taltal, Chile, Chemist.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1911. Budde, Dr. Carl, 1, Belford Road, Sunderland, Chemical Engineer.
1909. Buell, W. H., c/o Winchester Repeating Arms Co., New Haven, Conn., U.S.A., Chemist.
1909. Buggy, Thos., Butte, Montana, U.S.A., Assayer and Chemist.
1902. Bull, Irving C., 100, Maiden Lane, New York City, U.S.A., Chemist.
1899. Bult, Herbert J., 140, Fenchurch Street, London, E.C., Chemist.
O.M. Bumby, H., Bellevue, Sandbach, Cheshire, Iron and Chemical Works Director.
O.M. Bunker, H. E., 310, Kingston Road, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., Oficina de Ensayes F. C. C. del P., Callao, Peru, Analyst.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1910. Burbridge, Walter N., "Uplands," Foxley Lane, Upper Woodcote, Purley, Surrey, Analytical Chemist.
1896. Burford, Samuel F., The Ridgeway, Rothley, near Leicester, Analytical Chemist.
1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.

1889. Burgess, Geo., Sydney Cottage, Halebank, Widnes, Chemist.
1913. Burgess, Herbert E., Holly House, Graham Road, Dalston, N.E., Manufacturing Chemist.
1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, Solothurn, Switzerland, Chemist.
1899. Burkhardt, Dr. G. A., Württembergischestrasse 32, Berlin, W. 15, Germany, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., c/o Fraser Library, Montreal, Canada, Paper and Card Manufacturer.
1898. Burls, Herbert T., 2, Verulam Buildings, Gray's Inn, London, W.C., Mechanical Engineer.
1901. Burnand, Sydney, Manbré Saccharine Co., Ltd., Hammersmith, W., Manager.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks, Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, and (Journals) 1, Montague Place, Bedford Square, London, W.C., Architect.
1909. Burnett, Arthur, 2417, Washington Boulevard, Chicago, Ill., U.S.A., Chemist.
1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.
1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.
O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.
1910. Burrell, Keith, Burrell's Wharf, Millwall, London, E., Manufacturer.
1906. Burrough, Ernest J., Cale Distillery, Hutton Road, Lambeth, S.E., Rectifier.
1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.
1912. Burt-Gerrans, J. T., 46, Dewson Street, Toronto, Canada, Electro-Chemist.
1901. Burton, Alf., Canadian Dyers' Association, 2–16, Liberty Street, Toronto, Canada, Dyer and Finisher.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1904. Burton, T. R., c/o Scott, Greenwood, and Son, 8, Broadway, Ludgate Hill, London, E.C., Technical Journalist.
1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.
1913. Bush, Dr. Harry T., 7, Gracechurch Street, London, E.C., Chemical Engineer.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1913. Butler, Geo. B., West Lyn, Hawthorne Terrace, South Bank, R.S.O., Yorks, Assistant Blast Furnace Manager.
1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1905. Butler, Dr. T. H., c/o Wm. Butler and Co., Ltd., Crews Hole, Bristol, Chemist (Tar and Rosin Distillery).
1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.
O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.
1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.
1897. Butters, Charles, 54, New Broad Street, London, E.C., and (Journals) 121, 59th Street, Oakland, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado 8, Bilbao, Spain, Technical Chemist.
1905 Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.
1893. Byrom, T. H., Virol Research Laboratories, 10, Bedford Square, London, W.C., Analytical Chemist.
1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 940, Old South Building Boston, Mass., U.S.A., Manufacturing Chemist.
1907. Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Caddick, Arthur, Minas de Rio Tinto, Huelva, Spain, Works Chemist.
1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer.
1905. Cain, Dr. J. C., 24, Aylestone Avenue, Brondesbury Park, N.W., Colour Chemist.
1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.
1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.
1907. Caistor, J. W. Y., Ty Coch, Deganwy, North Wales, Chemist.
1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.
1897. Calder, W. A. S., 449, Hagley Road, Birmingham, Chemical Manufacturer.
1908. Caldwell, Dr. Robert J., Rosendale, Holland Park, Belfast, Ireland, Chemist and Works Manager.
1912. Caldwell, Wallace L., 1025½, North 24th Street, Birmingham, Ala., U.S.A., Engineering Chemist.
1888. Caldwell, Wm., Murray Street, Paisley, Scotland, Drysalter.
1912. Callan, Dr. Thomas, Chemical Laboratory, 49, High Street, Paisley, Technical Chemist.
1902. Calm, Dr. Chas. E., California Club, Los Angeles, Cal., and (Jnls.) P.O. Box 1517, New York City, U.S.A., Manufacturing Chemist.
1913. Calvert, A. F., Royston, Eton Avenue, London, N.W., Engineer.
1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.
1895. Cambier, Jacob, 1401, Carteret Avenue, Pueblo, Colo., U.S.A., Chemist.
1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.
1908. Cameron, Wm., Balik Pappan, Koetei, East Borneo Sugar Refinery Manager.
O.M. Cammack, J., 34, Wolseley Road, St. Helens Lancashire, Technical Chemist.
1910. Campagne, Emile, Usine de Radet, Maule (Seine et Oise), France, Chemical Engineer.
1886. Campbell, Andrew, 51, Cluny Drive, Edinburgh, Chemist (Mineral Oil).
1912. Campbell, Arthur F., "Westwood," Middleton, Manchester, Research Chemist.
1908. Campbell, Fred. A., The Working Men's College, Latrobe Street, Melbourne, Victoria, Australia, Principal.
1910. Campbell, James R., 57, Dacre Hill, Rock Ferry, Cheshire, Chemist.
1907. Campbell, John A., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1912. Campbell, Kennedy, c/o British Dyewood Co., Ltd., Parkhead, Glasgow, Chemist.
1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.
1911. Campbell, L. E., Dept. of Agriculture, Peradeniya, Ceylon, Chemist.
1908. Campbell, Max E., Avila, Cal., U.S.A., Chemist.
1909. Campbell, Peter, Kearny, N.J., U.S.A., Linoleum Manufacturer.
1911. Campbell, Wm. E., c/o Gutta Percha and Rubber, Ltd., O'Hara Avenue, Toronto, Canada, Industrial Chemist.
1909. Candee, Chas. N., 39, South Drive, Toronto, Canada, Rubber Manufacturer.
1908. Canning, Ernest R., 137, Great Hampton Street, Birmingham, Manufacturer.

O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.

1913. Cantelo, Robt. C., Metallurgy Dept., School of Mining, Kingston, Ont., Canada, Chemist.

1891. Carden, Albert J., 20—21, Harp Lane, London, E.C., Distiller.

1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.

O.M. Carey, Eustace, The United Alkali Co., Ltd., 30, James Street, Liverpool; and (Journals) The Groves, Grassendale Park, near Liverpool, Chemical Manufacturer.

1906. Carey, W. Gordon, Fairholme, Raby Road, Stockton-on-Tees, Cheshire, Chemist.

1904. Cargill, J. T., c/o Finlay, Fleming, and Co., Rangoon, Burmah, East India Merchant.

1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.

1884. Carmody, Prof. Patrick, River View, Rose Hill, Lostwithiel, Cornwall, Analytical Chemist.

1897. Carnell, Wm. C., 2136, North Camac Street, Philadelphia, Pa., U.S.A., Chemist.

1906. Caro, Dr. Nikodem, Meinekestrasse 20, Berlin W. 15, Germany, Analytical Chemist.

1893. Carpenter, Dr. C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.

1908. Carpenter, Edwin P., Culvert Works, Sheepcote Lane, Battersea, S.W., Manager of Casein, Ltd.

1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.

1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.

O.M. Carpenter, R. Forbes, 30, Buckingham Mansions, 359, West End Lane, West Hampstead, N.W., Ex-Chief Inspector under the Alkali, &c., Works Acts.

1904. Carr, Francis H., Kelvin, Church Avenue, Sidcup, and (Journals), Burroughs, Wellcome, and Co., Ltd., Dartford, Kent, Manufacturing Chemist.

1907. Carrier, C. F., jun., 1983, Railway Exchange Building, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1904. Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.

1905. Carter, Robert A., 4923. Osage Avenue, Philadelphia, Pa., U.S.A., Chemist.

1895. Carter, Stewart F., 43, Montana Street, North Adams, Mass., U.S.A., Technical Chemist.

1903. Carter, Thomas, West End View, Ravensthorpe, Dewsbury, Yorks, Works Chemist.

1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.

1911. Carty, Ronald D., The Laboratories, Public Works Ministry Gardens, Cairo, Egypt, Analytical Chemist.

1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.

1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.

1914. Casey, John A., Charlemont, Moy, Co. Tyrone, Ireland, Waterproof Manufacturer.

1903. Caspari, Dr. W. A., University College, Gower Street, London, W.C., Chemist and Physicist.

1899. Castro, J. Paul de, 1, Essex Court, Temple, London, E.C., Barrister-at-Law.

1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).

1909. Caulkin, Howard A., Mona Villa, Spencer Road, Belper, Analyst.

1906. Cave-Browne-Cave, E. J., Station Road, Brimington, Chesterfield, Works Chemist.

1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.

1914 Caw, Wm., c/o J. Watson and Sons, Whitehall Soap Works, Leeds, Chemist.

O.M. Cawley, G., 82, Victoria Street, Westminster, S.W., Chemical Engineer.

O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.

1897. Cawley, Thos. A., British Gelatin Works, Ltd., New Bedford Road, Luton, Gelatin Manufacturer.

1906. Chadsey, Stanley B., 476, Brunswick Avenue, Toronto, Canada, Chemist.

1891. Chadwick, Walter M., Thorneycroft, Westoe, South Shields, Chemical Works Manager.

1912. Chadwick, Walter W., 186, Wellington Street North, Hamilton, Ont., Canada, Chemist.

1910. Chakraborty, J., The Oriental Soap Factory, Goabagan, Calcutta, India, Technical Director.

1910. Challinor, Richard W., Chemical Laboratory, The Technical College, Sydney, N.S.W., Australia, Teacher of Chemistry.

1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.

1901. Chamberlain, G. E., 641, West Prairie Avenue, Decatur, Ill., U.S.A., Chemist.

1910. Chambliss, Prof. Hardee, Dept. of Chemistry, Oklahoma A. and M. College, Stillwater, Oklahoma, U.S.A., Professor of Chemistry.

O.M. Chance, A. M., Walcot, Torquay, Devonshire, Chemical Manufacturer.

1912. Chance, Clinton F., Messrs. Chance and Hunt, Ltd., Oldbury, near Birmingham, Managing Director.

1909. Chance, Edwin M., 61, South Penna Avenue, Wilkes-Barre, Pa., U.S.A., Chemist.

O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.

1912. Chandler, Lee L., Research Laboratory, Pittsburgh Plate Glass Co., Creighton, Pa., U.S.A., Assistant.

1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks, Analytical Chemist.

1890. Chapman, A. Chaston, 8, Duke Street, Aldgate, E.C., Analytical Chemist.

1906. Chapman Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., and (Journals) c/o F. Claudet, Ltd., 6 and 7, Coleman Street, London, E.C., Analytical Chemist.

1906. Chapman, E. A., c/o Robert Heath and Sons, Ltd., Norton Works, Stoke on-Trent, Works Chemist.

O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.

1894. Charlier, A. C. J., 3, Bedford Road, South Tottenham, N., Consulting Chemist.

1912. Charlton, H. W., Patent Office, Dept. of Agriculture, Ottawa, Canada, Chemical Patent Examiner.

1900. Chase, March F., 1111, Marquette Building, Chicago, Ill., U.S.A., Chemist.

1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.

1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.

1910. Chattopadhaya, P. C., 90, Maniktala Main Road Harrison Road P.O., Calcutta, India, Chemist.

1905. Cheeseman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.

1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.

1894. Cheney, John P., Messrs. Cheney Bros., South Manchester, Conn., U.S.A., Chemist and Silk Manufacturer.

1913. Chiaraviglia, Dr. Dino, Via Treviso 7, Rome, Italy, Director, Royal Explosives Laboratory.

1905. Chick, Oliver, 31, Auckland Road, Cranbrook Park, Ilford, Essex, Analytical Chemist.

1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.

O.M. Christie, J., Levenfield, Alexandria, Scotland, Dyer and Printer.

1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.

1914. Christie, John T., c/o Messrs. John Miller and Co., Sandilands Chemical Works, Aberdeen, Analytical Chemist.

1908. Christie, Malcolm, Ardenlea, Portland Park, Hamilton, Scotland, Analytical Chemist.

1910. Christie, Dr. M. G., c/o The Otto-Hilgenstock Coke Oven Co., Post Office House, Leeds, Assistant General Manager.

1898. Christison, Geo., 2, Kelvinside Gardens, Glasgow, Engineer.

1907. Christopher, George, Walkden Works, Verney Road, South Bermondsey, S.E., Consulting Chemist.
1907. Christopher, J. E., Solvay Coke Works, Kirkless, Wigan, Assistant in Charge.
O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1908. Chrystall, E. R., c/o Curtis's and Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.
O.M. Church, Sir Arthur, K.C.V.O., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1890. Church, Elihu D., jun., 27, Cedar Street, New York City, U.S.A., Soda Manufacturer.
1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U S A., Chemical Engineer.
1907. Churchill, Wm., Corning Glass Works, Corning, N.Y., U.S.A., Chemist.
1396. Claflin, Alan A., (Communications) 88, Broad Street, Boston ; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.
1909. Claflin, Albert W., 190, Waterman Street, Providence, R.I., U.S.A., Manufacturing Druggist.
1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1905. Clapp, Geo. A., 49, Federal Street, Boston, Mass., U.S.A., Chemist.
1891. Clapp, Ralph R., c/o B. P. Clapp Ammonia Co., Providence, R.I., U.S.A., Manager.
1889. Clapperton, J., jun., Analytical Chemist.
1913. Clark, A. Stanley, c/o Messrs. S. Pearson and Son, The Refinery, Minatitlan, Vera Cruz, Mexico, Technical Chemist.
1910. Clark, A. W., c/o Heath and Milligan Manufacturing Co., 1832, South Canal Street, Chicago, Ill., U.S.A., Superintendent.
1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.
1908. Clark, Chas. T., 1303, Sixth Street, Bay City, Mich., U.S.A., Manufacturing Chemist.
1913. Clark, Francis W., 35, Wilmington Square, London, W.C., Chemist.
1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.
1910. Clark, Henry, 25, Adelaide Crescent, Brighton, Oil Refiner.
1909. Clark, Hubert A., 83, Amherst Street, Montreal, Canada, Canner.
1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
1906. Clark, M. H., c/o Boston Rubber Shoe Co., Melrose, Mass., U.S.A., Chemist.
1902. Clark, Robt. M., 138, Bath Street, Glasgow, Chemist.
1906. Clark, Wm. B., 11, Fox Street Greenock, Chemist.
1907. Clark, Wm. H., 26, Barry Street, Dunston-on-Tyne, Analytical Chemist.
1912. Clark, William M., Niles Glass Works, Niles, Ohio, U.S.A., Chemist.
1904. Clarke, Alfred R., 613-617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.
1908. Clarke, Arthur F., 13, Sloane Street, London, S.W., Analytical Chemist.
1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.
1889. Claus, Wm. H., c/o Claus and Co., Ltd., Clayton, Manchester, Manufacturing Chemist.
1909. Clayton, Ellis, Hazeldene, Deerpark Road, Belfast, Ireland, Lecturer on Bleaching, Dyeing, and Printing.
1895. Clayton, Dr. G. C., Croughton, near Chester.
1909. Clayton, H., "The Brae," Station Road, Crayford, Kent, Technical Chemist.
1894. Clayton, Robt. H., 1, Parkfield Road, Didsbury, Manchester, Chemist.
1910. Clayton, Will, Melville House, Accrington, Works Chemist.
1905. Clayton, W. E., Navy Victualling Yard, Kowloon, Hong Kong, Superintendent.
1907. Clement, Leonard H., Agnew Street, Lytham, Lancs., Chemist.
1893. Clemes, J. H., Cheriton, Newquay, Cornwall.
1884. Clerk, Dr. Dugald, F.R.S., 57-58, Lincoln's Inn Fields, London, W.C., Engineer.
1905. Clexton, Thos. J., 285, Congress Street, Boston, Mass, U.S.A., Manager (A. Klipstein and Co.).
1906. Clifford, Jos., Laboratory, Public Works Ministry Gardens, Cairo, Egypt, Chemist.
1913. Clifford, Sydney G.; 3, Norman Villas, East Dulwich, S.E., Analytical Chemist.
1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
O.M. Cloud, T. C., 20, Bucklersbury, London, E.C., Metallurgist.
O.M. Clowes, Dr. F., The Grange, College Road, Dulwich, S.E.; retain Journals; Chemist.
1891. Clutton, J. H., Fonderie Mines de l'Aude, Villanière par Lastours (Aude), France, Assayer.
1911. Clymer, Wm. R., Publicity Department, National Carbon Co., Cleveland, Ohio, U.S.A., Manager.
1899 Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.
1911. Coates, Jos. E., The University, Edgbaston, Birmingham, Lecturer.
1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
1893. Cobb, Prof. Jno. W., The University, Leeds, Prof. of Coal Gas and Fuel Industries.
1894. Coblentz, Dr. Virgil, 23, Vine Street, Brooklyn, N.Y., U.S.A., Research Chemist (R. R. Squibb and Co.).
1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U S.A., Chemist.
1911. Cochrane, Capt. J. B., Royal Military College, Kingston, Ontario, Canada, Professor of Physics and Chemistry.
1901. Cockburn, John A., Mayville, Stevenston, Ayrshire, Analytical Chemist.
1902. Cocking, Allan T., c/o Kynoch, Ltd., Lion Works, Witton, Birmingham, Ammunition Manufacturer.
1905. Coes, Chas. S., 1024, East River Street, Hyde Park, Mass., U.S.A., Oil Chemist.
1903. Coggeshall, Dr. G. W., 1807, Belmont Road, Washington, D.C., U.S.A., Chemical Engineer.
1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.
1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
O.M. Cohen, Dr. J. B., 1, North Grange Mount, Headingley, Leeds, Professor of Organic Chemistry.
1897. Cohn, Alfred I., 122, East 74th Street, New York City, U.S.A., Chemist.
1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.
1904. Cohoe, Prof. W. P., 131, Walmer Road, Toronto, Canada, Professor of Chemistry.
1891. Colby, Albert L., 447, Lehigh Street, South Bethlehem, Pa., U.S.A., Metallurgical Engineer.
1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.
O.M. Colby, W. H., Cairn Villa, St. Branock's Road, Ilfracombe.
1893. Coleman, W. H., 31, Queen's Terrace, Ayr, Scotland, Chemical Engineer.
1913. Colgate, R. T., 53, London Road, Reading, Works Chemist.
1905. Collett, John H., Sunnycroft, Tuffley, and (Jnls.) The Librarian, Free Library, Gloucester, Chemical Manufacturer.
1887. Collett, J. M., Wynstone Place, Brookthorpe, Gloucester, Chemical Manufacturer.
1901. Colley, Bernard T., c/o Braden Copper Co., Rancagua, Chile, South America, Superintendent.
1908. Collier, F. C., 457, Lansdowne Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.

1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley. Textile Chemist.

1913. Collinge, H. G., c/o Naegeli and Co., Rua Theophilo Ottoni 21 (Caixa 562), Rio de Janeiro, Brazil, Technical Chemist.

1898. Collingridge, Frank, Highstone, New Road, Llanelly, South Wales, Chemist.

1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.

1888. Collins, W. Hepworth. *See* Hepworth-Collins. W.

1913. Collinson, R. W., c/o Messrs. J. and J. Colman, Ltd., Starch Dept., Carrow Works, Norwich, Starch Manufacturer.

1899. Collis, Walter T., Parkhurst, St. Peter's Road, Harborne, Birmingham, Chemist.

1910. Collitt, Bernard, Chem. Laboratory, Messrs. Ruston, Proctor, and Co., Ltd., Lincoln, Chemist.

1910. Colman, Fred. J., c/o Brotherton and Co., Ltd., Wear Tar Works, Sunderland, Chemist.

1891. Colman, Dr. H. G., Woodthorpe, New Malden, Surrey, Analytical Chemist.

1892. Colquhoun, Ludovic, Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.

1894. Colquhoun, W., Tapton Close, Tapton House Road, Sheffield, Engineer.

1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.

1906. Comber, A. W., 23, Courtenay Gardens, Upminster, Essex, Metallurgical Chemist.

1900. Comey, Dr. Arthur M., Upland Avenue, opposite Summit Street, Chester, Pa., U.S.A., Technical Chemist.

1911. Comey, Robert H., Wenonah, N.J., U.S.A., Bleacher.

1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.

1901. Connah, Jas., Laboratory, Custom House, London, E.C., Government Analyst.

1905. Conner, Arthur B., 217, West Boulevard, Detroit, Mich., U.S.A., Chief Chemist (Detroit Chemical Works).

1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.

1889. Conroy, Dr. Jas. T., 9, The Serpentine, Grassendale, Liverpool, Chemist.

1887. Constable, W. H., Australian Alum Works, Runcorn, Analytical Chemist.

1909. Cook, E. Bernard, 23, Cross Street, Finsbury, London, E.C., Manufacturing Chemist.

O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.

1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.

1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.

1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.

1891. Cooke, Arthur W., "Abbey View," Walnut Road, Torquay, Analytical Chemist.

1907. Cooke, J. J. Verdin, 9, James Street, Liverpool, Salt Manufacturer.

1904. Cooke, W. Ternent, The University, Adelaide, South Australia, Lecturer in Chemistry.

1910. Coombs, Frank A., Technical College, Sydney, N.S.W., Australia, Lecturer on Tanning.

1913. Cooper, G. Stanley, 92, Harcourt Road, Sheffield, Chemist.

1910. Cooper, Leonard H., Royal Crown Soap Co., Calgary, Alberta, Canada, Chemist.

1901. Cooper, T. S., Beekfoot, Birch Hall Lane, Manchester, Calico Printing Chemist.

1891. Cooper, Walter J., The Elms, Lavernock, South Wales, Cement Works Manager.

1890. Corcoran, Bryan, 31, Mark Lane, London, E.C., Chemical Engineer.

1899. Cornelison, Dr. Robt. W., 275, West Summit Street, Somerville, N.J., U.S.A., Consulting Chemist.

1909. Cornell, Fred, 16, Place Royal, Montreal, Canada, Chemical Merchant.

1894. Coste, J. H., 2, Savoy Hill, Victoria Embankment, W.C., and (Journals) Utopia, Gloucester Road, Teddington, Chemist (Public Health Dept., L.C.C.).

1913. Cotterill, John W., 9, Broad Street Corner, Birmingham, Analyst.

1911. Cottrell, Henry E. P., c/o North Western Cyanamide Co., 313, Winchester House, Old Broad Street, London, E.C., Manager.

1912. Coupe, Geoffrey, 43, Hampton Road, Forest Gate, E., Chemist.

1914. Courian, Noubar, 14, Oaklands Avenue, Toronto, Canada, Rug Manufacturer.

1914. Cousins, F. G., 1, St. Cuthbert's Place, North Road, Durham, Science Master.

1894. Cousins, W. J., 55, Clerkenwell Close, London, E.C., Consulting Chemist and Director.

1912. Couture, Philibert, 21, Pond Street, Worcester, Mass., U.S.A., Assistant Chemist.

1909. Coventry, Bernard O., Lahore, Punjab, India, Deputy Commissioner of Forests.

1903. Cowan, A. Wallace, Bayfield, Bowdon, Cheshire, Analytical Chemist.

1906. Cowan, George D., Bridge House, Bridge Road, Millwall, E., Manager, Desilverising Works.

1912. Cowan, H. W., Bell Filtration Co., Ltd., 305, Kent Building, Toronto, Canada, Water and Sewage Specialist.

1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.

1910. Coward, Hubert F., 216, Plymouth Grove, Manchester, Lecturer in Chemistry.

1897. Cowburn, Arthur W., 20, Mount Street, Manchester, Chemical Merchant and Analytical Chemist.

1907. Cowburn, J. Robert, 10, Eastwood Road, South Woodford, Essex, Technical Chemist.

1891. Cowper-Coles, Sherard Osborn, 1 and 2, Old Pye Street, Westminster, S.W., and (Jnls.) The Cottage, French Street, Sunbury-on-Thames, Metallurgical Engineer.

1905. Cox, Harold N., c/o Lalance and Grosjean Mfg. Co. Woodhaven, N.Y., U.S.A., Chemist.

1884. Craig, Geo., Chemical Laboratory, 95, Bath Street Glasgow, Technical Chemist.

1895. Craig, Dr. Thos. J. I., c/o Peter Spence and Sons, Ltd., Alum Works, Manchester, Chemist.

1908. Craig, Wm. J., c/o Rio Tinto Co., Casa Colon, Huelva, Spain, Analytical Chemist.

1911. Crake, Ralph V., British South African Explosives Co., Dynamite Factory, Modderfontein, Transvaal, Chemist.

1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.

1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.

1898. Cranfield, Wm., 11, Avondale Place, Halifax, Yorks, Teacher of Chemistry.

1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.

1902. Craven, Alfred B., Northcote, Thorpe Road, Selby, Yorks, Analytical Chemist.

1906. Craven, J. A., 119, Moorside, Armley, Leeds, Chemist.

1891. Craven, Jno., The Ark, South Bersted, Bognor, Sussex, Chemist.

1906. Craven, John L., Niederwald, Hebers Ghyll, Ilkley, Yorks, Chemist and Salesman.

O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.

1913. Crawford, John, c/o Lothian, 24, Briar Bank Terrace, Edinburgh, Works Chemist.

1908. Crawford, Lawrence, 17, Creswell Terrace, Dumfries, Scotland, Analytical Chemist.

1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.

O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and Broadway Chambers, Westminster, S.W., Chemist.

1901. Cribb, Cecil H., 136 Shaftesbury Avenue, London, W. Analytical and Consulting Chemist.

1909. Crichton, Charles, Kleinfontein Group C.A., Box 2, Benoni, Transvaal, Assayer.

1908. Crighton, Adam M., "London Place," Agecroft Print Works, Pendleton, Manchester, Calico Printer's Chemist.

1910. Crighton, David T., Nobel House, 195, West George Street, Glasgow, Buying Manager.

1905. Crighton, W. H., c/o Oro Concentration Co., Ltd., Globe Road, Kingsland Road, London. N.E., Chemist.

1890. Criper, Wm. R., c/o Messrs. D. Waldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.

1911. Croasdell, Jas. F., 32, Handen Road, Lee, S.E., Engineer.

1901. Cronquist, G. W., Torekow, Sweden, Consulting Ceramic Engineer.

O.M. Crookes, Sir Wm., O.M., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.

1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.

O.M. Crosfield, A. L., 46, Bidston Road, Oxton, Birkenhead ; (Journals) c/o Prof. B. Moore, Biochemical Dept., The University, Liverpool, Analytical Chemist and Assayer.

1896. Crosfield, Capt. G. R., Lodge Lane, Warrington, Soap Manufacturer.

1908. Crosland, Percy F., Century Dye Works, Elland, Yorks, Technical Chemist.

1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.

1894. Crossley, Prof. Arthur W., F.R.S., Pharmaceutical Society, 17, Bloomsbury Square, London, W.C., Professor of Chemistry.

1904. Crossley, T. Linsey, 318, Lagauchetière Street West, Montreal, Canada, Technical Chemist.

1908. Croston, Henry, 583, Leonard Street, Brooklyn, N.Y., U.S.A., Foreman.

1894. Crow, Henry W., Hart's Lane, North Street, Barking, E., Tar Distiller.

1884. Crow, Dr. J. K., Ivydene, Westcombe Park Road, Blackheath, S.E., Technical Chemist.

1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.

1906. Crowther, R. E., c/o Ferguson Bros., Ltd., Holme Head, Carlisle, Chemist.

1912. Cruikshanks, Dr. Geo. S., Royal Technical College, Glasgow, Chemist.

1884. Crumbie, W. D., 146, Washington Street, East Orange. N.J., U.S.A., Analytical Chemist.

1906. Cruser, Dr. Fred. Van D., c/o The Diamond Match Co., Barberton, Ohio, U.S.A., Chemical Engineer.

1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, South Africa, Chemist.

1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Wallsend-on-Tyne, Engineer.

1897. Culmann, Dr. J., c/o G. Siegle Co., Rosebank, Staten Is., N.Y., U.S.A., Chemist and Colourist.

1905. Culver, Ralph F., Ayer, Mass., U.S.A., Chemist.

1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.

1912. Cuming, Wm. F., c/o Cuming, Smith, and Co. Proprietary, Ltd., Yarraville, Victoria, Australia, Manufacturing Chemist.

1907. Cunningham, James E., Minas Peña del Hierro, Provincia de Huelva, Spain, Analytical Chemist.

O.M. Curphey, W. S., 87, Canfield Gardens, South Hampstead, N.W., Chief Alkali Works Inspector.

1898. Curtis, Marvin, 108, Front Street, San Francisco, Cal., U.S.A., Wine Chemist.

1903. Cushing, Robt. P., 313, Saurens Street, Olean, N.Y., U.S.A., Chemist.

1902. Cutbush, Chas. G., 55, Byne Road, Sydenham, Kent, Electrical Engineer.

1899. Cutler, Fred. F., 166, Essex Street, Boston, Mass., U.S.A., Publisher.

1913. Cutts, H. Cyril, Brooklyn, Private Road, Sherwood, Nottingham, Embroidery Manufacturer.

1904. Cutts, Henry E., c/o Stillwell and Gladding, 181, Front Street, New York City, U.S.A., Technical Chemist.

D

O.M. Dacie, J. C., 30, Montserrat Road, Putney, S.W., Soap Manufacturer (retired).

1911. Dager, Herman J., 278, Jarvis Street, Toronto, Canada, Dominion Food Inspector.

1897. Dains, Herbert H., c/o J. E. Ferguson, 2, Union Court, London, E.C., Analytical Chemist

1908. Dale, H. Gordon, St. Ives, Fitzjohn Avenue, Barnet, Herts, Analytical Chemist.

1908. Dalton, Leonard V., 17, Gracechurch Street, London, E.C., Geologist (Petroleum).

1884. Daniell, Louis C., Royal Standard Brewery, Tamworth, New South Wales, Brewer.

1904. Danker, Dan. J., 73, Dean Road, Brookline, Mass., U.S.A., Dyestuff and Chemical Merchant.

1903. Dannenbaum, Dr. H., c/o National Ammonia Co., Frankford, Philadelphia, Pa., U.S.A., Secretary and Treasurer.

1885. Darby, Jno. H., Howard Chambers, 155, Norfolk Street, Sheffield, Ironmaster.

1911. David, Edward J., 249, Wood Avenue, Tottenville, Staten Is., N.Y , U.S.A., Chemist and Assayer.

1900. Davidson, Alex., 173, Colinton Road, Edinburgh, Analytical Chemist.

1899. Davidson, Charles, 65, Cadder Street, Pollokshields, Glasgow, Analytical Chemist.

1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.

1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.

1891. Davidson, Richard, 133, Victoria Road, Dundee, Oil Merchant's Clerk.

O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.

1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.

1911. Davidson, Thos. A., 57, Strathyre Avenue, Norbury, S.W., Chemist and Varnish Expert.

1905. Davidson, Dr. Wm. B., City Gas Works, Nechells, Birmingham, Chemist.

1906. Davies, Harry R., 80, Prince Street, Jamaica Plain, Mass., U.S.A., Chemist.

1898. Davies, Herbert E., The Laboratory, 28 Chapel Street, Liverpool, Analytical Chemist.

1907. Davies, James, 12, Harefield Road, Brockley, London, S.E., Scientific Apparatus Maker.

1912. Davies, Jas. Gordon, c/o Curtis's and Harvey, Ltd., Powder Mills, Tonbridge, Kent, Chemist.

1911. Davies, Jas. H., c/o Lever Bros., Ltd., Royal Liver Building, Liverpool, Chemist.

1896. Davies, Llewellyn J., 103, Bute Road, Cardiff, Analytical and Consulting Chemist.

1886. Davies, M. L., Standard Chemical, Iron, and Lumber Co., Toronto, Canada, General Manager.

1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., The Cocoa Works, York, Research Chemist.

1908. Davies, T. H., c/o John Cox and Co.'s Successors, Stillhouse Lane, Bedminster, Bristol, Tanner.

O.M. Davis, A. R., 27, Wellington Road, Heaton Chapel, Stockport, Analytical Chemist.

1901. Davis, Bernard F., c/o Ore Trading Co., Casilla 112D, Santiago, Chile, Metallurgical Engineer.

1902. Davis, Charles B., c/o National Brewers' Academy, 402, West 23rd Street, New York City, U.S.A., Technical Chemist.

1902. Davis, Emerson, Detroit Chemical Works, Detroit, Mich., U.S.A., Chemist.

1912. Davis, E. Gordon, c/o Messrs. Curtis's and Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.

1908. Davis, G. Keville, 265, Strand, London, W.C., Chemical Engineer.

O.M. Davis, H. W., 18, Crescent Road, Kingston-on-Thames, Analytical Chemist.

1907. Davis. Robt. W., jun.. 2505. South Garnet Street, Philadelphia, Pa., U.S.A., Chemist.

1906. Davis, V. P., 221, West Exchange Street, Providence, R.I., U.S.A., Chemist.

1897. Davis, Wm. A., 7, Carlton Bank, Harpenden, Herts, Chemist.

1911. Davis, Wm. C., The Hollies, St. Paul's Road, Smethwick, near Birmingham. Chemist.

1900. Daw, Fred W., Duffryn House, Ebbw Vale, Mon., Metallurgical Chemist.

1903. Dawes, Arthur W., 577, Providence Street, Albany, N.Y., U.S.A., Chemist.

O.M. Dawson, C. A., 32, Elm Hall Drive, Mossley Hill, Liverpool, Technical Chemist.

1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals) 15, Wrottesley Road, Woolwich, S.E., Technical Chemist.

1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.

1913. Day, Frank E., c/o Condensed Milk Co. of Ireland, Lansdowne, Limerick, Ireland, Chemist.

1912. Day, G. A. C., Casilla No. 417, Lima, Peru (*viâ* New York). Oil Mill Manager.

O.M. Deacon, H. Wade, 8, Ullet Road, Liverpool; and (Jnls.) c/o C. E. Tyers, 186, Derby Road, Farnworth, Widnes, Alkali Manufacturer.

O.M. Deakin, H. T., Dewhurst, Egerton, near Bolton, Dyer.

1913. Deakin, J. Bartram, c/o Guest, Keen, and Nettlefolds, Ltd., By-Product Coke Ovens, Cwmbran, Mon., Coke Oven Manager.

1911. Dean, Arthur L., Sheffield Scientific School, New Haven, Conn., U.S.A., Assistant Prof. of Industrial Chemistry.

1903. Dean, Harry, Oak Villa, Greenhead Road, Huddersfield, Chemist.

1906. Dean, Harry, Armstrong College, Newcastle-on-Tyne, Demonstrator.

1892. Deaville, B., Beech Avenue, Nottingham Manufacturing Chemist.

1910. Deby, Bedford H., 27, Meadow Bank Avenue, Sharrow, Sheffield, Metallurgist and Chemist.

1899. De Castro, J. Paul. *See* Castro, J. Paul de.

1902. De Cew, J. A., 903, McGill Building, Montreal, Canada, Chemical Engineer.

1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.

1884. Deering, W. H., I.S.O., Beauworth, Moretonhampstead, Devon, late Chemist to War Department.

1900. Deerr, Noel F., Analytical Chemist.

1902. Deghuée, Dr. Jos. A., 39, West 38th Street, New York City, U.S.A., Chemist.

1911. Dehn, Dr. Frank B., c/o F. Heron Rogers, Broad Sanctuary Chambers, Westminster, S.W., Chemist.

1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.

1893. Delahaye, Philibert, 94, Rue St. Lazare, Paris (IX.), Gas Engineer.

1909. De Laire, Edgar, 47, Quai de Moulineaux. Issy, Seine, France, Industriel.

1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.

1908. Dellschaft, Dr. F. H., Winnington, Northwich, Cheshire, Manufacturing Chemist.

1910. De Meeus, Etienne, Beacon Falls, Conn., U.S.A., Chemist.

1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.

1909. Demuth, Rudolph, 68, Salusbury Road. London, N.W., Manufacturer.

1899. Denham, Wm. S., The United College, St. Andrews, Scotland.

1913. Denington, R. C., 69, Dover Road. South Wanstead, Essex, Research Chemist.

1891. Denison, Joseph R., Messrs. J. R. Denison and Co., Valley Dyeworks, Bradford, Yorks, Analytical Chemist.

1911. Dennis, Louis, 26, Clapton Mount, Halifax Yorks, Works Chemist.

1908. Dennis. Martin, 859, Summer Avenue, Newark, N.J.. U.S.A., Manufacturing Chemist.

1907. Dennison, Henry S., c/o Dennison Manufacturing Co., Framingham, Mass., U.S.A., Manufacturer.

1898. Dent, Dr. Frankland, Government Analyst's Dept., Singapore, S.S., Government Analyst.

1912. Depierres, Gaston, The Indestructible Paint Co., King's House, King Street, Cheapside, London, E.C., Managing Director.

1905. Derby, Wallace G., c/o Nichols Copper Co., Laurel Hill, New York City, U.S.A., Assayer.

1913. Desch, Dr. Cecil H., Metallurgical Dept., The University, Glasgow, Lecturer.

1912. Dettmann, A. H., Stuart Street, Longueville, Sydney, N.S.W.. Leather Manufacturer.

1914. Detwiler, Jas. G., Box 210, Port Arthur, Texas, U.S.A., Chemist.

1906. Deverell. Louis C., 1, Shortlands Grove, Shortlands, Kent, Chief Chemist.

1908. Dew, Joseph A., 32, Forest Drive West, Leytonstone, N.E., Varnish Manufacturer.

1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.

O.M. Dewar, Sir J., F.R.S., 21, Albemarle Street, London, W., Professor of Chemistry and Physics.

1889. Dewey, Fred. P., Lanier Heights, Washington, D.C. U.S.A., Metallurgist.

1904. Dewhirst, J. A., Imperial Chambers, Halifax, Yorks, Analyst.

1909. Dewhirst, Wm. B., c/o Sager, 1128 Sixth Avenue, New Brighton, Pa., U.S.A., Technical and Engineering Chemist.

1903. Diamond, Wm., c/o John Bowes and Partners, Ltd., Marley Hill Colliery, Swalwell, R.S.O., Durham, Works Manager.

1913. Diaz-Ossa, Prof. Belisario, Casilla 962, Santiago, Chile, Prof. of Chemistry.

O.M. Dibdin, W. J., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1913. Dick, James, c/o Canadian Explosives, Ltd., Beloeil Station, P.Q., Canada, Superintendent.

1902. Dick, John, Wharf Road, Cubitt Town, London, E., Manager and Chemist.

1904. Dick, W. D., c/o Hugh Baird and Sons, 29, St. Vincent Place, Glasgow, Analytical Chemist.

1898. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, London, E.C., Secretary.

1904. Dickenson-Gair, C. J. *See under* Gair.

1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.

O.M. Dickinson, A. J., 178, Lewisham High Road, Brockley, S.E., Tar Distiller.

1905. Dickinson, Cyril, Southwark Town Hall, Walworth Road, London, S.E., Analytical Chemist.

1898. Dickson, Samuel, 26, Tothill Street, Westminster S.W., Analytical Chemist.

1899. Dieckmann, Dr. Otto, 1180, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.

1914. Diehl, Dr. L. H., 703, Salisbury House, London Wall, London, E.C., Metallurgical Chemist.

1908. Diekman, Dr. George C., 115, West 68th Street, New York City, U.S.A., Professor of Pharmacy.

1894. Diestel, Wm., 117, Hudson Street, New York City U.S.A., Dyestuff Importer.

1908. Dill, Colby, Perth Amboy, N.J., U.S.A., Chemist.

1906. Dillon, Fred N., 16, Prospect Street, Fitchburg, Mass., U.S.A., Engineer.

1898. Dillon. Wm., The Lomas Gelatine Works, Southdown, Plymouth. Oil, Colour, and Varnish Manufacturer.

1911. Dissosway, Thurston N., 23, Vine Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Divine, Robt. E., 510, Bewick Avenue, Detroit, Mich., U.S.A., Chemist.

1899. Dixon, Fred. W., P.O. Box 43, Jamestown, N.Y. U.S.A., Dyer.

1888. Dixon, Prof. Harold B., F.R.S., Owens College, Manchester. Professor of Chemistry.

1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.

1909. Dixon, W. H., c/o Bryant and May, Ltd., Fairfield Works, Bow, London, E., Match Manufacturer.

1892. Dobb, Thos., c/o J. T. Dobb and Son, West Bar, Sheffield, Pharmaceutical Chemist.

O.M. Dobbie, J. J., F.R.S., Government Laboratory, Clement's Inn Passage, London, W.C., and (Jnls.) 4, Vicarage Gate, Kensington, W., Director.

O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.

1908. Dobbs, Ernest J., 16/17, Devonshire Square, Bishopsgate, London, E.C., Analytical Chemist.

1914. Dobson, Fred. W., Castle Grove, Nottingham, Lace Dyer and Dresser.

1913. Dobson, James, Holme Rook, Birch Lane, Longsight, Manchester, Technical Chemist.

1890. Dodd, A. J., Meadholme, Blackheath Park, S.E., Oil Manufacturer.

1907. Dodd, Arthur, Lyndhurst, Woolwich Road, Belvedere, Kent. Assistant Works Manager.

1889. Dodd, W. Ralph, Burton Grange, Goff's Oak, near Cheshunt, Chemical Works Manager.

1913. Dodds, Herbert H., c/o Kynoch, Ltd., Umbogintwini, Natal, Explosives Chemist.

1906. Dodds, Thos., c/o Reckitt and Sons, Ltd., and (Journals) 7, The Oval, Garden Village, Hull, Works Manager and Chemist.

1900. Dodge, Dr. Francis D., 291, Henry Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Dodsworth, Walter A., Journal of Commerce, 32, Broadway, New York City, U.S.A., Editor.

1897. Doerflinger, Wm. F., Rosebank, Staten Island, N.Y., U.S.A., Research Chemist.

1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.

1905. Dolan, H., Westbourne, Belvoir Road, Lower Walton, Warrington, Chemist.

1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.

1914. Donald, James R., Sulphide, Ont., Canada, Chemical Engineer.

1903. Donald, Dr. Jas. T., 318, Lagauchetière Street West, Montreal, Canada, Consulting Chemist.

1912. Donald, R. M., c/o Lever Bros. Co., 174, Broadway, Cambridge, Mass., U.S.A., Soapworks Manager.

1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.

1913. Donaldson, Richard, 63, Waverley Gardens, Crossmyloof, Glasgow, Assistant Manager.

1902. Donaldson, Thos., c/o British South African Explosives Co., Ltd., Modderfontein, Transvaal, and Journal to 3, Raise Street, Saltcoats, Scotland, Chemist.

1905. Donnan, Prof. F. G., F.R.S., Chemical Laboratories, University College, Gower Street, London, W.C., Professor of Physical Chemistry.

1886. Doolittle, Orrin S., 388, Palisade Avenue, Yonkers, N.Y., U.S.A., Chemist.

1905. Doolittle, Roscoe E., 109, Hillside Avenue, Glen Ridge, N.J., U.S.A., Chemist.

1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.

1911. Dorée, Dr. Charles, 58, Gore Road, South Hackney, London, N.E., Head of Chemistry Department, Borough Polytechnic.

1896. Doremus, Dr. Chas. A., 55, West 53rd Street, New York City, U.S.A., Professor of Chemistry.

O.M. Dott, D. B., Ravenslea, Musselburgh, Scotland, Analytical Chemist.

1911. Dougall, Jas. S. N., 305, Manufacturers Street, Montreal, Canada, Varnish Manufacturer.

1897. Douglas, Geo., Farfield Hall, Addingham, Yorks, Dyer.

1894. Douglas, Loudon M., Douglas Wharf, Putney, S.W., Chemical Manufacturer.

1909. Douglas, Robt. P., Prudential Buildings, Nelson Square, Bolton, Consulting Chemist.

1884. Douglas, William, Grafton House, Berkhamsted, Herts., Chemical Engineer.

1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.

1913. Doumin, Roland, 76, Tannsfeld Road, Sydenham, S.E., Analytical Chemist.

1900. Dow, Allan W., 126, Joralemon Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.

1908. Dow, John W., 564, Park Avenue West, Mansfield, Ohio, U.S.A., Manufacturing Chemist.

1905. Dowbiggin, James, Craiglands, Albert Park, Lancaster, Chemist.

1913. Dowell, Henry L., 25, Greenbank Terrace, Taunton, Somerset, Chemist

1912. Doxey, Carl W., c/o Whalley Abbey Printing Co., Whalley, near Blackburn, Printworks Chemist.

1901. Doxrud, Christian, Technical School, Christiania, Norway, Professor of Chemical Technology.

1907. Doyle, B. W., 245, Lindell Avenue, Leominster, Mass., U.S.A., Manufacturer.

1902. Drake, Bryant S., 5830, Colby Street, Oakland, Cal., U.S.A., Chemist.

1911. Drake, Joseph W. D., Three Mills Distillery, Bromley-by-Bow, London, E., Distillery Brewer.

1912. Drake, Louis L., 138, North La Salle Street, Chicago, Ill., U.S.A., Editor and Publisher.

1886. Dreaper, W. P., 37–39, Broad Street Avenue, London, E.C.: and (Journals) 27, Willow Road, Hampstead Heath, N.W., Consulting Chemist.

1906. Drew, W. Newton, Raincliffe, Ecclesfield, near Sheffield, Chemical Manufacturer.

1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.

O.M. Dreyfus, Dr. C., Claremont, Fallowfield, Manchester, Dye Manufacturer.

1904. Dreyfus, Dr. L. A., Maple Avenue, Rosebank, S.I., N.Y., U.S.A., Chemist.

1893. Dreyfus, S., Peel House, Peel Street, Denton, near Manchester, Chemist.

1899. Dreyfus, Dr. Wm., 57, East 96th Street, New York City, U.S.A., Chemist.

1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.

1910. Drury, Chas. Dru, Hendon Gas Works, Sunderland, Engineer.

1899. Ducas, B. P., 25-27, South William Street, New York City, U.S.A., Chemical and Dyestuff Importer.

1907. Ducca, Dr. Wilhelm A., c/o U.S. Rubber Co., 58th Street at 11th Avenue, New York City, U.S.A., Chemist.

1905. Duché, E., 6, Eastcheap, London, E.C., and (Jnls.) Usines Duché, Vilvorde, Belgium, Merchant.

1909. Duchemin, René P., 6, Rue Chanoinesse, Paris IV., France, Chemical Engineer.

1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., and (Jnls.) Vanbrugh Castle, Blackheath, S.E., Chemical Manufacturer.

1908. Duckworth, G. F., Merritton, Ont., Canada, Works Manager.

1905. Duckworth, Harry S., Garner Printworks and Bleachery, Garnerville, Rockland Co., N.Y., U.S.A., Printworks Chemist.

1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.

1913. Duff, Alex. R., 211, Fern Avenue, Toronto, Canada, Rubber Chemist.

1899. Duff, Wm. S., Merric Lands, Westbury Road, Buckhurst Hill, Essex, Manufacturing Chemist.

1905. Duffus, W. B., 118, Braid Road, Edinburgh, Chemist.

1901. Dufty, Lawrence, 92, Tom Lane, Nether Green, Sheffield, Analytical Chemist.

1905. Duggan, Edw. J., c/o Warner Chemical Co., 141, Broadway, New York City, U.S.A., Vice-President.

O.M. Duggan, T. R., 52, East 41st Street, New York City, U.S.A., Analytical Chemist.

1898. Duisberg, Dr. Carl, The Bayer Co., Ltd. (Journals) Farbenfabrik, Leverkusen, bei Cöln a R., Germany: (subscriptions) 19, St. Dunstan's Hill, London, E.C., Chemist.

1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.

1906. Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.

1889. Duncan, Arthur W., c/o J. Woolley, Sons and Co., Ltd., Victoria Bridge, Manchester, Analytical Chemist.

1909. Duncan, Jas., c/o Steel Bros. and Co., Ltd., 6, Fenchurch Avenue, London, E.C., Merchant.

1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.

1912. Dunkelsbuhler, F. S., 63, Brook Street, Grosvenor Square, London, W., Technical Chemist.

1905. Dunlop, Harry, 231, St. Vincent Street, Glasgow, Chemist.

1892. Dunn, Fred, 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.

O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.

O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.

1908. Dünschmann, Dr. Max, c/o Meister, Lucius, und Brüning, Ltd., Ellesmere Port, Cheshire, Manager.

1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.

1907. Dunstan, A. E., Technical College, East Ham, E., Head of Chemical Department.

1907. Dupré, F. H., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1907. Dupré, P. V., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1905. Durfee, Winthrop C., 516, Atlantic Avenue, Boston, Mass., U.S.A., Manufacturing Chemist.

1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Professor of Chemistry.

1911. Durkin, Jos. A., c/o Butterworth Judson Co., Newark, N.J., U.S.A., Chemical Superintendent.

1907. Durrans, Thos. H., 10, Titchfield Terrace, Regent's Park, London, N.W., Chemist.

1899. Duryea, Chester B., 120, 85th Street, Brooklyn, N.Y.. U.S.A., Starch Manufacturer.

1906. Dushman, Saul, Research Laboratory, General Electric Co., Schenectady, N.Y., U.S.A , Electrochemist.

1891. Dvorkovitz, Dr P., 4. Broad Street Place, London, E.C., Technical Chemist.

1912. Dyche-Teague, F. C.. 258, Gloucester Terrace, Hyde Park, London, W., Analytical Chemist and Bacteriologist.

O.M. Dyer, Dr. B., 17, Great Tower Street, London. E.C., Analytical and Consulting Chemist.

1907. Dyes, Dr. W. A., 32, New Bridge Street, London, E.C.

1911. Dyke, F. Montague, Nelson Croft, Church Road, Bebington, Cheshire, Analytical Chemist.

O.M. Dyson, C. E., Flint, North Wales.

1902. Dyson, George W., 24, Clarkehouse Road, Sheffield, Analyst.

1892. Dyson, Septimus, Nyddcombe, Warlingham, Surrey, Manufacturing Chemist.

E

1905. Eager, Chas. E., 77, Pearl Street, Boston, Mass., U.S.A., Merchant.

1912. Eames, A. Spencer, 176, Tower Bridge Road, London, S.E., Registrar, Leathersellers' Technical College.

1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.

1910. Eardley, J. F.. 265, Glossop Road, Sheffield, Pharmaceutical Chemist.

1913. Earl, J. C., c/o Hon. Mrs. Lewis Benacre, Glen Osmond, South Australia.

O.M. Earp, W. R., Preston Brook, near Warrington, Chemical Manufacturer.

1910. Easterfield, Prof. Thomas H., Victoria College, Wellington, New Zealand, Prof. of Chemistry.

1884. Eastick, C. E., 13, King Edward Street, Whitechapel, E., Sugar Refinery Director.

1909. Eastick, J. C. N., 49A, Clapton Common, London, N.E., Electrochemist.

O.M. Eastick, J. J., 2. St. Dunstan's Hill, London, E.C., Consulting Sugar Expert.

1890. Eastlake. A. W., Grosmont, Palace Road, Streatham Hill, S.W., Consulting Petroleum Engineer.

1909. Eastlake, William H., c/o Imperial Wire and Cable Co., Montreal, Canada, Chemist.

1906. Eaton, B. J , Kuala Lumpur, Fed. Malay States, and (Journals) 171, Ribblesdale Road, Streatham Park, S.W., Government Chemist.

1909. Eberlin, Leon W., 11, First Street, Rochester, N.Y.. U.S.A., Chemist.

1892. Eddy, Harrison P., 14, Beacon Street, Boston, Mass., U.S.A., Superintendent.

1913. Edge, Alfred, Ravenhurst, Clayton Bridge, Manchester, Technical Chemist.

1885. Edge, Anthony, 79, West Milton Street, Readville, Mass., U.S.A., Chemist.

1909. Edge, J. Harold, " Great Marld," Smithills, Bolton, Lancashire, Technical Chemist.

1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.

1908. Edmunds, Wm. T., 25. Church Road, Burry Port, South Wales, Assayer.

1911. Edwards, Alfred, The Laboratory, Meadow Lane Gas Works, Leeds, Analytical Chemist.

1909. Edwards, George M., 241, Pine Avenue West, Montreal, Canada, Paintworks Manager.

1902. Edwards, H. Leaton, The Shanty, Banks Avenue, Meols, Hoylake, Cheshire, Analyst.

1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.

1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.

1910. Eilsberger, Dr. Ernst, Deutsche Solvaywerke, Bernburg (Anhalt), Germany, Director.

1913. Eipper, William R., 1601, East 82nd Street, Cleveland, Ohio, U.S.A., Chemist.

1909. Eisenhart, M. H., c/o Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Chemist.

1901. Elkan, Leo A.. Dominick Street and Webster Avenue, Chicago, Ill., U.S.A., Tanner.

1901. Elkins, Arthur W., 116, Prospect Street, East Orange, N.J., U.S.A., Civil Engineer.

1884. Elliott, Dr. A. H., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Consulting Engineer and Chemist.

1912. Elliott, Edward, c/o Reckitts (Over-Sea), Ltd., Burke Street, Redfern, N.S.W., Australia, Chemical Engineer.

1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.

1896. Elliott, Dr. J. F., O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.

1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.

1905. Ellis, Carleton, 143, Gates Avenue, Montclair, N.J., U.S.A., Chemical Engineer.

1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.

1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.

1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.

1913. Ellis, Henry D., 30, Blackheath Park, S.E., Metallurgical Engineer.

1912. Ellis, Percival W., " Ellesmere," Pyrford, near Woking, Tanning Material Merchant.

1910. Ellis, Ridsdale, 723, Monadnock Building, Chicago, Ill., U.S.A., Patent Agent.

1910. Ellis, Rowland H., c/o Olympia Oil and Cake Co., Barlby Road, Selby, Yorks, Analytical Chemist.

1891. Ellis, Prof. W. Hodgson, 74, St. Alban Street, Toronto, Canada, Professor of Applied Chemistry.

1891. Ellison, Henry, Northfield, Cleckheaton, Yorks, Manufacturing Chemist.
O.M. Elmore, A. S., 72, Gloucester Terrace, Hyde Park, London, W., Electro-Metallurgist.
1907. Elsden, A. Vincent, 10, Gourock Road, Eltham, Kent, Analytical Chemist.
1911. Elsdon, Geo. D., Analytical Department, 11, Broad Street, Birmingham, Analyst.
1904. Elson, J. Hugh, Monroe Drug Co., Quincy, Ill., U.S.A., General Manager.
1909. Ely, Benjamin, The Limes, Pye Bridge, near Alfreton, Tar Distiller.
1910. Emanuel, Louis V., 165, Rector Street, Perth Amboy, N.J., U.S.A., Metallurgical Engineer.
1910. Embley, Dr. E. H., 245, Latrobe Street, Melbourne, Victoria, Australia.
1902. Emery, Arthur L., c/o Smith, Emery, and Co., 651, Howard Street. San Francisco, Cal., U.S.A., Chemical Engineer.
1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.
1907. Emslie, B. Leslie, 1102-1105, Temple Building, Toronto, Canada, Agricultural Chemist.
1894. Enequist, John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.
1904. Englehard, Charles, 30, Church Street, New York City, U.S.A., Platinum Importer.
1895. English, Frank H., 89, Belgrave Road, Wanstead, N.E., Analytical Chemist.
1899. Enright, Bernard, 233, North 4th Street, Allentown, Pa., U.S.A., Analytical Chemist and Director.
1906. Ephraim, Dr. Julius, II, Königgraetzerstrasse 69, Berlin, S.W., Germany, Chemist and Patent Agent.
1911. Epps, James W., Holland Street, London, S.E., Chemist.
1909. Epstein, Harry M., 281, Edgecomb Avenue, New York City, U.S.A., Works Manager.
1914. Erbslöh, S. H., Hafen 29, Düsseldorf, Germany, Engineering Chemist.
1907. Erdoes, Julius, 1100, Brook Avenue, New York City, U.S.A., Chemical Engineer.
1902. Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.
1904. Ermen, Walter F. A., The Cranbery, Juiz de Fora, Minas Geraes, Brazil, Analytical Chemist.
1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.
1897. Escher, Paul, c/o Swift and Co., Chemical Laboratory, Union Stock Yards, Chicago, Ill., U.S.A., Chemist.
1884. Esilman, A., 38, Norwood Avenue, Southport, Lancashire, Analytical Chemist.
1913. Esling, Fred., 57, Grove Road, Strood, Kent, Chemical Engineer.
1912. Espenhahn, E. V., c/o Metropolitan Gas Co., 186, Flinders Street, Melbourne, Victoria, Australia, Works Chemist.
1910. Esslemont, Alfred S., Royal Exchange Buildings, Hood Street, Newcastle-on-Tyne, and (Jnls.) Orde House, Morpeth, Northumberland, Electrical Engineer.
O.M. Estcourt, C., 5, Seymour Grove, Old Trafford Manchester, Consulting Chemist.
1903. Euler, C. G., 18–20, Platt Street, New York City, U.S.A., Chemical Agent.
1912. Evans, Edward V., South Metropolitan Gas Co., Old Kent Road, London, S.E., Chief Chemist.
1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.
1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.
1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.
1913. Evans, George A., c/o Australian Explosives and Chemical Co., Ltd., 135, William Street, Melbourne, Victoria, Australia, General Manager.
1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.
1908. Evans, Prof. Nevil Norton, Redpath Library, McGill University, Montreal, Canada, Associat Professor of Chemistry.
1889. Evans, R. E., Brewery Street, Stratford-on-Avon, Brewing Chemist.
1912. Evans, Sam, 4, Whickham Avenue, Dunston on Tyne, Chemist.
1912. Evans, Ulick R., 28, Victoria Street, Westminster, S.W., Consulting Electrochemist.
1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.
1909. Everette, Dr. W. E., 3512, South 11th Street, Tacoma, Wash., U.S.A., Consulting Chemical Engineer.
1912. Evers, Norman, c/o Allen and Hanbury's, Ltd., Bethnal Green, London, E., Analytical Chemist.
O.M. Evershed, F., c/o Clarke, Nickolls, and Coombs, Hackney Wick, N.E., Chemist.
1907. Eves, Archie P., c/o J. L. Gibney Tire and Rubber Co., Conshohocken, Pa., U.S.A., Chemist.
1894. Ewan, Dr. Thos., c/o Cassel Cyanide Co., Shuna Street, Maryhill, Glasgow, Chemist.
1905. Eynon, Lewis, 4, Stag Lane, Buckhurst Hill, Essex, Chief Chemist (London Beetroot Sugar Association).

F

1898. Fadé. Louis, c/o Dr. F. Stockhausen, Weissfrauenstrasse 7–9, Frankfort a/M., Germany, Chemist and Director.
1902. Faill, Jas., 52, Robertson Street, Glasgow, Technical Chemist.
1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.
1911. Fairchild, B. Tappen, 74, Laight Street, New York City, U.S.A., Analytical Chemist.
1910. Fairclough, Brereton, Quarry House, Appleton, near Warrington, Cheshire, Miller.
1911. Fairfield, Thos. J., c/o W. T. Glover and Co., Trafford Park, Manchester, Analytical Chemist.
1903. Fairhall, E. J., 11, Bishop's Avenue, Upton Manor, E., Chemist.
O.M. Fairley, T., 17, East Parade, Leeds, Analytical Chemist.
1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, Manufacturing Chemist.
1902. Fairweather, Wallace C., 62, St. Vincent Street, Glasgow, Engineer.
1898. Falding, F. J., 55, Broadway, New York City, U.S.A., Chemical Engineer.
1908. Fales, Harold A., 308, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Secretary (The W. N. Fales Co.).
1911. Farey, Frank O., 614, Canadian Express Building, Montreal, Canada, Chemist.
1910. Farr, Harry, Free Library, Cardiff, Librarian.
O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Chemist.
1913. Farrar, Stanley C., 104, Holly Road, Handsworth, Birmingham, Chemical Technologist.
1897. Farrell, Frank J., 15, Sandown Road, Great Yarmouth, Artificial Silk Manufacturer.
O.M. Farrington, T., 4, Waterloo Place, Cork, Ireland, Chemical Engineer.
1913. Farrow, F. D., Rhodes University College, Grahamstown, South Africa, Lecturer in Chemistry.
1909. Fath, Dr. Arthur, 149, Rue de Bruxelles, Ghent, Belgium, Chemical Engineer.
1903. Fawsitt, Dr. Chas. E., The University, Sydney, N.S.W., Australia, Prof. of Chemistry.
1914. Fearnley, C. A., 1, Alcester Terrace, Shepherd's Lane, Leeds, Technical Chemist.
1903. Feilmann, Dr. M. E., 92, Victoria Street, Westminster, S.W., Chemist.
1892. Feid, Walther, Linz a. Rhein, Germany, Chemical Works Director.

1913. Feldenheimer, Wm., 20, Holborn Viaduct, London, E.C., Clay Merchant.

1909. Fell, Wm. M. W., 27, Clarendon Road, Garston, Liverpool, Chemist.

1905. Felton, Herbert L., 516, East Second Street, South Boston, Mass., U.S.A., Distiller.

1900. Ferguson, Prof. Geo. A., 121, West 42nd Street, New York City, U.S.A., Professor of Analytical Chemistry.

O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.

1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.

1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.

1893. Fiebing, John H., 238, Reed Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.

1911. Field, Allan J., c/o G. Siegle Co., Rosebank, Staten Island, N.Y., U.S.A., Chemist.

1885. Field, E. W., Brewer.

1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.

1891. Field, Wm. Eddington, Martin Street, Elsternwick, Melbourne, Victoria, Chemist.

1900. Fillis, Frank, 106, London Road, Neath, South Wales, Cement Works Manager.

1907. Finch, Archibald M., Vitriol and Chemical Works, Cattedown, Plymouth, Chemical Manufacturer.

1910. Findlater, James, c/o Price's Patent Candle Co., Ltd., Bromborough Pool, near Birkenhead, Chief Chemist.

1910. Findley, Albert E., Dept. of Applied Science, The University, Sheffield, Lecturer.

1899. Fingland, Jno. J., Kaslo, B.C., Canada, Analytical Chemist.

1911. Fink, F. W., 420, Riverside Drive, New York City, U.S.A., Manufacturing Chemist.

1904. Finn, Cornelius P., Hemsworth Colliery, near Wakefield, Yorks, Coke Ovens Manager.

1903. Fischer, Dr. Carl, 213–215, Water Street, New York City, U.S.A., Chemist.

1903. Fish, Chas. C. R., 439, Boylston Street, Boston, Mass., U.S.A., Chemist.

1911. Fish, Charles W., Rose Hill, Rawcliffe Bridge, S.O., Yorks, Chemist and Paper Technologist.

1900. Fisher, Henry, 16, East 96th Street, New York City, U.S.A., Teacher of Chemistry.

1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.

1904. Fitch, A. J., 8, Waldgrave Gardens, Hall Lane, Upminster, Essex, Brewer's Chemist.

1900. Fitz-Randolph, R.B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.

1896. Flammer, E., c/o Kraemer und Flammer, Heilbronn a/N., Wurttemburg, Germany, Manufacturing Chemist.

1913. Fleming, M. D., 26, Aytoun Road, Pollokshields, Glasgow, Analyst.

1893. Fletcher, E. Morley, 30, Grosvenor Place, Newcastle-on-Tyne, Alkali Works Inspector.

O.M. Fletcher, F. W., c/o Fletcher, Fletcher, and Co., Ltd., Holloway, N., Manufacturing Chemist.

1907. Fletcher, H. T., c/o The Bauxite Refining Co., Hebburn-on-Tyne, Works Manager.

1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.

1904. Fletcher, Wm. E., 411, West Broad Street, Tamaqua, Pa., U.S.A., Chemist.

1912. Flürscheim, Dr. Bernhard J., Rushmoor, Fleet Hampshire, Research Chemist.

1899. Focht, Louis, 12, Atterbury Avenue, Trenton, N.J., U.S.A., Civil Engineer.

1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.

1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.

1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.

1911. Ford, Edward J., 36, Rue Vandermaelen, Molenbeek St. Jean, Brussels, Chemist.

1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte Mich., U.S.A., Secretary and Treasurer.

1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.

1885. Formoy, J. Arthur, Fairlight, Limpsfield, Surrey, Oil Expert.

1904. Forrest, Chas. N., Maurer, N.J., U.S.A., Chemist.

1898. Forrest, J. Kerr, Highdene, Albury Road, Guildford, Surrey, Manufacturing Chemist.

1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.

1905. Forrester, H. A., Fabrica de Productos Quimicos, Acevedo 1710, Palermo, Buenos Ayres, S. America, Chemical Works Manager.

1909. Forshaw, Arthur, c/o John Wright and Co., Ltd., Essex Works, Aston, Birmingham, Works Chemist.

1902. Forstall, Alf. E., 84, William Street, New York City, U.S.A., Consulting Gas Engineer.

1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, and (Jnls.) The River House, Burton-on-Trent, Chemist.

1907. Forster, Francis, c/o Champion, Druce, and Co., Ltd., 6, Laurence Pountney Hill, London, E.C., Lead Manufacturer.

1899. Forster, Dr. M. O., F.R.S., 84, Cornwall Gardens, South Kensington, S.W., Chemist.

1884. Forster, Sir Ralph C., Bart., c/o Messrs. Bessler, Waechter, and Co., Salisbury House, Finsbury Circus, London, E.C., Chemical Merchant.

1884. Forth, Henry, Stoke Lacy, Marple, Cheshire, Drysalter.

1907. Forward, Charles C., Dept. of Inland Revenue Laby., 317, Queen Street, Ottawa, Canada, Chemist.

1906. Foster, Robt. K., Church Street, Middle Brighton, Melbourne, Victoria, Pharmaceutical Chemist.

O.M. Foster, R. Le Neve, Fulshaw Cottage, Wilmslow, Cheshire, Manufacturing Chemist.

1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.

1906. Foucar, J. Louis, 15, Morden Road, Blackheath, S.E., Chemist.

1891. Fowler, Dr. Gilbert J., Rufford, Dickenson Road, Rusholme, Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).

1898. Fowler, Theo. V., P.O. Drawer 15, Buffalo, N.Y., U.S.A., Chemical Works Manager.

1896. Fox, A. Stanley, Uplees, Faversham, Kent, Explosives Works Manager.

1912. Fox, Charles P., 395, Doyle Street, Akron, Ohio, U.S.A., Chemist.

1913. Fox, Edward Carey, 27, Scarth Road, Toronto, Canada, Pork Packer.

1898. Fox, Jno., Varuna, Grappenhall, Cheshire, Analyst.

1911. Fox, Dr. John J., 6, Alkham Road, Stamford Hill, N., Government Analyst.

1909. Fox, J. J., 19, Blackheath Rise, Lewisham, S.E., Managing Director, Tidman and Son, Ltd.

O.M. Fox, T., jun., c/o Fox Bros. and Co., Ltd., Wellington, Somerset, Wool Manufacturer.

1905. France, Edward W., Philadelphia Textile School Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.

O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.

O.M. Francis, G. Bult, The British Drug Houses, Ltd., 22–30, Graham Street, City Road, London, N., Wholesale Druggist.

O.M. Francis, W. H., 11, Bramham Gardens, South Kensington, London, S.W., Wholesale Druggist.

1903. Francksen, Dr. Aug., 4803, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

1906. Frank, Prof. Dr. A., Bismarckstrasse 10, Charlottenburg, Germany, Chemist.

1908. Frank, Dr. Fritz, Lützowstrasse 96, Berlin, W., 68, Germany, Public Analyst.

1894. Frank, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.

1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, Indiarubber Manufacturer.

1912. Frankenburg, Sydney, Hetlerston Grange, Weaverham, Cheshire, Indiarubber Manufacturer.
1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.
1904. Frankl, A., Clothilde Chemical Works, Nagy Bocskó, Hungary, Manager.
O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbrough, Analytical Chemist.
O.M. Frankland, Prof. P. F., F.R.S., The University, Edgbaston, Birmingham, Professor of Chemistry.
1906. Fraps, Dr. Geo. S., Texas A. and M. College, College Station, Texas, U.S.A., Professor of Chemistry.
1901. Frasch, Hans A., 52, Broadway, New York City, U.S.A., Manager.
1900. Frasch, Herman, Whitehall Building, 17, Battery Place, New York City, U.S.A., Oil Refiner.
1910. Fraser, Arthur, Casilla 1464, Valparaiso, Chile, Analyat.
1891. Fraser, L. McG., Engineering Works, Dagenham, Essex, Chemical Engineer.
1902. Frederick, Geo. E., jun., P.O. Box 762, New York City, U.S.A., Chemical Merchant.
1885. Freear, H. M., Church Square, Ampthill, Beds. Analytical Chemist.
1900. French, Thos., 806, Stanley Street, Nelson, B.C., Canada, Chemist.
1911. French, Wm., Heron Chemical and Colour Works, Lancaster, Manager.
1903. Frerichs, Dr. F. W., 4320, Washington Boulevard. St. Louis, Mo., U.S.A., Manufacturing Chemist.
1913. Frew, John, Box 1, Johannesburg, South Africa, Chemist.
1907. Freytag, Henry, c/o O. Isler and Co., 35, Dickinson Street, Manchester, Chemical Merchant.
1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.
1899. Fritzsche, Karl, c/o Schimmel und Co., Miltitz, near Leipzig, Germany, Manufacturer of Essential Oils.
1884. Frost, Joe, Rocky Mounnt, Somerset Road, Huddersfield, Manufacturing Chemist.
O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.
1904. Fryer, P. J., 45, Burnaby Gardens, Chiswick, W., Analyst.
1889. Fuerst, Jos. F., 17, Philpot Lane, London E.C., Chemical and Oil Merchant.
1895. Fuerst, W. F., 87, Nassan Street, New York City, U.S.A., Chemical Merchant.
1913. Fulks, Elbridge B., 310, Columbia Building, Louisville, Ky., U.S.A., Manager, Tar Products Co.
1894. Fuller, Chas. J. P., 603, Chorley New Road, Horwich, near Bolton. Analytical Chemist.
1902. Fuller, Henry C., Institute of Industrial Research, Washington, D.C., U.S.A., Analytical Chemist.
1899. Fuller, Robt. F., Neston Park, Corsham, Wilts, Rubber Manufacturer.
O.M. Fuller, Wm., Vanbrugh Cottage, Maze Hill, S.E., Chemist.
1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.
1909. Fulweiler, W. H., c/o United Gas Improvement Co., Broad and Arch Streets, Philadelphia, Pa., U.S.A., Engineer.
1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

G

1909. Gaede, Chas. W., c/o National Silk Dyeing Co., Williamsport, Pa., U.S.A., Silk Dyer.
1913. Gage, Roscoe M., The Oaks, Springfield, Mass., U.S.A., Chemical Engineer.
1906. Gagnebin, Chas. L., 140, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1907. Gaines, Richard H., 147, Varick Street, New York City, U.S.A., Chemist (Board of Water Supply).
1904. Gair, C. J. Dickenson, 39, Cranston Road, Forest Hill, S.E., Analytical Chemist.
1912. Gajjar, M. J., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.
1890. Gajjar, Prof. T. K., The Lines, Surat, India, Consulting Chemist.
1912. Gale, R. C., 38, Scarsdale Villas, Kensington, W., Technical Chemist.
1884. Gall, Henry 2,ᵃ Rue Blanche, Paris, France, Technical Chemist.
1905. Gall, J. B., c/o Callender's Cable and Construction Co., Belvedere, Kent, Chemist.
1911. Gallagher, Jas. L., c/o Lever Bros., Ltd., Sydney, N.S.W., Australia, Chemist.
1897. Galletly, J. C., c/o Newlands and Warner, 135, St. Vincent Street, Glasgow, Rubber Chemist.
1901. Gallivan, Dr. Frank B., 113, Third Street, South Boston, Mass., U.S.A., Chemist.
1903. Gallum, Albert F., 1000, North Water Street, Milwaukee, Wis., U.S.A., Tanner.
1901 Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.
1901. Galpin, Harry T., 57, West 57th Street, New York City, U.S.A., Chemist.
1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio. U.S.A., Works Manager.
1887. Gamble, Jas. N., (Journals) A. E. Anderson, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.
1894. Gane, Eustace H., 91, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.
1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus, & Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.
1911. Garbutt, C. Durham, 2, Hartington Road, Garston, Liverpool, Analytical Chemist.
1911. Garcia-Robles, L., San Rafael Paper Co., Apartado 469, Mexico City, Mexico, Chemist.
1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.
1893. Gardiner, H. J., 242, 24th Street West, North Vancouver, B.C., Canada, Chemical Merchant.
1910. Gardner, Arthur L., 233, Water Street, Perth Amboy, N.J., U.S.A., Chemical Engineer.
1907. Gardner, Edward, The Tryst, Bigwood Road, Meadway, Hendon, N.W., Metallurgical Chemist.
1909. Gardner, Henry A., 19th and B. Streets N.W., Washington, D.C., U.S.A., Chemist.
1913. Gardner, Henry D., jun., Fairmead, The Goffs, Eastbourne, Technical Chemist.
1891. Gardner, Prof. Walter M., Technical College, Bradford, Director of Chemical and Dyeing Departments.
1897. Garfield, Jos., Thackley, Bradford, Yorks, Civil Engineer.
1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Chemist.
1910. Garland, Charles S., 57, Garratt Lane, Wandsworth, S.W., Chemist and Works Manager.
1907. Garland, Herbert, P.O. Box 417, Cairo, Egypt, Chemist (Government Laboratory).
1911. Garner, John H., Sewage Works, Deighton, Huddersfield, Chemist.
1890. Garrett, Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.
1900. Garrigues, W. E., 1304, Shelby Street, Louisville, Ky., U.S.A., Chemical Engineer.
1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.
1908. Garson, Jas. W., 12, Avenue Road, Crouch End, N., Managing Director, Lewis Berger & Sons, Ltd.
O.M. Garton, Sir Richard, Messrs. Hill, Garton, and Co., Southampton Wharf, Battersea, S.W., Glucose Manufacturer.
1886. Gascoyne, Dr. W. J., 27, South Gay Street, Baltimore, Md., U.S.A., Analytical Chemist.
O.M. Gaskell, Holbrook, Erindale, Frodsham, Cheshire, Alkali Manufacturer.
1902. Gaskell, Holbrook, jun., Hillcroft, Church Road, Woolton, near Liverpool, Engineer.
1908. Gatehouse, Frank B., "Maristowe," Butts Green Road, Hornchurch, Essex, Chemist and Technical Journalist.

1912. Gates, Alfred E., c/o Messrs. T. Lye and Sons, Luton, Beds, Works Chemist.

O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.

1906. Gaunt, Percy, Macclesfield Corporation Sewage Works, Prestbury, near Macclesfield, Chemist.

1912. Gee, Wm. J., 48, Kingsmead Road. Tulse Hill, London, S.W., Chemical Engineer.

1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison Street, New York City. U.S.A.. Consulting Chemist.

1912. Gellatly, Frank E., 644, Greenwich Street, New York City, U.S.A., Chemical Merchant.

1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.

1907. Gemmell, Wm., 13, Albany Gardens, Whitley Bay, Northumberland, Analytical Chemist.

1901. Gent, Percy W., Trentholme, Misterton, near Gainsboro', Chemist.

1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.

1905. George, J. K., 347, Fifth Avenue, New York City, U.S.A., Manufacturer.

1912. Georgeson, George, Mutual Life Building, corner George and Wynyard Streets, Sydney, N.S.W., Manager of Oil Companies.

1913. Gepp, Herbert W., c/o Amalgamated Zinc (De Bavay's), Ltd., Broken Hill, N.S.W., Australia, General Manager.

1906. Gerkensmeyer. Henry H., 207, Mississippi Avenue, Joliet, Ill., U.S.A., Chemist.

O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.

1912. Ghislain, Raoul, 18, Rue du Mont de Piété, Mons, Belgium, Chemical Engineer.

1908. Gianoli, Prof. Giuseppe, Piazza Cordusio 2, Milano, Italy, Chemical Engineer and Editor (L'Industria).

1912. Gibb, W. Doig, South Metropolitan Gas Co., 709, Old Kent Road, London, S.E., Chief Engineer.

1911. Gibbings, W. Alan, P.O. Box Sannomiya 174, Kobe, Japan. Works Manager and Chemist.

1903. Gibbings, Wm., Woodside, Halebank, Widnes, Works Manager.

1910. Gibbins, Roland B., 18, Wheeley's Lane, Birmingham, Chemical Manufacturer.

1902. Gibbon, Edw., Belvedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.

1904. Gibbs, A. E., c/o Pennsylvania Salt Manufacturing Co., Greenwich Point, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1913. Gibbs, Victor G., c/o Wm. Pearson, Ltd , Clough Road, Hull, Works Manager.

O.M. Gibbs, Wm. P., The Sulphite Pulp Mills, Hjerpen, Sweden, Analytical Chemist.

O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *viâ* Chester, Brick and Tile Manufacturer.

1905. Gibson, John, 360–366, Collins Street, Melbourne, Vic., Australia, Concrete Manufacturer.

1913. Gibson, R. M., 58, Chester Road, Buckley, *viâ* Chester, Clay Goods Manufacturer.

1913. Gibson, Stanton, 28, Lordship Park, Stoke Newington, N., Factory Chemist.

1905. Gibson, Wm. F., 72, Woodstock Avenue, Golders Green, N.W., Works Chemist.

1899. Gifford, Wm. E., c/o Baker and Co., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.

1892. Gilbard, J. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.

1905. Gilbertson, Isaac H., 33, Broad Street, Rhodes, near Middleton, Lancs, Calico Printer.

1903. Gilby, Joseph W., 58, Beeches Road, West Bromwich, Staffs, Works Chemist.

O.M. Gilchrist, Percy Carlyle, F.R.S., A.R.S.M., M.Inst.C.E. & M.E., Reform Club, Pall Mall, London, S.W., Metallurgist.

1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.

1900. Gildersleeve, W. H., Johnson City, Tenn., U.S.A., Chemist.

O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.

1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Professor of Technical Analysis.

1913. Gill, Harold W., South African School of Mines and Technology, Johannesburg, South Africa, Lecturer on Chemistry.

1909. Gill, John H., 16, Premier Road, Gregory Boulevard, Nottingham, Soapworks Chemist.

1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.

1901. Gilles, Wm. S., The Cottage, Bocking, near Braintree, Essex, Technical Chemist.

1910. Gillett, Horace W., c/o The Aluminium Castings Co., Detroit, Mich., U.S.A., Research Chemist.

1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.

1891. Gimingham, Edw. A., Croyland, Clapton Common, N., Technical Electrician.

1886. Girdwood, Dr. G. P., 615, University Street, Montreal, Canada, Professor of Chemistry.

1906. Girtin, Thomas, H. L. Raphael's Refinery, 48, Thomas Street, Burdett Road, London, E., Bullion Refiner.

1903. Gladding, Thos. S., 181, Front Street, New York City, U.S.A., Analytical Chemist.

1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.

1906. Glasel, Dr. Chas. J., Schönhauserstrasse 10, Berlin-Frz. Buchholz, Germany, Tanner.

1889. Glaser, Chas., 22, South Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.

1906. Glass, A. Melville, 291, Camden Road, London, N.W., Patent Agent.

1901. Glegg, Robt., Agricultural Laboratory, Marischal College, Aberdeen, Analytical Chemist.

1894. Glen, Chas., Glengowan Printworks, Caldercruix, Scotland, Calico Printer.

1884. Glendinning, H., Winnington House, Northwich, Cheshire, Technical Chemist.

1888. Gloag, Robt. F., Lothian Road, Middlesbrough, Secretary.

1912. Gloag, Vivian F., Millbury House, Darlington Road, Ferryhill, Co. Durham, Chemical Works Manager.

1896. Glover, H., 6445, Emlen Street, Germantown, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.

O.M. Glover, William, Albareda 27, Seville, Spain, Technical Chemist.

1911. Gmach, Ludwig T., Kew Bridge Label Works, Waldeck Road, Chiswick, W., Manufacturer.

1911. Goetschius, John M., c/o General Chemical Co., 25. Broad Street, New York City, U.S.A., Sales Manager.

1898. Golding, Jno., University College, Reading, Agricultural Chemist.

1906. Goldschmidt, Dr. Karl, Chemical Works, Essen-Ruhr, Germany, Manufacturing Chemist.

O.M. Goldschmidt, Dr. S. A., 11, Broadway, New York City, U.S.A., President (Columbia Chemical Works).

1897. Goldschmiedt, Dr. Guido, Wasagasse 9, Wien IX, Austria, Professor of Chemistry, University of Vienna.

1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).

1899. Goldsmith, Dr. Jno. N., 67, Chancery Lane, London, W.C., Chemist.

1906. Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.

1909. Goodban, Leonard, 43, Addison Gardens, Kensington, London, W., Works Chemist.

1912. Gooderham, J. Leys, 49, Wellington Street East, Toronto, Canada, Chemist.

1906. Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1904. Gooding, E. Claude, Willow House, Washford, Somerset, Chemist.

1913. Goodman, Alexander, c/o Lever Bros., Ltd., Sunlight Wharf, Upper Thames Street, London, E.C., Manager.
1898. Goodrich, Chas. C., 60, Broadway, New York City, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., Racefield, St. Margaret's Road, Altrincham, Cheshire, Soapmaker.
1913. Goodwin, H. W., c/o Charles Case and Sons, Westbury, Wilts, Analytical Chemist.
1894. Goodwin, Dr. W. L., Library Dept., Gordon Hall, School of Mining, Kingston, Canada, Professor of Chemistry.
O.M. Goppelsroeder, Prof. Dr. F., Leimenstrasse 51, Basel, Switzerland, Professor of Chemistry.
1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.
1909. Gosse, Abel, 122, Boulevard St. Germain, Paris, France, Engineer (Poulenc Frères).
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1890. Goulding, Sir Wm. J., Bart., North Wall, Dublin, Manure Manufacturer.
O.M. Gowland, Prof. W., F.R.S., 13, Russell Road, Kensington, W., Professor of Metallurgy (Royal School of Mines).
1886. Goyder, G. A., 110, Gawler Place, Adelaide, South Australia, Chemist and Assayer.
1890. Grabfield, Dr. J. P., c/o Morris and Co., Chemical Laboratory, Union Stock Yards, Chicago, Ill., U.S.A., Chemist.
1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.
O.M. Graham, C. C., Oriel House, Scarborough, Yorks, Technical Chemist.
1908. Graham, C. W., 54, Dingwall Avenue, Toronto, Canada, Chemist.
1913. Graham, Jos. I., Chemical Laboratory, Bentley Colliery, near Doncaster, Yorks, Chemist.
1883. Grandage, H., c/o S. Smethurst and Sons, Woolfold Dye and Bleach Works, Bury, Lancashire, Dyer.
1914. Grandel, Paulin, Etablissements Kuhlmann, 13, Square de Jussieu, Lille (Nord), France, Managing Director.
1897. Granger, Dr. J. Darnell, 57. Holmwood Street, Newtown, Sydney, N.S.W., Australia, Analytical Chemist.
1905. Grant, Alexander, 15, Hermitage Drive, Edinburgh, Baker.
1896. Graves, Geo. H., 219. West 81st Street. New York City, U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 1950, East 90th Street, Cleveland, Ohio, U.S.A., Chemist.
1914. Gray, George, 3, Victoria Drive, Rock Ferry, Cheshire, Technical Chemist.
1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
1911. Gray, Dr. G. W., c/o The Texas Co., Houston, Texas, U.S.A., Chairman Manufacturing Committee.
1910. Gray, H. Le Breton, c/o Eastman Kodak Co., Rochester, N.Y., U.S.A., Superintendent, Film Department.
1904. Gray, Jas., P.O. Box 5254, Johannesburg, Transvaal, Chemist.
1901. Gray, J. Campbell, The Cottage, Strines, near Stockport, Printworks Chemist.
1886. Gray, Jno., 3, Victoria Drive, Rock Ferry, near Birkenhead, Technical Chemist.
1896. Gray, Prof. Thos., Royal Technical College, Glasgow, Professor of Technical Chemistry.
1905. Gray, W. B., Messrs. Lever Bros., Durban, Natal, South Africa, Analytical Chemist.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1908. Gray, Wm. T., Port Credit, Ontario, Canada, Starch Manufacturer.
1909. Greeff, R. H., Thames House, Queen Street Place, London, E.C., and (Jnls.) "Arima," Denbridge Road, Bickley, Kent, Chemical Merchant.
1894. Greeff, R. W., Thames House, Queen Street Place, London, E.C., and (Jnls.) Elm Bank, Bromley, Kent, Chemical Merchant.
O.M. Green, Prof. Arthur G., 49, Cardigan Road, Headingley, and The University, Leeds, Professor of Tinctorial Chemistry.
1907. Green, Clarence, c/o Nicholson's Raincoat Co., Beaumont Works, St. Albans, Herts, Chemist.
1906. Green, Ernest, 98, Cheadle Road, Cheadle Hulme, Cheshire, Science Teacher.
O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.
O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.
1910. Green, Robert M., 24, Strand Arcade, Queen Street, Auckland, New Zealand, Chemist.
1908. Green, Dr. W. Heber, Chemical Laboratory, The University, Melbourne, Victoria, Lecturer in Chemistry.
O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.
1909. Greenhough, George D., 21, Mincing Lane, London, E.C., Chemical Broker.
1913. Greenough, Thomas R., Beechwood, Leigh, Lancashire, Analytical Chemist.
O.M. Greenway, T. J., c/o Potter's Sulphide Ore Treatment, Ltd., 369, Collins Street, Melbourne, Australia, Metallurgist.
1902. Greenwood, Conrad V., Noyna, Dowhills Road, Blundellsands, Liverpool, Cotton Mill Manager.
1907. Greenwood, Herbert W., c/o The Boundary Chemical Co., Ltd., Cranmer Street, Liverpool, Metallurgical Chemist.
O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Technical Chemist.
1897. Gref, Anthony, 117, Hudson Street, New York City, U.S.A., Patent Lawyer.
1909. Gregory, Cecil H., The Morgan Crucible Co., Ltd., Battersea, London, S.W., Crucible Manufacturer.
1907. Gregory, Joshua C., 128, Wellington Street, Glasgow, Analytical and Consulting Chemist.
1912. Gresham, Harold E., County Laboratories, 36, Dansie Street, Liverpool, Analytical Chemist.
1890. Griffin, Jno. R., Kemble Street, Kingsway, London, W.C., Chemical Apparatus Maker.
1886. Griffin, Martin L., c/o Oxford Paper Co., Rumford, Maine, U.S.A., Manager of Chemical and Electro-Chemical Department.
1912. Griffiths, Clement S., Central Queensland Meat Export Co., Ltd., Lake's Creek, Rockhampton, Queensland, Chemist.
1909. Griffiths, E., Dept. of Agriculture, 126, George Street North, Sydney, N.S.W., Australia, Chemist.
1902. Griffiths, Manfred E., Caizley House, Temple Road, Stowmarket, Suffolk, Explosives Chemist.
1912. Grimké-Drayton, Norman, Royal Mint Refinery, 19, Royal Mint Street, London, E., Metallurgist.
1902. Grimwade, Wilfrid R., 335—343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.
1900. Grimwood, Robt. G., 43, Leaside Avenue, Muswell Hill, N., Analytical Chemist.
O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.
1905. Grip, August E., 495, Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.
1909. Grist, John M., c/o Curtis's and Harvey, Ltd., Explosives Works, Cliffe-at-Hoo, Kent, Chemist.
1912. Groehing, Alb. von, 3. Lombard Street, London, E.C., Civil and Consulting Engineer.
1906. Groenewoud, Sidney H., 36, Grosvenor Road Highbury, N., Analytical Chemist.
O.M. Grossmann, Dr. J., 157, Plymouth Grove, Manchester, Consulting Chemist and Chemical Engineer.
1896. Grosvenor, Dr. W. M., Chemists' Building, 50, East 41st Street, New York City, U.S.A., Consulting Chemical Engineer.
1909. Grove, Daniel, "Yambo," Inverell, N.S.W., Australia, Diamond Buyer and Mine Owner.

O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).

1907. Groves, J. Stuart, c/o E. I. du Pont de Nemours Powder Co., Georgetown, S.C., U.S.A., Chemist.

1899. Gudemann, Dr. E., 903, Postal Telegraph Building, Chicago, Ill.. U.S.A., Chemist.

1906. Guess, Prof. Geo. A., Mining Building, The University. Toronto, Canada, Professor of Metallurgy.

1911. Guild, Edward J., 5, Grove Terrace, Leek, Staffs, Analytical Chemist.

1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.

1909. Gulliek, Wm. A., Government Printing Office, Sydney, N.S.W., Government Printer.

1906. Gulline, Percy, c/o Columbia Textile Co., Lowell, Mass., U.S.A., Agent.

1913. Gundlach, H. R., 814, Hollins Street, Baltimore, Md., U.S.A., Chemist.

1904. Gundlach, Walter, 249, West 104th Street, New York City, U.S.A., Superintendent of Colour Works.

1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.

1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs, Paper Mill Chemist.

1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., Thames House, Queen Street Place, London, E.C., Merchant.

1910. Günther, C. M., Condong Mill, Tweed River, N.S.W., Sugar Chemist.

1903. Guthrie, Alan, Dept. of Industries, Post Box 454, Madras, India, Leather Chemist.

1901. Guthrie, John M., 199, Ferry Road, Leith, Scotland, Analytical Chemist.

1909. Guttmann, Camillo J., 60, Mark Lane, London, E.C., Chemical Engineer.

1903. Guttmann, Dr. Leo F., School of Mining, Queen's University, Kingston, Ont., Canada, Professor of Physical Chemistry and Chemical Engineering.

1912. Guy, Wm. W., 6, Cecil Road, Upton Manor, E., Analytical Chemist.

1913. Gyton, Walter J., British Standard Cement Works, Rainham, Kent, Chemist.

H

1913. Haber, Prof. Dr. Fritz, Kaiser Wilhelm Institut, Faraday Weg 4, Post Lichterfelde 3, Berlin-Dahlem, Germany, Prof. of Physical and Electro-Chemistry.

1904. Hacking, D. H., Enfield Soap Works, Clayton-le-Moors, near Accrington, Soap Manufacturer.

1900. Haddoek, Arthur G. *See* Haydoek.

1887. Hadfield, Sir Robert A., Heela Works, Sheffield; 28, Hertford Street, Mayfair, London, W., and (Journals) c/o J. E. Mortimer, 220, Newhall Road, Attercliffe. Sheffield, Steel Founder.

1904. Hadley, Geo., Waterfall Lane, Blackheath, Staffs. Spelter Works Manager.

1906. Hagen, Dr. Carl, c/o E. I. du Pont de Nemours Powder Co., 20, Bishopsgate, London, E.C., Representative.

1887. Haig, Robert, Dollarfield, Dollar, Scotland, Chemical Engineer.

1904. Haigh, B. Wilson, By-Product Coke Oven Dept., Barnsley Main Colliery, Barnsley, Yorks, Chemical Engineer.

1896. Haigh, De Lagnel, 39, Hill Crest, Summit, N.J.. U.S.A., Chemist.

1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.

1910. Hailstone, Harold J., 44, Cordley Street, West Bromwich, Works Chemist.

1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Hake, C. Napier, Jnls. to c/o Dr. A. W. Hake, Medical School, Caxton Street, Westminster, S.W., Chemical Adviser.

1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.

1888. Hale, Edw. P., Endmoor, near Kendal, Analytical Chemist.

1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.

1905. Hall, Archibald A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.

1898. Hall. Clarence A., 18, McPherson Street, Mount Airy, Philadelphia, Pa., U.S.A.. Chemist.

1909. Hall, Harold, 98, Birkin Avenue, Hyson Green, Nottingham, Analyst.

1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.

1885. Hall, Lt.-Col. Jno. A., Longstone, Esquimault Old Road, Victoria, B.C., Canada, Analytical Chemist.

1912. Hall, Robert H., Weardale Tar Works, Spennymoor, Co. Durham, Chemical Works Manager.

1896. Hall, S. Godfrey, East London Soap Works, Bow, E., Soap Maker.

1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.

1893. Haller, H. Loft, 26, Scale Lane, Hull, Analytical Chemist.

1912. Halliday, McDonald, c/o The Lagunas Synd., Ltd., Oficina North Lagunas, Iquique, Chile, Analytical Chemist.

1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.

1900. Halloek, Dr. Albert P., 3, James Street, Yonkers, N.Y., U.S.A., Chemist.

1892. Hamaguchi, Gihei, IV., Toyoharacho, Komatsubaratori, Wakayamashi, Japan, Soy Manufacturer.

1897. Hambly, Fred J., Buckingham, Quebec, Canada, Chemist.

1901. Hambuechen, Carl, 120, Wabash Avenue, Bellevue, Ill., U.S.A., Consulting Chemical Engineer.

1910. Hamburg, Dr. Max, c/o The British Diamalt Co., Sawbridgeworth, Herts, Chemist and Manager.

1911. Hamilton, David J., Locksley, Helensburgh, Dumbartonshire, Oil Refiner and Paint Manufacturer.

1904. Hamilton, Edward H., Virginia Smelting Works, West Norfolk. Va., U.S.A., Manager.

1912. Hamilton, James, 9, Esplanade Avenue, Whitley Bay, Northumberland, Analytical Chemist.

1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, Ayrshire, Works Manager.

1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.

1898. Hammersley, W. Stanley, Rue Champhertrand, Sens (Yonne), France, Tanner.

O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.

O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.

1905. Hancock, Thos. J., 4029, North Springfield Avenue, Chicago, Ill., U.S.A., Chemist.

1900. Haneoek, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.

1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.

1889. Handy, Jas. O., Pittsburgh Testing Laboratory, Seventh and Bedford Avenues, Pittsburgh, Pa., U.S.A., Chief Chemist.

1888. Hanks, Abbot A., 630, Sacramento Street. San Francisco, Cal., U.S.A., Assayer.

1901. Hanna, Charles E., P.O. Box 600, Montreal, Canada, Secretary.

1905. Hanson, H. Norman, The Oaks, Huddersfield Road, Brighouse, Yorks, Research Assistant.

1908. Hanson, W. G., c/o United States Glue Co., Milwaukee, Wis., U.S.A.

1909. Harbord. F. W., 16, Victoria Street, Westminster, S.W., Consulting Metallurgist.

1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.

1904. Hard, Dr. James M. B., 2A, del Canadá, Colonia de Sta. Julia, Mexico, D.F., Chemist and Pathologist.

1901. Hardcastle, G. Fred., 307, East Park Road, Leicester, Teacher of Science and Technology.

1894. Harden. Dr. Arthur. F.R.S., 5, Cambridge Gardens, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.

1910 Hardie, Thos., Newcastle and Gateshead Gas Co., Tyneside Road, Newcastle-on-Tyne, Gas Engineer.

1909. Harding, Herbert, 54, Streathbourne Road, Upper Tooting, S.W., Assistant Examiner (H.M. Patent Office).

1908. Hardman, Benj., c/o Kodak, Ltd., Wealdstone, Middlesex, Analytical Chemist.

1912. Hardwick. Walter A. N., 26, West Kensington Mansions, London. W., Chemist.

1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.

1905. Hardy, Chas. H., c/o Reckitt and Sons, Ltd., Hull. Chemist.

1907. Harfeld, Louis E., c/o Messrs. Ohlenschlager Bros., Shanghai House, Botolph Lane, London, E.C., Merchant.

1913. Harger. Dr. John, Grange Hollies, Gateacre, Liverpool.

1906. Hargreaves, Frank, Hough Green, Widnes, Chemist.

1896. Hargreaves, James, May Villa, Peel House Lane, Widnes, Chemical Engineer.

O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.

1904. Harker, Dr. George, Mount Errington, Hornsby, Sydney. N.S.W., Australia, Chemist.

1909. Harland, Robert M., 37, Lombard Street, London, E.C., Analytical Chemist and Assayer

1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.

1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.

1905. Harper, Dr. Henry W., University of Texas, 2216, Rio Grande Street, Austin, Texas, U.S.A., Professor of Chemistry.

1912. Harper, J. G., Kynochtown, Stanford le Hope, Essex, Managing Chemist.

1913. Harper, William, P.O. Box Sannomiya 174, Kobe, Japan, Works Chemist.

1912. Harran, Dr. Edward B., Abbey Field, Sandbach, Cheshire, Chemist.

1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.

1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.

1897. Harris, Fred. W., 38, Cochrane Street, Glasgow, Public Analyst.

1907. Harris, John B., Danforth Avenue, Toronto, Canada, Manufacturer of Glues and Fertilisers.

1906. Harris, Jonathan W., c/o Western Electric Co., 463, West Street, New York City, U.S.A., Chemist.

1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchant.

1906. Harris, Wm. G., jun., 35, Fraser Avenue, Toronto, Canada, Metallurgist.

1905. Harrison, E. F., Langholm, Edgar Road, South Croydon, Analytical Chemist.

1909. Harrison, Edwin D., 86, Harrison Place, Irvington, N.J., U.S.A., Celluloid Manufacturer.

1883. Harrison, G. Herbert, Hagley, Stourbridge, Firebrick Maker.

1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, British Guiana, Chemist.

1907. Harrison, W., 3, Regent Terrace, Hyde Park, Leeds, and (Jnls.) Fuel Dept., The University, Leeds, Technical Investigator.

1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.

1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.

O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.

1890. Hart, H. W., Winthrop, Ansdell Road, Lytham, Lancashire, Analytical Chemist.

1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.

1908. Hartley, Bernard C., 56, Wood View, Manningham, Bradford, Analytical Chemist.

1912. Hartley, Harold, c/o The Richmond Gas Stove and Meter Co., Ltd., Warrington, Research Chemist.

1883. Hartley, Joseph, 73, East Road, Stockport Road, Longsight, Manchester, Technical Chemist.

1912. Hartley, Thos., 64 Westlecot Road, Swindon Wilts, Teacher of Technical Chemistry.

1905. Hartshorne, Wm. D., Arlington Mills, Methuen, Mass., U.S.A., Agent.

1901. Hartwell, S. Warren, 120, North Fourth Street, Easton, Pa., U.S.A., Chemist.

1908. Harvey, Arthur J., 265, Burdett Road, Limehouse, E., Chemist.

1885. Harvey, Ernest W., 36, Arthur Road, Wimbledon Park, London, S.W., A.R.S.M., Engineer.

1913. Harvey, Hildebrand W., Hutton Mount, Brentwood, Essex, Research Chemist.

1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.

1899. Harvey, Thos. F., 69, North Road, West Bridgford, Nottingham. Analyst (Drug Co.).

1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.

1908. Harvey, Wm. Ross, c/o R. Lehmann and Co., Ltd., Peninsular House, Monument Street, London. E.C., Starch Manufacturer.

1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.

1906. Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.

1900. Haslwanter, Chas., 447, Spruce Street, Richmond Hill, Long Is., N.Y., U.S.A., Analytical Chemist.

1897. Hasslacher, Jacob, P.O. Box 1999, New York City, U.S.A., President, Roessler-Hasslacher Chemical Co.

1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.

1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubbs, W., Starch Works Manager.

1906. Havercroft, Arthur E., Glenholme, Westbourne Road, Hornsea, Yorks, Chemist.

1899. Hawdon, H. S., Cleadon, near Sunderland, Chemical Works Manager.

1895. Hawker, E. W., Gladstone Chambers, Adelaide, South Australia, Metallurgist.

1910. Hawkes, Cornelius A., 43, Painswick Road, Gloucester, Analytical Chemist.

1902. Hawkins, Clement C., c/o The Texas Co., Port Neches, Texas, U.S.A., Chemist.

1897. Hawkins, Ernest M., Watling Chambers, Canterbury, Analytical Chemist.

1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.

1893. Hawkins, J. Dawson, c/o U. S. Reduction and Refining Co., Colorado Springs, Colo., U.S.A., President and General Manager.

1887. Hawliczek, Josef, c/o United Alkali Co., Intelligence Dept., Widnes, Consulting Chemical Expert.

1899. Haworth, Dr. Edw., Ivy Bank, Moughland Lane, Runcorn, Cheshire, Chemist.

1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).

1910. Haworth, John, 117, Millhouses Lane, Sheffield, Chemist and Sewage Works Superintendent.

1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.

1914. Hay, George S., 55, Shrubland Road, Hoe Street, Walthamstow, N.E., Analytical Chemist.

1910. Hay, J. Gordon, 37, Worcester Road, Bootle, Liverpool, Analytical Chemist.

1913. Hay, J. Thomas, Research Dept., Stark Rolling Mill Co., Canton, Ohio, U.S.A., Director.

O.M. Haydn-Morris, J., 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.

1900. Haydock, A. G., c/o The Castner-Kellner Alkali Co., Wallsend-on-Tyne, Technical Chemist.

1909. Haydon, James R., 91, Ampthill Road, Aigburth, Liverpool, Works Manager and Chemist.

1894. Haynes, David O., 82, Fulton Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."

1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Pharmaceutical Chemist.

1906. Hayworth, W. P., 24, Tower Road, Dartford, Kent, Chemist.

1905. Hazard, Fred R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).

1903. Hazen, Chas. R., 258, Prince Albert Avenue, Westmount, Quebec, Canada, Chemist.

1894. Heal, Carlton B., Hill Crest, Runcorn, Cheshire, Tanner.

1912. Healey, E., jun., St. Mary's Mills, Leicester, India-rubber Manufacturer.

1913. Heath, Geo. M., 787, Sherbrooke Street West, Montreal, Canada, Flour Mill Superintendent.

1905. Heathcote, Henry L., c/o Rudge-Whitworth, Ltd., Coventry, Research Chemist.

1904. Heaton, Noel, 72, Abbey Road, London, N.W., Colour Manufacturer.

1905. Heberlein, Dr. Edw., c/o H. T. Enthoven and Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.

1889. Hecht, Jos. L., c/o French and Hecht, Davenport, Iowa, U.S.A., Analytical Chemist.

1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.

1914. Hector, Alex. B., c/o Burroughs, Wellcome and Co., 481, Kent Street, Sydney, N.S.W., Australia, Manager.

1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.

1912. Hedley, Dr. Edgar P., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.

O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.

1908. Heilmann, Dr. Ernst, Güstrow, Mecklenburg, Germany, Chemical Manufacturer.

1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.

1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.

1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.

1898. Hemingway, Frank C. R., 17, Battery Place, New York City, and (Journals) 6, East Union Avenue, Bound Brook, N.J., U.S.A., Chemical Manufacturer.

1883. Hemingway, H., 9, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.

1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.

1910. Henderson, Ernest G., c/o Canadian Salt Co., Ltd., Windsor, Ont., Canada, Vice-President and Manager.

1883. Henderson, Prof. G. G., Royal Technical College, George Street, Glasgow, Professor of Chemistry.

1902. Henderson, Prof. Jas. A. Russell, Stranord, West Kilbride, Ayrshire, Professor of Chemistry and Physics.

1894. Henderson, Jos., Eskbank Ironworks, Lithgow, N.S.W., Australia, Blast Furnace Manager.

1894. Henderson, Norman M., Broxburn Lodge, Broxburn, Scotland, Oil Works Manager.

O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.

1893. Hendrick, Prof. Jas., Marischal College, Aberdeen, Professor of Agriculture.

1906. Henius, Dr. Max, 1135—1147, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.

1912. Henley, Andrew T., Lady's Well Brewery, Cork, Ireland, Technical Chemist.

1904. Henley, Hon. F. R., 9, Beaufort Gardens, London, S.W., Brewers' Chemist.

1905. Henning, Albert, c/o Hedley and Co., 92, Harrow Road, Leytonstone, N.E., Ester Manufacturer.

1906. Henning, C. I. B., c/o E. I. du Pont de Nemours Powder Co., Experimental Station, P.O. Henry Clay, Del., U.S.A., Chemist.

1914. Henshaw, D. M., c/o W. C. Holmes and Co., Ltd., Whitestone Ironworks, Huddersfield, Chemical Engineer.

1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.

1910. Hepburn, Edward, Priory Works, Dartford, Kent, Tanner.

1888. Hepworth-Collins, W., Junior Constitutional Club, Piccadilly, London, W.; retain Journals, Civil Engineer.

1906. Herig, Harry W., c/o General Chemical Co., Hudson River Works, Edgewater, N.J., U.S.A., Chemist.

1897. Heriot, T. H. P., Royal Technical College, Glasgow, Lecturer in Sugar Manufacture.

O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.

1903. Herreshoff, J. B. F., 620, West End Avenue, New York City, U.S.A., Chemical Engineer.

1887. Herriot, Wm. Scott, Clarewood, Thorntonhall, Lanarkshire, Mechanical Engineer.

O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.

1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Associate Professor of Metallurgy.

1898. Hersey, Dr. Milton L., P.O. Box 1086, Montreal, Canada, Consulting Chemist.

1903. Herstein, Dr. Bernard, Insular Collector of Customs, Manila, Philippines.

1906. Herty, Prof. Chas. H., University of N. Carolina Chapel Hill, N.C., U.S.A., Professor of Chemistry.

1906. Herz, Dr. Albert, c/o John Crossley and Sons, Ltd., Halifax, Yorks, Chemist.

1907. Hess, Arthur F., c/o A. Hess and Bro., Ltd., Kirkstall Road, Leeds, Oil Distiller.

1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.

1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.

1904. Heurich, Christian, 1307, New Hampshire Avenue, N.W., Washington, D.C., U.S.A., Brewer.

1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, Engineer.

1910. Hewitt, Arthur, c/o Consumers' Gas Co., 19, Toronto Street, Toronto, Canada, General Manager.

O.M. Hewitt, Dr. D. B., 28, Queen's Gardens, Hyde Park, London, W., Alkali Manufacturer.

1896. Hewitt, Dr. J. Theo., F.R.S., Clifford House, Bedfont, Middlesex, Lecturer.

1890. Hewlett, John C., 40—42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.

1907. Hewson, Geo. W., Grasmere, Field Terrace, Jarrow-on-Tyne, Analytical Chemist.

1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.

1894. Heyl, G. Edward, King's House, Kingsway, London, W.C., Chemical and Electrical Engineer.

1906. Heys, Charles H., Toronto Arcade, Toronto, Canada, Consulting Chemist.

1901. Hiby, Dr. Walter, c/o The Otto Hilgenstock Coke Oven Co., Ltd., Post Office House, Leeds, Chemical Engineer.

1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.

1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.

1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Higgin, W. H., c/o C. J. Schofield, Ltd., Alkali Works, Clayton, Manchester, Chemical Manufacturer.

1913. Higgins, A. Howard, Estrella, Hale Lane, Mill Hill, N.W., Metallurgist.

1886. Higgins, C. L., 41, Knowsley Road, Cressington Park, Liverpool, Manufacturing Chemist.

1905. Higgins, Dr. Eric, 12, Elleray Park Road, Wallasey, Cheshire, Chemist.

1905. Higgins, John M., 39, Queen Street, Melbourne, Vic.; Australia,, Consulting Metallurgist.

1908. Higgins, S. H., Luncarty Bleachfield, Perth, Chemist and Asst. Manager.

1909. Higson, Frank, 52, Chapel Street, Salford, Manchester, Analytical Chemist.

1909. Higuchi, Ken-ichi, Central Laboratory, South Manchuria Railway Co., Dairen, Manchuria, Chemical Engineer.

1911. Hilditch, T. P., Birchdene, Cross Lane, Grappenhall, Warrington, Research Chemist.

1903. Hill, Chas. Alex., c/o British Drug Houses, Ltd., 22—30, Graham Street, City Road, N., Chemist.

1897. Hill, Dr. Herbert M., 20, West Eagle Street, Buffalo, N.Y., U.S.A., City Chemist.

1907. Hill, James A., Technical Chemist.

1908. Hill, J. H. F., c/o Broken Hill Proprietary Co., Broken Hill, N.S.W., Australia, Mining Engineer.

O.M. Hill, J. K., 13, Osborne Place, Ibrox, Glasgow, Manufacturing Chemist.

1892. Hill, Sydney, c/o Blundell, Spence, and Co., Ltd., Hull, Analytical Chemist.

1903. Hill, W. Basil, Foss Islands Tannery, York, Tanner.

1902. Hill, Wm. G., jun., c/o Apsley Rubber Co., Hudson, Mass., U.S.A., Chemist.

1898. Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.

1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.

O.M. Hills, W., Oxford Works, Tower Bridge Road, London, S.E., Pharmaceutical Chemist.

1899. Hinchley, J. W., 55, Redcliffe Road, London, S.W., Chemical Engineer.

1904. Hinckley, J. F., 550, East 7th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.

O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dyeworks Manager.

1909. Hinks, Edward, 16, Southwark Street, London, S.E., Analyst.

1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.

1891. Hinman, Bertrand C., Coventry House, South Place, Finsbury, London, E.C., Metallurgical Chemist.

1912. Hinman, Jack J., jun., 507, East Eleventh Street, Indianapolis, Ind., U.S.A., City Analyst.

1909. Hirsch, Fritz, 51, Ferndale Avenue, Wallsend-on-Tyne, Analytical Chemist.

1914. Hirschberg, Dr. Leon, 46, Farringdon Street, London, E.C., Chemical Engineer.

1914. Hirst, A. Norman, Box 1106, Durban, South Africa, Consulting Chemist.

1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks, Works Chemist.

1907. Hirt, Wilhelm B., c/o Cuming, Smith, and Co., Ltd., Yarra Junction, Vic., Australia, Analytical Chemist.

1907. Hirtz, Dr. Heinrich, Chemist.

1896. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, Gas Engineer and Manager.

1913. Hitchcock, Thos. J., 28, Albany Road, Manor Park, Essex, Technical Chemist.

1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A., North Station, Providence, R.I. U.S.A., Printworks Superintendent.

1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.

1909. Hodgart, Matthew, Vulcan Works, Paisley, Engineer.

1894. Hodge, Andrew, Glenariff, Whaley Bridge, near Stockport, Printworks Chemist.

1913. Hodgetts, E. A. Brayley, Nobel Dynamite Trust, 220, Winchester House, Old Broad Street, London, E.C., Secretary.

O.M. Hodgkinson, Dr. W. R., 89, Shooter's Hill Road, Blackheath, S.E., Professor of Chemistry.

O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.

1913. Hodgson, Cyril V., 52, London Road, Chesterton, North Staffordshire, Works Chemist.

1897. Hodgson, Matthew, Ardmore, Church Hill, Wicklow, Ireland, Technical Chemist.

1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.

1910. Hodsman, Henry J., Dept. of Fuel and Coal Gas Industries, The University, Leeds, Chemist.

1906. Hogarth, Julius W., The University, Sydney, N.S.W., Australia, Demonstrator of Chemistry.

1886. Hogben, W., Post Office, Port Talbot, South Wales, and (Jul.) Malvern House Hotel, Great Malvern, Chemical Expert (Celluloid, etc.).

O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.

1905. Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.

1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.

1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.

1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Manufacturing Chemist.

1902. Holdsworth, Ernest T., "Holme Dene," Crossley Hall, Bradford, Dyer.

1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.

1884. Holgate, Thos., 61, Calton Road, Dulwich, S.E., Gas Engineer.

O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.

1892. Holland Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.

1909. Holliday, F. E., 81, Fulton Street, New York City, U.S.A.

1896. Hollings, J. Spencer, Brymbo, North Wales, Works Manager.

1909. Hollingworth, David V., Birchenwood Collieries, Kidsgrove, Stoke-on-Trent, Gas Analyst.

1903. Hollinshead, Peter, The Beeches, Weston Road, Runcorn, Cheshire, Chemist.

1900. Hollinshead, Dr. Warren H., Wingrove Avenue, Nashville, Tenn., U.S.A., Teacher of Chemistry.

1904. Holloway, E. G., c/o Jas. S. Kirk and Co., 360, North Water Street, Chicago, Ill., U.S.A., Chemist.

1890. Holloway, G. T., 9–13, Emmett Street, Limehouse, London, E., Consulting Chemist and Metallurgist.

1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.

O.M. Holmes, F. G., Thames Tar Works, Lower Road, Northfleet, Kent, Tar and Ammonia Distiller

1914. Holroyd, Thomas A., Carnatic House, Perambore Barracks, Madras, India, Colour Chemist.

1913. Holt, Dr. Alfred, Dowsefield, Allerton, Liverpool, University Reader in Physical Chemistry.

1900. Holthouse, Harold B., 106, Radcliffe Road, West Bridgford, Notts, Chemist.

1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.

1892. Holton, E. C., 601, Canal Road N. W., Cleveland, Ohio, U.S.A., Chemist.

1893. Holzapfel, Max, c/o Holzapfels, Ltd., Felling-on-Tyne, Manufacturer.

1893. Homfray, D., c/o La Fabrica de Papel, San Rafael, Est. de Mexico, Mexico, Analytical Chemist.

1909. Hook, Russell W., 8, Holton Street, West Medford, Mass., U.S.A.

1904. Hooker, A. H., c/o Hooker Electrochemical Co., Niagara Falls, N.Y., U.S.A., Manufacturing Chemist.

O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, London, S.W., Chemist.

1889. Hooper, Ernest F., c/o Brotherton and Co., Ltd., Wear Tar Works, South Dock, Sunderland, Technical Chemist.

1888. Hope, Jas., The Knoll, Lenzie, near Glasgow, and (Journals) The Nickel Co., Kirkintilloch, by Glasgow, Nickel Works Manager.

1904. Hopewell, Fredk., 59, William Street, Montreal, Canada, Manager.

1892. Hopkins, Erastus, Geneva, N.Y., U.S.A., Consulting Chemist.

1905. Hoppenstedt, A. W., c/o Schoellkopf and Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chemist.

1911. Hord, Arthur R., c/o W. H. Holmes and Sons, Portland Road, Newcastle-on-Tyne, Analytical Chemist.

1895. Horne, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist

1904. Hornsey, J. W., 233, Broadway, New York City, U.S.A., and (Journals) Searles, Cal., U.S.A., Chemical Engineer.

1913. Horrocks, Herbert, 253, Jelliff Avenue, Newark, N.J., U.S.A., Chemist.

1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.

1901. Horton, Edw., jun., Rothamsted Experimental Station, Harpenden, Herts, Chemist.

1906. Hoseason, Jas. H., Sun Buildings, 2, Bridge Street, Manchester, Chemical Manufacturer.

1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.

1899. Hoskins, Wm., 2009, Harris Trust Building, 111, West Monroe Street, Chicago, Ill., U.S.A., Chemist.

1914. Hough, Alex. T., Telok Ayer, Pontianak, Dutch West Borneo, Chemist.

1911. Hough, Samuel, c/o Lever Bros., Ltd., Balmain, Sydney, N.S.W., Australia, Chemist.

1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.

1892. Houston, John, 30, Princess Street, Manchester, Drysalter.

O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.

1901. Howard, Bernard F., Firbank, Loughton, Essex, Chemist.

O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.

1887 Howard, D. Lloyd, Uphall Works, Ilford, Essex, Chemical Manufacturer.

1898. Howard, Henry, 36, Amory Street, Brookline, Mass., U.S.A., Chemical Engineer.

1902. Howard, Nelson A., c/o General Chemical Co. of California, 705, Royal Insurance Building, San Francisco, Cal., U.S.A., General Manager.

1913. Howard, Tom, 57, Grey Street, Stalybridge, Cheshire, Chemist.

1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.

1912. Howe, Dr. Percy R., 536, Pleasant Street, Belmont, Mass., U.S.A., Dentist.

1904. Howell, Walter L., Room 314, Custom House, New Orleans, La., U.S.A., Chemist.

1899. Howles, Fred., c/o McDougall Bros., 66—68, Port Street, Manchester, Chemist.

1889. Howorth, F. Wise, 10, New Court, Lincoln's Inn, W.C., Technical Chemist and Chartered Patent Agent.

1907. Howroyd, Richard R., c/o Calder Mersey Extract Co., Ltd., Ditton, near Widnes, Chemist.

1914. Howson, Herbert G., 286, New Chester Road, Port Sunlight, Birkenhead, Analytical Chemist.

1906. Hoyler, Fritz, 93, Market Street, Perth Amboy, N.J., U.S.A., Chemist.

1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.

1900. Hübner, Julius, Linden, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).

1909. Hudson, Baker, Public Library, Middlesbrough, Librarian.

1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.

1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.

O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.

1908. Hughes, Wm. E., Chemical Laboratory, Messrs. W. Canning and Co., Great Hampton Street, Birmingham, Electro Chemist.

1906. Hulme, Robert B., 1162, Union Avenue, Memphis, Tenn., U.S.A., Chemical Engineer and Manager.

1909. Hultman, G. H., St. Paulsgatan 31, Stockholm, Sweden, Gas Engineer.

1905. Hulton, H. F. E., 15, Oak Hill Court, Putney, S.W., Chemist.

1905. Humel, Edward J., 13315, Detroit Street, Lakewood, Cleveland, Ohio, U.S.A., Chemist.

1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.

1902. Humphrey, Richard L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.

1903. Humphreys, A. C., 165, Broadway, New York City, and (Jnls.) Stevens Inst. of Technology, Hoboken, N.J., U.S.A., Engineer.

1913. Humphreys, Dr. R. E., 229, Laporte Avenue, Whiting, Ind., U.S.A., Chemist.

1908. Humphries, Albert E., Coxes Lock Mill, Weybridge, Surrey, Flour Miller.

1912. Humphries, Herbert B. P., Queen Anne's Chambers, Westminster, S.W., Consulting Chemist.

O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts., Gas Engineer.

1900. Hunt, Arthur V., 19, Park Road, Port Sunlight, Cheshire, Analytical Chemist.

O.M. Hunt, Chas., 17, Victoria Street, Westminster, London, S.W., Civil Engineer.

1909. Hunt, Edwin J., The Grange, Walsall, Staffs. Managing Director, Chance and Hunt, Ltd.

1883. Hunt, J. S., Appleton, Widnes.

1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.

O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.

1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.

O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.

1902. Huntly, Geo. N., 14, Old Queen Street, Westminster, S.W., Analytical and Consulting Chemist.

1904 Hurren, F. H., c/o The Rover Co., Ltd., Coventry, Analytical Chemist.

1894. Hurry, E. H., Llanover, Churt, Farnham, Surrey, Mechanical Engineer.

1894. Hutcheson, Jno. F., 39, St. Enoch Square, Glasgow, Chemical Manufacturer.

1912. Hutchin, C. D., c/o Messrs. Meredith and Drew, Ltd., High Street, Shadwell, London, E., Biscuit Manufacturer.

1900. Hutchinson, E. George, Gas Works, Carlisle, Manager.

O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.

1909. Hutchison, Chas. F., Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Photographic Emulsion Maker.

1909. Hütz, Dr. R., 32, India Street, Boston, Mass., U.S.A., Colour Chemist.

O.M. Huxley, Jas. H., c/o Vickers, Son, and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.

1906. Huyett, Miles C., 1005, Morgan Building, Buffalo, N.Y., U.S.A., Mechanical Engineer.

1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.

1902. Hyde, Austin T., Box 98, Rumford Falls Maine, U.S.A., Chemical Engineer.

1897. Hyde, B. T. Babbitt, 11, Broadway, New York City, U.S.A., Soap Manufacturer.

1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.

1899. Hyde, Wm. Grantley, Garden Wharf, Church Road, Battersea, S.W., Assayer.

1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.

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1912. Ibbotson, E. C., 28, Westwood Road, Porter Glen, Sheffield, Steel Manager.

1900. Ichioka, Dr. Tajiro, 19, Maruyama, Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).

1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.

1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.

1913. Illingworth, S. R., c/o Gas Lighting Improvement Co., Ltd., Pacific Wharf, West Ham, E., Works Chemist.

1909. Imison, C. S., The Cottage, Runcorn, Cheshire, Chemist, United Alkali Co.

1900. Imrie, John, 83, Horndean Road, Firth Park, Sheffield, Producer Gas and By-Products Plant Manager.

1900. Ingalls, Walter R., 505, Pearl Street, New York City, U.S.A., Mining Engineer and Metallurgist.

1889. Ingle, Dr. Harry, 6, Highfield Terrace, Kingston Road, Leeds, Organic Chemist.

1909. Ingleby, G. W., c/o John L. Seaton and Co., Ltd., Sculcoates, Hull, Director.

1906. Inglis, Dr. Jno. K. H., University of Otago, Dunedin, New Zealand, Professor of Chemistry.

1912. Inglis, Robert J. C., Chicago House, Cliffe at Hoo, Kent, Analytical Chemist.

1911. Innes, Dr. Alfred G., Fabrique de Soie Artificielle, Tubize, Belgium, Technical Chemist.

1909. Innes, R. Faraday, c/o The British Chrome Tanning Co., St. Andrew's Tannery, Northampton, Chemist.

1906. Innes, Dr. Wm. Ross, 19, St. James' Avenue, Cricklewood, N.W., Chemist.

1910. Irvine, Prof. J. C., Chemical Research Laboratory, The University, St. Andrews, Scotland, Professor of Chemistry.

1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.

1911. Irwin, George C., c/o S. H. Johnson and Co., Ltd., Carpenter's Road, Stratford, E., Manager (Engineering Works).

O.M. Irwin, W., Derwent Lodge, Cockermouth, Analytical Chemist.

1901. Isakovics, Alois von, Synfleur Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.

1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.

1912. Ivatt, Albert, The Engadine, Histon, Cambridge, Chemist (Foods).

1908. Ives, Herbert, 125, Pearl Street, Boston, Mass., U.S.A., Manager (Dyestuffs, etc.).

J

1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.

O.M. Jackson, Edward, Raven's Cliff, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.

1904. Jackson, Ernest W., Godrevy, Saltburn, Yorks, Analytical Chemist.

1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.

1883. Jackson, Frederick, 14, Cross Street, Manchester, Laboratory Furnisher.

1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.

1901. Jackson, Percy G., c/o National Boiler Insurance Co., St. Mary's Parsonage, Manchester, Chemist.

1890. Jackson, Saml., 3, Buckingham Gardens, Perambore Barracks, Madras, N., India, Analytical Chemist.

1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).

1898. Jackson, Thos., Thornton View, Clayton, Manchester, Chemical Manufacturer.

1900. Jackson, Victor G., 17, Doughty Street, London, W.C., Chemist.

1900. Jackson, Dr. W. Hatchett, Radcliffe, Library, Oxford, Librarian and Science Tutor (Keble College).

1893. Jackson, Rt. Hon. W. L., F.R.S. *See* Allerton, Rt. Hon. Lord.

1899. Jackson, W. Morton, c/o British Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.

O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.

1900. Jacoby, Areli H., c/o American Dyewood Co., 80, Maiden Lane, New York City, U.S.A., Chemist.

1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.

1886. Jago, Wm., 1, Garden Court, Temple, London, E.C., Barrister at-Law,

1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.

1893. James, Lawrence S., 28, Corona Street, Dorchester Center, Mass., U.S.A., Gas Inspector.

1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.

1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.

O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.

1911. Jarrom, Harry G., 41, Wilberforce Road, Hendon, N.W., Managing Director (Gallenkamp and Co.).

1900. Jarvie, Jas., Ferndale, Kenmure Avenue, Bishopbriggs, Scotland, Chemist.

1907. Jatar, S. B., 219, Upper Brook Street, C. on M., Manchester, Student.

1914 Jaubert, Dr. Geo. F., 155, Boulevard Malesherbes, Paris, France, Technical Journalist.

1910. Jayne, David W., c/o Barrett Manufacturing Co., Frankford, Philadelphia, Pa., U.S.A., Manager.

1913. Jeans, Harold, 165, Strand, London, W.C., Metallurgist.

1908. Jeffery, John H., 10, Daysbrook Road, Streatham Hill, London, S.W., Chemist and Metallurgist.

1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.

1905. Jenkins, Chas. D., 59, North Street, Newtonville, Mass., U.S.A., Chemist.

1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.

1912. Jenkins, Leslie C. W., 26, Ulundi Road, Blackheath, S.E., Chemist (Wood Dyeing).

1912. Jenkins, Rees, The White Cottage, Foleshill, Coventry, Analytical Chemist.

1894. Jenks, Robt. L., 1, Chamock Place, Calcutta, India, Chemist.

1911. Jennens, John H., 4, Highbridge Road, Wylde Green, nr. Birmingham, Analytical Chemist.

1908. Jennison, George, Beechwood, Tatton Road South, Heaton Moor, Stockport, Chemist.

1905. Jennison, Jas., Mountfield, London Road, Greenhithe, Kent, Chemist.

1904. Jepson, John Elliott, c/o Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.

1899. Jerdan, Dr. David S., Temora, Colinton, Midlothian, Chemist (Gelatin Works).

1899. Jessop, Louis V., Holmlea, 23, Woodville Road, Leytonstone, Essex, Chemist.

1904. Jewson, F. T., Earith, near St. Ives, Hunts, Chemist.

1896. Job, Robt., 649, Roslyn Avenue, Westmount, Quebec, Canada, Analytical Chemist.

1906. John, David, Haileybury, Ontario, Canada, Chemist.

1908. Johnson, Arthur, 25, Nursery Street, Pendleton, Manchester, Chemist.

1886. Johnson, A. E., 24, Parkdale, Wolverhampton, Analytical Chemist.

1904. Johnson, Cedric, Winnintgon Park, Northwich, Cheshire, Chemical Engineer.

1891. Johnson, Edmond E., c/o Adcocks, Drayton Park Works, Highbury, N., Chemical Engineer.

1904. Johnson, Dr. F. M. G., 286, Peel Street, Montreal, Canada, Chemist.

1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.

1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London. E.C., Sales Manager.

O.M. Johnson, J. E. J., 133, Earlham Grove, Forest Gate, E., Manufacturing Chemist.

1895. Johnson, Jesse F., P.O. Box 94, St. Anne de Bellevue, Quebec, Canada, Chemical Engineer.

1900. Johnson, John, c/o John Johnson and Co., 37th Street and Second Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1913. Johnson, J. Carroll, 9, Well Road, Hampstead, N.W., Chemist.

1900. Johnson, Jno. W. Haigh, West Riding Rivers Board, Wakefield, Yorks, Chemist.

1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.

1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.

1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.

1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.

1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.

1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.

1904. Johnston, Thos. J., 4, Garrioch Drive, Maryhill, Glasgow, Chemist.

1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Prince Bay, N.Y., U.S.A., Dental Enamel Manufacturer.

1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W.E.

O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.

1910. Johnstone, E. J., Watertown, N.Y., U.S.A., Consulting Engineer and Industrial Chemist.

O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.

1905. Johnstone, J. Swanston, Meridian Drug and Essence Co., Bond Street, Durban, Natal, Distiller.

1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.

1907. Jolliffe, Ernest H., Technical High School, 149, College Street, Toronto, Canada, Works Chemist.

1905. Jolliffe, Frank, 51, Vancouver Road, Forest Hill, S.E., Chemist.

1912. Jone, Hugo, 752, Broadway, Brooklyn, N.Y., U.S.A., Chemist.

1909. Jones, Arthur, c/o Grout and Co., Ltd., Silk Crape Works, Great Yarmouth, Technical Chemist.

1904. Jones, Arthur B., 981, Central Avenue, Plainfield, N.J., U.S.A., Superintendent.

1912. Jones, B. Vaughan, P.O. Box 27, Petersburg, Va., U.S.A., Chemist and Manufacturer.

1912. Jones, Charles, c/o Middleton Estate and Colliery Co., Ltd., Broom Pit, Leeds, Coke Plant Manager.

1902. Jones, David R., c/o Laurentian Chemical Co., Mont Tremblant, Quebec, Canada, Chemical Engineer.

1908. Jones, D. Trevor, "Mountain Ash," Ravenglass, Cumberland, Works Chemist.

1911. Jones, Edgar D., 3, Neville Road, Waterloo, near Liverpool, Analytical Chemist.

1912. Jones, E. Gabriel, City Analyst's Laboratories, Ashton Street, Liverpool, Assistant Public Analyst for Liverpool.

1910. Jones, E. Protheroe, The Golden Horseshoe Estates Co., Salisbury House, London Wall, London, E.C., Secretary.

1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.

1909. Jones, E. Willis, 22, Coleshill Terrace, Llanelly, South Wales, Chemical Manufacturer.

O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.

1897. Jones, Fred. W., 35, Addiscombe Road, Croydon, Technical Chemist.

1896. Jones, G. Cecil, 41, London Road, Forest Hill, S.E., Consulting Chemist.

1912. Jones, G. P., Cameron Powder Manufacturing Co., Emporium, Pa., U.S.A., General Manager.

1905. Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.

1907. Jones, Henry Williams, 200, Gravelly Hill, Birmingham, Analytical Chemist.

1893. Jones, Herbert. *See* Sefton-Jones, H.

1901. Jones, Herbert J., 40, Reginald Road, Forest Gate, E., Chemist.

1910. Jones, Ivor R., 54, Atlantic Chambers, Manchester, Chemical Merchant.

1905. Jones, J. E. Stacey, Hearsall Works, Coventry, Consulting Chemist and Technical Metallurgist.

1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.

1914. Jones, Leonard S., 66, Leyspring Road, Leytonstone, N.E., Works Chemist.

1894. Jones, M. W., Stonebeck, Brislington, Bristol, Manager (Oil and Colour Works).

O.M. Jones, Walter Norris, Lancashire Metal Works, Widnes, Technical Chemist.

1903. Jones, Wm. App, c/o Boston Artificial Leather Co., 200, Fifth Avenue, New York City, U.S.A., Chemist.

1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.

1912. Jordan, Walter L., 918, West 5th Street, Glendale, Cal., U.S.A., Chemical Engineer.

1908. Joselin, Percy H., 81, Bennerley Road, New Wandsworth, S.W., Chemist.

1905. Joseph, A. F., Ceylon Technical College, Colombo, Ceylon, Lecturer on Chemistry.

1900. Josephson, Edgar, c/o Pantazote Leather Co., Passaic, N.J., U.S.A.

1906. Joshua, Dr. Walter P., c/o The Cape Copper Co., Ltd., Briton Ferry, South Wales, Chemist.

1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.

1887. Joüet, Dr. C. H., 238, East 2nd Avenue, Roselle, N.J., U.S.A., Technical Chemist.

1889. Journaud, Louis, Poot Evêque, près Vienne (Isère), France, Technical Chemist.

1904. Jowett, Dr. H. A. D., Phœnix Mills, Dartford, Kent, Research Chemist.

1903. Joyce, Clarence M., P.O. Box 23, Arlington, N.J., U.S.A., Chemist.

O.M. Justice, Philip M., 55-56, Chancery Lane, London, W.C., Patent Agent.

K

1896. Kalbfleisch, Franklin H., 31, Union Square West, New York City, U.S.A., Chemical Manufacturer.

1908. Kaliski, Dr. Maximilian S., 118, West 119th Street, New York City, U.S.A., Technical Chemist.

1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.

1912. Kampen, Kurt van, The London Electron Works, Ltd., Horseferry Road, Limehouse, E., Managing Director.

1913. Kastle, Dr. Joseph H., Kentucky Agricultural Experiment Station, Lexington, Ky., U.S.A., Director.

1901. Kauder, Dr. E. c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.

1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.

1910. Kaufmann, George von, Solotwina, Ost-Galizien, Austria, and (Journals) Christ's College, Cambridge, Director (Austrian Petroleum Co.).

1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.

1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.

1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.

1912. Kay, Jas. H., Hazle Bank, Bolton Road, Ramsbottom, Lancashire, Soap Manufacturer.

O.M. Kay, Wm. E., 349, The Cliff, Broughton Park, Manchester, Printworks Chemist.
1910. Kaye, Henry R., c/o Cuming, Smith, and Co., Port Melbourne, Vic., Australia, Analytical Chemist,
1904. Kaye, Thos., 26, Rose Crescent, Perth, Scotland. Analytical Chemist.
1884. Keane, Dr. Chas. A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
O.M. Kearns, H. W., Baxenden, near Accrington, Dyer.
1897. Kearns, Jno. S., Cowpe Mills, Waterfoot, near Manchester, Chemist and Dyer.
1894. Kebler, Lyman F., 1322, Park Road, Washington, D.C., U.S.A., Chief of Drug Laboratory, Department of Agriculture.
1908. Keeble, A. J., Wereham Hall, Stoke Ferry, Norfolk, Land Owner.
1910. Keeler, Warren I., 214, Main Street, New Britain, Conn., U.S.A., Analytical Chemist.
1911. Keenan, Thomas J., 117, East 24th Street, New York City, U.S.A., Paper Chemist.
1910. Keillor, John, Hamilton Gas Light Co., Hamilton, Canada, Gas Engineer.
1908. Keith, Jas. W., c/o C. Tennant and Co., Ltd., Carnoustie, Forfarshire, Analytical Chemist.
1907. Keller, Dr. Edward, P.O. Box 363, Perth Amboy, N.J., U.S.A., Chemist and Metallurgist.
1905. Keller, Robt. J., 89, Barclay Street, New York City, U.S.A., Dyestuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1908. Kellogg, H. W., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., General Manager.
1910. Kemmerich, Dr. Wm. E., Farbenfabr. vorm. F. Bayer und Co., Leverkusen, bei Cöln, Germany, Chemist.
1907. Kendall, G. F., Chemical Works, Stratford-on-Avon, Chemical Manufacturer.
1912. Kennedy, Carl D., Chemist.
1912. Kent, Raymond W., East Palistine, Ohio, U.S.A., Chemist.
1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1899. Kern, Walter P., 266, Paulison Avenue, and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1906. Kerr, Charles H., c/o Pittsburg Plate Glass Co., Creighton, Pa., U.S.A., Ceramic Research Chemist.
1912. Kerr, R. Vaughan, c/o Señor D. Luis Moscardo. Alfredo Calderon 4, Valencia, Spain, Technical Chemist.
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
1897. Kerr, Wm. M., 712, La Fayette Building, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.
1909. Kesava-Menon, A., Chittur-Palghat, South Malabar, Madras, India, Chemist.
1902. Kessler, Henry W., 720, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.
1893. Kestner, Paul, 7, Rue de Toul, Lille. France, Chemist.
1900. Kewley, Jas., c/o Anglo-Egyptian Oilfields, Ltd., Suez, Refinery Manager.
1890. Keys, W. H., Hall End Works, West Bromwich, Oil and Chemical Manufacturer.
1913. Kilby, Jos. N., 11, Westfield Grove, Wakefield, Assistant Manager (Steel Plant).
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.
1901. Kilmer, Fred. B., c/o Messrs. Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemical Manufacturer.
O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.
1912. Kind, Georg E., 33, King Street, Covent Garden, London, W.C., Bookseller and Publisher.
O.M. King, A. J., Elleray, Windermere, Bleacher and Finisher.
1907. King, C. A., c/o The Farnley Iron Co., Farnley, near Leeds, Technical Chemist.
1913. King, Edward W., New Liverpool Rubber Works, Walton, Liverpool, Analytical Chemist.
1905. King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.
1911. King, Harold, 24, The Brent, Dartford, Kent, Chemist.
O.M. King, J. Falconer, 43, Stirling Road, Edinburgh, Consulting Chemist.
1910. King, John, Summerville Gardens, Latchford, Warrington, Lancashire, Works Manager.
1913. King, Dr. Robert C., V.O., Fifth Line 34, St. Petersburg, Russia, Chemist.
1895. King, Sidney J., Brean, Upton Road, Bexley Heath, Kent, Analytical Chemist.
O.M. King, Walter R., 16, Mincing Lane, London, E.C.; and (Journals) Torville, The Cliffs, Southend-on-Sea, Chemical Manufacturer.
1905. King, Warren C., 72, Front Street, New York City, U.S.A., President, Independent Chemical Co.
1896. Kingdon, Holman, c/o Joseph Crosfield and Sons, Warrington, Technical Chemist.
1908. Kingsbury, Percy C., German-American Stoneware Works, 50, Church Street, New York City, U.S.A., Chief Civil Engineer.
1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.
O.M. Kingzett, C. T., "Maplin," Frinton on Sea, Essex, and (Journals) Sanitas Co., Ltd., Locksley Street, Limehouse, E., Technical Chemist.
1906. Kinnersley, H. W., Branscombe, Merry Hill Road, Bushey, Herts, Chemist and Manufacturer.
1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.
1908. Kirkhope, T. Bertram, Sandbank, Gwithian, Hayle, Cornwall, Explosives Works Chemist.
1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.
1900. Kirkpatrick, Prof. Stafford F., 84, Gore Street, Kingston, Ont., Canada, Professor of Metallurgy.
1913. Kirsebom, Gustave, Braden Copper Co., Molino, Rancagua, Chile, Metallurgical Engineer.
1911. Kirstein, H. C., 7, Gracechurch Street, London, E.C., Consulting Engineer.
1902. Kitchen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.
1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.
1900. Kittredge, H. G., c/o The Kay and Ess Co., Dayton, Ohio, U.S.A., Chemist.
1908. Klaber, Wm., c/o Castle Kid Co., Camden, N.J., U.S.A., Chemist.
1900. Kleber, Dr. Clemens, Clifton Chemical Laboratory, Passaic, N.J., U.S.A., Director.
1911. Klein, C. A., 4, Brimsdown Avenue, Enfield Highway, Middlesex, Works Chemist.
1908. Klein, Dr. Friedrich, 762, Melrose Avenue, New York City, U.S.A., Chemist.
1909. Klemm, Wilfred E., 25, Marmion Road, Liverpool, Chemist.
1908. Klien, Dr. J. L., 7, King Street, Cheapside, London, E.C., Works Manager.
1903. Kline, Clarence M., 429, Arch Street, Philadelphia, Pa., U.S.A., Wholesale Druggist.
1889. Klipstein, A., 644—654, Greenwich Street, New York City, U.S.A., Chemical Manufacturer.
1902. Klipstein, Ernest C., 93, Prospect Street, East Orange, N.J., U.S.A., Chemical Merchant.
1913. Klotz, W. C., Canadian Ammonia Co., Ltd., Toronto, Canada, Chemist.
1891. Knaggs, Alfred B. 37, Mannville Terrace, Bradford, Technical Chemist in Dyeworks.
1911. Knapp, Arthur W., c/o Cadbury Bros., Ltd., Bourneville, nr. Birmingham, Analytical Chemist.
1911. Knapp, Harry P., Chemical Manufacturer.
1892. Knecht, Dr. E., Beech Mount, Marple, Cheshire, Professor of Tinctorial Chemistry.
1904. Kniffen, Frederick, 823, North Franklin Street, Wilmington, Del., U.S.A., Chemist.

1887. Knight, A. H., 51, Highfield Street, Liverpool, Assayer.

1903. Knight, Harley F., 14, Old Queen Street, Westminster, S.W., Analyst.

1884. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.

O.M. Knight, J. Baillie, Royal Primrose Soapworks, Silvertown, London, E., Soap Manufacturer.

1887. Knights, J. West, 67, Tenison Road, Cambridge, Analytical Chemist.

1885. Knipler, F., "Strathberg," Greensborough, near Melbourne, Victoria, Starch Manufacturer.

1907. Knoedler, E. L., c/o Welsbach Co., Gloucester City, N.J., U.S.A., Factory Foreman.

1910. Knott, E. Anthony F., The Priestman Collieries, Ltd., Ottovale Coke Works, Blaydon-on-Tyne, Works Chemist.

1911. Knowland, Daniel P., 89, Barclay Street, New York City, U.S.A., Chemist.

1904. Knowles, W. R., The Hollies, Wood Green, Wednesbury, Chemical Works Manager.

1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and (subs.) c/o Parbury, Henty, and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.

1906. Knudsen, Kristian Hv., Tofte Cellulosefabrik, Norway, Chemist.

1905. Koch, Dr. Geo. W., 905, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.

1911. Kochs, A. Victor, 301, Glossop Road, Sheffield, Gas Engineer.

1904. Koebig, Dr. J., Suite 1026, Union Oil Building, Los Angeles, Cal., U.S.A., Consulting Chemical Engineer.

1909. Kockkoek, Patrick R., Works Chemist.

1911. Koelle, Dr. G., Metallbank und Metallurgische Gesellschaft, Bockenheimer Anlage 45, Frankfurt a/M., Germany, Chemist.

1884. Kohn, Dr. Charles A. *See* Keane, Dr. Chas. A.

1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.

1913. Komuro, T., c/o A. Rawle, Lancaster House, Child's Hill, N.W., Chemical Engineer.

1913. Kondo, K., 136, Yoyogi, Tokyo, Japan, Chemical Engineer.

O.M. Kraftmeier, E., Bank Buildings, St. James's Street, London, S.W., Explosives Manufacturer.

1906. Krais, Dr. Paul, Lustnauer Allee, Tuebingen, Germany, Chemist.

1894. Krause, Dr. Albert H., 1444, West 98th Street, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).

O.M. Krause, Prof. Dr. G., Cöthen (Anhalt), Germany, Chemist.

1898. Krebs, H. J., 806, Franklin Street, Wilmington, Del., U.S.A., Manufacturing Chemist.

1908. Kress, Otto, 438, West 116th Street, New York City, U.S.A., Teacher of Science.

1900. Kunheim, Dr. Erich, Niederschöneweide, near Berlin, Germany, Chemist.

1904. Kunz, Dr. George F., c/o Tiffany and Co., 409, 5th Avenue, New York City, U.S.A., Gem Expert.

1905. Kurt, Franklin T., 553, Boylston Street, Boston, Mass., U.S.A., Professor of Chemistry, B.Y.M.C.A.

1907. Kutsch, Dr. Wm. A., c/o Corn Products Manufacturing Co., Pekin, Ill., U.S.A., Chemist.

1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.

1909. Kwoh, See Kwain, Municipal Technical College, Mukden, Manchuria, China, Chemical Engineer.

O.M. Kynaston, J. W., 3, Oak Terrace, Beech Street, Liverpool, Chemical Engineer.

1907. Kynaston, Wm. C. R., 9, Harland Road, Higher Tranmere, Birkenhead, Analyst.

L

1906. Lacell, Harold G., Ardoch, Nether Street, Finchley, N., Chemist.

1890. Lacey, E. C., St. Julian's Lodge, St. Julian's Farm Road, West Norwood, Manufacturing Chemist.

1903. Lachman, Dr. Arthur, 3037, Wheeler Street, Berkeley, Cal., U.S.A., Chemical Engineer.

1913. Laib, Walter, Rittman, Wayne Co., Ohio, U.S.A., Chemist (Ohio Salt Co.).

O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.

O.M. Lake, G., jun., Lee Mount, Glossop, Derbyshire, Analytical Chemist.

1907. Lake, Henry B., Lavorrick, Mevagissey, Cornwall, Chemical Engineer.

1900. Lamar, Wm. R., Lamar Chemical Works, 8—14 Johnson Street, Newark, N.J., U.S.A., President.

1898. Lamb, Morris Chas., Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Chemist.

1912. Lampitt, Leslie H., La Meunerie Bruxelloise, Haren Nord, Brussels, Belgium, Research Chemist.

1912. Lancaster, Harry C., 135, Ladbroke Road, Kensington, W., Managing Director.

1907. Lancaster, Harry M., Laboratory, Provincial Board of Health, 5, Queen's Park, Toronto, Canada, Chemist.

1910. Landrum, R. D., 1139, Belview Avenue, Canton, Ohio, U.S.A., Chemical Engineer.

1904. Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.

1910. Lane, J. Henry, 3, Arbour Square, Stepney, London, E., Chemist.

1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.

1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

O.M. Langdon, Dr. M. J., The Chemists' Club, 52, East 41st Street, New York City, U.S.A., Analytical Chemist.

1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.

1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Factory Manager.

1902. Langmuir, F. Leighton, 350, Bloor Street West, Toronto, Canada, Chemist.

1898. Langstaff, Wm., 39, Orchard Street, Elizabeth, N.J., U.S.A., Chemist.

1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks, Chemist and Manager.

1909. Lantsberry, Fred. C. A. H., Birmingham Small Arms Co., and (Journal) 63, Walford Road, Sparkbrook, Birmingham, Metallurgical Chemist.

1906. Lantz, Alfred, 139, Rue La Fayette, Paris, France, Colour Works Manager.

1903. Larter, Alfred T., 86, Inderwick Road, Stroud Green, N., Chemist.

1904. Lasher, F. G., 251, Bush Street, Brooklyn, N.Y., U.S.A., Chemist.

1884. Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.

1889. Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.

1907. Lathwood, Arthur, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., and (Journals) 23, Clarence Road, Wood Green, N., Chemist.

1909. Law, Douglas J., Trent Bridge Leather Works, Nottingham, Chemist.

1913. Law, John A., c/o Barry, Ostlere, and Shepherd, Ltd., Forth Works, Kirkcaldy, Scotland, Linoleum Works Director.

1907. La Wall, Chas. H. 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Lawrence, Jas., Box 737, Joplin, Mo., U.S.A., Explosives Manufacturer.

1911. Lawrence, Wm. A., Laboratory, 11, Vandewater Street, New York City, U.S.A., Director.

1904. Lawson, Jos. H. S., Rodney Street Works, Oldham Road, Manchester, Salesman.

1900. Lawson, Wm. L., c/o Great Western Sugar Co., Sterling, Colo., U.S.A., Chemist.

1894. Lawson-Johnston, G., (Journals) 29, Portman Square, W., and 1, King's Arms Yard, London, E.C., Chairman of Bovril, Ltd.

1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.

1907. Leach, Dr. F. P., Briarswood, Chester Road, Erdington, Birmingham, Research Chemist.

1908. Leake, Percy C., Deanbank Terrace, Ferryhill Village, Co. Durham, Tar Works Manager.

1898 Lean, Geo., 15, Park Terrace, Glasgow, Chemist.

1897. Leathart, Thos. H., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.

O.M. Leather, Dr. J. Walter, Agricultural Research Institute, Pusa, Behar and Orissa, India, Government Chemist.

1913. Lebach, Dr. Hans, c/o The Bakelite Co., Ltd., Orb Works, Cowley, near Uxbridge, Middlesex, Chief Chemist.

1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.

1907. Lecco, Prof. Marco T., Vasina 15, Belgrade, Servia, Professor of Chemistry.

1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).

1896. Lecomber, W. G., Cambridge Works, Knott Mill, Manchester, Engineer.

1896. Lederle, Dr. E. J., 39, West 38th Street, New York City, U.S.A. Chemist.

1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.

1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.

1903. Ledoux, Aug. D., 15, William Street, New York City, U.S.A., Importer of Pyrites.

1905. Lee, Ashton, Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, Frank W., Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, John C., Mountford Street, Brookline, Mass., U.S.A., Assistant Engineer (American Telegraph and Telephone Co.).

1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.

1911. Lee, Joseph, c/o Mr. Gill, 280, Alma Street, Rockhampton, Queensland, Works Chemist.

1885. Lee, S. Wright, 6-10, Whitechapel, Liverpool, Wholesale Druggist.

1906. Lee, William, 28, Sherard Gardens, Eltham, Kent, Works Chemist.

1912. Lees, Arnold, 14, Priory Street, York, Analytical Chemist.

1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.

1907. Lehmann, Dr. Adolf, University of Alberta, Strathcona, Alberta, Canada, Professor of Chemistry.

1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.

1906. Leigh, Edw. Collier, c/o Companhia de Gaz, Parà, North Brazil, Gas Works Manager.

1902. Leighton, A. E., Commonwealth Cordite Factory, Maribyrnong, Victoria, Analytical Chemist.

1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.

1904. Le Maistre, Fred J., Room 727, Du Pont Building, Wilmington, Del., U.S.A., Research Chemist.

1898. Leman, Wm. T., P.O. Box 747, Chicago, Ill., U.S.A., Oil and Asphalt Agent.

1908. Lemeland, Dr. P., 8, Rue Alfred de Vigny, Paris, France, Chemist.

1883. Lennard, F., Ifford Manor House, near Lewes, Sussex, Chemical Manufacturer.

1884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.

1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIII^e.), France.

1904. Lesley, R. W., 604, Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1907. Leslie, Dr. Fred. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Chemist.

1894. Leslie, Hugh M., 10, St. Andrew's Drive, Pollokshields, Glasgow, W., Chemical Engineer.

1904. Lessing, Dr. Rudolf, Southampton House, 317, High Holborn, London, W.C., Consulting Chemist.

1912. Lessner, C. B., Carril, Spain, Metallurgical Chemist.

1892. Lester, J. H., Grange Drive, Monton Green, Eccles, Lancs, Analytical Chemist.

1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.

1891. Lever, Sir Wm. H., Bart., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.

1909. Lever, W. Hulme, Heathfield, Bebington, Cheshire, Soap Manufacturer.

1901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.

1903. Levi, Dr. Louis E., 781, Sherman Boulevard, Milwaukee, Wis., U.S.A., Chemist.

1912. Levin, Isaac H., 796, Frelinghuysen Avenue, Newark, N.J., U.S.A., Chemist.

1906. Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.

1901. Levinstein, Dr. Herbert, c/o Levinstein, Ltd., Blackley, near Manchester, Chemist.

O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.

1903. Levy, Arthur G., 1927, Madison Avenue, New York City, U.S.A., Chemist.

1909. Levy, Louis S., 80, Maiden Lane, New York City, U.S.A., Editor, "American Perfumer."

1901. Levy-Mond, Dr. Albert. *See* Mond, Dr. Albert L.

1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.

1898. Lewin, H. James, Royal Clarence Yard, Gosport, Hants, Analytical Chemist.

1914. Lewis, C. Preston, 223, Brixton Hill, London, S.W., Technical Chemist.

1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.

1904. Lewis, Edw. W., c/o J. G. Ingram and Sons, London India Rubber Works, Hackney Wick, N.E., Chemist.

1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.

1905. Lewis, F. W., Aetna Powder Co., 143, Dearborn Street, Chicago, Ill., U.S.A., Secretary.

1900. Lewis, John, 76, Underhill Road, Lordship Lane, S.E., Cashier (Paint Works).

1909. Lewis, Reginald J., Govt. Explosives Office, 423, Flinders Lane, Melbourne, Australia, Chemist.

1900. Lewis, Dr. S. Judd, The Laboratories, Staple Inn Buildings, High Holborn, London, W.C., Analytical Chemist.

1914. Lewis, Prof. W. C. McC., Muspratt Laboratory, The University, Liverpool, Professor of Physical Chemistry.

1913. Lewkowitsch, Mrs. K. J., The Lewkowitsch Laboratories, 71, Priory Road, West Hampstead, N.W.

1907. Leyson, Lewis T., c/o Standard Bank of South Africa, Johannesburg, Transvaal, Analytical Chemist.

1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.

1913. Lichtenstein, L. M., Royal Albert and Victoria Docks Chemical Works, Silvertown, London, E., Manufacturing Chemist.

1904. Lichtenthaeler, Robt. A., Rhode Island Agricultural Experiment Station, P.O. Box 112, Kingston, R.I., U.S.A., Chemist.

1913. Lidholm, J. H., c/o Alby United Carbide Factories, Ltd., 308, Winchester House, Old Broad Street, London, E.C., Chemical Engineer.

1904. Lieber, Dr. Hugo, 25, Madison Avenue, New York City, U.S.A., Chemist.

O.M. Liebmann, Dr. A., The Whim, Weybridge, Surrey, Consulting Chemist.

1913. Liebreich, Dr. Erik, 30, Kronprinzen Ufer, Berlin Germany, Chemist.
O.M. Lighttoot, T. E., Fernleigh, Accrington, Calico Printer's Chemist.
1905. Liley, Thos. A., 46, Westover Road, Bramley, Leeds, Chemist.
1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.
1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.)
1908. Lindfield, James H., c/o Messrs. Martineau, King Edward Street, Whitechapel, E., Technical Chemist.
1897. Lindsay, Robt., Transvaal G.M. Estates, Pilgrim's Rest, Lydenburg, Transvaal, Chemist.
1911. Line, Chas. A., 39, Beaufort Road, Edgbaston, Birmingham, Technologist.
1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, London, E.C., Consulting Chemist.
1905. Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.
1896. Lishman, Geo. P., Lambton Coke Works, Fence Houses, Co. Durham, Colliery Chemist.
1905. Little, Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.
O.M. Littlejohn, Jas., c/o Littlejohn and Whitby, P.O. Box 849, Johannesburg, Transvaal, Analytical Chemist.
1911. Liu, Hamilton C., Dept. of Public Works, Board of Interior Affairs, Pekin, China, viâ Siberia, Chemist.
1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.
1886. Liversedge, A. J., 63, Northampton Road, Croydon, Mechanical Engineer.
1914. Liversedge, John A., May Morn Mills, Mangaron, near Wellington, New Zealand, Assistant Lead Mill Manager.
1906. Liversedge, S. G., Elmhurst, Chalkwell Park Drive, Leigh on Sea, Essex, Analytical Chemist.
1904. Liverseege, J. F., Analytical Dept., 44, Broad Street, Birmingham, City Analyst.
O.M. Liversidge, Prof. A., F.R.S., Field Head, Coombe Warren, Kingston, Surrey, Professor of Chemistry.
1907. Liversidge, Bernard, Cliffhurst, Clifton Crescent North, Rotherham, Yorks, Analytical Chemist.
1883. Livingston, W. J., 30, Fountayne Road, Stoke Newington Common, London, N., Analytical Chemist.
1903. Llewellyn, Ivor P., 149, Moorland Road, Stockport, Chemist.
1907. Llewellyn, W. B., 61, Belgrave Road, New Moston, Manchester, Chemist.
1909. Lloyd, Edward, 27, Broomgrove Road, Sheffield, Chemical Engineer.
1913. Lloyd, Prof. Francis E., Dept. of Botany, McGill University, Montreal, Canada, Prof. of Botany.
1904. Lloyd, Leonard B., Broadford Tannery, Broadford, Victoria, Australia, Tanner.
1907. Lloyd, Dr. Lorenzo L., Technical College, Bradford, Yorks, Lecturer in Chemistry.
1908. Lloyd, Capt. M. B., 3, Neville Terrace, Onslow Gardens, London, S.W., Director of Curtis's and Harvey, Ltd.
1900. Lloyd, Thos. H., c/o Quibell Bros., Newark-on-Trent, Analyst.
1909. Lobley, A. G., Mill Bank, Trefriw, North Wales, Chemist.
1888. Lodge, Edw., 35, Scale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.
1891. Loewenthal, Dr. R., Uhlandstrasse 39, Frankfurt a/M., Germany, Lecturer on Dyeing.
1907. Lomax, E. Lawson, Mowbreck, Farington, near Preston, Chemist.
1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.
1909. Long, George, Cudahy, Wis., U.S.A., Glue Maker.
1898. Longstaff, Dr. Jas. P., Chemical Department, The University, Edinburgh, Assistant.
1908. Longwell, Alex., 404, Lumsden Building, Toronto, Canada, Mining Engineer.
1890. Lord, F. J., Winmarleigh, Southborne, Bournemouth, Hants, Analytical Chemist.
1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lancs, Chemist and Manager.
O.M. Lorenz, H., 7 and 8, Idol Lane, London, E.C., Chemical Merchant.
1904. Lorimer, John H., 280, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.
1905. Loring, Lindsley, 40, Central Street, Boston, Mass., U.S.A., Vice-President (Cochrane Chemical Co.).
1909. Lorleberg, C., c/o R. W. Greeff and Co., Thames House, Queen Street Place, London, E.C., Chemical Merchant.
O.M. Lorrain, Jas. G., Staple Inn Buildings, Holborn, London, E.C., Chartered Patent Agent.
1904. Lossen, Dr. Clemens F., Boulevardul Independentei 8, Ploesti, Roumania, Chemist.
O.M. Lott, F. E., The Laboratory, Bridge Chambers, Burton-on-Trent, Consulting Brewing Chemist.
O.M. Louis, D. A., 123, Pall Mall, London, S.W., Metallurgist and Mining Engineer.
1894. Louis, Prof Henry, Armstrong College, Newcastle-on-Tyne, Professor of Mining.
O.M. Love, Dr. E. G., 124, East 15th Street, New York City, U.S.A., Analytical Chemist.
1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Broxburn Oil Co., Ltd.).
1895. Lovejoy, Frank W., 22, Seneca Parkway, Rochester, N.Y., U.S.A., Chemical Engineer.
O.M. Lovibond, J. W., The Pleasaunce, Lake, near Salisbury, Tintometer Manufacturer.
O.M. Lovibond, T. W., West Jesmond House, Newcastle-on-Tyne, Brewer.
1913. Low, Frank S., c/o Cutler-Hammer Manufacturing Co., 144th Street and Southern Boulevard, New York City, U.S.A., Chemical Engineer.
1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.
1911. Lowcock, J. Harold, Garstang, Kemerton Road, Beckenham, Kent, Chemist.
1913. Lowe, Austin, 41, Lavender Sweep, Battersea, S.W., Research Chemist.
1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.
1905. Lowe, Houston, The Lowe Bros. Co., 452, East Third Street, Dayton, Ohio, U.S.A., Paint and Varnish Maker.
O.M. Lowe, W. F., 18, Hough Green, Chester, Analytical Chemist.
1885. Lowson, Dr. J. G. F., Snitterfield House, Stratford-on-Avon, Paper Maker.
1906. Lowson, Wm., The University, Leeds, Chemical Lecturer.
1895. Lucas, Alf., Laboratories, Public Works Ministry Gardens, Cairo, Egypt, Analyst.
1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.
1914. Lucas, Wm. A., c/o Braden Copper Co., Rancagua, Chile, Chemist.
O.M. Luck, A. Courtenay, Laboratorio de Explosivos, Darsena Norte, Buenos Aires, Argentina Explosives Chemist.
1913. Lucy, Arthur J., c/o Turner, Morrison and Co., Calcutta, India, Consulting Engineer.
1900. Lummus, Walter E., 39, Bassett Street, Lynn, Mass. U.S.A., Manager.
1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, Scotland, Technical Chemist.
1910. Lumsden, William W., 39, Caledonia Road, Saltcoats, Scotland.
1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.
1888. Lundholm, Carl O., 220, Winchester House, Old Broad Street, London, E.C., Explosives Works Manager.
1913. Lunge, Ernest, 2, Plowden Buildings, Temple, London, E.C., Barrister-at-Law.
O.M. Lunge, Dr. G., Carmenstrasse 37, Zürich, Switzerland, Professor of Chemistry.

1885. Lupton, Sydney, 102, Park Street, Grosvenor Square, London, W.
1884. Lüthy, Otto, P.O. Box 63, Maywood, N.J., U.S.A., Analytical Chemist.
1913. Lycett, P. J., c/o The County Chemical Co., Ltd., Bradford Street, Birmingham, Chemist.
1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds, Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Leagrave Hall, near Luton, Beds, Straw Dyer.
1884. Lyle, James, Ardesco, West Silvertown, E., Sugar Refiner.
1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.
1896. Lymn, Arthur H., Sanctuary House, Tothill Street, Westminster, S.W., Consulting Chemical and Gas Engineer.
1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks, Tar Distiller.
1906. Lyons, Robert H., c/o Canadian Explosives, Ltd., Vaudreuil Station, Quebec, Canada, Chemist.
O.M. Lytle, A. M., North of Ireland Chemical Co., Ltd., 34, Victoria Street, Belfast, Ireland, Chemical Manufacturer.

M

1908. Maas, Milton A., 92, William Street, New York City, U.S.A., Manufacturing Chemist.
1911. Mabbitt, Alan T., 3, Wallwood Road, Leytonstone, N.E., Analytical Chemist.
1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1891. Macadam, Herbert E., Dalkeith, Glengall Road, Woodford Green, Essex, Manure Works Manager.
1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.
1912. McAfee, Dr. A. M., c/o The Gulf Refining Co., Bayonne, N.J., U.S.A., Chemist.
1894. McAlley, Robt., Bankside, Falkirk, Scotland, Paint Works Manager.
1892. Macara, Thos., jun., 20, Denton Road, Stroud Green, N., Chemist.
1912. McArly, T. P., Mount Lyell Mining and Railway Co., Queenstown, Tasmania, Chemist and Assayer.
1887. McArthur, James B., Price's Patent Candle Co., Limited, Belmont Works, Battersea, S.W., Chemist.
O.M. McArthur, J. S., 74, York Street, Glasgow, Consulting Chemist and Metallurgist.
1901. Macarthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.
1892. McArthur, Thos., 711, Tower Building, Water Street, Liverpool, Drysalter and Dyewood Extractor.
1912. Macaulay, J. W., Evermonde, Holmlands, Monkseaton, Northumberland, Metallurgical Chemist.
1911. McBride, K. R., Glens Falls, N.Y., U.S.A., Colour Chemist.
1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.
O.M. McCallum, J. M., Southdene, Paisley, Scotland, Soap Manufacturer.
1914. McCarthy, Robt. A., Bertram Street, Mortlake, Sydney, N.S.W., Australia, Assistant Chemist (Australian Gas Co.).
1905. McCaw, Lt.-Col. W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.
1905. McCleary, Wm., 61, Station Road, Pendlebury, near Manchester, Finisher.
1910. McColl, A. L., 60, Addingham Road, Mossley Hill, Liverpool, Chemist.
1907. McConnan, Dr. Jas., 8, Crosby Road South, Waterloo, Liverpool, Chemist.
1903. McCourt, Cyril D., 45, Braxted Park, Streatham Common, S.W., Chemist.
1912. McCoy, James P. A., Research Division, Westinghouse Electric and Manufacturing Co., East Pittsburg, Pa., U.S.A., Analytical Chemist.
1913. McCrady, McH., 9, St. James' Street, Montreal, Canada, Chemist and Bacteriologist.
1897. McCrae, Dr. John, Government Laboratories, P.O. Box 1080, Johannesburg, Transvaal, Government Analyst.
1898. McCreath, Wm. D., Quantock Vale Cider Works, North Petherton, Bridgwater, Cider Manufacturer.
1911. McCulloch, Norman G., Rhodes Works, Rhodes, Manchester, Chemist and Calico Printer.
1903. McCully, R. E. J., 7, London Road, Northfleet, Kent, Analytical Chemist.
1910. Macdonald, Alexander, Brampton House, Camphill Avenue, Langside, Glasgow, Clerk.
1912. McDonald, Allan D., "Belgrano," Milngavie, near Glasgow, Manufacturing Chemist.
O.M. Macdonald, Andrew, 72, Great Clyde Street, Glasgow.
1912. McDonald, Donald, Cleeve House, Bexley Heath, Kent, Analytical Chemist.
1897. MacDonald, G. W., Whitefriars, Rochester, Kent, Chief Explosives Research Chemist (Curtis's and Harvey, Ltd.).
1910. Macdonald, J. L. A., 13, Howard Place, St. Andrews, Fife, Scotland.
O.M. Macdonald, J. W., 8, Prince of Wales Terrace, Kensington, W., Analytical Chemist.
1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.
O.M. McDonald, T. McG., Walilabo Estate, St. Vincent, West Indies, Sugar Chemist.
1906. Macdougald, Geo. D., City Laboratory, 13, Shore Terrace, Dundee, City Analyst.
1895. McDougall, Isaac, jun., 68, Port Street, Manchester, Chemical Manufacturer.
1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.
1906. McDowall, Wm., 42, Herriet Street, Pollokshields, Glasgow, Analytical Chemist.
1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."
1901. McEwen, Duncan C., c/o Chosen Gold Mines, Ltd., Kok-Kang-Kol Mine, Chung-An, Korea, Metallurgical Chemist.
1908. McEwen, Stewart R., c/o Chemical Laboratories, Ltd., 148, Van Horne Street, Toronto, Canada, Chemist.
1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
1910. McFarlane, John, 6, Gordon Terrace, Shettleston, Glasgow, Metallurgist.
O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardiff, Works Manager.
1901. McFarlane, Walter, The Lodge, Brinscall, near Chorley, Printworks Manager.
1893. McGhie, T. Burns, c/o Bwana M'Kubwa Copper Mining Co., Bwana M'Kubwa, Northern Rhodesia, Metallurgist.
1904. McGill, Dr. A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.
1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.
1887. McGlashan, John, P.O. Balapur Tolodi, Tehnil Brahmapuri, Dist. Chanda, India, Technical Chemist
1906. McGregor, Russell, 15, Frodingham Road, Scunthorpe, Lincolnshire, Analytical Chemist.
1896. McIlhiney, Dr. Parker C., 7, East 42nd Street, New York City, U.S.A., Chemist.
O.M. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.
O.M. MacIndoe, G. D., Ness Street, Invercargill, New Zealand. Public Analyst and Consulting Chemist.
1903. Macintire, Benj. Gould, 2226, West 17th Street, Wilmington, Del., U.S.A., Chemist.
1913. MacIntosh, George, 352, Elm Avenue, Westmount, Montreal, Canada, Glycerin Works Manager.

1909. McIntyre, George D., c/o Morris and Co., Nationa Stock Yards, Oklahoma City, Okla., U.S.A., Technical Chemist.
1914. MacIvor, R. W. Emerson, c/o Metals Recovery, Ltd., 47, Victoria Street, Westminster, S.W., Consulting Chemist.
1910. Mackay, Angus, Laboratory, Wellpark Brewery, Glasgow, Brewer's Chemist.
1911. Mackay, F., 3, Albany Terrace, Shettleston, Glasgow, Analytical Chemist.
1914. McKay, Gordon P., 13, Prince Arthur Avenue, Toronto, Canada, Chemist.
1912. McKechnie, Alex., Chad Hill Cottage, Edgbaston, Birmingham, Copper Smelter.
O.M. McKechnie, D. M., The Grange, Halewood, near Liverpool, Copper Extractor.
1904. McKechnie. R. D., Mount Gerald, Larbert, Stirlingshire, Chemical Engineer.
1887. McKellar, W. G., c/o United Alkali Co., Ltd., St. Rollox Works, Glasgow, Technical Chemist.
1895. McKenna, Dr. Chas. F., 50, Church Street, New York City, U.S.A., Chemist.
1899. McKenzie, Alex. H., 17, North Street, North Adams, Mass., U.S.A., Colour Mixer.
1909. Mackenzie, Kenneth G., c/o The Texas Co., Bayonne, N.J., U.S.A., Chemist.
1893. McKerrow, C. A., 8, Berners Street Mansions, London, W.; and (Journals) c/o Mitchells, Ashworth, and Co., 23-24, Old Bailey, London, E.C. Consulting Chemist.
1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1911. McKey, Arthur W., 216, Milk Street, Boston, Mass., U.S.A., Sales Agent.
1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.
1912. McKillop, G. F., Oilworks, Broxburn, West Lothian, Scotland, Works Chemist.
1890. McKillop, Jno., 32, Aynho Road, Hammersmith, W., and (Jnls.) c/o W. Müller, 69A, Great Queen Street, Kingsway, W.C., Metallurgist.
1902. McKim, Wm., 37, Fairview Street, Yonkers, N.Y., U.S.A., Colour Maker.
1908. McLaren, Alex., 22, Moss Lane, Walton, Liverpool, Analytical Chemist.
1908. McLaren, Alex. W., 3, Hayfield Terrace, Langside, Glasgow, Analytical Chemist.
1914. McLaren, John, c/o Chiswick Polish Co., Ltd., Burlington Lane, Chiswick, W., Works Chemist.
1898. McLaurin, Robt., Homesteads, Cambusbarron, Stirling, Chemist.
1909. MacLaurin, Dr. Robert D., University of Saskatchewan, Saskatoon, Saskatchewan, Canada, Chemist.
1905. McLellan, Basil G., c/o Rowntree and Co., Ltd., The Cocoa Works, York, Technical Chemist.
1910. MacLellan, George A., 1, Montague Terrace, Glasgow, W., Rubber Manufacturer.
1910. MacLennan, Alex., Tannery, Ross, Herefordshire, Rubber Chemist.
1908. Macleod, Alex., Mount Pleasant, Old Kilpatrick, Dumbartonshire, Analytical Chemist.
1892. McLeod, Jas., Gas Works, Greenock, Manager.
1912. McMaster, Prof. Le Roy, Washington University, St. Louis, Mo., U.S.A., Assoc. Prof. of Chemistry.
1904. McMullen, Alan, Saint James' Gate, Dublin, Ireland, Brewer.
1889. McMurtrie, J.M., 212, West Regent Street, Glasgow, Brass Founder.
1895. McMurtry, G. C., Templemore, Richmond, Nelson, New Zealand, Manager.
O.M. Macnab, W., 10, Cromwell Crescent, London, S.W., Analytical Chemist.
1907. McNaughton, Wm. G., Port Edwards, Wis., U.S.A., Chemist.
1908. McQueen, James, jun., Phœnix Chemical Works, Pollokshaws, Glasgow, Chemical Manufacturer.
1912. McRae, J. A., 184, University Avenue, Kingston, Ont., Canada, Research Chemist.
1909. McWhirter, James, c/o Wm. Beardmore and Co., Laboratory, Parkhead Forge, Glasgow, Metallurgical Chemist.
1910. Madge, Norman, c/o Continental Rubber Co. of New York, 11, Vandewater Street, New York City, U.S.A., Chemist.
1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1901. Magruder, Egbert W., Department of Agriculture, Richmond, Va., U.S.A., Chemist.
1912. Main, Hugh, Almondale, Buckingham Road, South Woodford, N.E., Analytical Chemist.
1998. Main, Wm., Piermont, N.Y., U.S.A., Chemist.
1904. Mair, William, 37, Morningside Drive, Edinburgh, Chemist.
1905. Major, Ernest, "Scafield," Day Street, Drummoyne, Sydney, N.S.W., Manufacturing Chemist.
O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks, Tar Distiller and Chemical Manufacturer.
1910. Male, C. E., Brookland House, Cottenham, Cambs, Chemist.
1886. Mallinckrodt, Edw., Library, Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.
1912. Manley, Chas. E., 8, Wilmington Gardens, Barking, Essex, Paint and Colour Works Manager.
1893. Mann, Harold H., Agricultural College, Poona, Bombay, India, Research Chemist.
1899. Mann, Jas. S., 19, Stopford Road, Upton Manor, Essex, Analyst.
1891. Mann, John C., 33, Nicholls Street, West Bromwich. Staffs, Chemist.
1903. Mannhardt, Hans, 1104, Oakdale Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Mannington, H. T., Marshlea, Beaconsfield Road, Farnworth, Widnes.
1909. Manns, Dr. J., c/o C. W. Schmidt, Varnish Works, Stratford, E., Chemist.
1892. Mansbridge, Wm., 4, Norwich Road, Wavertree, Liverpool, Chemist.
1904. Marckworth, O. S., Ohio Testing Laboratory, 426, Chamber of Commerce, Columbus, Ohio, U.S.A., Director.
1883. Markel, Dr. K. E., 20, Queen's Gate Terrace, South Kensington, S.W., Technical Chemist.
1905. Marland, Percy, c/o Brotherton and Co., Ltd., Provan Chemical Works, Millerston: and (Journal) 155, Hyndland Road, Glasgow, Technical Chemist.
1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.
1912. Marly, Dr. Simon M., 34, Arbour Street, Southport, Analytical Chemist.
1914. Marples, Morris E., The River Plate Fresh Meat Co., Ltd., Campana, F.C.C.A., Argentina, Chief Chemist.
1904. Marris, H. C., 68, Schlüsselburg Prospect, St. Petersburg, Russia, Analytical Chemist.
1901. Marsden, Dr. Fred., Technical Institute, Madura, South India, Chemist.
1906. Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.
O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.
1883. Marsh, W., Union Alkali Co., Soho Works, Ancoats, Manchester, Chemical Manufacturer.
1895. Marshall, Arthur, Waverley Cottage, Naini Tal, India, Chief Chemical Examiner.
1895. Marshall, Francis G., 56, Bewick Road, Gateshead, Technical Chemist.
1908. Marshall, John, Cudbear Street, Hunslet, Leeds, Dyeware Manufacturer.
1913. Marshall, Philip W., c/o The Fred. Crane Chemical Co., Armoury Close, Bordesley Green, Birmingham, Lacquer Manufacturer (retired).
1883. Marshall, Wm., Laboratory, Ladybrook Road, Cheadle Hulme, Cheshire, Dyer.
1884. Marshall, Wm., 9, Castello Avenue, Putney Park, S.W., Analytical Chemist.
1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass., U.S.A., Merchant.
1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.

1895. Martin, Chas. H., 50, Longmead Road, Claremont, Pendleton, Manchester, Oil and Soap Works Manager.

1913. Martin, Edwin J., c/o Jas. Martin and Sons, Luton, Beds, Bleacher and Dyer.

1911. Martin, Dr. G., 4. Bertram Road, Hendon, N.W., Science Teacher and Industrial Chemist.

1911. Martin, G. F. Wesley, Castle Park, Lancaster, Chemist.

O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.

1899. Martin, Wm. E., 111, Belle Vue Road, Durban, Natal, South Africa, Chemist.

1911. Martin, Wilmot S., 2, Coronation Terrace, Truro, Cornwall, Analyst and Assayer.

1887. Martineau, Sydney, Streatham Grove, Norwood, S.E., Sugar Chemist.

1907. Martius, Dr. C. A. von, Voss Strasse 12, Berlin, Germany, Dyestuff Manufacturer (retired).

1894. Martyn, T. Graham, Box 5, Maraisburg, Transvaal, South Africa, Metallurgist.

1909. Marx, Robert J., 133–139, Finsbury Pavement, London, E.C., Engineer.

1908. Mason, Douglas H. C., 448, Confederation Life Building, Toronto, Canada, Manufacturer.

1904. Mason, Dr. Edward D., 32, Vernon Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.

1911. Mason, Francis A., c/o Murphy and Lonsdale, 4, Queen Square, Leeds, Analytical Chemist.

1906. Mason, Dr. Frederic S., 90, Beekman Street, New York City, U.S.A., Manufacturing Chemist.

1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.

1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.

1910. Mason, James H., 180, Richmond Street West, Toronto, Canada, Metallurgist.

1906. Mason, M. Edgar, 268, Fox Street, Aurora, Ill., U.S.A., Consulting Chemist.

1906. Massa, Corradino, Castelguelfo Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.

O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.

1908. Masson, R. Duncan, c/o Messrs. R. Silcock and Sons, Stanley Hall, Union Street, Liverpool, Analytical Chemist.

1902. Masujima, Prof. Bunjiro, c/o K. Takebe, 25, Gazenbocho, Azabuku, Tokyo, Japan, Prof. of Applied Chemistry.

1910. Matchet, Andrew S., 13, Bute Gardens, Muirend, Cathcart, Glasgow, Analytical Chemist.

1911. Mather, Hubert, Lonsdale Terrace, Whitefield, Lancashire, Chemist.

O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.

1904. Mather, J. Cecil, Works Chemist.

1900. Mather, Wm., c/o The Standard Chemical Co., St. Henri, Montreal, Canada, Chemist.

1907. Matheson, A. Greville E., Hawkesbury, Chinley, Derbyshire, Engineer.

1890. Matheson, W. J., c/o Cassella Color Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.

1901. Mathew, W. E. B. de Vere, Dinham, Hillside Gardens, Wallington, Surrey, Analytical Chemist.

1900. Mathews, Dr. Jno. A., c/o Halcombe Steel Co., Syracuse, N.Y., U.S.A., Managing Director.

1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.

1913. Mathuram, Dr. A., Guru Medical Hall, Trichinopoly, South India, Pharmacist.

1888. Mátos, Dr. Louis J., (Comms.) 103, North 19th Street, East Orange, N.J., and (Jnls.) c/o Cassella Color Co., 182–4, Front Street, New York City, U.S.A., Chemist.

1896. Matsui, G., 10, Nishikatamachi, Tokio, Japan, Chemical Engineer.

1912. Matthewman, Fred. P., Analyst's Office, L.B. and S.C. Railway Co., Brighton, Chief Chemist.

O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton-on-Trent, Brewing Chemist.

1907. Matthews, Dr. F. E., Ashlawn, The Glebe, Blackheath, S.E., Technical Research Chemist.

1899. Matthews, Dr. J. Merritt, 5, Berwyn Street, East Orange, N.J., U.S.A., Professor of Chemistry and Dyeing.

1912. Maude, A. H., Wadham House, Toynbee Hall, Commercial Street, London, E., Technical Chemist.

1889. Mawdsley, W. H., G.P.O., Rockhampton, Queensland, Chemist.

1903. Maxim, Hudson, 698, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.

1894. Maxwell, Jno., Solway Chemical Works, Silloth, Cumberland, and (communications) English Street, Carlisle, Chemical Manure Manufacturer.

1903. Maxwell, Orin P., c/o West Virginia Pulp and Paper Co., Luke, Md., U.S.A., Chemist.

1911. May, Clarence E., 320, South Walnut Street, Bloomington, Ind., U.S.A.

1897. May, George H., 35, Graycliff Road, Newton Centre, Mass., U.S.A., Assistant Chemist.

1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.

1903. Mayer, Andrew, jun., 176, Sixth Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1896. Mayfield, A. S., Oakdene, Newland Park, Hull, Analyst.

1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.

1885. Mayhew, E. W. A., Manufacturing Chemist.

1900. Maywald, F. J., 89, Pine Street, New York City, U.S.A., Technical Chemist.

1909. Meanwell, Chas. W., 15, Woodlands Crescent, Muswell Hill Road, London, N., Analytical Chemist.

1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.

1896. Meggitt, Loxley, Wheatsheaf Works, Alexandria, Sydney, N.S.W., Australia, Analytical Chemist.

1901. Meier, Dr. Franz, c/o Society of Chemical Industry in Basle, Basle, Switzerland, Chemist.

1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.

1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Research Chemist.

O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.

1911. Mellerio, Lucien P., 5, Coburg Mansions, Brunswick Square, London, W.C., Technical Assistant.

1912. Melling, S. E., Lynton, Prestwich Park, Manchester, Analytical Chemist.

O.M. Mellon, W. W., Woodlands, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.

1910. Mellor, Dr. Jos. W., 19, Villas, Stoke-on Trent, Ceramic Chemist.

1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.

1909. Melville, Robt. L., Box 655, G.P.O., Auckland, N.Z., Chemist.

1912. Mennell, Harold, 41, Wolverton Road, Stony Stratford, Bucks, Analytical Chemist.

1893. Mensching, Dr. C., Mersey Chemical Works, Bromborough, Cheshire, Chemist.

O.M. Menzies, R. C., Inveresk Mills, Musselburgh, Scotland, Paper Maker.

1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.

1890. Merck, Dr. E., Darmstadt, Germany, Manufacturing Chemist.

1905. Merck, George, Merck and Co., 45, Park Place, New York City, U.S.A., Manufacturing Chemist.

1899. Merrill, Frank H., 2420, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.

1906. Merrils, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.

1909. Merriman, C. E. B., 74, Trent Boulevard, West Bridgford, Nottingham, Technical Chemist.

1909. Merriman, H. J., 244, Victoria Park Road, South Hackney, N.E., Research Chemist.

1905. Merrin, A. C., 194–200, Bishopsgate, London, E.C., Assistant Editor and Analyst.

1904. Merry, Jno. B., 74, Park Hill Road, Harborne, Birmingham, Metallurgical Chemist.
1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks, Chemist.
1905. Merz, Eugene, Newark, N.J., U.S.A., Superintendent, Heller and Merz Co.
1897. Meslans, Prof. M., 6, Rue de Navarin, Paris, France, Professor of Chemistry.
O.M. Messel, Dr. R., F.R.S., 147, Victoria Street, London. S.W., Chemical Manufacturer.
1913. Metcalf, Frederick A., 16, Offord Street, Passaic, N.J., U.S.A., Chemist.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.
1886. Metcalf, Jno., Moorfield Chemical Works, Altham, near Accrington, Tar Distiller.
1908. Metcalfe, Ernest D., Messrs. Curtis's and Harvey, Ltd., Cannon Street House, London, E.C., Secretary.
1906. Methley, Bernard, Ferndale, Moorgate, Rotherham, Yorks, Engineering Chemist.
1898. Metz, Herman A., P.O. Box 753, New York City, U.S.A., Chemical Merchant.
1905. Metzis, Josef, Anglicia Petroleum Co., Drohobycz, Galicia, Austria, Manager of Refinery.
1900. Mewborne, Robt. G., c/o Kentucky Tobacco Products Co., Louisville, Ky., U.S.A., Chemist.
1907. Meyer, Dr. Erwin, c/o Morgan and Wright, Detroit, Mich., U.S.A., Chemist.
1898. Meyer, Dr. Franz, c/o R. Wedekind und Co., Uerdingen a/Rhein, Germany, Metallurgical and Chemical Engineer.
1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.
1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.
1912. Michie, Arthur C., The Wallsend Laboratories, Wallsend-on-Tyne, Technical Chemist.
1909. Michie, John L., 13, Falside, Paisley.
1907. Micklethwait, Miss Frances M. G., 15, St. Mary's Square, Paddington, W., Chemist.
1911. Middlemass, Alphonso, 59, Promenade, Portobello, Midlothian, Works Chemist.
1904. Mighill, Dr. Thos. A., 15, Exchange Street, Boston, Mass., U.S.A., Chemist.
1896. Miles, G. Wellington, Room 214, 88, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.
1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.
1912. Millar, Chas. J., c/o Turner, Morrison, and Co., Paint Dept., 6, Lyons Range, Calcutta, India, Analytical Chemist.
1899. Millar, Jas. H., P.O. Box 4975, Johannesburg, Transvaal, Manufacturing and Analytical Chemist.
1909. Millar, Jas. Hill, Chief Chemist's Laboratory, St. James' Gate Brewery, Dublin, Chemist.
1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.
O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.
1914. Miller, Eric F., Carnbuck Club, Perambur Barracks, Madras, India, Chemist.
1889. Miller, Geo., Thornlea, Beaconsfield Road, Farnworth, Widnes, Technical Chemist.
1893. Miller, Dr. Harry E., 305, Palm Avenue, Oakland, Cal., U.S.A., Chemist.
1883. Miller, Dr. H. von. *See* Miller-Aichholz, Dr. H. von.
1894. Miller, Dr. John A., 44–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.
1888. Miller, J. Hopkins, 86, North Frederick Street, Glasgow, Dyeworks Chemist.
1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.
1901. Miller, Stuart B., c/o du Pont Powder Co., Emporium, Pa., U.S.A., Chemical Engineer.
1901. Miller, Dr. W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.
1884. Miller, W. M., Caledonia Estate, Prof. Wellesley, Penang, S.S , Sugar Chemist.
1883. Miller-Aichholz, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.
1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.
O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Emeritus Professor of Technical Chemistry and Consulting Chemist.
1904. Mills, Dr. J. E., University of South Carolina, Columbia, S.C., U.S.A., Analytical and Consulting Chemist.
1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.
1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., Finsbury Court, Finsbury Pavement, London, E.C., Chemical Products Salesman.
1903. Milnes, Cresswell, The Cedars, Holborough, near Rochester, Cement Works Manager.
1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.
1902. Milnes, Ernest E., Park Print Works, Halifax, Yorks, Chemist.
1909. Mindeleff, Chas., c/o American Smelting and Refining Co., Maurer, N.J., U.S.A., Chemist.
1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.
1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.
1898. Mitchell, G. D. H., c/o 559, Summer Avenue, Newark, N.J., U.S.A., Chemist.
1904. Mitsugi, R., c/o Tokio Gas Co., Senju Works, Senju, Tokio, Japan, Chemist.
O.M. Mitting, E. Kennard, 38, Harold Road, Norwood, S.E., Technical Chemist.
1908. Miyake, Hanzaburo, Ensuiko Sugar Factory, Shineisho, Formosa, Japan, Chemist.
1909. Miyoshi, K., Osaka Gas Works, Iwasakisho, Nishiku, Osaka, Japan, Engineer.
1909. Mock, Hugo, 220, Broadway, New York City, U.S.A., Lawyer.
1905. Modi, Dr. E. M., Meher Buildings, Tardeo, Bombay, India, Manufacturing and Analytical Chemist.
1910. Moe, Carl, Daisy, La., U.S.A., Chemist.
1906. Moe, Eldor H., Box 266, Salt Lake City, Utah, U.S.A., Chemist.
1911. Mohan, Richard T., 93, MacNab Street North, Hamilton, Ont., Canada, Chemist.
O.M. Mohr, Dr. B., 69A, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.
1894. Mole, Herbert B., Royal Albert Brewery, Queen's Road, Reading, Brewer.
1901. Mond, Dr. Albert L., c/o Hubers and Mond, 19, Southampton Buildings, Chancery Lane, London, W.C., Chemical Engineer.
1899. Mond, Emile S., 22, Hyde Park Square, London, W., Technical Chemist.
1891. Mond, Dr. Robt. L., Winnington Hall, Northwich. Chemist.
1906. Monier-Williams, G. W., 32, St. Leonard's Terrace, Chelsea, S.W.
1908 Monk, Chas. W., 102, Bloomfield Road, Plumstead, Kent, Chemist.
1909. Monk, Reginald H., 388, Grosvenor Avenue, Westmount, P.Q., Canada, Chemical Engineer.
1890. Moodie, Wm. E., Alexandria Works, Alexandria, Scotland. Analytical Chemist.
1905. Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Barrister-at-Law.
1898. Moody, Dr. Herbert R., College of the City of New York, and (Journals) 330, Convent Avenue, New York City, U.S.A., Professor of Chemistry.
1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.
1902. Mooney, Luke, Box 1085, Fort Worth, Texas. U.S.A.
1887. Moore, Chas. C., 33, Clarendon Road, Garston Liverpool, Chemist.
1901. Moore, Dr. Chas. W., c/o Crosfield and Sons, Ltd. Laboratory, Warrington, Chemist.
1907. Moore, Ernest P., c/o The Steel Co. of Canada, Hamilton, Ont., Canada, Chemist.

1911. Moore, Ernest W., c/o Messrs. T. G. Tickler, Ltd., Southall, Middlesex, Analytical Chemist.

1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.

1906. Moore, F. H., Messrs. G. H. Ogston and Moore, 87–89, Aldgate, London, E., Analytical Chemist.

1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.

1914. Moore, Harold, c/o Mirrlees, Bickerton, and Day, Hazel Grove, Stockport, Chemist.

1912. Moore, Joseph W., Kinderton House, Runcorn, Works Chemist.

1905. Moore, Leslie R., 14, Elm Street, Concord, Mass., U.S.A., Chemist.

1899. Moore, Quintin, jun., c/o Wm. Beardmore and Co., Ltd., Parkhead Forge, Glasgow, Works Manager.

1885. Moore, R. T., 142, St. Vincent Street, Glasgow, Mining Engineer.

1899. Moore, Dr. Russell W., 121, Madison Avenue, New York City, U.S.A., Chemist.

1890. Moore, Thos., 213, Heathfield Road, Birmingham, Analytical Chemist.

1910. Moorhouse, Samuel, 138, New Road, Blackley, Manchester, Secretary and Oil Specialist.

1905. Moorwood, F. Colin, c/o W. H. Dyson, The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Steel Manufacturer.

1903. Moran, Geo. A., 98, Massachusetts Avenue, North Andover, Mass., U.S.A., Chemist.

1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.

1902. More, Andrew, Ellesmere, King's Road, Walton-on-Thames, Analytical Chemist.

1908. Morfey, Harold, c/o The Mitchell Main Colliery Co., Wombwell, near Barnsley, Yorks, Manager of By-Products Works.

1901. Morgan, Dr. Gilbert T., Royal College of Science for Ireland, Dublin, Ireland, Professor of Chemistry.

1905. Morgan, Prof. Jerome J., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Instructor in Engineering Chemistry.

1912. Morgan, Sidney, Petaling Estate, Selangor, Federated Malay States, Analytical Chemist.

1906. Morgan, Thos., "Meirion," Dovedale Road, Mossley Hill, Liverpool, Manufacturing Chemist.

1898. Morgan, T. M., 370, Wood Avenue, Westmount, Quebec, Canada, Cement Works Manager.

O.M. Moritz, Dr. E. R., 45, Great Tower Street, London, E.C., Brewing Chemist.

1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.

1902. Morrell, Dr. R. S., Messrs. Mander Bros., Colour and Varnish Works, Wolverhampton, Chemist.

1884. Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.

1906. Morris, A. H., c/o Magee, Marshall, and Co., Crown Brewery, Bolton, Lancs, Brewer.

1898. Morris, Edgar F., 60, Millgate, Stockport, Research Chemist.

1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.

1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.

O.M. Morris, J. Haydn. *See* Haydn-Morris, J.

1908. Morris, Wm. J., 31, Prince Alfred Road, Wavertree, Liverpool, Chemist.

1911. Morrison, G. R., Oficina Reducto, Santa Catalina, Iquique, Chile, Chemist.

1910. Morrison, J. A. S., c/o Clark, Son, and Morland, Ltd., Glastonbury, Somerset, Leather Chemist.

1910. Morrison, John W., Gas Offices, Sheffield, Gas Engineer.

1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.

1906. Merrow, Jas. M., 71, Tache Avenue, Norwood Grove, St. Boniface, Man., Canada, Analytical Chemist.

1901. Morse, Willard S., Seaford, Del., U.S.A., Manager.

1904. Morson, Thos. D., 14, Elm Street, Gray's Inn Road, London, W.C., Chemist.

1906. Morson, T. Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.

1907. Morton, George A., 37, Hillside Road, Menlove Avenue, Mossley Hill, Liverpool, Chemist.

1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.

1902. Mosbaugh, F. R., c/o Anglo-Canadian Leather Co., Huntsville, Ont., Canada, Chemist.

1911. Mosenthal, E. Macqueron de, 9, Rue Neuve, Versailles, France, Chemist.

1912. Moss, J. Miles, jun., c/o Lever Bros., Ltd., Eastern Avenue, Toronto, Canada, Chemist.

1894. Moszczenski, J. B., 216, Ovington Avenue, Brooklyn, N.Y., U.S.A., Consulting Chemist.

1897. Motion, Jno., c/o The Joseph Dixon Crucible Co., Jersey City, N.J., U.S.A., Assistant Superintendent.

1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.

1884. Moult, J., 3, Gladstone Terrace, Gateshead-on-Tyne, Secretary.

1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.

1905. Moulton, Rt. Hon. Sir J. Fletcher, F.R.S., 57, Onslow Square, London, S.W., Lord Justice of Appeal.

1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).

1905. Mrazsek, F. M., 23, West Cromwell Road, London, S.W., Consulting Chemist.

1904. Muckenfuss, A. M., University, Miss., U.S.A., State Chemist.

1907. Mueller, Dr. Carl, Alte Weinsteige 48, Stuttgart, Germany, Chemist.

1890. Muir, Jas. Stanley, 23, Lilybank Gardens, Glasgow, Chemist.

O.M. Müller, Dr. H., F.R.S., 13, Park Square East, Regent's Park, London, N.W., Research Chemist.

1913. Mumford, E. Moore, 75, High Street, Chorlton on Medlock, Manchester, Bio-chemist.

1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.

1887. Munroe, Prof. Chas. E., George Washington University, Washington, D.C., U.S.A., Professor of Chemistry and Dean.

1900. Munsell, Dr. Chas. E., c/o Devoe and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.

1900. Munton, Fred. T., Craigmore, Winsford, Cheshire, A.R.S.M., Analytical Chemist.

1904. Murdoch, Alexander, 507, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.

1912. Murdoch, Barclay B., c/o Messrs. Wm. Gossage and Sons, Soap Works, Widnes, Lancs., Technical Chemist.

1886. Murdoch, R. H. M., Norwood, Saltcoats, Ayrshire, Explosives Chemist.

1899. Murphy, Albert J., 3 and 4, Queen Square, Leeds, Brewer's Chemist.

1906. Murphy, Frederic W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.

1901. Murray, Benjamin L., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.

1903. Murray, Chas. B., 407, Perry Payne Building, Cleveland, Ohio, U.S.A., Chemist.

1914. Murray, John E., c/o Emerson Drug Co., 64, Spadina Avenue, Toronto, Canada, Laboratory Superintendent.

1898. Murray, Rd., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.

1908. Murray, Dr. Thos. J., Municipal Technical School, Wolverhampton, Lecturer on Chemistry.

1905. Murray, Wm. Wallace, Chemist.

1905. Murrill, Dr. Paul I., c/o U.S. Rubber Co., 11th Avenue and 58th Street, New York City, U.S.A., Representative.

O.M. Muspratt, Dr. E. K., Seaforth Hall, near Liverpool, Alkali Manufacturer.

1894. Muspratt, Max, The Grange, Fulwood Park, Liverpool, Technical Chemist.

O.M. Muspratt, S. K., 9, Church Street, Flint, North Wales, Alkali Manufacturer.

1907. Musso, Louis A., Box 956, G.P.O., Sydney, N.S.W., Australia, Technical Chemist.

1895. Muurling, I. J. R., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.

1911. Myers, Ernest M., Sharrow, Basford Park, Stoke on Trent, Coke Oven Manager and Chemist.

1891. Myers, Dr. Wm. S., 71, Nassau Street, New York City, U.S.A., Director.

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1902. Naef, Dr. Ernest E., 17, Park Road, Clydach, Swansea, South Wales, Chemist.

1913. Nagase, Denzo, 36, Flanchford Road, Ravenscourt Park, W., Engineer.

1908. Nagle, J. C., Fern Bank, Edge Lane, Stretford, Manchester, Glucose and Starch Manufacturer.

1913. Nair, Valliyil G., Calico Mills, Ahmedabad, India, Chemist and Colourist.

1897. Nairn, Michael, Dysart House, Fife, Linoleum Manufacturer.

1909. Nakai, S., Miike Colliery Office, Omuta-machi, Chikugo, Japan, Engineer.

1903. Nakayama, T., c/o Fuji Paper Co., Mill No. 5, Yebetsu, Hokkaido, Japan, Chemist.

1901. Nanabhai, Krishnalal, "Laxmi Nivas," Girgaum Back Road, Bombay, India, Technological Chemist.

1912. Nanavati, Balabhai J., Rickey Road, Ahmedabad, India, Oil Manufacturer.

1893. Napier, Jno. W., Gas Works, Alloa, Scotland, Manager and Chemist.

1904. Napper, Sidney S., c/o S. Courtauld and Co., Ltd., Foleshill Road, Coventry, Chemist.

1897. Nash, L. Myddleton, Westlands, Princess Road, Finsbury Park, N., Works Chemist.

1910. Nash, N. C., Treleaven, Darling Street, Balmain East, Sydney, N.S.W., Works Chemist.

1908. Nasmith, M. E., 1, Ferndale Avenue, Toronto, Canada, Baker.

1900. Nathan, Lt.-Col. Sir Frederic L., R.A., The Royal Palace Hotel, Kensington, W., Superintendent, Nobel's Explosives Works.

1907. Nauckhoff, Sigurd, c/o Nitroglycerin Aktiebolaget, Vinterviken, Stockholm, Sweden, Chemical Engineer.

O.M. Naylor, W. A. H., The British Drug Houses, Ltd., 22–30, Graham Street, City Road, London, N., Manufacturing Chemist.

1909. Neal, C. S., Acme White Lead and Colour Works, Detroit, Mich., U.S.A., Manager.

1899. Neate, Percy J., 49, Frognal, Hampstead, N.W., Director of Cement Co.

1905. Neech, Herbert R., Doddington Lane, Swallowbeck, Lincoln, Chemical Engineer.

1905. Needham, Edward R., c/o The Northern Chemical Co., 16, Blythswood Square, Glasgow, Manufacturing Chemist.

1905. Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.

1906. Neil, Dr. Archibald A., c/o Brunner, Mond, and Co., Caxton House, Westminster, S.W., Chemical Engineer.

1890. Neill, Geo. D., 78, Drum Frochar Road, Greenock, Sugar Refiner.

1898. Neilson, Alex. McG., Umbilo, Durban, Natal, Analytical Chemist.

1911. Neilson, R. G., c/o Burmah Oil Co., Ltd., P. Box 67, Rangoon, Burmah, Assistant Works Manager.

1910. Neiman, Howard S., Suite 1579, 50, Church Street, New York City, U.S.A., Patent Attorney.

1902. Neish, Dr. Arthur C., Columbia University, New York City, U.S.A., Chemist.

1911. Nello, Vincent, Baldwin's Hill, Loughton, Artists' Colour Manufacturer.

1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.

1913. Nesbitt, Cosby T., 19, Osborne Road, Brimsdown, Middlesex, Metallurgical Chemist.

1906. Nestell, Raymond J., c/o Western Precipitation Co., 1016, West Ninth Street, Los Angeles, Cal., U.S.A., Analytical Chemist.

1902. Neumann, Dr. Edgar, 7 and 8, Idol Lane, London, E.C.

1903. Neumann, Dr. Max, Dambachthal 9, Wiesbaden, Germany.

O.M. Newall, F. S., Washington Station R.S.O., Co. Durham, Chemical Manufacturer.

1905. Newall, Jos., Hill Cliffe, Heath Road, Runcorn, Cheshire, Chemist.

1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Manager.

O.M. Newlands, W. P. R., 10, Cricklade Avenue, Streatham Hill, S.W., Sugar Chemist.

O.M. Newton, Jno., Verney Road, Rotherhithe New Road, London, S.E., Manure Manufacturer.

1912. Newton, Leonard O., 41, Bennett Park, Blackheath, S.E., Analytical Chemist.

1901. Nibelius, Axel W. T., c/o Neptune National Powder Co., Emporium, Pa., U.S.A., Chemist.

1904. Nichols, C. W., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.

1905. Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).

1888. Nichols, Dr. Wm. H., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.

1905. Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.

1904. Nicholson, Wilfred E., Hunslet Chemical Works, Leeds, Chemical Manufacturer.

1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, Chemist.

1903. Nicoll, Frank, 28, Coudray Road, Southport, Chemist.

1905. Nieghorn, Albert, 120, Mill Street, Toronto, Canada, Agent.

1900. Nield, J. H., c/o General Chemical Co., Edgewater, N.J., U.S.A., Superintendent.

1898. Nightscales, Geo., 642, Holderness Road, Hull, Oil Merchant.

1899. Nihoul, Dr. Edw., 204, Rue St. Laurent, Liège, Belgium, Director of the Liège Tannery School.

O.M. Nimmo, Jas., 35, Whitworth Road, South Norwood, S.E., Analytical Chemist.

1907. Nims, H. E., c/o The Fiberloid Co., Indian Orchard, Mass., U.S.A., Chemist.

1885. Nishigawa, T., 20, Hirakawa Cho, Go Chome, Tokyo, Japan, Works Director and Chemical Engineer.

1898. Nishikawa, Prof. Dr. T., Dept. of Applied Chemistry, Kyushu Imp. University, Fukuoka, Japan, Prof. of Applied Chemistry.

1908. Noble, Sir Andrew, Bart., K.C.B., F.R.S., Jesmond Dene House, Newcastle-on-Tyne.

O.M. Nölting, Prof. Dr. E., 27, Lazarethstrasse, Mülhouse, Alsace, Germany, Professor of Chemistry.

O.M. Norman, Sir Frederick J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.

1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.

1913. Norman, T. Stanley, Lyndhurst, Runcorn, Cheshire, Chemical Manager.

1890. Norman-Bott, Dr. Wm., 17, St. Helen's Place, London, E.C., Consulting Chemist.

1908. Norris, Wm. H. H., 41, Aldborough Road, Ilford, Essex, Chemist.

1902. North, Barker, 33, Ashgrove, Great Horton Road, Bradford, Assistant Professor of Chemistry.

1909. Northcote, Reginald S., 28, Wellington Street East, Toronto, Chemist.

O.M. Northing, J., The Murrough, Wicklow, Ireland, Technical Chemist.

1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.

O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).

1911. Norton, Samuel J., 22, Bushnell Road, Balham, S.W., Engineer and Manager.

1887. Norton, Dr. T. H., c/o Wm. Bryce, 54, Lothian Street, Edinburgh, U.S. Consul.
1899. Noyes, Henry, c/o Noyes Bros., 153 7, William Street, Melbourne, Victoria, Engineer.
1901. Noyes, Prof. Wm. A., University of Illinois, Urbana, Ill., U.S.A., Editor (J. Amer. Chem. Society).

O

1910. Oakden, W. E., 2, Gledhow Terrace, South Kensington, S.W., Director of Research Laboratory.
1905. Oakes, F. J., jun., 141, Milk Street, Boston, Mass., U.S.A., Secretary, Oakes Manufacturing Co.
1904. Oberländer, Dr. Otto, 29, Queen Street, London, E.C., Research and Consulting Chemist.
1904. O'Brien, Claude H., Malgrave, Cairns, North Queensland, Supervising Chemist.
1900. O'Brien, Frederick, Lynwood, Grange Road, Bishopsworth, near Bristol, Analytical Chemist.
1905. Oburg, W. F., 33, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer (Merrimac Chem. Co.).
1902. Ockel, Reinhold, Schumannstrasse 31, Bonn a Rhein, Germany, Technical Chemist.
1901. O'Connor, Chas. P., 7, Fairfield Street, Montclair, N.J., U.S.A., Analytical Chemist.
1908. O'Day, John, 32, India Street, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.
1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.
1911. Oehler, Prof. John, Carlstadt, N.J., U.S.A., Assoc. Professor of Chemistry (Columbia University).
1908. Ogilvie, Jas. P., Homedale, Hendon Lane, Church End, Finchley, N., Chemist.
1901. Ogston, Alex. G., Heath Park, near Aberdeen, Soap Manufacturer.
1903. Ohlenschlager, J. G., jun., Shanghai House, Botolph Lane, London, E.C., Chemical Merchant.
1905. Ohliger, Willard, c/o F. Stearns and Co., Detroit, Mich., U.S.A., Chemist.
1907. Oke, Alfred W., 32, Denmark Villas, Hove, Sussex, Solicitor.
1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.
1912. Oliver, Ralph R., c/o Southern Fibre Co., Portsmouth, Va., U.S.A., Paper Chemist.
1888. Oliver, Wm. Letts, 251, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.
1910. Oliver, Willie, 30, Woodstock Street, Spotland, Rochdale, Works Chemist.
1914. Ollé, Arch. D., "Kareema," Charlotte Street, Ashfield, N.S.W., Australia, Electro-therapeutist.
O.M. Ollerenshaw, S., 96, Davyhulme Lane, Urmston, Manchester, Technical Chemist.
1906. Olmsted, Fred. A., c/o Willamette Pulp and Paper Co., Oregon City, Oregon, U.S.A., Chemical Engineer.
1904. Olney, Prof. L. A., 118, Riverside Street, Lowell, Mass., U.S.A., Professor of Chemistry and Dyeing.
1902. O'Neill, Chas., c/o Bleachers' Association, Ltd., 4, Norfolk Street, Manchester, Chemist and Colourist.
1907. Oppen, Wm. A., Vera Chemical Co., Stoneham, Mass., U.S.A., Chemist and Superintendent.
1905. Ormandy, Dr. W. R., 53a, Barton Arcade, Manchester, Consulting Chemist.
1898. Ormerod, Dr. Ernest, 62, Dale Street, Liverpool, Consulting and Analytical Chemist.
1894. Ormerod, John, Globe Leather Works, Castleton, Manchester, Tanner and Currier.
O.M. Orr, A., 80, Hunter Street, Sydney, New South Wales, Analytical Chemist.
O.M. Orr, J. B., Crossacres, Woolton, Liverpool, Chemical Manufacturer.
1899. Orr, Thos. W., c/o W. Orr, 26, Renfield Street, Glasgow; and (Journals) Lethnot, Burnside, Rutherglen, Glasgow, Chemist.
1907. Ortved, Niels C., c/o Hiram Walker and Sons, Ltd., Walkerville, Ont., Canada, Chemist and Fermentologist.
1900. Osbourne, Jno. P., 6, Garrioch Drive, Maryhill, Glasgow, Analytical Chemist.
1900. O'Shaughnessy, Francis R., 42, Temple Street, Birmingham, Consulting Chemist.
1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Chemistry (University of Sheffield).
1912. Osius, George, Canadian Ammonia Co., Ltd., Foot of Meldrum Street, Detroit, Mich., U.S.A., Secretary and Treasurer.
1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.
1912. Oswald, Jacob, c/o Messrs. Fels and Co., 73rd Street and Woodland Avenue, Philadelphia, Pa., U.S.A., Soap Works Technical Manager.
1905. Otsuki, Prof. Chiri, Chemical Laboratory, Kyoto Imperial University, Kyoto, Japan, Professor of Applied Chemistry.
1898. Oushkoff, John P., Warwarka 5, Moscow, Russia, Chemical Manufacturer.
1906. Oxley, Horace F., c/o Natal Soap Works Co., Durban, South Africa, Chemist.
1908. Oxley, John C., Claycroft, Guiseley, near Leeds, Aniline Colour Merchant.

P

1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.
1904. Page, Edwin P., Glenroy, Highland Grove, Worksop, Notts, Chemist.
1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.
1892. Paine, Augustus G., 200, Fifth Avenue, New York City, U.S.A. President of Paper Making Co.
1906. Palm, Otto G., 41, Colborne Street, Toronto, Canada, President (Atteaux Dye and Chemical Co.).
1903. Palmenberg, O. W., 50, East 41st Street, New York City, U.S.A., Consulting Chemist and Fuel Engineer.
1902. Palmer, Fred. G., Chemist and Acid Superintendent.
1887. Palmer, T. Chalkley, c/o American Dyewood Co., Chester, Pa., U.S.A., Manufacturing Chemist.
1887. Palmer, Thos. C., c/o W. J. Fraser and Co., Ltd., Dagenham, Essex, Engineer.
1907. Palmer, Wm. J., c/o Pinchin, Johnson, and Co., Ltd., Pinchin's Wharf, Silvertown, E., Analytical Chemist.
1911. Paniker, Ramni, Consejo de Ciento 288, 2°, 2ª, Barcelona, Spain, Leather Trades Chemist.
1898. Parker, Charles H., Rose Cottage Works, Whitmore Reans, Wolverhampton, Chemist.
1891. Parker, Edw., Laburnum House, Rushford Avenue, Levenshulme, Manchester, Analytical Chemist.
1894. Parker, Dr. J. Gordon, Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Principal.
1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.
1901. Parker, Richard H., 147, Seymour Avenue, Newark, N.J., U.S.A., Analytical Chemist.
O.M. Parker, Thos., Severn House, Iron-bridge, Salop, Electrical Engineer.
1894. Parker, Thos. J., 25, Broad Street, New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.
1903. Parker, Wm. B., 1, Murray Road, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).
1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist (U.S. Appraisers).
1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.
1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.
1914. Pascoe, Charles F., Canadian Steel Foundries, Ltd., Longue Pointe Works, Montreal, Canada, Metallurgist.

1901. Pass, James, Onondaga Pottery Co., Syracuse, N.Y., U.S.A., Pottery Manufacturer.

1909. Passmore, Dr. Francis W., 81, Queen Victoria Street, London, E.C., Consulting Chemist.

1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Professor of Chemistry.

1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.

1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.

1887. Paton, J. M. C., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.

1901. Patterson, Chas. A., Woodbury, N.J., U.S.A., Analytical Chemist.

O.M. Patterson, Geo., c/o The Manbré Saccharine Co., Ltd., Fulham Palace Road, Hammersmith, W., Technical Chemist.

1909. Patterson, G. H., Ivanhoe, Linden Grove, West Hartlepool, Works Manager.

1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.

O.M. Patterson, T. L., Maybank, Finnart Street, Greenock, Sugar Works Manager.

1902. Patterson, Wm. Hamilton, Monksferry Chemical Laboratory, Birkenhead, Technical Chemist.

O.M. Pattison, Jas., Drimnamona, Kilmalcolm, Chemical Merchant.

1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.

1909. Patton, H. G., c/o Fred Rueping Leather Co., Fond du Lac, Wis., U.S.A., Chemist.

1904. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.

1908. Paul, David M., c/o Japanese Explosives Co., Hiratsuka, Sagami, Japan, Chemist.

1891. Paul, Jas. H., 11, Glenluce Road, Blackheath, S.E., Analytical Chemist.

1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.

1904. Payne, A. G. C., 6, Bradford Place, Penarth, near Cardiff, Chemist.

O.M. Payne, J. B., 13, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.

1912. Peachey, S. J., 8, Halesden Road, Heaton Chapel, Stockport, Lecturer in Chemistry.

1910. Peacock, Samuel, Suite 910, 165, Broadway, New York City, U.S.A., Chemist and Metallurgist.

1912. Pearce, Geoffrey V., 14, Park Crescent, Portland Place, London, W., Chemical Manufacturer.

1894. Pearce, Jas. Stanley, Priest's Mere, Tadworth, Surrey, Chemical Manufacturer.

1897. Pearce, Richard, 6, Beach Lawn, Waterloo, Liverpool, Metallurgist.

1883. Pearce, W., M.P., Chemical Works, Bow Common, London, E., Chemical Manufacturer.

1903. Pearcy, A. C., 43, Marlborough Mansions, Cannon Hill, London, N.W., Director, Explosives Co.

1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A. Chemist.

O.M. Péchiney, A. R., Villa Les Rochers, Hyères (Var), France, Chemical Engineer.

1898. Peck, Dr. Ernest L., High Lawn, Bromborough, Cheshire, Chemist.

1894. Peden, Jno., 11, Duff Street, Greenock, Analytical Chemist.

O.M. Pedler, Sir Alexander, C.I.E., F.R.S., 28, Stanhope Gardens, Queen's Gate, London, S.W., Director of Public Instruction (retired).

1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.

1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, and (Journals) c/o F. J. Willott, Victoria Garesfield Colliery, Rowlands Gill, Co. Durham, Colliery Owner.

1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.

1897. Pellew, Chas. E., 111, East 78th Street, New York City, U.S.A., Adjunct Professor of Chemistry.

1912. Pellizza, Dr. A., Sta. Rosa, Necoxtla, Estada Vera Cruz, Mexico, Colourist.

1904. Pelly, Russell George, 3, Wingate Road, Hammersmith, W., Analytical Chemist.

1914. Penfold, A. R., Sydney Technical College, Harris Street, Sydney, N.S.W., Australia, Chemist.

1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.

1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.

1885. Pentecost, S. J., Alexandra Mount, Mapperly Hill, and (Journals) Lenton Works, Nottingham, Lace Dresser.

1887. Pentermann, H. T., 37, Clifton Crescent, Peckham. S.E., Brewing Chemist.

1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.

1885. Perkin, A. G., F.R.S., Grosvenor Lodge, Grosvenor Road, Leeds, Technical Chemist.

1898. Perkin, Dr. F. Mollwo, 199, Piccadilly, London, W., Head of Chemical Department, Borough Polytechnic.

1887. Perkin, Dr. W. H., F.R.S., 5, Charlbury Road, Oxford, Professor of Chemistry.

1893. Perkins, T. S., 30, Tiffany Place, Brooklyn, N.Y., U.S.A., Chemist.

1912. Perrin, Wm. R., jun., 530, King Street East, Toronto, Canada, Secretary and Treasurer.

1901. Perry, Chas. M., Greene, Kent County, R.I., U.S.A. Bleach and Dyeworks Chemist.

1887. Perry, David, 15, Woodlands Terrace, Glasgow, and (Journals) Forth and Clyde Chemical Works, Nitshill, near Glasgow, Manufacturing Chemist.

1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.

1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.

1903. Perry, Robt. Swain, 3500, Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President (Harrison Bros. and Co.).

1897. Peter, Dr. A. H., 2508, Broadway, New York City, U.S.A., Chemist.

1908. Peters, John M., c/o National Lead Co., 111, Broadway, New York City, U.S.A., White Lead Manufacturer.

1909. Petrie, A. Swanston, c/o Gibbs and Co., Iquique, Chile, S. America, Analytical Chemist.

1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.

1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers N.Y., U.S.A., Chemist.

1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.

1892. Pettigrew, Robert, c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.

1902. Pettitt, Alf., 457, State Street, Brooklyn, N.Y., U.S.A., Chemist.

1913. Petty, G. N., 6, Kingsthorpe Road, Sydenham, S.E., Chemist.

1913. Pfleiderer, B. J., Westwood Works, Peterborough, Engineer.

1912. Pfleiderer, Kurt, Westwood Works, Peterborough, Mechanical Engineer.

1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.

1908. Philip, Prof. James C., Imperial College of Science and Technology, South Kensington, S.W., Professor of Physical Chemistry.

1903. Philipp, Herbert, 152. High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.

1912. Phillips, G. A., Laboratory, The Powell Duffryn Co., Aberdare, Mon., Chemist.

O.M. Phillips, Harcourt, Lynwood, Turton, Lancs., Analytical Chemist.

1911. Phillips, Henry A., Royal Gunpowder Factory, Waltham Abbey, Essex, Chemist.

1910. Phillips, Prof. Percy P., Thomason College, Rurki, United Provinces, India, Professor of Chemistry.

1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.
1911. Phillipa, William E., 45, Ben Lamond Avenue, Toronto, Canada.
1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.
1911. Philpotts, Wilfred C., 35, Sandford Avenue, Toronto, Canada, Gasworks Chemist.
1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.
1904. Pickard, Glenn H., c/o American Linseed Co., 110th Street and Torrence Avenue, South Chicago, Ill., U.S.A., Manager of Oils Dept.
1905. Pickard, Greenleaf W., Amesbury, Mass., U.S.A., Electrical Engineer.
1902. Pickard, Dr. R. H., Billinge View, Blackburn, Teacher and Analyst.
1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.
1913. Pierce, Jas. B., jun., Engineers' Club, Scranton, Pa., U.S.A., Chemist, Barium Products Co.
1888. Pilkington, G., 9, Knowsley Street, Bury, Lancashire, Analytical Chemist.
1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.
1894. Pilling, John E., 229, Hornby Road, Blackpool, Chemist.
1906. Pincott, Emile S., 222, St. James Street, Montreal, Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).
1910. Pinnock, Douglas R., c/o The Nucoa Butter Co., 4th Street and Avenue A, Bayonne, N.J., U.S.A., Chemist.
1905. Pinnock, H. T., 11, Fountain Road, Edgbaston, Birmingham, Chemist.
1883. Pipe, Jas., Woodburn, Irvine, Scotland, Chemical Manufacturer.
1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1910. Pisart, F., 74, Avenue Blonden, Liège, Belgium, Chemical Engineer.
1907. Pitman, Brig.-Gen. John, 167, Berkeley Avenue, Orange, N.J., U.S.A., U.S. Army (retired).
1913. Pitt, Septimus A., Central Public Library, Coventry, Librarian.
1902. Pittard, Jno., West Ham Chemical Works, West Ham, E., Chemical Manufacturer.
1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1909. Piutti, Prof. Dr. Arnaldo, Instituto Chimico-farmaceutico, R. Universita, Napoli, Italy, Director.
1899. Pizey, Jas. H., c/o S. Pearson and Son, The Refinery, Minatitlan, Vera Cruz, Mexico, Chemist.
1894. Platten, Frank, c/o Elliot's Metal Co., Selly Oak Works, near Birmingham, Metallurgical Chemist.
1890. Platts, Jno. C., "Sandygate," Chapel Lane, Wilmslow, Cheshire, Metallurgical Chemist.
1896. Plaut, Albert, P.O. Box 380, New York City, U.S.A., Wholesale Druggist.
1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.
1914. Plews, George, jun., c/o Braden Copper Co., Molino, Rancagua, Chile, Chemist.
1907. Poetschke, Paul, c/o L. D. Caulk Co., Milford, Del., U.S.A., Chemist.
1901. Pollard, Wm., Oakfield, Hitchin, Herts, Chemist (H.M. Geological Survey).
1904. Pollitt, Dr. Geo. P., 4, Whitehall Court, London, S.W., Chemist.
1902. Pollitt, Jas. C. T., 7, Grosvenor Road, Handsworth, Birmingham, Managing Chemist.
1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.
1890. Pomeroy, Dr. Chas. T., Bramhall Road, Rahway, N.J., U.S.A., Ink Manufacturer.
1909. Pond, Dr. Francis J., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Professor of Chemistry.
1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.
1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.
1895. Pont, Pierre S. du, c/o Dr. C. L. Reese, E.I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A., Explosives Manufacturer.
1912. Pope, Chester H., 39, Waldemar Avenue, Winthrop, Mass., U.S.A., Ink Manufacturer.
O.M. Pope, S., 34, Clarendon Road West, Chorlton-cum-Hardy, Manchester, Chemical Works Manager.
1899. Pope, Thos. H., The University, Edmund Street, Birmingham, Chemist and Lecturer on Brewing.
1900. Pope, Prof. W. J., F.R.S., University Chemical Laboratory, and (Journals) Holmesdale, Brooklanda Avenue, Cambridge, Professor of Chemistry.
1912. Porritt, B. D., c/o North British Rubber Co., Ltd., Castle Mills, Edinburgh, Chief Chemist.
1911. Porteous, Jas. W., c/o Bolckow, Vaughan, and Co., Ltd., Grange Hill, Bishop Auckland, Co. Durham, Chemist and Coke Oven Manager.
1902. Porter, J. Edw., P.O. Box 785, Syracuse, N.Y., U.S.A., Chemist.
1901. Porter, Jno. L., 8401, Panola Street, New Orleans, La., U.S.A., Chemist.
1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
O.M. Potter, E. P., Chemical Works, Little Lever, near Bolton, Alkali Manufacturer.
1900. Potts, Geo. E., 200, Fifth Avenue, New York City, U.S.A., Explosives Manufacturer.
1910. Potts, Harold E., 66, Leasowe Road, Wallasey, Cheshire, Research Chemist.
1900. Powell, Harry J., 125, Thurlow Park Road, Dulwich, S.E., Glass Manufacturer.
1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.
1907. Powers, Wm. A., c/o A. T. and S. F. R. R. Co., Topeka, Kans., U.S.A., Chief Chemist.
1902. Powney, Wm. E. F., 35, Priory Avenue, Hornsey, N., Analytical Chemist.
1912. Prasad, Prof. H., Government College, Ajmer, India, Professor of Science.
1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.
1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.
1903. Prentice, Jas., Cossipore Sugar Works, Cossipore, Calcutta, India, Chemist.
1911. Prescott, Alfred, 63, Corporation Street, Manchester, Chemical Agent.
1900. Prescott, Prof. Saml. C., 585, Boylston Street, Boston, Mass., U.S.A., Prof. of Ind. Biology.
1905. Preston, Jas. F., 403, Andover Street, Lowell, Mass., U.S.A., Manufacturing Chemist.
O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.
1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.
1904. Prichard, Norman B., 40, Quebec Street, Sherbrooke, Quebec, Canada, Superintendent.
1905. Priest, Geo. Wesley, Beaver Leather Manufacturing Co., 28, Ferdon Street, Newark, N.J., U.S.A., General Manager.
1899. Prinsen-Geerligs, H. C., Wanningstraat 17, Amsterdam, Holland, Director of Sugar Cane Experimental Station.
1912. Pritchard, Thos. W., Wilmington, N.C., U.S.A., Wood Distiller.
1912. Prittie, Frank H., Southern Pacific Railway Laboratory, Sacramento, Cal., U.S.A., Assistant Chemist.
1896. Prochazka, Dr. Geo. A., c/o Central Dyestuff and Chemical Co., Newark, N.J., U.S.A., Colour Manufacturer.

O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds. Lecturer on Tanning.
1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.
1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.
O.M. Proctor, C., 118, Grosvenor Road, London, S.W., Analytical Chemist.
1901. Propach, C., 146, West Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.
1912. Propach, Dr. Wilhelm, Dynamit Act.-Ges. vorm. A. Nobel und Co., Alsterdamer 391, Hamburg, Germany, Chemist.
1913. Prosser, Richard, 4478, St. Catherine W., Westmount, Que., Canada, Chemical Agent.
1906. Pudney, S. H., 156, Bellwood Avenue, Toronto, Canada, Chemist.
1905. Pugh, John V., Guiting House, Allesley, near Coventry, Works Director (Rudge-Whitworth, Ltd.).
1899. Pullar, Edmund, Keirfield, Bridge of Allan, Scotland, Manufacturer.
O.M. Pullar, R. D., Pullar's Dyeworks, Perth, Scotland, Dyer.
1913. Pulsifer, Lanson V., c/o Messrs. Valentine and Co., 364, Manhattan Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.
1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, Professor of Chemistry.
1913. Purves, G. Thomson, Coke Ovens Dept., Auchengeich Colliery, Chryston, Scotland, Manager.
1905. Pyman, Dr. Frank Lee, "Sedgley," Selborne Road, Sidcup, Kent, Chemist.

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1903. Queeny, Jno. F., Monsanto Chemical Works, 1800, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.
1903. Queneau, Augustin L. J., Jemeppe sur Meuse, Belgium, Metallurgical Engineer.
1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.
1902. Quinan, Kenneth B., Cape Explosives Works, Somerset West, C.C., South Africa, and (subscriptions) c/o Cape Explosives Works, Ltd., 15, St. Swithin's Lane, E.C., Superintendent.

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1911. Race, Joseph, City Hall, Ottawa, Canada, City Bacteriologist.
1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.
1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.
1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.
O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.
1885. Ramsay, W., c/o Cammell, Laird, and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.
1911. Ramsay, Wm. G., Research Chemist.
1913. Ramsbottom, Dr. J. E., 98, Peabody Road, South Farnborough, Hants, Chemist.
1906. Ranck, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.
1909. Randall, George, Severn Bank Tannery, Worcester, Tanner.
1910. Ranken, Charles, 19, Stockton Road, Sunderland, Analytical and Consulting Chemist.
1901. Ransom, Francis, The Chilterns, Hitchin, Herts, Manufacturing Pharmaceutical Chemist.
1905. Ransom, H. B., St. Stephen's House, Victoria Embankment, Westminster, S.W., Consulting Engineer.
1910. Ransome, A. Oswald, Beechwood, Greenock Road, Paisley, and (Journals) Warton, Carnforth, Lancashire, Works Chemist.
1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).
1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.
1908. Rassow, Prof. Dr. Berthold, Stephanstrasse 8, Leipzig, Germany, General Secretary, Vereins Deutscher Chemiker.
1893. Ratcliff, Frank D., Stourbank House, Stourport, Vinegar Brewer.
1904. Ratcliffe, C. F., Haigh Park Chemical Works, Stourton, near Leeds, Tar Distiller.
1914. Ratcliffe, Henry, Leeds Phosphate Works, Ltd., Midland Road, Hunslet, Leeds, Technical Chemist.
1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.
1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.
1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.
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1909. Rawson, H. Wyatt, c/o Chartered Bank of India, Taiping, Perak, Fed. Malay States.
1909. Rayner, Arthur B., Normanhurst, Alexandra Park Road, Muswell Hill, N., Chemical Broker.
1912. Rayner, Edgar A., 71, Welldon Crescent, Harrow-on-the-Hill, Analytical Chemist.
1895. Read, E. J., c/o Pretoria Portland Cement Co., Ltd., P.O. Box 405, Pretoria, South Africa, Analyst.
1913. Read, Dr. John, University Chemical Laboratory, Cambridge, Assistant to Prof. of Chemistry.
1890. Reade, Thos., Sebright House, Tettenhall Wood, Wolverhampton, Manufacturing Chemist.
1908. Reavell, J. Arthur, 37, Parliament Street, Westminster, S.W., Engineer.
1912. Reddie, J. A., Sewage Disposal Works, Halifax, Yorks, Chemist.
1902. Redfern, C. G., 15, South Street, Finsbury, London, E.C., Patent Agent.
O.M. Redwood, Sir Boverton, Bart., 4, Bishopsgate, London, E.C., Petroleum Expert.
1887. Redwood, Robt., 4, Bishopsgate, London, E.C., Secretary.
1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.
1902. Reed, Herbert C., 227-229, Fulton Street, New York City, U.S.A., Cons. Tanning Chemist.
1906. Reed, William, Works Manager.
1893. Reekie, J. A., Buckton Grange, Stalybridge, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1897. Rees, W. H., El Dorado Oil Works, West Berkeley, Cal., U.S.A., Chemist.
1906. Rees, Walter J., 36, Holly Lane, West Smethwick, near Birmingham, Glass Works Chemist.
1900. Reese, Dr. Chas. L., Eastern Laboratory, P.O. Box 424, Chester, Pa., U.S.A., Chemist.
1913. Regan, Colston J., 14, Penerley Road, Catford, S.E., Analytical Chemist.
1897. Reid, Andrew, c/o L. and J. McLellan, 65, Port Dundas Road, Glasgow, Chemist.
1909. Reid, David E., Kodak Park, Rochester, N.Y., U.S.A., Chemist.
1906. Reid, James, Caldercruix Mills, by Airdrie, Scotland, Chemist.
1913. Reid, J. Meston, Vernon Lodge, Gateacre, Liverpool, Manufacturing Chemist.
1905. Reid, Dr. John H., Cranford, Barton Heys Road, Formby, Lancs, Chemist.
1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemist.
O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.

1893. Reid, Wm., jun., Bombay Dyeworks, Dadur, Bombay, India. Dyer.
1904. Reinherz, Otto, 3, Selborne Villas, Manningham, Bradford, Yorks, Chemist.
1906. Reinhold, Gustave, 26, Kidbrook Park Road, Blackheath, S.E., Works Manager.
1910. Reiter, Dr. Kaspar, Bayrischzell, Hochkreut, Bavaria, Chemist.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopœia.
1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lancs, Consulting Chemist.
1903. Remsen, Professor Ira, Johns Hopkins University, Baltimore, Md., U.S.A., Professor of Chemistry.
1911. Renaud, Paul, 8, Rue Nouvelle, Paris (9^e), France, Consulting Engineer.
O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.
1911. Rentschler, Mahlon J., c/o Oakland Chemical Co., Rossville, Staten Is., N.Y., U.S.A., Bacteriologist.
1901. Renwick, Frank F., Sunny Side, Weald Road, Brentwood, Essex, Chemist (Photographic Works).
1907. Reoch, Robert A. S., Pacific Mills Printworks, Laurence, Mass., U.S.A., Printworks Superintendent.
1894. Rettie, Theodore, 10, Doune Terrace, Edinburgh, Metallurgical Chemist.
1895. Reubens, Chas. M., 68, Cliff Street, New York City, U.S.A., Chemist.
1912. Reuter, Dr. L., Glycerin Manufacturer.
1905. Revis, Cecil, 5, Carlton Villas, Station Road, Barnes, S.W., Analyst.
O.M. Reynolds, Dr. J. Emerson, F.R.S., 3, Inverness Gardens, Kensington, W., Professor of Chemistry.
1912. Reynolds, Wm. Colebrook, "Wharfdale," Upminster, Essex, Manufacturing Chemist.
1913. Rhead, T. F. Eric, Home Office Experimental Station, Eskmeals, Cumberland, Research Chemist.
1908. Rhoads, J. Edgar, 2211, Shallcross Avenue, Wilmington, Del., U.S.A., Leather Chemist.
O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.
1892. Rhodes, P. J., Bridge House, Church, Accrington, Dye and Print Works Manager.
1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.
1888. Richardson, Dr. Clifford, Room 1615, Woolworth Building, 233, Broadway, New York City, U.S.A., Chemical Engineer.
1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1884. Richardson, F. W., County Analyst's Office, Bradford, Yorkshire, Analytical Chemist.
1900. Richardson, Jno. H., 57, Cavendish Drive, Rock Ferry, Cheshire, Manager.
1905. Richardson, L. G., 66, Bishopgate Street, Norwich, Chemist.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., Linfield, Wood Lane, Headingley, Leeds, Drysalter.
1894. Richardson, Wm. H., Newsky Thread Mills, Malaja, Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1898. Richmond, Jno. R., The Hollies, Blurton, Longton, Staffs, Alkali Works Manager.
1901. Richmond, Sylvester O., Royal William Yard, Plymouth, Analytical Chemist.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905. Ridge, H. M., 62, London Wall, London E.C., Mining Engineer.
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1899. Riederer, Emil J., Foreite Works, Landing, N.J. U.S.A., Works Chemist.
1902. Riederer, Dr. Herman S., 160, Clifford Street, Newark, N.J., U.S.A., Chemist.
1907. Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A., Chemist.
1892. Riker, Jno. J., 19, Cedar Street, New York City, U.S.A., Merchant.
O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.
1913. Riley, George, Etna Works, South Lambeth Road, London, S.W., Chemical Engineer.
1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.
1912. Riley, Walter A., 100, King Street, Norwich, Brewer.
1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., "Lauriston," Ardrossan, Ayrshire, Explosives Chemist.
1901. Ripley, Philip F., 7, Abbott Street, Andover, Mass., U.S.A., Chemist.
1907. Roberts, Chester, Swarthmore College, Swarthmore, Pa., U.S.A., Superintendent.
O.M. Roberts, F. G. Adair, Oak Hill Lodge, Hampstead, N.W., and Jnls. to H. Shankster, 57, Balfour Road, Ilford, Chemical Manufacturer.
1901. Roberts, H. E. U., c/o British Explosives Synd., Pitsea, Essex, Chemist.
1911. Roberts, H. W., Dynamite Factory, Somerset West, Cape Province, South Africa, Chemist.
1902. Roberts, Wm. H., City Analyst's Office, Ashton Street, Liverpool, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.
1897. Robertson, Andrew J., 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.
1910. Robertson, Charles, c/o Messrs. S. Allsopp and Sons, Ltd., Burton-on-Trent, Brewer.
1900. Robertson, Jas., Barncraig, South Medrox, by Glenboig, Analytical Chemist.
1910. Robertson, Dr. Joseph G., Braidwood, Tollcross, Glasgow, Manufacturer.
1891. Robertson, Dr. Robt., Research Dept., Royal Arsenal, Woolwich; and (Journals) 29, Charlton Road, Blackheath, S.E., Research Chemist.
1910. Robertson, William, Chemical Dept., City and Guilds College, Exhibition Road, London, S.W., Lecturer and Research Chemist.
1913. Robins, Edmund A., c/o Messrs. Kodak, Ltd., Wealdstone, Middlesex, Assistant Works Manager.
1913. Robinson, C. Stanley, 86, Edgbaston Road, Smethwick, Birmingham, Works Chemist.
1897. Robinson, Clarence J., 708, Jewett Avenue, West New Brighton, N.Y., U.S.A., Chemist.
1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
O.M. Robinson, H. H., 42, Penywern Road, Earl's Court, S.W., Analytical Chemist.
1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
1911. Robinson, Jas. H., 11, East Street, Rugby, Analytical Chemist.
O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.
1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow: and (communications), The Villa, Nitshill, Chemical Works Manager.
1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.
1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1905. Rodger, R. L., The Peña Copper Mines, Ltd., 736, Salisbury House, London Wall, E.C., Manager.
1909. Rody, Franz A., 258, Van Buren Street, Newark, N.J., U.S.A., Chemist.

1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks, Works Manager.
1910. Roessler, Dr. F., 89, High Street, Perth Amboy, N.J., U.S.A., Chemist.
1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.
1900. Rogers, Geo. J., 32, Chudleigh Road, Brockley, S.E., Chemist.
1908. Rogers, Harry V., Ash Street, Ilkeston, Derbyshire, Engineer.
1907. Rogers, Henry L., Casilla 1118, Buenos Aires, Argentina, Analytical Chemist.
1909. Rogers, Herbert, 52, Cannon Street, London, E.C., Rubber Works Chemist.
1899. Rogers, John, c/o Nobel's Explosives Co., Ltd., Nobel House, Glasgow, Chemist.
1910. Rogers, L. Joslyn, Chemical and Mining Building, The University, College Street, Toronto, Canada.
1911. Röhm, Dr. Otto, Weiterstädterstrasse 4/6, Darmstadt, Germany, Chemist.
1898. Roller, H. C., 493, Central Avenue, Newark, N.J., U.S.A., Superintendent.
1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
1909. Rollin, Hugh, Overdene, Riding Mill-on-Tyne, Chemical Manufacturer.
O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.
1907. Rolph, George M., c/o California and Hawaiian Sugar Refining Co., Crockett, Cal., U.S.A., Sugar Refiner.
1905. Romanes, J. W., c/o Brotherton and Co., Ltd., Litherland, Liverpool, Chemical Engineer.
O.M. Roscoe, Rt. Hon. Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.
1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.
1901. Rose, Jno. Leonard, 3, Florence Road, Ealing, W., Chemist.
1902. Rosebrugh, Prof. T. R., 2425 South State Street, Syracuse, N.Y., U.S.A., Professor of Electrical Engineering.
1897. Rosengarten, Dr. Geo. D., P.O. Box 1625, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1913. Rosenplaenter, Carlos B., 2, Elmbourne Road, Upper Tooting, S.W., Petroleum Technologist.
1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.
1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.
1910. Ross, Thos. M., c/o Burmah Oil Co., Ltd., P.O. Box 67, Rangoon, Burmah, Analytical Chemist.
1911. Ross, Prof. W. J. Clunies, 12, Church Street, Ashfield, Sydney, N.S.W., Australia, Prof. of Chemistry (Sydney Technical College).
1910. Rossati, Guido, 226, Lafayette Street, New York City, U.S.A., Agricultural Chemist.
1911. Rossi, Dr. Carlo, 29, Via Leopardi, Milano, Italy, Electro-chemist.
1906. Rossi, Louis M., c/o General Bakelite Co., Perth Amboy, N.J., U.S.A., Works Manager.
1913. Rossini, Jas. L., c/o New Oil Refining Process, Ltd., Bradfield Road, Silvertown, E., Oil Works Manager.
1906. Rossiter, E. C., Brougham, West Hagley, Worcestershire, Chemical Engineer.
1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.
O.M. Rottenburg, Dr. Paul, 55, West Regent Street, Glasgow, Chemical Merchant.
1903. Rouse, Wm., Woodburn, Arthurlie Street, Barrhead by Glasgow, Chemist.
1906. Rowell, Herbert W., 36, Thornbury Road, Osterley Park, W., Analytical Chemist.
O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.
1904. Rowley, Ernest W., Chemical Laboratory, C.M.E. Department, North Eastern Railway, Darlington, Analytical Chemist.
1908. Rowley, Frank, 4, Doughty Street, London, W.C., Metallurgist.
1913. Rowley, Henry, 41, Barrack Street, Perth, Western Australia, Analyst.
1901. Rowley, Walter Eugene, c/o National Aniline and Chemical Co., 100, William Street, New York City, U.S.A., Chemist.
1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.
1913. Rowse, Walter W., 39, Oliver Street, Boston, Mass., U.S.A., Representative of Cassella Color Co.
1896. Royal-Dawson, H., 5, University Road, Galway, Ireland, Chemist.
1898. Royle, Chas. L., c/o Cartavio Sugar Co., Trujillo, Peru, Sugar Chemist.
O.M. Royse, Sir Samuel W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.
1913. Rubinstein, I. H., 164, Cheetham Hill Road, Manchester, Technical Chemist.
1902. Rücker, Dr. Hermann von, 91, Lancaster Avenue, Buffalo, N.Y., U.S.A., Chemist.
1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.
1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs, Analytical Chemist.
1911. Rudnick, Paul, c/o Armour and Co., Union Stock Yards, Chicago, Ill., U.S.A., Chemist.
1908. Rudolf, Prof. Norman S., Dept. of Applied Chemistry, Indian Institute of Science, Bangalore, India, Professor.
1909. Rudorf, Dr. G., 52, Cranley Gardens, Muswell Hill, N., Manufacturing Chemist.
1884. Ruffle, Jno., Musley, Ware, Herts, Consulting Chemist and Electrician.
1905. Rüger, Richard, 389, New Chester Road, Rock Ferry, Cheshire, Chemist.
1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., 100, William Street, New York City, U.S.A., Chemical Merchant.
1909. Ruiloba, J. A., c/o U.S. Steel Corporation, 71, Broadway, New York City, U.S.A., Engineer.
1910. Rule, Dr. Alexander, The University, Liverpool, Lecturer in Chemistry.
O.M. Rumble, C., 169, Gleneldon Road, Streatham, S.W., Chemist.
1899. Rumbold, Wm. R., Calverley Lodge, Tunbridge Wells, Kent, Electro-Metallurgist.
1913. Rumi, Dr. Tomás J., Calle Saenz-Peña No. 722, Buenos Aires, Argentina, Doctor of Chemistry.
1911. Runeckles, A. R., c/o Brotherton and Co., Ltd., Litherland Tar Works, Liverpool, Technical Chemist.
1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.
1899. Rushby, Wm., Oak View, Batley, Yorks, Analyst.
1906. Russell, David, Rothes, Markinch, Fife, Scotland, Paper Maker.
1912. Russell, George H., c/o Michaelis, Hallenstein, and Co. Propy., Ltd., Footscray, Vic., Australia, Leather Trades Chemist.
1913. Russell, Stanley, Seifenfabrik Sunlight, Olten Switzerland, Works Manager.
1912. Russell, Thomas F., 131, Steade Road, Sheffield, Analytical Chemist.
1910. Russell, William, 146, Peel House Lane, Widnes, Lancashire, Chemist.
1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.
1909. Ryall, W. E., c/o North-West Soap Co., 63, Garden Reach, Calcutta, India, Soapworks Chemist.
1905. Ryan, Prof. F. G., c/o Parke, Davis, and Co., Detroit, Mich, U.S.A., Manufacturing Chemist.

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1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.
1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.

1905. Sabio, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.
1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.
1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.
1896. Sadtler, Dr. S. S., c/o Samuel P. Sadtler and Son, 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical and Consulting Chemist.
1897. Sage, C. Edward, 10, London Street, London, E.C., Consulting Chemist.
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1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.
1885. Salamon, Jno., Ferry Road, Rainham, S.O., Essex, Manufacturing Chemist.
1911. Salamon, Maurice S., 79, Mark Lane, London, E.C., Consulting Analyst.
1884. Salis-Mayenfeld, Dr. E. von, 24, South Allen Street, Albany, N.Y., U.S.A., Technical Chemist.
1907. Samuel, Marcus R. A., c/o Compania General de Tabacos Filipinas, 37, Fenchurch Street, London, E.C., Merchant.
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1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.
1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.
1910. Sandeman, Archibald, Ruchill Oil Works, Glasgow, Chemist.
1906. Sanders, J. McConnell, Struan, Beaconsfield Road, Blackheath, S.E., Analytical and Consulting Chemist.
1895. Sanderson, John, c/o B. S. Cohen, Ltd., Neasden Lane, London, N.W., Chemist.
1907. Sandig, A., P.O. Box 702, Chicago, Ill., U.S.A., Sales Manager.
1890. Saniter E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.
1913. Saravi, Dr. Alberto, Calle Libertad 86, Paraná, Entre-Rios, Argentina, Professor of Chemistry.
1901. Sargent, Dr. Geo. W., c/o Crucible Steel Co. of America, Oliver Building, Pittsburgh, Pa., U.S.A., Chemist and Metallurgist.
1910. Sargent, R. N., c/o Roessler and Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemical Engineer.
1911. Sauer, J., 121, Van Breestraat, Amsterdam, Holland, Sugar Chemist.
1910. Sauerschnig, José, P.O. Box 313, Mexico City, Mexico, Acid Manufacturer.
1903. Saunders, Lewis E., 123, Buffalo Avenue, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.
1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.
1911. Saville, W. B., 5, Howard Street, Horton Lane, Bradford, Yorks, Analytical Chemist.
1895. Sawers, Wm. D., 7, Minard Road, Partick Hill, Glasgow, Chemist.
1907. Saxe, Joel B., P.O. Box 1086, Montreal, Canada, Chemist.
1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.
1890. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.
1913. Scarfe, H. Crespin, "Chikatoo," Willifield Way, Hendon, N.W., Public Officer.
1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Schack-Sommer, Dr. G., 87, Victoria Street, London, S.W., Sugar Refiner.
1908. Schad, Dr. Philip, The Gables, Hartford, Cheshire, Manufacturing Chemist.
1910. Schaefer, Dr. George L., New York Quinine and Chemical Works, 105, North 11th Street, Brooklyn, N.Y., U.S.A., Chemist and Technical Manager.
1903. Schanche, H. G., 3101, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1912. Schapiro, Hugo H. B., Wadsworth, Ohio, U.S.A., Chemist.
1908. Schatzmann, Dr. Paul, Isleben bei Fluelen, Switzerland, Chemist.
1908. Scheele, Edward H., 3, Lloyds Avenue, London, E.C., Chemical Merchant.
1903. Scheidel, Dr. Aug., c/o Commonwealth Portland Cement Co., 4, O'Connell Street, Sydney, N.S.W., Australia, Managing Director.
1886. Schellhaas, Henry Alf., Thornhill, Beech Road, Hartford, Northwich, Mechanical Engineer.
1904. Schenck, Henry, c/o Merck and Co., Box 1443, New York City, U.S.A.
1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.
1905. Schill, Dr. Emil, 603, West 111th Street, New York City, U.S.A., Chemist.
1909. Schlagintweit, Theo., 94, Market Street, Manchester, Imperial German Consul.
1902. Schlegel, Jno. Wm., New York Sugar Refinery, Long Island City, N.Y., U.S.A., Chemist.
1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.
1901. Schlichting, Emil, 38, Cranberry Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Schmidt, J., 52, Camberwell Green, London, S.E., Works Manager.
1907. Schmitt, Charles A., The Carter's Ink Co., Cambridge "C.," Boston, Mass., U.S.A., Chemist.
1906. Schneible, Joseph, 934-6, People's Gas Building, Chicago, Ill., U.S.A., Chemical Engineer.
1904 Schniewind, Heinrich, jun., Susquehanna Silk Mills, 18, West 18th Street, New York City, U.S.A., Vice-President and Treasurer.
1907. Schober, Prof. W. B., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.
1904. Schoeller, Dr. Walter R., 10, Bedford Place, London, W.C., Metallurgical Research Chemist.
1902. Schofield, Prof. Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
1908. Scholefield, Fred., c/o Messrs. Burgess, Ledward, and Co., Ltd., Dyehouse Dept., Walkden, Manchester, Works Chemist.
O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.
1906. Schroeder, C. M. E., Rutherford, N.J., U.S.A., Analytical Chemist.
1895. Schroeder, E. August, c/o Church and Dwight Co., 1416, Willis Avenue, Syracuse, N.Y., U.S.A., Chemist.
1908. Schüll, Gustav, Messrs. Carl Schleicher und Schüll, Düren, Rheinland, Germany, Filter Paper Manufacturer.
1906. Schulten, Dr. C., P.O. Box 279, Calcutta, India, Analytical Chemist.
1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.
1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.
1893. Schüpphaus, Dr. R. C., 1466, Dean Street, Brooklyn, N.Y., U.S.A., Consulting Chemist.
1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.
1908. Schwalbe, Dr. Carl G., Neue Kreugstrasse 17, Eberswalde, bei Berlin, Germany, Professor (Kgl. Forstakademie).
1907. Schwamm, Chas. A., c/o Antoine Chiris, 20, Platt Street, New York City, U.S.A., Chemist.
1889. Schweich, Emile. *See* Mond, Emile S.
1894. Schweitzer, Dr. H., Riverside Mansions, corner 113th Street and Riverside Avenue, New York City, U.S.A., Chemical Expert.
1906. Schwenn, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President.
1906. Scott, Alex. C., 26, Prince's Square, Bayswater, London, W., Explosives Manufacturer.
1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.

1889. Scott, Ernest G., c/o Ernest Scott and Co., Ltd., Kingsway House, Kingsway, London, W.C., Chemical Engineer.

1912. Scott, Harold M., 32, Woodfield Road, Cheadle Hulme, Cheshire, Works Chemist.

1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.

1894. Scott, Jno. Gillespie, Annislea, Clermiston Road, Corstorphine, Edinburgh, Analytical Chemist.

1912. Scott, Jno. William, 576, Church Street, Toronto, Canada.

1913. Scott, Wm. Chas., c/o The Bay View Foundry Co., Sandusky, Ohio, U.S.A., Chemist.

1913. Scott, Wm. C., Bay View Foundry, Sandusky, Ohio, U.S.A., Chemist.

1907. Scott, Wm. F., c/o Madison Woollen Co., Madison, Maine, U.S.A., Manager.

1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical and Consulting Chemist.

1904. Scoville, Wilbur L., c/o Parke, Davis, and Co., Detroit, Mich., U.S.A., Analytical Chemist.

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1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, and (Jnl.) 30, Cobham Road, Westcliff-on-Sea, Technical Chemist.

1898. Searle, Alfred B., The White Building, Fitzalan Street, Sheffield, Analytical Chemist.

1901. Sederholm, Erik, K. Flottans Varf, Stockholm, Sweden, Chemist (Royal Navy Board).

1905. Seeker, A. F., 160, Midwood Street, Brooklyn, N.Y., U.S.A., Food Analyst.

1907. Seelemann, Dr. A., c/o Sprengstoffwerke Dr. R. Nahnsen und Co., Mönckebergestrasse 31, Hamburg, Germany, Managing Director.

1907. Seidensticker, Lewis J., c/o Atlantic Sugar Refineries, Ltd., St. John, New Brunswick, Canada, Chief Chemist.

1896. Seldner, Rudolph, 383, St. John's Place, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.

1904. Seligman, Dr. Richard, Point Pleasant, Putney Bridge Road, Wandsworth, S.W., Chemist.

1908. Sellen, Elijah, Gasworks Laboratory, M.L.H. & P. Co., Elm Station, Montreal, Canada, Chemist.

1905. Sellers, Geo. E., Hopton Lane, Mirfield, near Huddersfield, Aniline Colour Maker.

1898. Sen (Gupta), Nagendra Nath, 18, Lower Chitpur Road, Calcutta, India, Physician and Chemist.

1910. Sen, Prof. Rajendra Nath, Engineering College, Sibpur, Bengal India, Professor of Tinctorial Chemistry.

1899. Senior, Francis L., Box 31, Sanford, Maine, U.S.A., Mill Chemist.

1906. Setz, C. F., Herculaneum, Mo., U.S.A., Chemist and Metallurgist.

1905. Sewell, B. F. Brooke, P.O. Box 70, Washington, D.C., U.S.A., Chemical Engineer.

1896. Seyler, Clarence A., Public Analysts' Office, Nelson Terrace, Swansea, Chemist and Assayer.

1907. Seymour, Tom G., Kilton, Northway, Wavertree, Liverpool, Analytical Chemist.

1911. Seymour-Jones, R. A., Oaklands, Hilltop, Latchford, Warrington, Research Chemist.

1903. Shacklady, T. G., Hope Point, Cliffe at Hoo, Kent, Technical Chemist.

1911. Shah, Prof. P. G., 759, Sankdi Sheri, Ahmedabad, India, Professor of Chemistry, Forman Christian College.

1906. Shah, Prof. S. J., Dhanasutar's Street, Ahmedabad, India, Consulting Chemist.

1905. Shainwald, R. L., jun., 100, William Street, New York City, U.S.A., Chemist.

1892. Shanks, Arch., 5, Green Lodge Terrace, Greenhead, Glasgow, Chemist.

1908. Shanks, John, Dalmeny Park, Barrhead, near Glasgow, Sanitary Engineer.

1904. Sharples, G. H., Newton Gardens, Middlewich, Cheshire, Works Chemist.

1905. Sharples, Philip P., 560, Concord Avenue, Belmont, Mass., U.S.A., President (Natl. Coal Tar Co.).

1884. Sharples, Stephen P., 22, Concord Avenue, Cambridge, Mass., U.S.A., Analytical Chemist.

1911. Sharrock, Charles W., Lion Works, West Thurrock, Grays, Essex, Cement Manufacturer.

1900. Sharwood, Dr. Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.

1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.

1913. Shaw, T. W. A., "Springfield," Dee View Road, Heswall, Cheshire, Process Manager.

1912. Shaw, W. D. Hamilton, c/o Coppée Coke Oven Co., Ltd., King's House, Kingsway, London, W.C., Technical Chemist.

1912. Shearman, Cecil H., The Tees Bone Mill, Thornaby-on-Tees, Managing Director.

1904. Shedden, Frank, 25, Middleborough Road, Coventry, Science Master.

1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.

1912. Shelley, F. F., Apothecaries Hall, Blackfriars, London, E.C., Analytical Chemist.

1912. Shelley, Wm. E., 20, Mount Street, Manchester, Engineer.

1911. Shelton, James, 44, Barclay Road, Fulham, S.W., Chemist.

1913. Shengle, J. C., c/o Major Bros., Ltd., Kiangsu Chemical Works, Shanghai, China, General Manager.

1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.

1889. Shepard, Dr. Chas. U., (communications) P.O. Box 42, Summerville, S.C.; and (Journals) P.O. Box 284, Charleston, S.C., U.S.A.

1906. Shepard, Jas. H., Experiment Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.

1907. Shepheard, Fred. G., Kilbeg Cottage, Carrutherstown, Ruthwell, Dumfriesshire, Chemist.

1904. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E., Analytical Chemist.

1893. Shepherd, H. H. B., Crayside, Bexley, Kent, Chemist.

1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.

1909. Shepherd, Stephen W., c/o Brotherton and Co., Ltd., Nechells Chemical Works, Birmingham, Works Manager.

1899. Shero, John E., c/o Aluminium Co. of America, Niagara Falls, N.Y., U.S.A., Chemist.

1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.

1896. Shimomura, Prof. K., Shinkarasumaru Kojinguchi Sagaru, Kyoto, Japan, Professor of Chemistry.

1905. Shoffstall, Arthur S., 269, Second Street, New Brighton, Staten Is., N.Y., U.S.A., Chemist.

1899. Sholes, Chas. E., 80, Maiden Lane, New York City, U.S.A., Chemical Agent.

1900. Shonk, Albert, 10, Dartmouth Road, Hendon, N., Analytical Chemist.

1897. Shores, Dr. Jeff. H., 20, Saltwell View, Gateshead-on-Tyne, Chemist.

1904. Short, Andrew, 3, Prudhoe Terrace, Tynemouth, Northumberland, Works Chemist.

1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.

1910. Shrimpton, Jno. K., Bound Brook, N.J., U.S.A., Works Manager.

1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.

1899. Shuler, Darius P., Fredericktown, Mo., U.S.A., Chemist.

1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.

1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.

1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.

1902. Sibley, Samuel E., Hawthorne, King Street, Randwick, Sydney, N.S.W., Australia, Technical Chemist.

1907. Siebel, Fred. P., 960-962, Montana Street, Chicago, Ill., U.S.A., Analytical Chemist.

1902. Siebold, Alfred, c/o Lactose Ltd. Hibernia Works, Tipperary, Ireland, Technical Chemist.
1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.
1912. Sillars, Daniel, The Laboratory, Bolckow, Vaughan, and Co., Ltd., South Bank, S.O., Yorks, Metallurgical Chemist.
1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.
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1912. Simmance, John F., 25A, Westminster Palace Gardens, Victoria Street, Westminster, S.W., Managing Director (Alexander Wright and Co.).
1911. Simmons, Thos. A., 298, Ditchling Road, Brighton, Analytical Chemist.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 80, Bishopsgate, London, E.C., Chemical Engineer.
1905. Simons, Albert J., Pontianak, Dutch West Borneo, viâ Singapore, S.S., Engineer.
1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1905. Simpson, Henry, 26, Austen Avenue, Sherwood Rise, Nottingham, Works Chemical Assistant.
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1900. Sims, W. Edgar, c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Assistant Manager.
1894. Sinclair, Dr. W., 250, Ferry Road, Leith, Scotland, Chemist.
1890. Sindall, R. W., 2, Oxford Court, Cannon Street, London, E.C., Paper Chemist.
1911. Singh, Shersingh W., N.W. Railway, Kasur, Punjab, India, Engineer.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., 321, Great Clowes Street, Higher Broughton, Manchester, Demonstrator of Chemistry.
1914. Sjödahl, H.A., c/o The Chatfield Manufacturing Co., Station P., Cincinnati, Ohio, U.S.A., Chemist.
1912. Skellon, Herbert, Helsby Cable Works, Helsby, near Warrington, Chemist.
1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Managing Director.
1897. Skertchly, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.
1891. Skilton, C. F. E., c/o Beamish and Crawford, Ltd., Cork, Ireland, Brewer.
1901. Skinner, Hervey J., 71, West Chestnut Street, Wakefield, Mass., U.S.A., Chemist.
1908. Skinner, Wm., 38, Sauchiehall Street, Glasgow, Analytical Chemist.
1904. Skirrow, Dr. F. W., State University, Boulder, Colo., U.S.A., Research Chemist.
1911. Skjold, E., Elm View, The Avenue, Erith, Kent, Technical Manager and Chemist.
1904. Skowronski, S., c/o Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.
1891. Skurray, Thos., The Brewery, 40, Ock Street, Abingdon, Berks, Brewer.
1913. Slade, Dr. Roland E., University College, Gower Street, London, W.C., Lecturer in Physical Chemistry.
1904. Slator, Dr. Arthur, 174, Ashby Road, Burton-on-Trent, Lecturer and Demonstrator.
1912. Slattery, F. J., 42, Mathews Park Avenue, Stratford, E., Analytical Chemist.
1906. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.
1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.
1913. Slusser, Holland B., 318, Sixth Street N.W., Canton, Ohio, U.S.A., Analytical Chemist.
1883. Smail, J. I., Warren Wood, Hayes Common, Beckenham, Kent, Chemical Manufacturer.
1908. Small, Bertram G., Leahurst, Broughton Park, Manchester, Engineer.
1898. Small, Fritz H., 28, Berwick Street, Worcester, Mass., U.S.A., Chemist.
1904. Smart, Bertram J., Government Testing Laboratory, Lithgow, N.S.W., Australia, Chemist.
O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.
1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1898. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyers' Manager.
1897. Smith, Allan, c/o The Edward Partington Pulp and Paper Co., Reversible Falls Mill, St. John, N.B., Canada, Chemist.
1911. Smith, Andrew, c/o Leech, Neal, and Co., Ltd., Spondon, Derby, Colour Manufacturer.
1896. Smith, Andrew T., c/o Castner Kellner Alkali Co., Ltd., 257, Royal Liver Building, Liverpool, General Manager.
1905. Smith, Arthur, Town End Chemical Works, Bramley, Leeds, Chemical Manufacturer.
1912. Smith, Arthur R., c/o Messrs. J. Watson and Son, Ltd., Whitehall Soap Works, Leeds, Chemist.
1893. Smith, Edgar B., c/o Dominion Tar and Chemical Co., Box D, Transcona, Manitoba, Canada, Manager.
1906. Smith, E. A. Cappelen, c/o American Smelting and Refining Co., 165, Broadway, New York City, U.S.A., Metallurgical Engineer.
1913. Smith, Edward C., 18, Constance Street, and c/o Canadian National Carbon Co., Ltd., 99, Paton Road, Toronto, Canada, Superintendent.
1895. Smith, Dr. E. Ellsworth, Suite 80, Chemists' Building, 50, East 41st Street, New York City, U.S.A., Consulting Physiological Chemist.
1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.
1911. Smith, E. Woodhouse, Central Laboratory, City Gasworks, Nechells, Birmingham, Chief Chemist.
1903. Smith, Ewing, c/o Dunlop Tire and Rubber Goods Co., Toronto, Canada, Analytical Chemist.
1903. Smith, F. M., 100, William Street, New York City, U.S.A., President (Pacific Coast Borax Co.).
1891. Smith, Francis P., 131—133, East 23rd Street, New York City, U.S.A., Chemist.
1907. Smith, Frank Morse, 100, William Street, New York City, U.S.A., Chemical Merchant.
O.M. Smith, G., Rosehall Terrace, Falkirk, Scotland, Explosives Works Manager.
1908. Smith, George A., 1433, President Street, Brooklyn, N.Y., U.S.A., Chemist (Printing Ink Manufacturing).
1907. Smith, George D., 247, Atlantic Avenue, Boston, Mass., U.S.A., Salesman.
1890. Smith, Harry E., 36, Beersford Place, East Cleveland, Ohio, U.S.A., Analytical Chemist.
1904. Smith, Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.
1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.
1905. Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.
1901. Smith, H. Procter, Hightfield, Shotton Lane, Shotton, Flintshire, Metallurgical Chemist.
O.M. Smith, H. R., 1, Aubert Park, Highbury, London, N., Analytical Chemist.
1905. Smith, Hugh Dunford, 7 and 9, The Side, Newcastle-on-Tyne, Analytical Chemist.
1906. Smith, Irwin J., P.O. Box 506, Troy, N.Y., U.S.A., Salesman.
O.M. Smith, Jas., Ash Grove House, Radcliffe, Manchester.
1897. Smith, James, Sunnyside, Groes Road, Cressington, near Liverpool, Analytical Chemist.
1903. Smith, James, "Lyndhurst," Frodsham, and (Jnls.) Ditton Copper Works, Widnes, Metallurgist.
1907. Smith, Jas. C., c/o Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Dyer.
1893. Smith, Jas. F., 41, Grange Avenue, Scarborough, Yorks, Analytical Chemist.
1901. Smith, J. Cruickshank, King's House, King Street, London, E.C., Technical Chemist.

O.M. Smith, Dr. J. H., 21, Rue de la Pointe, Garenne-Colombes, Seine, France, Chemist.
1888. Smith, J. Tertius, Richmond House, Plaistow, Essex, Technical Chemist.
O.M. Smith, Jno. W., 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A., Analytical Chemist.
1890. Smith, J. Wm., 1615, West Genesee Street, Syracuse, N.Y., U.S.A., Alkali Works Manager.
1896. Smith, Jos. Kent, 8, Hillfoot Road, Woolton, Liverpool, Metallurgical Chemist.
1910. Smith, L. Hewgill, c/o The New Transvaal Chemical Co., Delmore, Transvaal, Technical Chemist.
1911. Smith, N. Garrett, c/o Edison and Swan U.E.L. Co., Ltd., Lamp Dept. Laboratory, Ponders End, N., Analytical Chemist.
1898. Smith, R. F. Wood, 90, Lower Thames Street, London, E.C., Consulting Chemist.
1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist.
1890. Smith, Robert Watson, c/o Alex. Smith, 53, Glencairn Drive, Pollokshields, Glasgow, Chemical Works Manager.
1897. Smith, Theophilus R., 217, Hylton Road, Sunderland, Chemist.
1907. Smith, Thorn, 49, West Larned Street, Detroit, Mich., U.S.A., Chemist.
1910. Smith, Vincent, Athlone, Eagle Road, Wembley, Middlesex, Technical Chemist.
1903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.
O.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Editor of Society's Journal.
1908. Smith, Dr. Watson, jun., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.
O.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.
1910. Smith, W. C., c/o The Anchor Cable Co., Leigh, Lancashire, Analytical Chemist.
1909. Smith, Wm. G., 23, Wickham Way, Parklangley, Beckenham, Kent, Chemical Merchant.
O.M. Smithells, Prof. A., F.R.S., The University, Leeds, Professor of Chemistry.
O.M. Smithers, F. O., 171, Adelaide Road, London, N.W., and (Jnls.) c/o W. E. Harrison, Technical School, Goldshill Road, Handsworth, near Birmingham, Chemical Agent.
1902. Smoot, Albert M., 99, John Street, New York City, U.S.A., Analytical Chemist.
1909. Smoot, Chas. C., III., c/o C. C. Smoot and Sons Co., North Wilkesboro', N.C., U.S.A., Tanning Chemist.
1902. Smythe, Dr. J. S., 22, Rawlinson Road, Southport, Analytical Chemist.
1888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.
1908. Snell, Professor John F., Macdonald College P.O., Prov. Quebec, Canada, Professor of Chemistry.
1896. Snowdon, J., jun., Messrs. Snowdon, Sons and Co., Millwall, E., Chemical and Oil Manufacturer.
1900. Sodeau, Dr. Wm. H., Torpedofabrik, Fiume, Hungary, Chemist.
1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors Nobelkrut).
1894. Sohn, Chas. E., 52, Fore Street, London, E.C., and (Journals) 82, Wightman Road, Harringay, N., Analyst.
1912. Solomon, J. Bernard, 56, Priory Road, London, N.W., Tannery Chemist.
1906. Solomon, M., Birmingham Carbon Works, Witton, Birmingham, Manager.
1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.
1884. Sommer, Adolf, Corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.
1909. Sommer, Dr. Albert, Munchnerplatz 14 pt, Dresden, Germany, Engineer Chemist.
1912. Sorley, Jas., Novara, Mount Vernon, Glasgow, Analytical Chemist.
1904. Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.
1904. Southerden, F., 11, Gordon Road, Exeter, Teacher of Chemistry.
1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.
O.M. Sowerby, W. M., c/o United Alkali Co., Ltd., Allhusen Works, Gateshead-on-Tyne, Manager.
1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
1910. Spackman, Henry S., 2211, Chestnut Street, Philadelphia, Pa., U.S.A., President of Engineering Co.
1904. Sparre, Fin, c/o E. I. du Pont de Nemours Powder Co., Experimental Station, Henry Clay P.O., Del., U.S.A., Director.
1913. Speedy, Alan, 1, Creighton Avenue, East Ham, Essex, Technical Chemist.
1904. Speiden, C. C., 46, Cliff Street, New York City, U.S.A., Chemical Merchant.
1905. Speight, W. E., Hacken Sewage Works, Great Lever, Bolton, Chemist.
1909. Speirs, Wm., c/o W. N. Gemmill and Co., 142, Queen Street, Glasgow, Chemical Broker.
1883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.
1911. Spence, Dr. David, Research Laboratory, The B.F. Goodrich Co., and (Journals) P.O. Box 188, Akron, Ohio, U.S.A., Director.
1900. Spence, Howard (Journals), Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1909. Spence, Jno., 74, Buchanan Street, Glasgow, Analyst.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.
1903. Spencer, A. Gordon, 601—603, Canadian Express Building, Montreal, Canada, Chemist.
1913. Spencer, Richard D., Les Savonneries Lever, Haubourdin-lez-Lille, Nord, France, Works Chemist.
1897. Sperry, Erwin S., "The Brass World," 260, John Street, Bridgeport, Conn., U.S.A., Metallurgist and Editor.
1884. Spiegel, Dr. Adolf, Messel bei Darmstadt, Germany, Analytical Chemist.
1903. Spielmann, Dr. P.E., 21, Cadogan Gardens, London, S.W., Chemist.
1906. Spiera, Dr. V. G., c/o Inchiostrificio-Veneto, Treviso, Italy, Chemist.
1889. Spies, Adolph, 21, Broadwater Down, Tunbridge Wells, Chemical Merchant.
1885. Spiller, A., 20, Holly Avenue, Newcastle-on-Tyne, Electrician.
O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.
1914. Spilman, G. H., c/o The Chiswick Polish Co., Chiswick, W., Works Chemist.
1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.
1909. Sprague, F. O., c/o Cattarangus Tanning Co., Olean, N.Y., U.S.A., Chemist.
1912. Sprent, Dr. Colin, c/o Compania Mexicana del Petroleo, El Aguila, Apartado 116, Minatitlan, Vera Cruz, Mexico, Chemical Engineer.
O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.
1910. Stadler, Hans, c/o Herr Kommerzienrat J. Stadler, Prague, Austria, Technical Chemist.
O.M Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburgh, Pa., U.S.A., Consulting Chemist.
1914. Staley, Homer F., Standard Sanitary Manufacturing Co., Pittsburgh, Pa., U.S.A., Technical Director.
1904. Standfast, Jno. T., Prince Regent's Wharf, Silvertown, E., Chemist.
1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.
1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.
1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.

O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Manager.

1896. Statham, Noel, c/o West Virginia Pulp and Paper Co., 200, Fifth Avenue, New York City, U.S.A., Engineer.

1907. Stand, Joseph E., c/o W. W. Lawrence and Co., Pittsburg, Pa., U.S.A., Chemist.

1904. Stauffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.

1895. Stead, J. Christopher, 55, Chancery Lane, London, W.C., Technical Chemist.

O.M. Stead, J. E., F.R.S., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.

O.M. Stebbins, Dr. J. H., 50, East 41st Street, New York City, U.S.A., Analytical Chemist.

1896. Steel, Fred. W., c/o General Chemical Co., Ltd., Auburn, Sydney, Australia, Works Manager.

1900. Steel, Jno. S., Achernar, Blackburn, Melbourne, Vic., Australia, Chemist.

O.M. Steel, Thos., Colonial Sugar Refining Co., O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.

1905. Steiger, George, c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.

1912. Steiner, Bernard C., Enoch Pratt Free Library, Baltimore, Md., U.S.A., Librarian.

1897. Steinhart, Dr. Oscar J., c/o Twite and Steinhart, 65, London Wall, London, E.C., Consulting Metallurgist.

1912. Steinhoff, Fred., 24, Walbrook, London, E.C., Chemical Manufacturer.

1903. Stell, S. F., 25, Henry Street, Keighley, Yorks, Teacher of Chemistry.

1887. Stenhouse, T., 166, Drake Street, Rochdale, Analytical Chemist.

1908. Stenhouse, Thos., jun., Chemical Laboratory, H.M. Dockyard, Portsmouth, Analytical Chemist.

1904. Stephen, A. E., 67, Castlereagh Street, Sydney, N.S.W., Australia, Analytical Chemist.

1911. Stephens, C. E., c/o Spies Bros. and Co., 102, Fenchurch Street, London, E.C., Chemical Merchant.

1884. Stephens, H. Chas., Avenue House, Finchley, N., Ink Manufacturer.

1892. Stephens, M. E., 57—60, Aldersgate Street, London, E.C., Ink Manufacturer.

1913. Stephenson, Guy, Bankfoot Laboratory, Crook, Co. Durham, Analyst.

1909. Stephenson, Henry H., Authors' Club, 2, Whitehall Court, London, S.W., Technical Chemist.

1909. Stephenson, Herbert F., 8, The Park, Mitcham, Surrey, Analytical Chemist.

1889. Stern, Arthur L., 148, High Street, Burton-on-Trent, Brewing Chemist.

1912. Sterne, Edward T., School of Mining, Queen's University, Kingston, Ont., Canada, Chemist.

O.M. Steuart, D. R., Osborne Cottage, Broxburn, West Lothian, Oilworks Chemist.

1903. Steven, A. B., Royal Technical College, Glasgow, Lecturer on Dyeing.

1907. Steven, Michael M., Laboratory, Glenochil Distillery, Menstrie, Scotland, Analytical Chemist.

1899. Stevenot, G. A., 280, Baltic Street, Brooklyn, N.Y., U.S.A., Chemist.

1902. Stevens, Dr. Hy. P., Laboratory, 15, Borough, London Bridge, S.E., Consulting Chemist.

1894. Stevens, Jno. H., 295, Ferry Street, Newark, N.J., U.S.A., Manufacturing Chemist.

1908. Stevens, J. Venn, 147a, Clapton Common, London, N.E., Analytical Chemist.

1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.

O.M. Stevenson, W., Standard Works, 95A, Southwark Street, London, S.E., Chemical Manufacturer.

1913. Steward, H. Bernard, Rose Hill House, Coseley, near Bilston, Staffs, Enamel Chemist.

1912. Stewart, Allan E., 136, Bedford Road, Toronto, Canada, Chemist.

1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.

1903. Stewart, Jas., "The Gas World," 8, Bouverie Street, Fleet Street, London, E.C., Editor.

1909. Stewart, Jeffrey, India Refining Co., McKean and Swanston Streets, Philadelphia, Pa., U.S.A., Works Manager.

1890. Stewart, Robt., 46, Westbourne Road, Luton, Chemical Works Manager.

O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Kirkcaldy, Fife, Technical Chemist.

1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.

1904. Stieglitz, Dr. Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.

1904. Stiff, John T., 68, Dover Road, Northfleet, Kent, Works Chemist.

1903. Stillwell, Albert G., 76½, Pine Street, New York City, U.S.A., Chemist.

1903. Stingelin, Dr. Fritz, 31, Hongggerstrasse, Zürich, 6, Switzerland, Chemist.

1900. Stockdale, Edgar, c/o R. Dewhurst and Co., Ltd., Printworks, Batley, Yorks, Colour Mixer.

1888. Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.

1887. Stocks, H. B., 33, Prenton Park Road, Birkenhead, Cheshire, Analytical Chemist.

1903. Stoddard, Jesse D., 674, Woodward Avenue, Detroit, Mich., U.S.A.

1885. Stoddart, F. Wallis, Grafton Lodge, Sneyd Park, Bristol, Analytical Chemist.

1899. Stokes, Alf. W., Laboratory, Town Hall, Paddington Green, W., Public Analyst.

1910. Stokes, Edward S., c/o Metropolitan Board of Water Supply and Sewerage, Pitt Street, Sydney, N.S.W., Australia, Medical Officer.

1900. Stone, Geo. C., c/o New Jersey Zinc Co., 55, Wall Street, New York City, U.S.A., Engineer.

1899. Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.

O.M. Storey, I. H., Haverbreaks, Lancaster, Chemical Manufacturer.

1914. Storie, George B., 62, Vineyard Hill Road, Wimbledon, S.W., Works Manager.

1902. Storr, Bertram V., 26, The Square, Garden Suburb, Ilford, Essex, Chemist.

1914. Stott, Augustus P., 20-26, Brunswick Place, City Road, London, N., Manager.

1909. Strachan, Jas. T., c/o Hendon Paper Works Co., Ltd., Sunderland, Works Chemist.

1912. Strange, E. Halford, 7, Staple Inn, Holborn, London, W.C., Technical Research Chemist.

1903. Strayer, D. W., 428, West King Street, York, Pa., U.S.A., Chemist.

1912. Strevens, J. E., c/o Taranaki Oil Wells, Ltd., New Plymouth, New Zealand, Technical Chemist.

1903. Strickler, Emerson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.

1909. Strivens, Percy R., Ash Villa, St. Andrew's Road South, St. Annes-on-Sea, Lancs, Analytical Chemist.

1896. Stuart, Harry T. R., Fir Bank, Woolfold, near Bury, Printworks Manager.

O.M. Stuart, T. W., 7, Livingston Drive, Sefton Park, Liverpool, Alkali Works Manager.

1896. Stubbs, Augustus J., 16, Avenida del Tibidabo, Barcelona, Spain.

1903. Sturrock, Capt. G. C., R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India, Assistant Superintendent.

1908. Suart, Arthur B., c/o Johnson and Sons' Smelting Works, Paul Street, Finsbury, London, E.C., Bullion Refiner.

1895. Sudborough, Dr. J. J., Indian Institute of Science, Bangalore, India, Lecturer in Chemistry.

1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.

1910. Sulzer, Albert F., 16, Beverly Street, Rochester, N.Y., U.S.A., Chemical Engineer.

1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.

1907. Sundar-Ram, Minakshi, c/o Parry and Co., Ranipettai, N. Arcot, Madras, India, Agricultural Chemist.
1913. Sundeman, G., c/o C. E. Davis' Packing Co., Fleeton, Va., U.S.A., Chemist.
1912. Sutcliffe, J. A. L., c/o Price's Co., Ltd., Belvedere, Kent, Analytical Chemist.
1906. Sutermeister, Edwin, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A. Chemist.
1884. Sutherland, D. A., 26, Victoria Street, Westminster, S.W., Consulting Technical Chemist.
1909. Sutherland, Daniel M., Ashgrove, Sunbury Common, Middlesex, Works Manager.
1894. Sutherland, Geo., Croft Cottage, Bonhill, Scotland, Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1906. Sutherland, John, c/o The Bauxite Refining Co., Ltd., Hebburn-on-Tyne, Manager.
O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, Chemical Manufacturer.
O.M. Sutton, Dr. Francis, Norfolk County Laboratory, Redwell Street, Norwich, Analytical Chemist.
1886. Sutton, F. Napier, 6, Grosvenor Gardens, Cricklewood, N.W., Alkali Works Inspector.
1900. Sutton, W. Lincolne, Redwell Street, Norwich, Public Analyst.
O.M. Swan, Sir Jos. W., F.R.S., Overhill, Warlingham, Surrey, Chemist and Electrician.
1913. Swan, J. Waldron, 211, Castle Street, Luton, Beds, Gas Works Chemist.
1906. Sweet, Everell F., 52, Union Street, Boston, Mass., U.S.A., Importer.
1905. Swenarton, W. Hastings, 2, Rector Street, New York City, U.S.A., Patent Lawyer.
1904. Swindells, Seth, Liverpool Road, Kidsgrove, Stoke-on-Trent, Chemist.
1912. Swinden, Dr. Thos., 12, Nether Edge Road, Sheffield, Metallurgist.
1901. Swinton, Ralph S., c/o W. J. Bush and Co., Inc., Linden, N.J., U.S.A., Analytical Chemist.
1912. Sykes, Charles D., 95, Vicarage Road, Langley, near Birmingham, Chemical Works Manager.
1902. Sylow, Paul L. P. G., New Farm Sugar Refinery, Brisbane, Queensland, Analytical Chemist.
1906. Symes, Langford P., Belfast Freezing Works, Christchurch, New Zealand, Chemist.
1906. Symonds, Abram E., Wick Lane Colour Works, Old Ford Road, Bow, E., Colour Manufacturer.
1910. Szilagyi, L. F., 39, Belsize Avenue, London, N.W., Consulting Engineer.

T

1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).
1910. Tainsh, Peter, Belmont, Sorbie Road, Ardrossan, Ayrshire, Technical Chemist.
1909. Tait, Walter Scott, Church Farm, Bebington, Cheshire, Works Manager.
1896. Takagi, T., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chemical Engineer.
O.M. Takamatsu, T., 13, Nishikatamachi, Hongo, Tokyo, Japan, Analytical Chemist.
O.M. Takamine, Dr. Jokichi, 550, West 173rd Street, New York City, U.S.A., Engineer.
1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).
1912. Talley, Herbert, c/o Independent Powder Co. of Mo., Joplin, Mo., U.S.A., General Manager.
1910. Tanahashi, Dr. T., 486, Sendamachi, Fukagawa, Tokyo, Japan, Manufacturing Chemist.
1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan, Chemist.
1900. Tankard, Arnold R., 67, Ferens Avenue, Cottingham Road, Hull, Analytical Chemist.
1911. Tarver, Percy, 2095, East 36th Street, Cleveland, Ohio, U.S.A., Chemist (Sherwin-Williams Co.).
O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.
1910. Tatlock, Chas. S. A., c/o The Standard Chemical Products Co., Ltd., Irvine, Scotland, Analytical Chemist.
O.M. Tatlock, R. R., 156, Bath Street, Glasgow, Consulting Chemist.
1902. Tatters, Hugh Lee, 10, Birchfield Road, Widnes, Analytical Chemist.
1906. Tattersfield, Frederick, 96, Bewick Road, Gateshead-on-Tyne, Analyst.
1905. Taveau, René de Mortemer, 1809, North Calvert Street, Baltimore, Md., U.S.A., Chemist.
1901. Tayler, Jno. Bernard, Anglo-Chinese College, Tientsin, North China, Chemist.
1903. Taylor, Alvin M., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.
1907. Taylor, C. Marshall, Port Reading, N.J., U.S.A., Chemist.
1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.
1886. Taylor, G. Crosland, Crane House, Crane Wharf, Chester, Electrical Engineer.
1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.
O.M. Taylor, H. E., 1, Alexandra Park Gardens, Glasgow, Lead Works Manager.
1883. Taylor, Jas., "Greenleaf," Brierley Street, Mosman, N.S.W., Australia, Government Metallurgist.
1898. Taylor, Jas. M., Tynevale, Groes Road, Cressington, Liverpool, Analytical Chemist.
1888. Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.
1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.
1901. Taylor, Sidney H., 63, Wolstenholme Road, Sharrow, Sheffield, Works Chemist.
1898. Taylor, Walter, 475, Grosvenor Place, Limefield, Bury, Lancs, Technical Chemist.
1905. Taylor, Wm. H., 36, Glenhouse Road, Eltham Park, Kent, Chemist.
1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.
1899. Teas, Wm. Holmes, Marion, Va., U.S.A., Chemist.
1913. Tebbutt, Oswold N., 4, Salisbury Villas, Cambridge, Cement Works Manager
O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.
1905. Teeple, Dr. J. E., 50, East 41st Street, New York City, U.S.A., Director.
1908. Teichfeld, Arnold, Tasna 6, Warsaw, Russia, Chemist in Ceramic Industry.
1904. Teller, George L., 31, North State Street, Chicago, Ill., U.S.A., Chemist.
1906. Tempany, Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.
1913. Tennant, C. A., c/o C. Tennant Sons and Co. (Montreal), Ltd., C.P.R. Tel. Chambers, Montreal, Canada, Chemical Importer and Agent.
1884. Tennant, Jas., Fairlie, Ayrshire, Lead and Colour Manufacturer.
1913. Tennant, Robt., 4, Park Terrace, Queen's Drive, Crosshill, Glasgow, Analytical Chemist.
1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., 206, Bay Street East, Savannah, Ga., U.S.A., Chemist.
1908. Terleski, Fred. H., 11, Oaklands Road, Kersal, Manchester, Technical Chemist.
1911. Terrey, Augustus G., c/o The Limmer Asphalte Paving Co., Ltd., Leamouth Wharf, Orchard Place, Blackwall, E., Chemist.
1884. Terry, Hubert L., (Journals) Fairfield House, Brook Road, Fallowfield, Manchester; and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.

O.M. Tervet, R., 68, Windsor Road, Leyton, Essex, Oil Works Manager.
1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.
1908. Thatcher, Dr. C. J., 1352, Hudson Terminal Building, New York City, U.S.A., Consulting Chemist and Patent Expert.
1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.
1909. Thaxter, Gerald N., c/o Brewer and Co., Worcester, Mass., U.S.A., Chemist.
1908. Theis, Dr. Friedrich C., Konigsteinerstrasse 60, Höchst a/Main, Germany, Chemist.
1910. Thom, T. Mathieson, Woodlands, Cheshunt, Herts, Chemical Engineer.
1908. Thom, Wm. H., 1024, Dovercourt Road, Toronto, Canada, Chemist.
1911. Thomas, Benjamin F., 808, Pine Street, Chattanooga, Tenn., U.S.A., President, Cocalola Bottling Co.
1911. Thomas, D. Hibbert, 56, Waun Road, Morriston, Glamorganshire, Chemical Works Manager.
1912. Thomas, Frederick, c/o Williams Bros. and Co., Colour Manufacturers, Hounslow, Middlesex, Chemist and Works Manager.
1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.
1909. Thomas, John, Highfield, Brettell Lane, near Stourbridge, Analytical Chemist.
O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.
1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector.
1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.
1908. Thomas, Oswald J. D., c/o Canada Cement Co., Ltd., Plant No. 3, Hull, Quebec, Canada, Analytical Chemist.
1888. Thomas, S. Percy, c/o Baird and Tatlock, 14, Cross Street, Hatton Garden, London, E.C., Technical Chemist.
1898. Thomas, Wm. Harrison, jun., c/o The Apponang Co., Apponang, R.I., U.S.A., Printworks Chemist.
1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.
1905. Thompson, Alf. J., c/o R. W. Greeff and Co., Thames House, Queen Street Place, London, E.C., Chemical Merchant.
1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.
1898. Thompson, Edw. C., Froyle House, 42, Westcombe Park Road, Blackheath, S.E., Manufacturing Chemist.
1909. Thompson, Edwin, 25, Sefton Drive, Liverpool, Manufacturing Chemist.
1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.
1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1913. Thompson, Howard, 20, Kingsway, Northwich, Cheshire, Analytical Chemist.
1907. Thompson, Jas. G., Donegall Quay Mills, Belfast, Ireland, Corn Miller.
1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.
1912. Thompson, Kenworthy J., 644, Mabbett Avenue, Milwaukee, Wis., U.S.A., Chemist, Federal Rubber Works.
1907. Thompson, Milton S., 72, Broad Street, Boston, Mass., U.S.A., Manufacturer.
O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.
1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.
1884. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.
1907. Thomson, H. N., 211, South Sixth Street, Salt Lake City, Utah, U.S.A., Metallurgist.
1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).
1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.
1899. Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.
O.M. Thomson, W., Royal Institution Laboratory, 79A, Princess Street, Manchester, Analytical and Consulting Chemist.
1890. Thomson, Wm. Thos., Royal Gunpowder Factory, and (Journals) Forest View, Honey Lane, Waltham Abbey, Essex, Explosives Chemist.
1902. Thorburn, Jas., 30, Cromartie Avenue, Newlands, Glasgow, Analytical Chemist.
1910. Thorne, Carl B., c/o Riordan Paper Co., Hawkesbury, Ontario, Canada, Manager.
O.M. Thorne, Dr. L. T., Highlands, The Crescent, Belmont, Surrey, and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.
1907. Thornewell, A. R., 139, Vicarage Road, Langley, near Birmingham, Works Chemist.
O.M. Thorneycroft, Wallace, (Jnls.) Plean House, Plean, Stirling, and 113, St. Vincent Street, Glasgow, Technical Chemist.
1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.
1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.
1899. Thornton, Wm., c/o J. S. MacArthur and Co., Porcupine, North Ontario, Canada, Chemist.
1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.
1911. Thorp, John W., Granville Street, Barnsley, Yorks, Tar Works Manager.
1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.
1906. Thorp, Walter, Sorrentoville, Dalkey, Co. Dublin, Ireland, Analytical Chemist.
O.M. Thorpe, Sir Edward, C.B., F.R.S., Whinfield, Salcombe, South Devon, Professor of Chemistry.
1905. Thorpe, Prof. J. F., F.R.S., The Imperial College, South Kensington, London, S.W., Professor of Organic Chemistry.
1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.
1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co. Aurora, Ill., U.S.A., Chemist.
1904 Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist
1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.
1913. Tilburn, Charles, The Australian Explosives and Chemical Co., Ltd., Deer Park, Vic., Australia, Works Manager and Explosives Chemist.
1908. Tillberg, Erik W., Westervik, Sweden, Extract Manufacturer.
1900. Tilley, Jas. W., 35A, Southwark Street, London, S.E., Research Chemist.
1906. Tillson, Henry E., 5946, Christian Street, Philadelphia, Pa., U.S.A., Dyer.
1901. Timmans, W. G., The Basford Chemical Co., Ltd., Basford, Nottingham, Chemical Manufacturer.
1912. Timmis, Shirley S., Messrs. Wm. Gossage and Sons, Ltd., Soap Works, Widnes, Lancs, Soap Manufacturer.
1905. Tindall, W. B., 39, St. Mary Street, Toronto, Canada, Secretary and Treasurer.
1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.
1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1890. Tobey, C. H., Burks Falls, Ontario, Canada, Tannery Chemist.
1894. Toch, Maximilian, 320, Fifth Avenue, New York City, U.S.A., Chemist.
1886. Todd, A. M., c/o The A. M. Todd Co., Kalamazoo, Mich., U.S.A., Manufacturing Chemist and Distiller of Essential Oils.

1913. Tomlinson, George G., Anglo-Chilian Nitrate and Railway Co., Tocopilla, Chile, South America, Chemist.
1914. Tompkin, Albert, 77, Market Side, Bulwell, Nottingham, Pharmacist.
O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.
1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.
1909. Tonry, Wm. S., Passaic Street, near Elm Street, Maywood, N.J., U.S.A., Chemical Engineer.
1913. Toppin, Richmond D., Millett Street, Hurstville, Sydney, N.S.W., Chemist.
1907. Torrey, Dr. Joseph, Craigie Lea, Blundellsands, Liverpool, Engineer.
O.M. Towers, J. W., Widnes, Lancashire, Analytical Chemist.
1907. Towler, A. E., c/o Sulphide Corporation, Cockle Creek, N.S.W., Australia, Chemist.
1909. Townend, Harry, Public Library, Bury, Lancashire, Librarian.
1897. Towse, Walter, Elswick Leather Works, Newcastle-on-Tyne, Technical Chemist.
1904. Toyne, Francis D., c/o Kelsall and Kemp, Ltd., Woodhouse Mills, Norden, near Rochdale, Chemist.
1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.
1900. Traquair, Jno., Ayer, Mass., U.S.A., Analytical Chemist.
1906. Travell, Norman E., Grosvenor Avenue, Mapperley Park, Nottingham, Lace Dresser.
1893. Travers, Prof. Morris W., F.R.S., Indian Institute of Science, Bangalore, India, Director.
1889. Trechmann, A. O., The Old Palace, Rochester, Kent, Cement Manufacturer.
1911. Trechmann, C. T., Warren Cement Works, Hartlepool, Cement Manufacturer.
1895. Treharne, F. Gwilym, Wrangbrook, Llanishen, near Cardiff, Analytical Chemist.
1885. Trewby, Herbert, Lampetts, Fyfield, Essex, Analytical Chemist.
1909. Trier, Thorvald G., 237, West 22nd Street, New York City, U.S.A., Technical Chemist.
1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.
1898. Tripp, Dr. E. Howard, 26, Chaucer Road, Bedford, Science Master.
O.M. Trobridge, A., c/o Trobridge and Co., Ltd., Heworth Shore, Felling-on-Tyne, Technical Chemist.
1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst.
1900. True, Percival E., 392, Raymond Street, Elgin, Ill., U.S.A., Chemical Engineer.
1887. Tsukiyama, S., 2nd of No. 2116, Fukiai-chō, Kobe, Japan, Paper Mills Chemist.
1894. Tucker, Alex. E., 55, Station Street, Birmingham, Metallurgist and Chemist.
1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.
1886. Tuer, Arthur H., Douglas House, Worthington, near Wigan, Analytical Chemist.
1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.
1909. Tulloch, Capt. T. G., Bank Buildings, St. James' Street, London, S.W., Director of Public Companies.
1901. Tulloch, Wm. F., c/o Joseph Watson and Sons, Ltd., Whitehall Soap Works, Leeds, Merchant.
1914. Tungay, Sydney J., Haughton's Ltd., 30, St. Mary at Hill, London, E.C., Chemical Engineer.
1909. Tunks, Dr. F. R., Powder Mills, Tonbridge, Kent, Manager.
1904. Tunnell, Raymond W., 251, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.
1899. Turnbull, Dr. Andrew, 18, Hackins Hey, Liverpool, Consulting Chemist.
1888. Turnbull, G. W., Ash Cottage, North Road, Carnforth, Lancashire, Metallurgical Chemist.
1904. Turnbull, R. H., Messrs. Turnbull's (Glasgow) Ltd., 20, Strand Road, Calcutta, India, Chemist.
1884. Turnbull, W. S., 38, Bath Street, Glasgow, Chemical Manufacturer.
1911. Turner, Prof. A. J., Technical Institute, Byculla, Bombay, India, Professor of Chemistry.
1902. Turner, Basil, 83, Pitt Street, Sydney, N.S.W., Australia, Metallurgist.
1902. Turner, Jos., c/o Read Holliday and Sons, Ltd., and (Jnls.) Azo House, Birkby, Huddersfield, Chemist.
1905. Turner, Prof. Thomas, 75, Middleton Hall Road, King's Norton, Birmingham, Professor of Metallurgy.
1897. Turney, Fred. N., 12, Dieghem Straat, Saventham, near Brussels, Belgium, Leather Dresser.
1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.
1908. Turnill, Thos. W., c/o Atlas Preservative Co., Windmill Lane, Deptford, S.E., Works Chemist.
1905. Tutwiler, Carrington C., Real Estate Trust Building, Philadelphia, Pa., U.S.A., Consulting Gas Chemist.
1890. Tweedy, Jas., 245, Burdett Road, Limehouse, E., Metallurgical Chemist.
1905. Twigg, Geo. F., 57, Val Plaisant, St. Heliers, Jersey, Gas Works Chemist.
1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.
1913. Twomey, Jerome, 21, Onslow Road, Elm Park, Liverpool, Research Chemist.
O.M. Twynam, T., Wynyard House, Coatham Road Redcar, Yorks, Metallurgist.
1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.
O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.
O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E.; and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.

U

1907. Udal, John P., Ridge Road, Berea, Durban, Natal, Engineer.
1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.
1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.
O.M. Umney, C., Fernbrake, Branksome Wood Road, Bournemouth; and (Journals) 48, Southwark Street, London, S.E., Manufacturing Chemist.
1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.
1889. Underhill, Thos. J., "Stanley," Quernmore Road, Bromley, Kent, Inspector of Stores.
1885. Underwood, G. R., 10, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.
1904. Uyeda, Toyokitsu, 54, Matsugayechō Kitaku, Osaka, Japan, Chemist.

V

1911. Vakil, Kapibram H., No. 5, Santa Cruz, Bombay, India, Chemist.
1896. Van der Linde, Harold, c/o Century Rubber Co., Plainfield, N.J., U.S.A., President.
1895. Vanderpoel, Dr. Frank, 175, Park Avenue, Orange, N.J., U.S.A., Chemist.
1913. Van Doren, W. V., 1646, Garfield Boulevard, Chicago, Ill., U.S.A., Chemist.
1903. Van Dyck, Edwin M., 57, Greene Street, New York City, U.S.A., Chemist and Ink Maker.
1897. Van Gelder, Arthur P., c/o Hercules Powder Co., Kenvil, N.J., U.S.A., Superintendent.
1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.

1896. Van Laer, Norbert, Truman's Brewery, Burton-on Trent, Brewer and Chemist.
1897. Van Marken, J. C., 10, Amalia Straat, The Hague, Holland, Chemical Engineer.
1888. Vargas-Vergara, J. M., Apartado No. 120, Bogota, Colombia, S. America, Metallurgical Chemist.
1910. Vass, David, Gas Works, Perth, Manager.
1912. Ventress, Ernest W. S., c/o Messrs. Lever Bros., Kabushiki Kaisha, P.O. Box Sannomiya 174, Kobe, Japan, Oil Mill Manager.
1898. Verity, Ben., 550, Hood Street, Fall River, Mass., U.S.A., Print Works Chemist.
1904. Vernon, Dr. R. H., Chemical Engineer.
1908. Vickers, Benj. Threlfall, Gascoigne Street, Boar Lane, Leeds, Oil Merchant.
O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.
1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.
1908. Vieweg, Dr. Walter, Ganghoferstrasse 11, Frankfurt a M., Germany, Chemist.
1909. Virolleaud, Leopold, 3, Rue de Paris, St. Denis, Seine, France, Chemical Engineer.
1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.
O.M. Voelcker, E. W., 1, Tudor Street, London, E.C., Analytical and Consulting Chemist.
1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.
1897. Vogel, Julius L. F., Parliament Mansions, Victoria Street, Westminster, S.W., Engineer.
1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.
1897. Voorhees, Louis A., 111, Carroll Place, New Brunswick, N.J., U.S.A., Agricultural Chemist.
1899. Voorhees, Samuel S., Bureau of Standards, Washington, D.C., U.S.A., Chemist.
1902. Vorisek, Dr. Anton, College of Pharmacy, 115—119, West 68th Street, New York City, U.S.A., Instructor.
1885. Voss, Hermann, Holstein, Silver Lane, Purley, Surrey, Manure Works Manager.
1899. Voss, Walter A., Carlton Chemical Works, Glengall Road, Millwall, E., Manufacturing Chemist.

W

1896. Wachtel, Gregory, Alexandrowski Prospect 15, St. Petersburg, Russia, Chemical Engineer.
1905. Waddell, Montgomery, 30, Church Street, New York City, U.S.A., Consulting Engineer.
1911. Waddock, Wm. P., 666, Harris Street, Ultimo, Sydney, N.S.W., Milk Analyst.
1913. Wade, Albert J., 33, Kimberley Avenue, East Ham, E., Sugar Analyst.
1902. Wade, Frank, 26, St. Ronan's Avenue Southsea, Analytical Chemist.
1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.
1889 Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.
1911. Waele, Armand de, c/o Linoleum Manufacturing Co., Staines, Technical Chemist.
1897. Wagner, Dr. Theodore B., Room 2229, 17, Battery Place, New York City, U.S.A., Chemist.
1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.
1906. Wagstaffe, Dr. E. A., 22, Blackfriars Street, Manchester, Analytical Chemist.
1906. Wahl, Dr. Robert, 1135—1147, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewers' School.
1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.
1908. Wait, Douglas, c/o R. Gay and Co., Ltd., Langthorne Works, Stratford Market, London, E., Analytical Chemist.
1901. Waite, C. Nelson, c/o The Jessop and Moore Paper Co., Delaware Mills, Wilmington, Del., U.S.A., Chemist.
1899. Wakefield, Wm. C., Mill Street East, Savile Town, Dewsbury, Chemical Manufacturer.
1905. Waldenberger, Dr. C. A., 62, Mercer Street, Jersey City, N.J., U.S.A., Chemist.
1894. Waldman, Louis J., 78, Willett Street, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.
1895. Waldstein, Dr. Martin E., 23, Broadwater Down, Tunbridge Wells, Kent, Manufacturing Chemist.
1887. Walker, Archibald, Newark Castle, Ayr, Scotland, Distiller.
1913. Walker, F. H., jun., 3, Stannington Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1914. Walker, Fred. W., Rosemont, Bath Street, Saltburn, Yorks, Analytical Chemist.
1908. Walker, George, c/o Anglo-Persian Oil Co., Mohammera, Persia, via Bombay, Analytical Chemist.
1913. Walker, Henry, c/o C. von Grueber, 31 and 33, High Holborn, London, W.C., Chemical Engineer.
1897. Walker, H. V., 193, Lincoln Avenue, Newark, N.J., U.S.A., Chemist.
1894. Walker, Prof. Jas., D.Sc., F.R.S., 5, Wester Coates Road, Edinburgh, Professor of Chemistry (University of Edinburgh).
1897. Walker, Jas. W., Marine Lodge, Irvine, Scotland, Chemical Manufacturer.
1906. Walker, Jas. W., Stonydale, Oakamoor, Stoke-on-Trent, Assayer.
1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.
1910. Walker, John S., Hiratsuka, Sagami, Japan, Explosives Chemist.
1884. Walker, S. R., Fern Bank, Starling Road, Radcliffe, Manchester, Foreman Dyer.
1912. Walker, Prof. W. O., Dept. of Chemistry, School of Mining, Kingston, Ont., Canada, Professor of Chemistry.
1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.
1897. Wallace, Edwin C., 92, Corey Street, West Roxbury, Mass., U.S.A., Chemist.
1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.
1897. Wallace, Robt. A., 66, Holland Road, London, W., Chemical Manufacturer.
O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.
1906. Wallerstein, Leo, 177, West 72nd Street, New York City, U.S.A., Chemist.
1899. Wallerstein, Dr. Max, 24—26, West 30th Street, New York City, U.S.A., Chemist.
1913. Walmsley, Samuel R., c/o Chillagoe, Ltd., Forsayth, North Queensland, Australia, Assayer.
1886. Walsh, F. T., 12, Valentine Street, West Newton, Mass., U.S.A., Colour Printer.
1901. Walsh, Lionel O. P., c/o Dominion Tar and Chemical Co., Ltd., Sydney, Cape Breton, Canada, Chemist.
1903. Walsh, Peter H., P.O. Box 569, Magog, Quebec, Canada, Analytical Chemist.
1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.
1908. Walton, Robert H., Railway Stores, Eveleigh, Sydney, N.S.W., Analyst.
1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1911. Walton, Wm. Keighley, Beechwood, Upper Rushton Road, Thornbury, Bradford, Analyst.
1895. Want, W. Philip, 194—200, Bishopsgate, London, E.C., Pharmacist and Editor.
1901. Warburton, Frank, 50, Rosebery Road, Muswell Hill, N., Manager.
1904. Warburton, George H., 75, Mill Lane, West Hampstead, N.W., Analytical Chemist.
1896. Warburton, Thos., 14, Sunny Bank Road, Longsight, Manchester, Chemist.
1912. Ward, Dudley R., 83, St. Paul's Street West, St. Catherine's, Ontario, Canada, Analytical Chemist.

O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.

1891. Ward, G. J., Hallam Fields, Ilkeston, Notts, Civil Engineer.

1898. Ward. John. Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts, Manager.

1899. Ward, Wm. J., 11, Manor Road, Sale, Manchester, Chemist.

1908. Wardleworth, Theo. H., 168, Côte Saint Antoine Road, Westmount, Montreal, Canada, Manufacturing Chemist.

1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.

1913. Warner. Arthur L. D., P.O. Box 203, Edgewater, N.J., U.S.A , Sugar Refiner.

1899. Warnes, Arthur R., 13—17, Green Lane, Hull, Consulting Technical Chemist.

1912. Warren. E. Bruce, c/o Indian Rubber and Gutta Percha Telegraph Works Co., Silvertown, E., Consulting Analytical Chemist.

1890. Warren, Fiske, c/o S. D. Warren and Co., Laboratory Cumberland Mills, Maine, U.S.A., Paper Manufacturer.

1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.

1907. Warren, W. H., Gas Works, Beckton, E., Gas Engineer.

1912. Warriner, C. E., City Analyst's Office, Fort William, Ont., Canada, Analyst and Bacteriologist.

1911. Washburn, Frank S., Stahlman Building, Nashville, Tenn., U.S.A., President, American Cyanamid Co.

1913. Wassmer, Dr. Eugene, Chapel Place Laboratory, Maundy Place, Broadway, Westminster, S.W., and (Journals) 4, Rue de l'Ecole de Chimie, Geneva, Chemist.

1885. Waterfall. W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.

1902. Watkins, E. J., 72, King's Road, Peckham. S.E., Works Chemist.

1898. Watkins, Willard H., c/o Schoellkopf, Hartford, and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.

1894. Watmough, Benj., 1, Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.

1884. Watson, Chas., Rose Bank, School Road, Moseley, Birmingham, Manufacturing Chemist.

1894. Watson, Chas. Ernest, 33, Oxford Road, St. Anne's on Sea, Lancashire, Chemical Assistant

1908. Watson, C. I. Wilkinson, c/o Wailuku Sugar Co., Wailuku, Maui, Hawaiian Islands, Chemist.

1901. Watson, Herbert J., 64, Peel House Lane, Widnes, Chemist.

1903. Watson, H. W., Rose Villa, Roper Avenue, Gledhow, Leeds, Analytical Chemist.

1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.

1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.

O.M. Watson, Jno. C., Farwell Bleachery, Laurence, Mass., U.S.A., Printworks Chemist.

O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.

1901. Watt, Francis L., 10, Northcote Chambers, Reiby Lane, Circular Quay, Sydney, N.S.W., Australia, Analytical Chemist.

1906. Watt, Dr. H. E., Blandfield Chemical Works, Wheatfield Road, Edinburgh, Chemist.

1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.

1908. Watts, Jno. Wm., Newcastle Tar Works, Blaydon-on-Tyne, Manager.

1910. Watts, Reginald H. Pole, 57, Leagrave Road, Luton, Beds., Research Chemist.

1907. Waumsley, Harry, 12, Rowhill Mansions, Clapton, N.E., Chemical Engineer.

1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.

1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.

1905. Webber, W. J., 40, Central Street, Boston, Mass., U.S.A., Manufacturing Chemist.

1912. Weber, Dr. Max G., 151, Water Street, Perth Amboy, N.Y., U.S.A., Works Manager.

1901. Webster. Geo. J., P.O. Box 1003, Marquette, Mich., U.S.A.. Secretary.

1902. Webster, Jno., Laboratory of Pathological Chemistry, St. Mary's Hospital, London, W., Analyst.

1906. Weddell. George, 20, Grainger Street West. Newcastle-on-Tyne, Manufacturing Chemist.

1904. Wedekind, Rud., Uerdingen, Niederrhein, Germany, Manufacturer of Alizarin and Bichromates.

1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A.. Chemist.

1902. Weed, Hy. T., 176, Prospect Park West, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.

1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.

1904. Weil, Jacob A., c/o The Power Gas Corporation, Ltd., Stockton-on-Tees, Chemist.

1910. Weinberg, Dr. Arthur von, "Buchenrode," Forsthaus-strasse, Frankfurt a/M, Germany, Dyestuff and Chemical Manufacturer.

1906. Weir, James, c/o Imperial Varnish and Color Co., 6—24, Morse Street, Toronto, Canada, Chemist.

1902. Weiskopf, Dr. Erich, Authors' Club, Whitehall Court, London, S.W., Works Manager.

1910. Weiss, John M., c/o Barrett Manufacturing Co., Research Dept., Hudson Heights, N.J., U.S.A., Chemist.

1908. Weissmüller, Edward F., Spring Lodge, Helsby, Cheshire, Chemist.

1905. Weissmüller, Ernest C., Craig Leith, Overton, Frodsham, Cheshire, Research Chemist.

1910. Welch, Bertie M., 80, Hunter Street, Sydney, N.S.W., Australia. Assayer.

1912. Weld, Fred. C., 263, Fairmount Street, Lowell, Mass., U.S.A., Analytical Chemist.

1899. Weldon, Leonard E., Hadleigh, Alma Street, Sherwood Rise, Nottingham, Dyer.

1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.

1912. Wells, Jas. H., 18, Alwyne Place, Canonbury, London, N., Metallurgist.

1885. Welsh, Jas., Standard Mills, Ferguson Road, Bombay, India, Printworks Manager.

1890. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.

O.M. Welsh, W., Holt Town Oil Works, Manchester.

1905. Welt, Dr. Ida, 101, West 109th Street, New York City, U.S.A., Chemist.

1906. Wenger, Francis E., Clivedon, Wolstanton, Stoke-on-Trent, Ceramic Colour Manufacturer.

1909. Wescott, J. P., jr., 55, Washington Park, Newton ville, Mass., U.S.A.. Manager, Atlas Chemical Co.

1903. Wesener, Dr. John A., 31, North State Street, Chicago, Ill., U.S.A., Consulting Chemist.

1889. Wesson, D., 111, South Mountain Avenue, Montclair, N.J., U.S.A., Cotton-oil Expert.

1908. West, Chas. A., c/o American Camphor Refining Co., 14, Fulton Street, Boston, Mass., U.S.A., President.

1903. West, Leonard, Selworthy, Quarndon, Derby, Manufacturing Chemist.

1909. West, Percy. C. H. 40 Museum Street, London, W.C., Analytical Chemist.

1900. Westenfelder, B. D., 1414, Race Street, Cincinnati, Ohio, U.S.A., Chemist.

1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.

1898. Weston, David B., Sharon, Mass., U.S.A., Chemist.

1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.

1885. Weston, Wm., 2, Ulundi Road, Blackheath, S.E., Analytical Chemist.

1890. Wetter, Jasper, Room 23, Holborn Hall, Gray's Inn Road, London, W.C., Patent Agent.

1912. Weyman, Geoffrey, 70, Manor House Road, Jesmond, Newcastle-on-Tyne, Technical Chemist.

O.M. Whalley, L. J. de, 18, Brandram Road, Lee, S.E., Sugar Chemist.
1909. Wharton, Fredk. M., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Chemist.
1908. Wheaton, H. J., Spondon, near Derby, Chemical Engineer.
1909. Wheeler, Edward, 144, Earlsdon Avenue, Coventry, Demonstrator of Chemistry.
1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 4, Fairfield Terrace, Higher Openshaw, Manchester, Metallurgical Chemist.
1906. Wheeler, Frank G., 683, Harris Street, Appleton, Wis., U.S.A., Chemist.
1907. Wheeler, R. Vernon, Home Office Experimental Station, Eskmeals, Cumberland, Chemist.
1912. Wheeler, Thorne L., c/o Edible Products Co., 156—186, East 22nd Street, Bayonne, N.J., U.S.A., Chemist.
1895. Wheelwright, Dr. E. W., 14, Carisbrooke Road, Edgbaston, Birmingham.
1909. Whiffen, G. Goodman, Lombard Road, Battersea, London, S.W., Chemical Engineer.
O.M. Whiffen, Thos. J., Cerris House, West Hill, Putney, S.W., Manufacturing Chemist.
O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1899. Whitaker, Milton C., Columbia University, New York City, U.S.A., Chemist.
1895. Whitaker, Thos., Aire Vale Dye Works, Newlay, near Leeds, Dyer.
O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks, Dyer's Chemist.
1893. White, Arthur F., 2, Melbourne Grove, Thornbury, Bradford, Yorks, Manufacturing Druggist.
1901. White, H. Graham, 28, Brancote Road, Oxton, Birkenhead, Works Chemist.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
1911. White, John W., c/o E.C. Powder Co., Green Street Green, Dartford, Kent, Works Chemist.
O.M. White, Paul T., Hortonfield House, West Drayton, Chemical Manufacturer.
1910. White, P. Winzar, Mayfield, Hayes, Middlesex, Manufacturing Chemist.
1911. White, Walter W., c/o Citro Chemical Co., Maywood, N.J., U.S.A., Secretary and Manager.
1912. Whitehead, Charles E., 20, Albion Road, Chesterfield, Derbyshire, Chemist.
1903. Whitehouse, P. L., 16, Lombard Street, West Bromwich, Staffordshire, Oil Chemist.
1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.
1885. Whiteley, R. Lloyd, The Institute, West Bromwich, Staffordshire, Principal.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1911. Whitley, George, jr., c/o Ridley, Whitley, and Co., Ltd., Angel Road Works, Edmonton, N., Linoleum Manufacturer.
1912. Whitney, Wm. L., c/o U.S. Graphite Co., Saginaw, Mich., U.S.A., Chemist.
1885. Whittaker, C. J., Somerville, Fairhaven, Lytham, Lancashire, Chemical Engineer.
1904. Whittier, Charles T., 78, Brinkerhoff Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, Chemist.
1884. Whowell, F., Croich Hey, Tottington, Bury, Lancs, Bleacher.
1910. Whymper, R., St. Clare's, St. Mary's Road, Ditton Hill, Surbiton, Chemist.
1899. Wiarda, Jno. C., 259–273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1913. Wickenden, Leonard, c/o West Virginia Paper and Pulp Co., 521, West 23rd Street, New York City, U.S.A., Research Chemist.
1908. Wickes, Clarence S., 28, Franklin Avenue, Merchantville, N.J., U.S.A., Factory Superintendent.
1905. Widmann, Eugene A., 588, 5th Street, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.
1904. Wieler, Eric E., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1906. Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.
1883. Wiggin, W. W., 55, George Street Parade, Birmingham, Nickel Refiner.
1897. Wigglesworth, R., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Wightman, Charles, Springfield, Stevenage, Herts.
1913. Wigner, J. H., Warddykes, Frodsham, Cheshire, Works Chemist.
1906. Wikner, Sigurd A., "Lynton," Kingsbury Road, Gravelly Hill, Birmingham, Tar Works Chemist.
1899. Wild, Roland C., The Grange, New Eltham, Kent, Analytical Chemist.
1893. Wilder, F. L., 10, Forest Rise, Walthamstow, Essex, Assayer.
1902. Wilder, Salmon W., jun., 33, Broad Street, Boston, Mass., U.S.A., Treasurer.
1911. Wildt, Dr. Edwin, c/o Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Technical Chemist.
1912. Wiley, Samuel W., 15, South Gay Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.
1899. Wilkens, H. A. J., 60, Broadway, New York City, U.S.A., Mining Engineer.
1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1911. Wilkinson, Frank, West Lodge, Handsworth, near Sheffield, Chemical Manufacturer.
1904. Wilkinson, Prof. J. A., South African School of Mines and Technology, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks, Chemical Manufacturer.
1903. Willard, C. T., c/o The Singer Manufacturing Co., Elizabethport, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C., Patent Agent.
1911. Willcox, Stuart J., 46, Mulgrave Street, Liverpool, Chemist.
1903. Williams, Chas E., Thornhayes, Sleaford, Seed Crusher.
1895. Williams, David T., 42, Finsbury Square, London, E.C., Chemist and Assayer.
1912. Williams, Egbert R., c/o Northern Aluminium Co., Shawinigan Falls, P.Q., Canada, Chemist.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1908. Williams, Herbert E., 28, Cranston Road, Forest Hill, S.E., Chemist.
1904. Williams, Jno. T., 815, Madison Avenue, New York City, U.S.A.
1913. Williams, Jos. H., 49, Addison Road, Snaresbrook, Essex, Works Chemist.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, 94, Telford Avenue, Streatham Hill, S.W., Chemist.
1885. Williams, Rowland, 79, Queen Square, Lancaster, Analytical Chemist.
1912. Williams, Samuel B., Penelvan, Roskear, Camborne, Cornwall, Metallurgist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue East Orange, N.J., U.S.A., Chemist.
1885. Williams, T. Howell. *See* Idr[illegible] T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, 150, Mystic Street, West Medford, Mass. U.S.A., Textile Engineer.

1887. Williams. W. Collingwood, 36, Dansie Street, Liverpool, Analytical Chemist.
O.M. Williams, W. J., 5004, Griscom Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.
1894. Williamson, J. Alex., The Croft, Chase Court Gardens, Enfield, N., Analytical Chemist.
1911. Williamson, John, jun., Alne Hill, Camp Road, Maryport, Cumberland, Tanner.
O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.
1903. Wills, J. Lainson, c/o Otto F. Stifel's Union Brewing Co., Gravois and Michigan Avenues, St. Louis, Mo., U.S.A., Technical and Brewing Chemist.
1905. Wills, Wm. H., 23, Willow Street, Waltham, Mass., U.S.A., Dyer.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.
1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.
1910. Wilson, Dr. Forsyth J., Royal Technical College, Glasgow, Lecturer.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1902. Wilson, Geo. W., Viaduct House, Dinting, near Manchester, Works Chemist.
1899. Wilson, Gordon, Benallan, Kirkintilloch, and (Journals) Apartado 92, Zacatecas, Mexico, Chemist and Assayer.
1886. Wilson, Jno., Tyneside, 381, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., "Lynton," Dingle Hill, Colwyn Bay, North Wales, Chemical Engineer.
1909. Wilson, Jno., Battersea Polytechnic, London, S.W., Head of Chemical Dept.
1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.
1906. Wilson, J. Murray, c/o Canadian Explosives, Ltd., Transportation Building, Montreal, Canada, Technical Chemist.
1902. Wilson, Leonard P., 8, Chester Street, Coventry, Technical Chemist.
1910. Wilson, Leslie, West Bank, Doxey, near Stafford.
O.M. Wilson, R. H., Egglecliffe P.O., Co. Durham, Chemical Manufacturer.
1912. Wilson, S. Siddons, 154, Burges Road, East Ham, Essex, Analytical Chemist.
1909. Wilson, Wm. J., 12, Vicarage Park, Plumstead, Kent, Chemist.
1908. Wilson, William James, Tirohanga, North End Road, Devonport, Auckland, New Zealand, Consulting Cement Engineer.
1890. Wilson, W. W., Dalmonach House, Alexandria, Dumbartonshire, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1912. Windsor, P. L., Library, University of Illinois, Urbana, Ill., U.S.A., Librarian.
1913. Windsor-Richards, W., c/o Allen West and Co., Ltd., Lewes Road, Brighton, Chemist.
1892. Wingfield, T. R., 12, Suffolk Road, Bournemouth West, Brewer.
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1908. Winkler, Hermann, Bockenheimer Anlage 43, Frankfurt a/Main, Germany, Merchant.
O.M. Winser, P. J., Heath House, Knutsford, Cheshire, Consulting Chemist.
1907. Winsloe, Louis S., 1, Booth Street, Manchester, Manufacturing Chemist.
1892. Winstanley, W. Hy., Birch House, Cheadle Hulme, Cheshire, Technical Chemist.
1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.
1907. Winther, [illegible] A., Chemische Fabrik Griesheim-Elektron, Werk Oehler, Offenbach a/Main, Germany, Chemist.
1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.
1889. Wishart, Jno., Oakbank Oil Co., Ltd., 29, St. Vincent Place, Glasgow, General Manager.
1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.
1906. Withey, Wm. S., Burry Port, South Wales, Chemist.
O.M. Witt, Dr. Otto N., Ebereschenallee 10, Westend, bei Berlin, Professor of Chemistry.
1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.
1912. Wolff, Dr. Salamon, c/o Messrs. Mather and Platt, Park Works, Manchester, Chemical Engineer.
1911. Wollaston, T. Roland, Dirleton House, Priory Road, Sale, Cheshire, Consulting Engineer.
1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.
1914. Wood, A. S., c/o Messrs. Levinstein, Ltd., Blackley, Manchester, Works Chemist.
1906. Wood, E. Escott. Hurricane House, Brymbo, near Wrexham, North Wales, Chemist and Metallurgist.
1900. Wood, Frank, Ardsley House, near Barnsley, Yorks, Assistant Manager (Glass Works).
1901. Wood, Frank S., 12, Carlton Avenue, Hornsea, East Yorks., Cement Works Chemist.
1909. Wood, Hubert R., c/o Fenner and Alder and Co., Fenner's Wharf, Millwall, E., Works Chemist.
1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.
1906. Woodall, Sir Corbett, Palace Chambers, Westminster, London, S.W., Civil Engineer.
O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Limehouse, London, E., Chemist.
1910. Woodhead, Arthur E., Dyeing Dept., The University, Leeds, Research Student.
1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.
1900. Woodrow, John, 84, Harpenden Road, Manor Park, E., Chemist.
1906. Woodward, Horace A., Cowell Avenue, West Orange, N.J., U.S.A., Chemist.
1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.
1914. Wooldridge, H. B., Tottenham Brewery, Tottenham, N., Brewer.
O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.
1905. Woore, N. L., c/o South Australian Gas Co., Brompton, Adelaide, South Australia, Works Chemist.
1901. Worden, Edw. C., Millburn, N.J., U.S.A., Manufacturing Chemist
1909. Work, Charles O., 22, Cambridge Road, Great Crosby, Liverpool, Analytical Chemist.
1914. Worley, Prof. Fred. P., University College, Auckland, New Zealand, Prof. of Chemistry.
O.M. Worrall, H., Culmington House, Stanton Lacey, Ludlow, Dyer.
1903. Worstall, Robt. A., 21, North La Salle Street, Chicago, Ill., U.S.A., Paint and Varnish Specialist.
1900. Worthington, Arthur, Lynwood, Great Lever, Bolton, Chemist and Manager.
1896. Wrampelmeier, T. J., 565, Monadnock Building, San Francisco, Cal., U.S.A., Chemist.
O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.
1904. Wright, Allister M., Box 617, G.P.O., Christchurch, N.Z., Chemist (Christchurch Meat Co.).
1912. Wright, Arthur, 111, Broadway, New York City, U.S.A., Lawyer.
1895. Wright, Arthur C., c/o Turner, Morrison, and Co., 6, Lyons Range, Calcutta, India, Chemist.
1908. Wright, C. Harold, Government Laboratory, Port of Spain, Trinidad, B.W.I., and (Journal) 3, Virginia Terrace, Leeds, Analytical Chemist.
1904. Wright, Chas. L., 123, South Madison Avenue, La Grange, Ill., U.S.A., Chemical Engineer.
1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.
1907. Wright, John Henry, 16, Norwood Avenue, Shipley, Yorks. Technical Chemist.
1885. Wright, Jos., 19, Arboretum Street, Nottingham Lace Dresser.

O.M. Wright, L. T., Junior Constitutional Club, Piccadilly, London, W., Chemical Engineer.
1910. Wright, Robert, 122, York Street, Jarrow-on-Tyne, Blast Furnace Manager.
1911. Wright, Robt., c/o Thos. Adams, Ltd., Sherwood Hill Works, Nottingham, Bleacher and Dyer.
1900. Wright, Walter J., 59, Stone Street, Faversham Kent, Chief Chemist (Cotton Powder Co.).
1890. Wulfling, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.
1907. Würster, Oscar H., c/o Lever Bros., Ltd., Toronto, Canada. Soap Works Chemist.
1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.
1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.
O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.
1908. Wyler, Dr. Max, c/o Levinstein, Ltd., Blackley, Manchester, Manufacturing Chemist.
1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 17, Taptonville Road, Sheffield, Professor of Chemistry.

Y

1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.
1897. Yates, W. H., Durley Park, Keynsham, Bristol, Technical Chemist.
1913. Yeomans, Wm. W., 40, Alleghany Street, Buffalo, N.Y., U.S.A., Chemist.
1906. Yerkes, Leonard A., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.
1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.
1894. Yocum, Dr. Jno. H., 325, Academy Street, Newark, N.J., U.S.A., Chemist.
1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.
1900. Yoshitake, E., Nishihara Machi, Koishikawa, Tokyo, Japan, Chemist.
1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.
1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.
1902. Young, Chas. C., c/o Farbenfabriken of Elberfeld Co., 117, Hudson Street, New York City, U.S.A., Colourist.
1890. Young, Dr. Geo., Bradda, Church Crescent, Church End, Finchley, N., Chemist.
1913. Young, Hamish, Springfield, Brownside Road, Cambuslang, by Glasgow, Chemist.
1904. Young, James, 45, Palace Grove, Bromley, Kent, Chemist.
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1886. Young, Jno., Claremont House, Beverley Road, Hull, Gas Engineer.
1909. Young, John, P.O. Box 164, Akron, Ohio, U.S.A., Analytical Chemist.
1904. Young, Jno H., c/o The Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.
1898. Young, J. W., 22, Maxwell Drive, Glasgow, S., Inspector under Alkali Acts.
1912. Young, Robert, 1, Kelvinside Terrace West, Glasgow, W., Chemist.
1909. Young, R. F., c/o Institution of Mining and Metallurgy, Salisbury House, London, E.C., Chemist and Metallurgist.
1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.
O.M. Young, W. C., Laboratory, 24, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.
1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks, Chief Chemist

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1899. Zabriskie, C. B., c/o Pacific Coast Borax Co., 100, William Street, New York City, U.S.A., Manager.
1897. Zacharias, Dr. P. D., Philhellinon Street 22, Athens, Greece, Industrial Chemist.
1912. Zanetti, Joaquin E., Columbia University, New York City, U.S.A., Chemist.
1906. Zaremba, Edw., 707, D. S. Morgan Building, Buffalo, N.Y., U.S.A., President (Zaremba Co.).
1906. Zdanowicz, Joseph, 37, Queen's Gate Gardens, South Kensington, S.W., Chemical Engineer (Artificial Silk).
1899. Zilz, Henry, Northumberland House, Richmond, S.W., Merchant.
O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.
1905. Zimmermann, Chas., 9 and 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.
1897. Zinsser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.
1913. Zortman, Dr. Israel H., c/o Messrs. Rosenberg and Co., 259, High Holborn, London, W.C., Research Chemist.
1912. Zwingenberger, Dr. Otto K., c/o Roessler and Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemical Engineer.

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